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BELIEFS, ATTITUDES, DEMOGRAPHICS AND KNOWLEDGE: THE SOCIAL DIMENSIONS OF HARVESTING DECISIONS MADE BY PRIVATE FOREST-LAND OWNERS IN VIRGINIA

By

Sandra Sawtelle Hodge

A DISSERTATION

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

DOCTOR OF PHILOSOPHY

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ABSTRACT

BELIEFS, ATTITUDES, DEMOGRAPHICS AND KNOWLEDGE: THE SOCIAL DIMENSIONS OF HARVESTING DECISIONS MADE BY PRIVATE FOREST-LAND OWNERS IN VIRGINIA

By

Sandra Sawtelle Hodge

Sixty-one percent of the total land area of the state of Virginia is forested. Over seventy-seven percent of this forested land is owned by approximately 300,000 non-industrial private forest (NIPF) landowners. The decisions they make regarding the management of their forested land can have a profound impact on the general environment, including the availability of forest resources and timber supplies, aesthetic enjoyment, wildlife habitat, recreation and the quality of life for current and future generations of Virginians.

This research explores how beliefs and attitudes about natural resources and the environment, held by NIPF landowners in Virginia, affect their decision to harvest. The influence of other causal variables, socio-demographic variables and levels of knowledge about forestry and forest management, were also examined. Hierarchical attitude theory was used to study how beliefs flow from general to specific and affect decisions. Based on this theory, a model was constructed which investigated causal relationships among the different levels of beliefs and attitudes and the influence of other causal variables on the decision to harvest. Path analysis, a form of multivariate analysis, was used to explore these relationships. A total of 1306 randomly-selected NIPF landowners in Virginia were sampled using a mail questionnaire.

Beliefs and attitudes were found to be hierarchically arranged, and influenced by socio-demographics and information about natural resources and forestry. Having information about forestry and forest management was a key variable in dispelling uninformed beliefs about forestry issues and in effecting who decided to harvest. Future research efforts on NIPF landowners should focus on the integration of social science and forestry to determine the impacts of social dimensions on decisions regarding forest resource management. The design of forestry outreach education should also include those NIPF landowners whose primary management objectives are aesthetic, such as scenic beauty and preserving nature. The policy implications, at the state and local levels, of developing and implementing such programs are discussed.

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CHAPTER ONE

INTRODUCTION

Virginia's private forest landowners

Virginia has 25.4 million acres of land, of which 15.4 million acres, or 61% of the total land area of the state, are forested. Over 77% of this forested land is owned by non-industrial private forest (NIPF) landowners. It is estimated that there are about 300,000 NIPF landowners in Virginia (pers. comm. Virginia Department of Forestry). Among NIPF landowners are farmers who own private forest land incidental to their farmland; professionals for whom private forest land is unrelated to their occupation; recreationists who have sought private forest land for personal enjoyment; and members of younger generations who inherited private forest land without any specific intention for its use. NIPF lands have also been purchased by those with an interest in preserving the natural beauty of their lands. Forested lands owned by forest product industries, (e.g., firms that manufacture wood products such as lumber, plywood or paper), are not considered NIPF lands.

Each day NIPF landowners in Virginia are making land-use management decisions, decisions which relate to both financial and nonfinancial benefits. In terms of financial benefits, privately-owned forest lands in Virginia provide about seventy-five percent of the timber for forest industries in the state. In turn, these forest industries are the primary manufacturing industry in the state and employ over 120,000 people (Virginia Department of Forestry, 1988). Non-financial benefits are also important to NIPF landowners and many of their land-management decisions reflect their concerns with aesthetic enjoyment, secluded living, wildlife habitat, and recreation and hunting opportunities (Wright, 1988).

From 1975 to 1985, over 600,000 acres of forested land in Virginia, an average of 60,000 acres a year, were converted to other land uses, principally, high-density residences, commercial, industrial

and agricultural development (USDA, 1986). This shrinking of the forest resource base makes the role of current Virginia NIPF landowners even more important in the management of the Commonwealth's remaining forest resources because they hold such a significant amount of forested land. The types of decisions Virginia NIPF landowners make can have profound effects on the general environment, including the availability of forest resources and timber supplies, aesthetic enjoyment, wildlife habitat, recreation and the quality of life for current and future generations of Virginians.

The comment is often heard that forests have been around for millennia and have continued to grow and supply resources without human management. This has been true in the past. However, with increasing population growth and conversion of forested land to various forms of land use (mentioned above), there is less of a resource to utilize. This now necessitates a more conscientious approach to the management of remaining forest resources, regardless of whether they are managed for financial or non-financial benefits. Due to the shrinking of this resource base, managing forested land for wildlife, because of loss of habitat, can be as important as managing it for production of forest products.

The problem--beliefs, attitudes and forest management

Within forestry, much of the research focus on private forest landowners in the United States has been, and still is, on their ability to supply timber and other marketed forest outputs. This supply is dependent on the intensity of management that is practiced. According to Alig and Wear (1992:35), the production levels from private forest lands have not reached their potential and could benefit from more intensive management so that these lands could provide more timber. They predict that the issue of more intensive management will become increasingly important as more changes in the forest-land base take place over the next 50 years (Ibid.:35). But the issue of whether

private forest landowners can manage their forested land more intensely to produce commercial timber, may be a moot point. If private forest landowners do not want to manage their forest land for commercial timber production because they value it for other reasons, then the potential for commercial timber production will remain just that--potential. Their reasons for ownership may not include commercial timber production, regardless of the biological potential of the land and the technical information available for realizing this potential.

Many NIPF landowner objectives are not related to timber production but to non-financial objectives. These non-financial objectives may include viewing wildlife, secluded living, aesthetic enjoyment, recreation and hunting. When compared to a market objective of managing the land for timber production, which might motivate NIPF landowners to seek information and assistance about forest management, these non-market objectives may not do so. While ownership of forested land may satisfy the non-market objectives of the NIPF landowner, it may also result in a lack of knowledge about managing the resource, due to perceptions that only forest land which are being harvested need management. Thus, it is important to understand the factors which may constrain Virginia NIPF landowners from harvesting, even though it may be a viable forest management practice, e.g., for culling dead or infected trees, regenerating certain species, and creating specific types of wildlife habitat.

Social dimensions play prominent roles in influencing why certain decisions are made regarding natural resource use. It is now recognized that resource problems are complex phenomena and in addition to focusing on the physical and biological aspects of natural resources, more attention must be given to the social dimensions surrounding decisions related to resource use. Beliefs, values and attitudes, while not representing the whole spectrum of social dimensions, are a critical component in how societies perceive natural resources. Natural

resources have no meaning until society gives them one. Nature, in itself, has no values. No species are assigned more value than others and as Boulding (1978:19) has indicated "(nature) cares no more about the whooping crane or the blue whale than she did about the dinosaur". Thus, the meanings people attach to environmental materials determines their designation--whether they end up as natural resources, taboos or even remain unseen (Burch, 1984). Through beliefs, values and attitudes humans construct images of nature and it is "in terms of these images of nature, rather than the actual structure of nature, that they act" (Rappaport, 1979). In fact, Schmitt and Grupp (1976) criticize those studying environmental issues for not taking into consideration the symbolism people attach to natural resources. Even the locations, the places in the environment, where people choose to be may be symbols for certain cultural values they have (Firey, 1945).

Beliefs are defined as "... the association of characteristics, qualities and attributes with an object" (Ajzen and Fishbein, 1980:62) which an individual accepts as true or factual (Bruvold, 1973), sometimes regardless of evidence to the contrary. They do not imply an evaluation, goodness or badness, of an object or concept but rather what one thinks exists or does not exist (Fishbein, 1967). Rokeach (1968:124) considers values to be beliefs also, where a value is an "abstract ideal...positive or negative not tied to any specific attitude object or situation, representing a person's beliefs about ideal modes of conduct and ideal terminal goals". Beliefs and values can be conscious or unconscious, perhaps defying an explanation as to why they are held. Often, the concepts of beliefs and attitudes are used interchangeably without distinguishing a belief from an attitude. There is a link between beliefs and attitudes in that attitudes are "an organization of beliefs around an object or situation predisposing one to respond in some preferential manner"; they have a dimension of judgment (Rokeach, 1968:112; McGuire, 1985:239). Thus, decisions are,

in themselves, reflections of attitudes. They are evaluative in nature and express the way people feel about something.

According to Ajzen and Fishbein (1980) and Rokeach (1968), the decisions a person makes about certain subjects are primarily based on the beliefs and attitudes he/she holds about the subject being considered. The collection of beliefs and attitudes around certain aspects of a person's social reality is called a "social paradigm" (Olsen et al., 1992) and it is used to make decisions about perceived reality. Because Virginia NIPF landowners have the freedom to manage their forested land as they choose, there is a great need to understand their social paradigms as they relate to forest resources. What are the beliefs and attitudes that they hold regarding forest resources? How do these beliefs and attitudes influence their land-use decisions, especially their decision to harvest?

Human decision-making behavior is complex. This, in turn, makes the study of beliefs and attitudes as they relate to behavior equally complicated. By the time adulthood is reached, a person may hold countless beliefs, forming that person's belief system--- "a set of interrelated beliefs, dealing with a broad social condition or type of activity" (Olsen et al., 1992:15). This whole belief system may have some psychological organization but not necessarily a logical one. Further complicating the complexity of studying beliefs and attitudes as they relate to human decision-making is that there may be inconsistencies in what humans say they believe and what they actually It has been suggested by several attitude researchers, including do. Rokeach (1968:128) and Heberlein (1981:241), that other levels of beliefs and attitudes may exist between the beliefs, attitudes and behavior which were measured, and that the other levels also need to be measured.

The question of how beliefs and attitudes held by NIPF landowners in regard to their forest resources affects their relationship with

forest resources, takes on more urgency as population shifts take place in the United States. There is a general movement out of urban areas to more remote rural locations (Bradley, 1984:5). Part of this trend adds to the number of private forest landowners who currently live in rural areas of the United States. Whatever the objective of their ownership, NIPF landowners have the potential to make a significant contribution to renewable resource management. It is estimated that NIPF landowners hold approximately 362 million acres, or 75% of all U.S. timberland (Alig and Wear, 1992). Timberland refers to any forest land "that can produce 20 cubic feet of industrial wood per acre per year and is not withdrawn from timber production or reserved for other uses such as wilderness" (Waddell et al., 1989).

Problem to be addressed and importance of the research

The problem which will be addressed by this research is the extent to which beliefs and attitudes held by Virginia NIPF landowners, regarding natural resources in general and forest resources in particular, affect their decisions to harvest. Different levels of beliefs and attitudes will be measured using hierarchical attitude theory. How certain cognitive and sociological variables, acting as direct causal or mediating variables (which influence the kind and degree of relationships between two other variables), may influence Virginia NIPF landowner beliefs and attitudes will also be examined.

Currently, little is known about NIPF landowners in the State of Virginia. The Virginia Department of Forestry would like to know more about who they are, what they want and how to reach them to implement stewardship programs. These programs are designed to assist Virginia NIPF landowners in making informed decisions about managing their forested land, be it for market or non-market commodities. Sociodemographic information provided by this research will be used to develop a baseline data set about NIPF landowners in the state. This research is also important in terms of gaining further understanding

about how the attitudes and beliefs of NIPF landowners in Virginia influence decisions they make about managing their forested land.

Maloney and Ward (1973) see the current concern over the long-term viability of natural resources arising from the effects of maladaptive human behavior toward the environment. They emphasize the need to understand human behavior by examining the beliefs and attitudes of the people involved. Without information on the general and specific beliefs and attitudes of Virginia NIPF landowners regarding forested land, it will be difficult to determine which level of beliefs and attitudes lead to decisions to harvest and which do not. A review of the NIPF literature will show that a great deal of information has been collected about NIPF landowners. However, none of the studies have focused on the relationship between the beliefs and attitudes these landowners hold regarding natural resources, and how the beliefs and attitudes might affect the choices NIPF landowners make about managing their forested land.

Gaining more insight into the beliefs and attitudes held by NIPF landowners in the Commonwealth regarding forestry and forest management, and thus, what may contribute to, or constrain, forest management decisions by the Virginia NIPF landowner, will assist the Virginia Department of Forestry in planning and providing forestry education to this group. Effective forest management programs are critical to the future of the forest resources in the Commonwealth of Virginia.

In order to develop effective forestry education programs for Virginia NIPF landowners, it is also necessary to discover the knowledge these landowners already have about forests and forest management. Part of this research is devoted to questions which test the levels of knowledge about forestry and forest management, from simple to complex, held by NIPF landowners in Virginia. What are their levels of knowledge? Is it as basic as knowing that pine species stay green yearround? Or, is it complex enough that they would know which harvesting

practice is most effective for regeneration of oak? By having information on the levels of forestry and forest management knowledge held by Virginia NIPF landowners, forest education programs can be designed at the most appropriate knowledge level. Although they may express concern about the future viability and health of their forested resources, Virginia NIPF landowners may not have the necessary levels of knowledge about forestry and forest management to make decisions which will achieve this viability.

Description of the dissertation

This dissertation explores how the beliefs and attitudes about natural resources and the environment, held by NIPF landowners in Virginia, affect their decision to harvest. Their levels of knowledge about forestry and forest management will also be examined. Using different belief and attitude scales related to natural resources and the environment, a model will be constructed which will examine causal relationships among different levels of beliefs and attitudes and how these relationships affect the decision to harvest. In addition, the model will include other causal variables, such as cognitive and sociodemographic variables, which might also influence harvesting decisions. Path analysis, a form of multivariate analysis, is a method applied to a causal model formulated on the basis of knowledge and theoretical considerations (Pedhazur, 1982), and will be used to explore these relationships. Path analysis is presented in a graphic format by using a path model. (For a more detailed explanation, see page 44 in Chapter 4).

In Chapter 2, the theoretical framework for the dissertation is discussed. In Chapter 3, a review of the literature is presented. This includes the belief and attitude literature, NIPF landowner literature, and literature about the environmental scales which will be used in this research. The research methods, including questionnaire design,

construction of the variable and measurement model and development of the causal model will be presented in Chapter 4. Research results are presented and discussed in Chapter 5 and the conclusions and implications of the study, as well as suggestions for further research, are addressed in the last chapter.

CHAPTER TWO

THEORETICAL FRAMEWORK

Beliefs and attitudes: From general to specific

According to Rokeach (1968:128), behavior is a function of attitudes involving two dimensions -- an attitude toward the situation which exists and the other dimension, an attitude toward the object under consideration. That is, attitudes about an object are tied to that object in a particular situation. Take the issue of clear cutting, a timber harvesting practice where all the trees in an area, regardless of age or size, are removed. The object under consideration is the practice of clear cutting. The other part of the equation is the situation in which clear cutting occurs. People may be opposed to clear cutting on mountain slopes in the western United States but faced with an area of dead oaks in the Appalachians, devastated by a gypsy moth infestation, the opposition to clear cutting the dead stand may not be as much of an issue. Thus, the object being considered remains clear cutting but, because the situation has changed, the attitudes towards the object are different. Rokeach (Ibid.: 126) suggests that in measuring attitudes when the focus is primarily on the object, without consideration of the situation, inconsistencies might be observed.

The question of attitude-behavior inconsistency is not new. Over forty years ago, Chien (1948:178) stated "people may act contrary to their attitudes". Snyder (1982) found this viewpoint supported by other empirical research which found weak links between attitudes expressed by individuals and their behavior in germane situations (Fishbein and Ajzen, 1975: Deutscher, 1973; Wicker, 1969). He suggests that this inconsistency raises the question of whether meaningful attitudebehavior relationships exist at all. Rokeach (1968:128) disagrees. He argues that inconsistency does not signify the lack of an attitudebehavior relationship but rather, that people must be acting in accord with "a second (or third or fourth) attitude that overrode the first in

importance", suggesting that attitudes may have a hierarchial structure. It may be that people do exhibit behaviors inconsistent with their expressed beliefs. But this may not be due to a lack of an attitudebehavior relationship. What may be true is that the level of attitude under examination is not specific enough to relate to the behavior exhibited, suggesting researchers may not have obtained all the information relevant to measure accurately the attitude-behavior relationship. This is also discussed by Heberlein (1981:241) who found that one needs to "draw out linkages" between different levels of attitudes (general to specific) and behavior.

Poole and Hunter (1980) reviewed the literature regarding the theory that attitudes have a hierarchial structure and are arranged logically. They cite works in two areas of research to support this-social psychologists who have proposed that attitudes are hierarchically arranged and researchers investigating human information processing, who also suggest this may be the case. In addition to proposing that attitudes are hierarchically and logically arranged, Hunter and Poole (1980:250) suggest that these logical arrangements flow one way, from more general to specific attitudes. More general attitudes influence less general ones but not vice versa (Ibid:250). Thus, to effect attitude change at the more specific level, messages would need to be targeted at the levels of attitude which preceded the more specific one being targeted for change. Based on this assumption, they have improved upon a hierarchical model first presented by Hunter et al. (1976) to measure causal relationships between levels of attitude which lead to specific behaviors. Heberlein (1981:261), in a review of different environmental attitude measures, provides support for the work of Hunter and Poole, speculating that "low correlations found in studies of attitudes and behaviors are due to the differences in specificity of the attitude and behavior measure", indicating that the attitude measures are usually very general with multiple items, yet aimed at a very

specific behavior. Richmond and Baumgart (1981) found environmental attitudes among fifth-year secondary school students to be hierarchically-related.

Bart (1972) explored how a hierarchy of attitudes toward the environment could be used to find which attitudes would need to be changed in order for a specific environmental attitude to be produced. He found that the attitudes in his study, which related to who in society should bear the costs of pollution, were hierarchicallyarranged. Based on his findings, he proposed that environmental curricula could use the hierarchy concept to plan a sequence of learning experiences to change damaging attitudes about the environment. He also found that attitudes relating to personal behaviors formed a linear hierarchy independent of other more public attitudes and that ecological attitudes with the fewest positive responses were related to restrictions on personal freedoms or personal purchasing patterns. Crespi (1971) found that attitudes which were specific and relevant to the object under consideration, rather than general attitudes, were better predictors of behavior. In a study on the use of lead-free gasoline, Heberlein and Black (1976) found that attitude measures that are more specific to a given behavior are better predictors of that behavior than more general attitudes. A study by Liska (1974) revealed that both specific and general patterns of behavior were only affected by attitudes of the equivalent level of generality. In research done by Weigel and Newman (1976), attitude scores which represented broad concerns about the environment made only modest predictions of behavior. However, when highly specific, behaviorally-focused attitude measures were used, the predictions were stronger.

Hierarchical attitude theory

Hierarchical attitude theory provides the theoretical framework for this dissertation on Virginia NIPF forest landowners. Hierarchical

attitude theory was used by Padmanabhan (1981) and is based on work by Hunter (Hunter et al., 1976; Poole and Hunter, 1980). Their work examines the logical, hierarchical relationship among attitudes and beliefs, specifically predicting the relationships between general and specific attitudes and beliefs as well as the relationship between attitudes, beliefs and behaviors. According to the model, the relationships between a general attitude or belief and a specific behavior are mediated by attitudes or beliefs of a more specific nature. General attitudes or beliefs are not highly correlated with any particular behavior but are superordinate to many attitudes or beliefs which <u>do</u> correlate with specific behaviors (Padmanabhan, 1981:4). Research by Fishbein and Ajzen (1974) and Tittle and Hill (1967) has supported this.

Padmanabhan (1981:10-15) has reviewed the literature concerning attitude-behavior relationships in conjunction with his research testing the hierarchical model by Hunter et al. (1976) and Poole and Hunter (1980). He notes that

General attitudes are not irrelevant. General attitudes become indirectly relevant to a large number of specific behaviors, though not maximally related to any one of them. Consequently, while a general attitude may not strongly affect one specific behavior, its effect on a large number of behaviors can be very large in total.

In a survey exploring the relationship between abstract environmental attitudes (that we are suffering from an energy crisis) and a specific behavior (returning beer bottles), Padmanabhan (1981) designed environmental attitude scales and then tested the concept of a hierarchical model. He found that 1) causal relations between a few environmental attitudes have a hierarchical structure, 2) the effects of a few central attitudes flow to a large number of more specific attitudes, and 3) behavior is more closely related to specific attitudes than to the general ones. In Padmanabhan's study, an intermediate level of beliefs mediated between general beliefs about resource shortages and specific beliefs that individuals could do something, which resulted in a particular outcome. He found that the influence of higher order general environmental beliefs on behavior is indirect and mediated by more specific environmental beliefs. Thus, the causal chain goes from general attitudes to a specific behavior:

General attitude Intermediate attitude Specific attitude Behavior

The influence of more general environmental attitudes on behavior is mediated by more specific environmental attitudes and within the hierarchy from general to specific, these beliefs are logically related to one another, either by logical implication or logical necessity.

Logical necessity and logical implication

Padmanabhan and Hunter (n.d.) found that in some cases, certain logical relationships exist between beliefs. In one, "logical necessity", acceptance of a preceding belief is necessary before the acceptance of the one following. In another, "logical implication", the relationships between the beliefs are logically implied, but it is not necessary to believe the first in order to believe the second. Logical necessity and logical implication offer explanations for certain causal relationships among variables and can contribute to a more complete understanding about why some people may exhibit a particular behavioral outcome and why others do not. It is important to understand the difference between the two because there are different rates of adoption among attitudes in the two types of relationships (Padmanabhan and Hunter, n.d.), and they can influence how one might design an educational program to change uninformed beliefs.

In cases of logical necessity, in order for an individual to progress to a more specific belief or attitude from a general one, that individual has to accept each attitude in the casual chain. In logical necessity, belief A is necessary for belief B; this means that belief B can only be held if A is held. Thus, if belief A is not held, then B will be not be held. For example, the proposition "there is a need to conserve forest resources" might have the proposition "there is a shortage of forest resources" as a logical necessity. If a shortage of forest resources were not perceived, then there would be no need to conserve them. Thus, "there is a shortage of forest resources" is logically necessary for "there is a need to conserve forest resources". However, while it is logically necessary for A to be true in order for B to be true, it does not mean that B is true--it may or may not be. Someone may believe "there is a shortage of forest resources" but not believe there is a need to conserve, as they may think that technology will be developed to mitigate the shortage. The rate of acceptance may be slower for beliefs which are related by logical necessity because until belief A is accepted ("there is a shortage of forest resources"), belief B ("there is a need for conservation of forest resources") will not be accepted. Even further, there is no guarantee that if A is accepted B will be accepted. It is also helpful to know if the relationship between beliefs is one of logical necessity as it can assist in developing an educational strategy, in this case an environmental one, to convince people to accept the beliefs. A relationship of logical necessity indicates that it may take more of an effort to design an environmental education program as it may involve several levels in the hierarchy-belief A and belief B. People who don't believe A will have to be convinced and, since there is no guarantee of acceptance of belief B even if A is accepted, it may also be necessary to convince people of belief B.

Logical implication is different. In cases of logical implication, the different beliefs logically <u>imply</u> one another. If A implies B, and A is believed to be true, then one can immediately conclude that B is true because it is implied by A. Contrary to logical necessity (where if A is not true, B will not be true), with logical implication if A is not held, it does not mean B will not be held--it may or may not be. Thus, it is not necessary that A be held to accept B. For example, someone may believe that "harvesting adversely affects wildlife habitat" (A) and therefore, "we need to provide more wildlife habitat" (B). For those who believe A is true, it then implies B. However, some may believe A to be false, but they may not believe B to be false. They may be a member of a local hunting organization that has knowledge about the positive effects of harvesting on wildlife habitat and may merely feel more wildlife habitat is needed so they can hunt.

In terms of the rate of acceptance, beliefs related by logical implication have faster rates of acceptance. For example, if one believes A to be true, then, because B is implied by A, B will immediately be adopted. Unlike logical necessity, one does not need to be convinced of belief B if they believe A to be true. Even if A is believed to be false, it will not be necessary to convince people of A before they would be willing to believe B. First, they may already believe it. Or, if even if they didn't, it still may mean less of an effort to plan environmental education programs as one only needs to be convinced of one belief--belief B. Suppose that people do not believe that "harvesting adversely affects wildlife habitat", and you want to convince people that more "wildlife habitat is needed", one could suggest a variety of issues which would provide logical implication. Loss of habitat to residential development and agriculture, or even the wish to view more wildlife, all might logically imply a need for more wildlife habitat. Thus, rather than focusing on

one specific belief, several could be presented that may be acceptable to convince people of the need for wildlife habitat.

Logical necessity and logical implication are relationships among beliefs and attitudes in a hierarchical chain but do not apply to the last link between beliefs and attitudes and behaviors.

Other non-belief causal variables

Causal variables, such as socio-demographic or information variables, can influence whether beliefs and attitudes are accepted from one level to the next. Non-belief variables may play four different roles: 1) as a causal-prior, where the non-belief variable is causally antecedent to the first belief; 2) as a moderating variable, which strengthens or weakens the relationship; 3) as a causal-alternative, where these non-belief variables may influence the second link in the hierarchy, or, 4) as an intervening variable, where the non-belief variable intervenes between two variables.

Because these variables will be used in a path analysis, they can play different roles and affect relationships of both logical necessity and logical implication. Because path analysis is concerned with correlations between variables, and there are no perfect correlations, it means that within each belief there are both those who have accepted and rejected the belief. Accepting beliefs in each level of the hierarchy is necessary before one can move down the hierarchy. The potential relationships are illustrated in Figure 1. Causal-prior variables could influence whether the first variable in chain is accepted or rejected. Causal-alternative variables could affect whether belief B is accepted. In terms of the logical implication relationship, because belief A is accepted, belief B will immediately be adopted, the influence of a causal alternative variable is on those who believe A to be false and may also have rejected B. In a logical necessity relationship, the influence will also be on the acceptance of B. The role of the mediating variable may always be one which strengthens or

weakens a relationship. It is the assumption of this model that intervening variables are only possible with relationships of logical implication. This is because with logical necessity, A is necessary for B, which means that no other variables intervene. In logical implication, this is not so. Intervening variables are possible as A implies B but is not necessary for B. Thus, there may actually be a causal chain, $A \longrightarrow B \longrightarrow C$, where B is intervening, but may not have been observed because it was not measured.



Figure 1: Effects of non-belief variables on belief and attitude hierarchies

Padmanabhan (1981:11) describes the hierarchical model as operating on the following premises: 1) that people respond to objects or concepts in three ways--with beliefs (about the states of the world), attitudes (emotion or affect) and behavior; and, 2) where objects or concepts are logically arranged, then beliefs, attitudes and behaviors will be related. Concepts can be frequently organized into logical classes or subclasses that have a superordinate-subordinate relationship with one another and are arranged at different levels from the most abstract and general to the most concrete and specific.

Hypotheses to be tested

The proposition being tested in this research is that Virginia NIPF landowners hold certain beliefs and attitudes about the environment and natural resources, and that this environmental view affects their forest land management decisions. A hierarchical model of beliefs and attitudes at the general level about conserving natural resources and at a more specific level about forest resources, will be used to test the following hypotheses. The first hypothesis to be tested follows one tested by Padmanabhan (1981). It is:

- beliefs, attitudes and behavior exist as a hierarchical network. Specifically,
 - a. causal relations between environmental beliefs and attitudes are structured in a set of hierarchical relationships;
 - b. the causal structure of environmental beliefs and attitudes is arranged from the most abstract and general to the most concrete and specific;
 - c. the relationships between beliefs and attitudes at different levels of the hierarchy will be related by logical necessity; and
 - d. the influence of higher order beliefs and attitudes on behavior are indirect and mediated by more specific ones.

This hypothesis tests that environmental beliefs, which lead to a particular behavioral outcome, exist in a hierarchical structure from general to more specific and that levels of beliefs and attitudes are related by logical necessity. Further, it will test that higher levels of beliefs and attitudes have an indirect relationship with behavioral outcome and will be mediated by more specific beliefs and attitudes toward the behavioral outcome.

The second hypothesis will add to the previous work done with the hierarchical model. It is:

2) additional variables, non-belief variables acting as causalpriors, causal alternatives and moderators, influence the logical necessity relationships in the belief hierarchy and provide more explanation about why certain beliefs at the different levels may be accepted.

This examines the proposition that as more variables are added to the model, their effect can help explain why individuals may move from one level of beliefs or attitudes to the next and why some do not.

CHAPTER THREE

LITERATURE REVIEW

The hypotheses put forth in Chapter 2 will test the relationships between socio-demographic factors, beliefs and attitudes, and other nonbelief causal variables and decision-making behavior. The literature review covers these issues, both in general and in relation to NIPF landowners.

NIPF landowners, socio-demographics and decision-making

Human interactions with forests or forestry-related issues have been studied from various perspectives, one being socio-demographics. In general, these surveys reported that NIPF landowners who held occupations as farmers/ranchers, professional and skilled persons, and retired persons were more likely to own forested land than those NIPF landowners who held other occupations. Among NIPF landowners, they are more likely to be white than other races, male rather than female, over 45 years of age than under, and are more likely to have completed at least 12 years of formal education. Most NIPF landowners were individual forest-land owners, as opposed to other NIPF ownership types such as private corporations or associations. Among NIPF landowners, their income and length of ownership varied. For NIPF landowners, purchase was the most common method of land transfer although acquiring land through inheritance was also cited. The majority of NIPF landowner respondents lived on or near their forested land (Kingsley and Finley, 1975; Kingsley, 1976; Birch, 1979; Kingsley and Birch, 1977 and 1980; Carpenter et al., 1982; Carpenter and Hansen, 1986; Greene and Blatner, 1986; Blatner and Greene, 1989; Rossen and Doolittle, 1987; and Hickman, 1984).

Socio-demographic variables have been shown to have an effect on who joins environmental organizations. In a study of four groups of forest recreationists in Michigan, Nelson (1987) found that certain

socio-demographic (education, income, gender, residence location and ownership of forested land) differences existed among the four groups. The groups who were highest in education and income were the most likely to be members of preservation or conservation groups. These results were supported by another study, which explored a socio-demographic profile of Sierra Club members. It found that members of the Sierra Club tended to have more professional occupations and higher income levels than non-members (King, 1989).

In an effort to identify communication media which might influence forest land-use decisions NIPF landowners in Maryland (Kingsley and Birch, 1980) and Kentucky (Birch and Powell, 1978) were asked to indicate which publications they read or organizations they joined which were related to natural resource issues. In both studies, the majority of NIPF landowners surveyed were not members of any conservation, farmer or sportsman's associations. When they were active, the National Wildlife Federation was the most predominant organization in Maryland and different sportsman's clubs predominated in Kentucky. In Maryland, <u>National Wildlife</u> and <u>Ranger Rick</u>, both publications of the National Wildlife Federation, were the most widely read. <u>Field and Stream</u> and <u>Sports Afield</u> were next. In Kentucky, <u>Kentucky Farmer</u> was most widelyread followed by <u>Field and Stream</u>.

In a Michigan study, Nelson (1987) found that a small to moderate amount of variance in attitudes about timber management was explained by differences in social memberships--forest recreationists (hunter or anglers) or those politically active in the forest management process in Michigan, who had either requested information or commented on Michigan's forest management policies.

In terms of land use decisions, Kingsley and Birch (1980) explored whether Maryland NIPF landowners read environmental publications or join similar organizations and concluded that owners who are interested enough to join a conservation organization or subscribe to a publication

were primarily interested in wildlife resources and few had an interest in managing their forested resources for timber production.

Many studies have focused on the socio-demographic characteristics of NIPF landowners who would be most likely to make certain land-use decisions regarding their forested land. Studies have explored whether NIPF landowners have harvested, the practices used and whether professional forestry assistance was sought (Kingsley and Finley, 1975; Kingsley, 1976; Birch, 1979; Kingsley and Birch, 1977 and 1980; Carpenter et al., 1982; and Carpenter and Hansen, 1986). It was found that for those respondents who said they had harvested, harvesting practices seemed to depend on the size of the landholding. Owners of smaller forested land holdings (less than 50 acres), used the selection method and diameter cut most often when harvesting. Clear cutting was the least cited but was used on the majority of large tracts, usually more than 100 acres. In terms of who selected the trees to be harvested, NIPF landowners with forested holdings in the small to medium-sized category (10 to 100 acres) most often reported that they were the ones who selected the trees, without forestry assistance. Overall, only 10-18% of NIPF landowners who harvested requested forestry assistance, which was provided by the state agency responsible for forestry activities. In general, those requesting forestry assistance tended to be younger than the average NIPF landowner, better educated, have a higher income level and larger land holdings than those who did not request forestry assistance. When asked about using private consulting foresters or industry foresters, only a few NIPF landowners did so. This group usually had significant amounts of forested land, in some cases enough to employ their own forester.

Binkley (1981), Holmes (1986), and Hyberg and Holthausen (1989) found that levels of income and education of NIPF landowners are related to decisions not to harvest. In the Northeast and Southeast, NIPF landowners with higher incomes and education levels are less likely to
harvest timber than those NIPF landowners with lower incomes. In Michigan, Carpenter and Hansen (1986) also studied intentions to harvest. Those who had occupations as professionals, executives or skilled labor indicated an intent to harvest. Farmers were least likely. This, however, is contradicted by results from Greene and Blatner (1986). They found that with NIPF landowners in the Ozarks being a farmer, more years of formal education, and larger woodland sizes were positively associated with timber management. Retired NIPF landowners were found least likely to manage their timber, although they do harvest. In Minnesota, occupation did not seem to have as important an influence as the size of landholding (Carpenter et al., 1982).

While many studies have examined the reasons why decisions regarding certain forest management practices were made, none have explored the possibility of a hierarchical set of relationships among beliefs and forest land-use decisions.

Beliefs, attitudes and NIPF landowner decision-making

Beliefs about forest-land management are particularly important when addressing the question of sustainability and the need for stewardship. If those who do not harvest have attitudes and beliefs about certain forest management practices related to harvesting which are uninformed, then part of a stewardship program strategy would be to identify areas where education about forestry or forest management practices would be needed to dispel any uninformed beliefs. Knowledge of the beliefs held by NIPF landowners is important to gain insight into factors which may constrain certain forest land-use decisions.

In several studies, (Kingsley and Finley, 1975; Kingsley, 1976; Birch, 1979; Kingsley and Birch, 1977 and 1980; Carpenter et al., 1982; Carpenter and Hansen, 1986; Greene and Blatner, 1986; Rossen and Doolittle, 1987; Hickman, 1984; and Brock et al., 1985) NIPF landowners did not harvest because they believed that it would destroy the scenery

and/or hunting. They also expressed an opposition to harvesting and distrust of loggers. Beliefs held by New England NIPF landowners regarding wildlife management on their lands affected the decisions they made about harvesting. Few harvested or had an intention to harvest as it was believed to be threatening to wildlife management (Alexander and Kellert, 1986). Blatner and Greene (1989) found somewhat different results. The NIPF landowners who said they did not harvest believed their woodlands to be too small but they did not hold anti-timber management attitudes. In fact, many showed an interest in managing their forested land for non-market objectives such as recreation and wildlife management.

Using qualitative methods, Brock et al. (1985) assessed the beliefs and attitudes of retired NIPF landholders in West Virginia regarding their forested property. One part of the study addressed the issue of sustainability, that is, there were few NIPF landowners who had concern about the future viability of the resource and were actively managing their forested land. For those who harvested, many did not know about professional forestry assistance or believed they had enough knowledge about forest management, although this was not tested. Most of the respondents said they did not harvest and they had negative attitudes about loggers and timber cutting, which were mostly centered around the condition of the land after logging. Much of the concern focused on the damage done to young stock, erosion resulting from roads and skid trails and damage from heavy equipment to farms roads and fields. The majority of the owners interviewed felt clear cutting was bad.

Two longitudinal studies of attitudes towards harvesting had interesting results. In a study from three different time periods in Michigan, Carpenter (1985) found that even though forest land changed ownership during the 20 years between the three studies, the proportion of landowners favoring or opposing timber harvesting was reasonably

constant. Similar results were reported from a study in Delaware (Turner et al., 1977), where the proportion of NIPF landowners who said they would never harvest remained constant, even though some parcels had been transferred to new owners. New owners may hold different attitudes toward forest management or, the same owners may change their attitudes as either circumstances or perceptions change.

Other causal variables and NIPF landowner decision-making

In addition to beliefs and attitudes, other causal variables may influence why certain forest land-use decisions are made, such as reasons for ownership, reasons for not harvesting and levels of knowledge about forestry and forest management.

Why people own their forest land has been the basis of numerous studies, in an effort to link reasons for ownership with land-use decision-making. Kingsley and Finley (1975), Kingsley and Birch (1977 and 1980), Carpenter et al. (1982), Greene and Blatner (1986), Rossen and Doolittle (1987), Hickman (1984) and Brock et al. (1985) investigated reasons for owning forested land, whether the landowner has harvested, and if they did, why they did so. In terms of reasons for ownership, aesthetics, recreation and the fact that it was part of a residence were primarily cited. Those who owned their forested land for a primarily economic reason, to realize profits from forest products, were more likely to harvest than those who owned their land for aesthetics -- non-economic commodities such as scenic beauty, recreation, etc. (Kingsley, 1976; Kingsley and Birch, 1977; and Birch and Kingsley, 1978). Haymond (1988) found similar results in her study on NIPF landowners identified as "opinion leaders" in eight rural counties in South Carolina. The study focused on why these NIPF landowners valued their forest land. They indicated they valued their land primarily for lifestyle enhancement (viewing wildlife, privacy, recreation, etc.), although many did indicate an interest in economics and timber

production. Haymond also found that with this particular group there was a relationship between occupation and reasons for valuing their forest land--those who did not derive their main income source from products from their forested land valued it more for aesthetic reasons or lifestyle enhancement. However, those who did derive their principal income from their forested resources were more interested in economics and timber production. Greene and Blatner (1989) found similar results, that is, owners who managed or sold timber expressed financial objectives for their woodlands, rather than aesthetic objectives.

Other reasons given for not harvesting had to do with the physical resource--the timber was too immature, the area too small, the timber of too poor quality or too small a volume (Binkley, 1981; Holmes 1986; Hyberg and Holthausen, 1989; Kurtz and Lewis, 1981).

In a number of studies, economic issues associated with forest management and perceptions of the market for the timber influenced land use decisions. Binkley (1981), Holmes (1986), and Hyberg and Holthausen (1989) found that reasons least often given for not harvesting were more temporary in nature: market prices too low; selling land; land in unsettled estate; saving it for heirs; retirement or emergency income; or no market. Kurtz and Lewis (1981) used a psychological testing technique (Q-sort) to determine why NIPF landowners arrive at certain decisions. They developed a framework which explored owner motivations for making certain timber management decisions (Ibid: 285). The framework involved motivations, objectives, and constraints which led to forest management strategies. Owner types were then established using this technique. They found that certain constraints, e.g., the market for timber at the time or certain societal issues such as the lack of financial assistance for replanting, impeded forest management decisions. Alig et al. (1990) explored some of the economic reasons NIPF landowners choose to harvest and suggested that an NIPF landowner's decision to harvest is based on market factors, such as changes in

interest rates and changing policy environments. These factors influence forest-land management as they affect NIPF landowner decisions regarding planting rates, silvicultural treatments for stand management and when to harvest. Brock et al. (1985) found a reluctance on the part of West Virginia NIPF landowners to invest a lot of money in forest management due to the long-term nature of realizing a return on their timber resources.

In their study of NIPF landowners in the Ozarks, Greene and Blatner (1986) found that those who had contact with a forester were more likely to manage their timber that those who had no contact.

Knowledge about the environment, and the effect of this knowledge on behavior, is important in trying to understand what leads to certain decisions. Dispoto (1977), in a study of students at Rutgers University, found that knowledge about the environment had a moderate effect on their behavior regarding environmental issues. The author concluded that "what people know about the environment may be more important than what they feel about it" in terms of environmental behavior (Ibid:458). Arbuthnot and Lingg (1975) reported that culture may have an influence on whether environmental knowledge affects environmental behavior. In a study on differences in recycling behaviors between a group of Americans and a group from France, they found that there was a high degree of consistency between environmental action and both general and environmentally specific attitudes for the Americans but not the French. Environmental knowledge also predicted environmental action for the Americans but, again, not the French. They concluded that environmental knowledge acts a mediating variable between attitudes and behavior.

A search of the literature did not indicate any studies that empirically examined the relationship between knowledge of forestry and forest management and forest land-use decisions. However, studies were found which focused on certain aspects of knowledge about forestry,

although they did not investigate the influence that the knowledge held by the respondents may have had on their specific forest management decisions. One study (Kingsley and Birch, 1980) explored conservation and forestry knowledge, although the guestions were very general. The authors concluded that in order for forested land to be managed for the production of renewable forest resources, a good deal of forestry education would be needed as the knowledge level of the respondents was low. In the South, Kaiser (1985) found that many NIPF landowners held the belief that after pine forests are harvested, natural regeneration would suffice to produce the same quality stock of pine which existed prior to harvesting. This indicates a lack of knowledge on the part of these NIPF landowners as, in the majority of cases, site preparation, e.g., prescribed burning, the application of herbicides, and replanting pine seedlings, is necessary to ensure good stocking levels. Without this preparation, hardwoods will reestablish dominance on the site. Healy and Short (1981) mention that foresters find new landowners may be misinformed about the economics of harvesting and how it could benefit them and this lack of information tends to lead more to a "preservationist" attitude than one of conservation.

General environmental beliefs

Padmanabhan's scales

Padmanabhan (1981) developed belief and attitudes scales to test for environmental attitudes about recycling. He was interested in how beliefs and attitudes are hierarchically-related (see discussion on theoretical framework, Chapter 2), and the scales he designed reflected hierarchical levels of beliefs and attitudes, from a general, abstract level to a more specific level where the beliefs and attitudes specifically addressed recycling. For this research, several of the scales are universal enough that they provide measures which can adapted and applied to NIPF landowners in Virginia to capture their beliefs and

attitudes about the environment. Because he was interested in recycling, the beliefs he designed for the most specific level are not relevant.

To measure concern about the environment at the most general abstract level, Padmanabhan tested for beliefs such as "the resource shortage is real", "the resource shortage is serious", "consumers must conserve" and "individuals can help conserve". The next level of beliefs and attitudes was more focused and addressed the society's responsibility towards resource use using scales which measured the level to which society should control resources and the rights of society versus the rights of individuals.

One of the limitations of Padmanabhan's research is that he did not explore the effect of any non-belief causal variables, such as socio-demographics, on beliefs and attitudes in the hierarchy.

The NEP scale

The NEP (New Environmental Paradigm Scale) (Dunlap and Van Liere, 1978) is similar to Padmanabhan's in that it measures general level beliefs and attitudes about the environment. The basic assumption underlying the NEP scale is that humans are equal members of the natural world and not exempt from the cause and effect of their interactions with the physical environment. Instead of resources being seen as limitless, the NEP contends that humans must live within the constraints imposed by finite resources.

In contrast to Padmanabhan's scales, the effects of sociodemographic variables on the NEP scale have been explored. Studies using the NEP scale have focused on the relationship of knowledge and socio-demographics to general environmental attitudes. Abbott and Harris (1986) used the multi-dimensional NEP scale to test the relationship of socio-demographic characteristics with environmental attitudes of residents of northern New York state and unlike other studies, found that acceptance of the scale was not highly correlated

with socio-demographic characteristics. Arcury et al. (1986) and Arcury and Johnson (1987) explored the relationship of the NEP scale and sociodemographic characteristics with knowledge about environmentallyrelevant issues. A positive environmental attitude, higher income and education levels and being male were associated with higher levels of knowledge. However, a self-reported measure of environmental knowledge was used and the authors stressed the need for a better measure--that is, one that tests actual knowledge by asking respondents questions for which there are right or wrong answers. In a 1990 study, Arcury again used the NEP scale to test whether environmental knowledge has an association with environmental attitudes, as well as the direction of the knowledge-attitude relationship. He found a direct relationship but it weakened when socio-demographic controls were applied. While he felt the relatively strong correlation of education to both knowledge and environmental attitude suggested that knowledge leads to attitude, causality was not resolved. In a third study (1990), Arcury and Christianson examined the influence of a drought in Kentucky on environmental attitudes using the NEP scale. Data was examined from surveys done in 1984 and 1988. They found a small increase in environmental attitudes over the four-year period, the most significant increase being in the county which had actually experienced water restrictions. In addition, environmental attitudes were positively associated with education, income, living in more urban areas and being male. Caron (1989) studied the environmental attitudes of urban blacks and found that there was moderate support for the NEP scale. Additionally, it was found that the more years of education the respondent had, the more likely they were to hold positive environmental attitudes associated with the NEP scale.

The relationship between attitudes, knowledge and sociodemographic characteristics relevant to environmental issues has been the focus of other researchers. Ramsey and Rickson (1976/77), in a

study which investigated the relationship between attitudes and knowledge relevant to environmental issues, suggest that knowledge and attitudes have a circularity, that is where one does not solely precede the other but rather some knowledge may lead to certain attitudes and more gains in knowledge are made with a new attitude. They report that knowledge appears to lead to moderate attitudes about the environment, as opposed to leading to more strongly-held or more weakly-held attitudes. Socio-demographic factors such as higher levels of education, and more information from mass media were also found to lead to more moderate attitudes about the environment. However, earlier research by Bultena et al. (1975) involving citizens living near a proposed reservoir project contradicts this. He found that higher levels of education led to more intense attitudes, pro and con. Sigelmann and Yaranella (1986), testing a multivariate model of knowledge about the economy and the environment, found that the primary factors related to knowledge about the environment were gender, race and education, with age and income displaying no independent relationship.

Hypothesized hierarchical model

The issues discussed in the theoretical framework and the literature search--the hierarchical arrangement of environmental beliefs and attitudes, the effects of socio-demographics and other causal variables on these beliefs and attitudes and the effects of the beliefs and attitudes on forest land-use decision-making, have been brought together in a hypothesized model. The hypothesized model will provide a framework for constructing the measurement model for the path analysis.

It is hypothesized that NIPF landowners in Virginia will make decisions about managing their forested land based on their beliefs, attitudes and levels of knowledge they have about forestry and forest management. These decisions will also be influenced by other nonbelief variables, external to the hierarchical belief chains.

The behavior being investigated is whether private forest landowners make the decision to harvest timber (Figure 2). It is further hypothesized that in the model, the beliefs and attitudes which lead to the outcome variable (decision to harvest) will be hierarchically-arranged from general to intermediate to most specific and that these hierarchies will be related by logical necessity. The different levels of beliefs and attitudes found in the hierarchical model are indicated by the labels on the left of the model--general, intermediate and specific. The variables below the specific level indicate other causal variables which could potentially influence the decision to harvest. The general level is designed to measure more general, abstract beliefs about the environment. It is composed of scales from Padmanabhan's research and the NEP scale. Beliefs about the whether the resource shortage is real, whether humans need to live within the confines of finite resources (NEP), whether the resource shortage is serious, whether consumers can conserve and whether individuals can help are all very general. At the intermediate level, the beliefs are designed to be somewhat more specific in regard to resources and resource use. Beliefs about conserving Virginia's forested resources and whether society, including the State of Virginia, should be control resource use are explored. At the most specific level, the scales are related to questions about the rights of Virginia NIPF landowners to do what they want with their land as well as their obligation towards conservation and managing their forest land for future generations.

The construction of the hypothesized model begins with the influence of socio-demographic variables on other variables. Based on the literature, it is hypothesized that the socio-demographic $(1)^1$

¹The number in parentheses corresponds to the variable number in the hypothesized model in Figure 2.



Figure 2: Proposed hierarchical model: Levels of beliefs and attitudes, and other causal variables which afffect Virginia NIPF landowner's decision to harvest

variables, e.g., age, education, income, occupation and location of current residence (rural versus urban) will have a direct effect on whether environmental/conservation organizations are joined and/or similar publications which are read (2). This includes younger NIPF landowners; NIPF landowners with more education; NIPF landowners with higher incomes: and, NIPF landowners who hold more professional occupations, who would be more likely to join environmental/conservation organizations. These same socio-demographic variables are hypothesized to have an influence on whether it is believed the resource shortage is real (3) and that resources are finite and humans must live within the constraints imposed by finite resources (NEP scale) (4). Based on the NIPF landowner literature, it is also hypothesized that sociodemographic variables will have a direct effect on reasons for ownership of forested land and reasons for not harvesting. NIPF landowners with higher education and income levels will be more likely to own their forested land for non-economic reasons and to be less likely to harvest. The researcher does not hypothesize a direct relationship between sociodemographics and other causal variables but makes the assumption that the potential effects will be indirect with beliefs and attitudes acting as intervening variables.

Whether one joins environmental/conservation organizations and/or reads similar type publications (2) is also hypothesized to have a direct influence on whether or not it is believed that the resource shortage is real (3). Those who do join these organizations or read similar publications will be more likely to accept that the resource shortage is real.

Based on hierarchical attitude theory, the Virginia NIPF landowners will move down the hierarchy to the intermediate level of attitudes if they accept the attitudes at the general level of the model. In order to move down the hierarchy from the general level to the intermediate level, beliefs at the general level must first be

accepted, based on the premise of logical necessity. For Virginia NIPF landowners to believe that resources are finite and humans must live within the constraints imposed by finite resources (NEP scale) (4), they must first accept that there is a reason to be concerned, e.g. that there is a resource shortage (3). If there is no concern about a resource shortage, then there will not be a concern about how finite resources are. Once Virginia NIPF landowners accept that there is a shortage (3), then they can move to the next belief--that resources are finite and humans must live within the constraints this imposes (4). Believing resources are finite (NEP) (4) will allow the NIPF landowner to consider the seriousness of the resource shortage. If they don't consider resources finite, then any concern about resource shortages will not be perceived as serious. Assuming that Virginia NIPF landowners do believe in a resource shortage (3) and do believe it is serious (5), then they will decide how they believe it might be alleviated. Some will believe the shortage is serious (5) and believe that consumers as a group, can help to alleviate it (6). Others, will believe that the shortage is serious (5) but see their role as individuals as being more important and not dependent on group action (7). If they don't feel the resource shortage is serious, then they will not feel the need to conserve or help alleviate the shortage.

Once beliefs are accepted that consumers or individuals can alleviate the resource shortage, they can move to the intermediate level and consider conservation of Virginia's forest resources (8). If they do not believe that consumers as a group or individuals themselves can make a difference, then they will not be able to consider conservation of Virginia's forested resources.

At the intermediate level in the hierarchy, there will be concern over the conservation of Virginia's forest resources and the role of society, that is, the citizens of Virginia, in controlling natural resource use. Those who accept that society must control resources and

that society's rights should prevail over individual rights (9), must first be concerned that there is a reason for controlling resources. They must feel that Virginia's forests need conserving and that society must assume this responsibility (8). Thus, if society controls resources, conservation can be more of a priority.

Once it is accepted that society has to play more of a role in controlling resource use, Virginia NIPF landowners will be able to move to the most specific level of the belief hierarchy which deals with beliefs related to their own private forest lands. Those who accept that society has rights over individual rights when it comes to Virginia's resources, will accept that Virginia NIPF landowners do not have the right to do whatever they want with their forested land (10) regardless of the consequences. Once one accepts that they do not have the right to do what they want with their land regardless of the consequences (10), they will then be able to consider beliefs related to issues about conservation. When one is concerned about the consequences of their actions on their forested land, they will be more likely to believe that conservation issues must be weighed alongside decisions to make profits from their forested land (11). Those who do not accept that conservation must be considered with profit-making decisions on their forested land, will be less likely to believe that they have a moral obligation to protect their land for future generations (12). However, those who do believe that they have a moral obligation to protect their forest land for future generations (12) will have accepted the belief that conservation must be considered when making decisions regarding profit from their forested lands. Because one believes in a moral obligation to protect their forested land for future generations, it would seem that they would be likely to decide to harvest trees (20) from their property as this is a strategy for renewable forest resources management.

Even though the Virginia NIPF landowner believes in managing his/her resources so that the needs of future generations can be met certain variables may have an influence on whether the decision to harvest is actually made. These include the reasons why the Virginia NIPF landowner owns the forested land (13) (e.g., for non-financial or financial commodities), their knowledge of forestry and forest management (14), whether they participate in forest land-use programs (15), reasons for not seeking professional forestry assistance (16), whether they seek professional forestry assistance (17) and their reasons for not harvesting (18).

The hypothetical model will now be used to construct a measurement model for a path analysis to explore the causal relationships among the variables.

CHAPTER FOUR METHODS

Sample selection

In April of 1991 a mail survey was sent to 1306 randomly chosen persons, with both in-state and out-of-state addresses, who own forested land in Virginia. This method was chosen because it could reach the greatest number of NIPF landowners in the most cost-effective manner. These Virginia NIPF landowners were selected from six randomly chosen forested counties in Virginia (Figure 3) which the Virginia Department of Forestry felt contained adequate forest land to get a sufficient number of NIPF landowners. Counties with large urban centers (e.g., those in Northern Virginia near Washington, D.C. and in close proximity to Richmond) and had little forested land were excluded from the random selection.

The population surveyed was Virginia NIPF landowners with 20 or more forested acres. Twenty forested acres was chosen as a cut-off because it is the minimal amount of forested land one can own and participate in forest land-use programs in the counties which have them. Forest land-use programs allow those landowners with 20 acres or more of forested land to qualify for a county tax exemption if they apply for the program and meet certain qualifications (e.g. having a forest management plan prepared by a professionally-trained forester). The determination of whether a county has a forest land-use programs is made by the county, not at the state-level. The reason forest land-use was considered was to investigate whether those Virginia NIPF landowners who lived in counties with a forest land-use program and participate in the program had higher levels of knowledge than those who either lived in a country with a forest land-use program.

A multi-stage sampling method was used to select the Virginia NIPF landowners for the survey. The first stage was to select counties in

Virginia and the second stage was to select NIPF landowners within the county. For the first stage, representative county selection was based on two criteria: 1) that each geographic region in the state be represented--the Coastal Plain, the Piedmont and the Mountain area, and, 2) that of the two counties selected from each region, one county had forest land-use and one did not. This means that in one county in each region had a forest land-use program in which Virginia NIPF landowners could participate. The other county did not have the program. Having counties with and without forest land-use will allow a comparison between counties in the same geographic area to see if there may be an effect on knowledge levels given the forest land-use requirement to have a professional management plan. The six counties chosen are listed below (see Figure 3).

<u>Counties with forest land-use</u> Mountain--Warren County Piedmont--Madison County Coastal Plain--Gloucester County

<u>Counties without forest land-use</u> Mountain--Highland County Piedmont--Prince Edward County Coastal Plain--Greensville County

These six counties provided the sampling frame from which a random sample of Virginia NIPF landowners was selected to be surveyed. In each county, between 195-250 NIFP landowner names were drawn using an interval sampling method. In this case, it was an interval between names, using a random starting place, which one counted in order to draw a sample for the county, based on the number of landowners in the county. Since the number of landowners in each county varied, the interval that one would use between names also varied. For example, in Warren county the interval between names was fifteen. Thus, every fifteenth name would receive a questionnaire, unless the name was a duplicate. In this case, the interval continued until a name was identified which was not a duplicate. The county tax records in each county clerk's office were used to draw the names in the random sample



because they are updated yearly for tax assessment and would provide the most up-to-date source of addresses. Information on the amount of forested land held by landowners in the county was also available through cross-referencing a land-use file. As each name was selected, it was cross-referenced to ensure it met the 20-acre criterion.

This multi-stage random sampling process was used in order to ensure a representative sample of Virginia NIPF landowners who own more than 20 acres, without bias to region or county forestry programs.

Questionnaire design

A questionnaire (Appendix A) was designed, based on the literature search and hypothesized model, to elicit responses from Virginia NIPF landowners in the following areas: socio-demographic characteristics; beliefs and attitudes about natural resources in general and forest resources in particular; knowledge about forestry and forest management; and, behaviors involving different aspects of forest management practices such as harvesting practices. In order to account for the total number of acres owned in each county, including ownership of multiple parcels, the respondents were permitted to answer questions pertaining to characteristics of land ownership (i.e. length of ownership, type of ownership, etc.) and harvesting practices for up to five parcels. The areas of the questionnaire, and the content of the questions are discussed.

Pretest

A pretest was done by means of interviews, not by mail. The interviews took place in Albemarle County, Virginia, in March 1991. Twenty NIPF landowners, with varying sizes of acreage and who had made various forest management decisions, were interviewed. The pretest sample was interviewed using the questionnaire to determine its clarity, feasibility, comprehensiveness and completion time. The interviewees were asked to identify any words, ideas, or other concepts which they

did not understand. In addition, they were asked at the conclusion of the interview to identify any concerns which they felt may not have been addressed by the questionnaire.

Cover letter and follow up mailings

Upon completion of the pretest and necessary revisions the questionnaire was reproduced and mailed with a cover letter. The cover letter format used followed that proposed by Dillman (1978:169). The cover letter included such items as study objectives and its social usefulness; why the respondent's answer was important; a promise of confidentiality and an explanation of the identification number on the questionnaire; why the study might be useful to the respondent; and what to do if questions arose. The cover letter, questionnaire and a return envelope were sent to 1306 Virginia NIPF landowners whose names were randomly drawn in the six counties. Two hundred thirty-four (234) were sent to Highland county; 227 to Warren county; 200 to Gloucester county; 195 to Prince Edward; 250 to Greensville; and 200 to Madison. They were sent bulk mail due to the cost of first class postage (\$1.30 each) and the reality of a limited research budget. Envelopes were addressed with labels from a word processor. The cover letter and envelope had the logo and address of the Michigan State University Department of Forestry to encourage landowners to open the packet and to discourage against bias which might be generated if stationery from the Virginia Department of Forestry was used.

A week after the initial mailing, a follow up postcard was sent, with first class postage, to everyone. Three weeks after the date of the first mailing, a second letter and replacement questionnaire were sent, again by first class postage, to those who had not responded. While it would have been desirable to send a third questionnaire seven weeks later by certified mail, neither time nor financial resources would permit this. All follow-up correspondence addressed the issues which Dillman (1978: 183-190) stresses. For example, the postcard

thanked those who had responded and encouraged those who had not done so to do so. The successive follow-up letters emphasized the importance of the study and the respondent's participation. The cover letters can be found in Appendix A.

Response Rate

Of the original 1,306 surveys which were mailed out, 119 were undeliverable either because the address was incorrect, the Virginia NIPF landowner had moved and left no forwarding address, or the addressee was deceased. The total reaching the intended addresses was 1,187. Six hundred and fourteen (614) people responded to the survey, resulting in a response rate of 51.7%. Of the 614 responses, 531 questionnaires provided usable data for the survey. It was determined that a sample size of 531 was sufficient to allow results to be generalized to the state as a whole and produced an estimated sampling error of less than 4.5% (Ott et al., 1983:201-203).

The reasons why 83 were not able to be used included only minimal or incorrect completion of the questionnaire or because respondents indicated they did not own at least 20 forested acres. The number of usable responses by county are listed below:

Area	<u>Land-use</u>	Responses	<u>No Land-use</u>	Responses
Nountains	Warren	99	Highland	100
Piedmont	Madison	79	Prince Edward	85
Coastal Plain	Gloucester	88	Greensville	80

Method of analysis--path analysis

Data from the questionnaires was analyzed using SPSS/PC+ (SPSS, Inc., Chicago), PACKAGE (Hunter and Cohen, 1969) for confirmatory factor analysis, and PATHPAC (Hunter and Hunter, 1977) to run the path analysis.

Path analysis is a method applied to a causal model formulated by the researcher on the basis of knowledge and theoretical considerations (Pedhazur, 1982). A path diagram is used as graphical representation of the casual relationships among the set of variables that will be subjected to path analysis. The causal flow in the path diagram is unidirectional. In other words, at a given point in time, a variable cannot be both a cause and effect of another variable. Among the assumptions made with path analysis are that 1) the relationship among the variables in the model are linear, additive and causal; 2) there is a one-way causal flow in the system and reciprocal causation between variables is ruled out; and 3) the variables used are measured on an interval scale. The strength of the relationship between variables is indicated by the path coefficient. Path coefficients "indicate the direct effect of a variable hypothesized as a cause of a variable taken as an effect" (Ibid: 583). In a path analysis, path coefficients are derived by ordinary least squares estimation by regressing each variable onto its causal antecedents. If a variable has only one antecedent, then the path coefficient is the correlation between the dependent variable and its antecedent. If the variable has a number of antecedents, the path coefficients are the standardized regression coefficients, or beta weights, obtained from the multiple regression of the dependent variable onto the antecedent variables within the model.

Questionnaire content and zero-order results

Taking into consideration the data collected and content of the hypothesized model, a determination was made as to which items would be necessary to construct the measurement model. Seventy-three items were identified by the researcher. A correlation matrix was run on the items and can be found Appendix C. The items were then grouped into the scales and items represented in the hypothesized model--sociodemographics; access to environmental information; general, intermediate and specific attitude and belief scales; and other causal variables. A total of forty (40) scales and items resulted. The scales and items are listed below, following the format of the hypothesized model.

Socio-demographic characteristics $(1)^2$

The socio-demographic items chosen for the model included age, education, income, retirement status, occupation, where the respondent now lives (rural vs. urban area), where the respondent grew up (rural vs. urban area), whether s/he lives in a county with a forest land-use program or not, the total amount of forested acres they own and the region in which they own the forested land.

Age, education and income are interval variables and will be used as such in the path model. However, to provide an idea of their distributions, they have been presented in categories and these frequencies can be found in Table 1.

Table 1. Age, educa	tion and income
---------------------	-----------------

Items	Percentage responding	(n)	
		508	
0-45 years	17.1		
46-60 years	33.1		
61-70 years	28.3		
71 + years	21.5		
Education		518	
Grade school and some high school	15.4		
Finished high school	24.9		
Some college	13.9		
Finished college	21.2		
Beyond college	24.5		
Income		L.R.L	
Less than \$20,000	10 4		
\$20 000 to \$39 000	25 4		
840 000 to 660 000	26.7		
\$70,000 to \$07,777	20./ 29 K		
	20.3		

It was necessary to create an ordinal variable for occupation, which was categorical, in order to rank the occupations in terms of prestige and to create an index for the variable to be used in the path model. Current and former occupations were categorized in terms of the 1980 Census occupational classifications and then combined according to the Hodge-Siegel-Rossi Prestige scores (Siegel, 1971). Professional and

²The numbers in parentheses correspond to the variables in the hypothesized model in Figure 2.

technical positions were rated highest. Farmers and related occupations ranked in approximately the middle of the index. Service employees and laborers ranked at the lower end of the spectrum. Housespouses, while presented in the distribution of occupations (Table 2) for purposes of illustration, were not counted in the analysis and were treated as missing.

A new variable was created for whether a respondent was retired. This includes both NIPF landowners who were formerly employed and people who were never employed outside the home. "Not" retired also includes respondents who were never employed outside the home. In all cases, if a respondent reported s/he was or was not retired, that report was used, except in places where a person also reported a current occupation. In that case, the status of current employment took precedence over the status of retirement. Those cases which were missing were treated as missing values and considered as either retired or "not" retired. Frequencies for retirement status and current and former occupations are presented in Table 2.

Items	Percentage responding		
Retired	(n= 531)		
Yes	35.4		
No	58.0		
Nissing	6.6		
Occupation	Current (n=269)	Before retiring (n=192)	
Executive, administrative and managerial	19.0	10.4	
Professionals	24.2	29.7	
Technicians and related support	3.7	.0	
Sales occupations	8.2	6.8	
Administrative support, including clerical	1.9	4.7	
Protective service	1.5	1.0	
Service occupations, except protective	.7	3.6	
Farming, forestry, and fishing occupations except farmers	7.1	3.1	
Farmers	15.6	10.9	
Precision production, craft and repair	1.5	8.3	
Machine operators, assemblers and inspectors	3.3	1.1	
Transportation and material moving	1.1	3.6	
Handlers, equipment cleaners, helpers, laborers	1.1	.0	
Housewife	1.1	6.3	
Retired military	N/A	7.8	

 Table 2.
 Retirement status, current occupation and occupation before retirement

Respondents were asked where they grew up and where they now live. This socio-demographic variable will be used to determine if where the respondent grew up or now lives has an effect on other variables in the measurement model. Frequencies are given in Table 3.

Table 3. Where respondents grew up and live now

	<u>Live now</u> (n=522) Percentage	<u>Grew Up</u> (n=519) Percentage	
In a large city (over 500,000)	10.0	8.1	
A medium city (50,000 to 500,000)	9.6	11.8	
A small city (10,000 to 50,000)	10.7	9.2	
A small town (2,500 to 100,000)	10.7	9.8	
A small village (2,500 or less)	10.7	10.8	
Open countrynot on a farm	7.9	11.4	
On a farm	34.1	38.9	

It was originally hypothesized that in order to have a unbiased sample, NIPF landowners needed to be chosen from the three different geographical areas of the state. It was also determined that within each area, one county should have a forest land-use program and the other should not, so as to be able to investigate if there was an effect of participating in forest land programs and levels of forestry knowledge. A variable was created which allowed a comparison of counties with a forest land-use program, and those without, to other variables. Table 4 lists the frequencies.

Table 4. Live in county with forest land-use

Live in a county with	a forest land-use program	(n= 531)
Yes		50.1
No		49.9

The variable "total forested acres" included forested acres owned by the respondent in the six counties surveyed, in other areas of Virginia, and in other states. This resulted in 157,574 acres being reported, with a 297 acres being the mean and 109 acres for the median. Fifteen (15) percent of the 531 respondents from the six sample counties reported that they also owned forest acreage in other counties of Virginia; for the 79 NIPF landowners reporting such acreage, the mean amount owned in other counties was 524 acres, while the median was 70 acres. Thirty-five (35) percent of the 531 respondents from the six sample counties reported that they also owned forested acreage in the United States, outside of Virginia; for the 188 NIPF landowners reporting such acreage, the mean amount owned in the United States was 92 acres while the median was 20 acres. A breakdown of acreage by class size for the survey area, as well as by the total forested acreage owned is presented in Table 5.

Forest acrease owned by area	Total acres		Hean	Hedian
Six-county survey area In Virginia, outside of survey area In other states Total forested acreage	98,890 41,436 17,248 157,574		188.0 524.5 92.0 296.8	91.0 70.5 20.0 109.0
Acreage by class size for six counties surveyed 0 to 50 acres 51 to 100 acres 101 to 250 acres 251 to 500 acres over 500 acres	(n = 526)	31.7 22.8 25.1 12.4 8.0		
Acreage by class size for total forested acreage 0 to 50 acres 51 to 100 acres 101 to 250 acres 251 to 500 acres over 500 acres	<u>owned</u> (n = 526)	25.0 21.9 25.7 15.5 11.9		

Table 5. Forested land owned by area and class size

For the six counties surveyed, respondents reported the number of parcels they owned, for up to five parcels, with the mean being 1.5 parcels and the median, one parcel. The number of parcels owned per respondent, and the mean and median acreage size, of the parcels reported for the six county survey area are listed in Table 6.

Items	Percentage responding	
Parcel ownership in six counties surveyed at least one parcel	(parcels = 861) 525	
at least two parcels	184	
at least three parcels	83	
at least four percels	44 25	
at tepst live partets	EJ	
Size, in acreage, of parcels in the six-county	SULVEY ALEA	
	Nean Nedian	

Parcel 1	139	70
Parcel 2	76	46
Parcel 3	80	45
Parcel 4	72	49
Percel 5	83	30

As geographic region was assumed to present a possible bias, counties were selected from the three geographic regions in the state. In order to measure region, two variables were created which represented two of the regions selected for the survey in which respondents own forested land. The purpose of using the two variables in the correlation matrix was to be able to determine if, indeed, there was an effect on responses based on the county in which the respondent owned the land, as the geophysical characteristics of the areas vary. Because they are the two most extreme, the Mountain region and the Coastal plain were selected. (The Piedmont area can be considered a transition area between the two.) The frequencies for the geographic region variables are in Table 7.

Table 7.Geographical regions in Virginia in which forested land is
owned

Geographical regions	in Virginia in which	forested land is	owned. (n= 531)	
Mountain area Piedmont area Coastal plain			37.5 30.9 31.6	

Access to environmental/conservation information

Organizations joined (2)

This item indicates whether NIPF landowners join environmental and/or conservation organizations. The frequency for the item is given in Table 8, as well as the frequencies for the types of organizations joined (respondents could check more than one).

Tal	ble	8.	Organi	Lzat:	Lons	joined ((2))
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Items	Percentage responding	(n)
Joins organizations	······································	451
Yes	31.9	
No	68.1	
Organizations		143
Virginia Forestry Association	31.4	
Nature Conservancy	27.2	
National Wildlife Federation	25.8	
Different Sportsmen's associations	25.1	
Audubon	19.0	
Virginia Wildlife Federation	13.0	
Sierra Club	8.3	
Wilderness Society	6.9	
Tesak Valton League	63	
Trout Unlimited	2.8	

Publications read (2)

This item indicates whether NIPF landowners read publications related to environmental/conservation type issues. The frequencies for the item are given in Table 9, along with the frequencies for the publications read (respondents could check more than one).

Table 9. Publications read (2)

Items	Percentage responding	(n)
Reads/subscribes to publications		446
Yes	55.4	
No	44.6	
Publications		247
Virginia Wildlife	53.0	
National Wildlife	20.0	
Field and Stream	26.7	
Outdoor	22.2	
Virginia Forests	19.0	
Tree Farm News	17.4	
Sports Afield	13.8	
Auduban	12.9	
American Forests	8.5	
National Parks and Recreation	8.0	
Forest Farmer	4.8	
Journal of Forestry	2.8	

Beliefs and attitudes (3 through 12)

Scoring for the belief and attitude items which form the general, intermediate and specific level environmental scales in the hypothesized model was as follows: Strongly agree (SA) = 1; Agree (A) = 2; Neutral (N) = 3; Disagree (D) = 4; and, Strongly Disagree (SD) = 5. In order to have the high score for all the belief and attitude items reflect an environmental stance as opposed to low scores reflecting a nonenvironmental stance, some items were reverse scored, i.e., Strongly Agree = 5, etc. The frequencies of the items in the following tables which are preceded by a superscript "*" indicates items which have been reverse-scored. Missing values were considered invalid and not included in the analysis. Pair-wise deletions were used as opposed to list-wise. Pair-wise deletions are those cases that have valid values on both variables used in the calculations and are included in the calculation. Otherwise, the cases are deleted (SPSS,Inc.).

The standard measure of reliability reported is Cronbach's alpha. A reliability refers to the likelihood that a given measurement procedure will yield the same description of a given phenomenon if that measurement is repeated (Babbie, 1986:114). Cronbach's alpha is one of the most commonly understood measures of reliability (Norusis, 1990:B- 190). Cronbach's alpha can be interpreted as the expected correlation (from 0 to 1.00) between the researcher's measure for a concept and all other possible measures of the same concept with the same number of items, even though the items, themselves, may differ. Like any correlation, a Cronbach's alpha of .90 or above is rare. However, Cronbach's alpha is easily influenced by the number of items in the scale. Scales with more items tend to be more reliable.

Questions to measure beliefs and attitudes about natural resources in general, and forest resources in particular, included ones designed by different researchers. Some were designed by Padmanabhan (1981) and are indicated by a (P). Those in the NEP scale (Dunlap and Van Liere, 1978), were used verbatim and are included in Table 11. Other questions, analogous to ones used by Padmanabhan on recycling, were modified by this researcher to reflect forestry issues and are indicated by an (A). And, finally, still other questions were designed entirely by the researcher to capture beliefs and attitudes about forest resource use in Virginia and on NIPF land in Virginia and are indicated by an (R).

Beliefs and attitudes--general level

Shortage is real (3)

Items in this scale reflect a general belief that the natural resource shortage is real. Frequencies for the items from are given in Table 10, followed by the reliability for the statement.

Table 10. Shortage is real (3)

Items						
	SA"	A	N	D	SD	(n)
PWe will have plenty of natural resources						
and developing them	4.5	21.7	26.2	35.3	12.3	465
A)The "scarcity of natural resources" is just a threat invented by						
environmentalists	3.2	9.7	17.2	49.6	20.3	464
R)The concern about the environment is						
just a passing tad	1.5	5.4	10.7	60.9	23.4	466

Reliability = .65

* SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD =Strongly Disagree.

(P) = designed by Padmanabhan (1981)
(A) = adapted from Padmanabhan (1981)

(R) = designed by the researcher

NEP scale (4)

All items in the NEP scale appear as originally designed (Dunlap and Van Liere, 1978). There were indications from the literature that the NEP scale was not uni-dimensional (Geller and Lasley, 1985; Noe and Snow, 1990). This means that it measured more than one dimension or concept. Given this, a factor analysis was performed on the items in the scale. The results of a factor analysis confirmed that it was not uni-dimensional (Appendix B) and that two concepts were being measured. They were the concept (Factor 1) that "humans must respect nature and live within Earth's carrying capacity" and the concept (Factor 2) "humans do not rule over nature". The concept that "humans must respect nature and live within Earth's carrying capacity" is designed to measure how strongly it is believed that humans must live interdependently with nature. Whether or not it is believed that humans were created to rule over nature, that is, to use nature to suit their needs, is measured by the concept "humans do not rule over nature". The frequencies and the reliabilities for the two concepts appear in Table 11.

Table 11. NEP scale factors (4)

Items		Pe				
	SA	٨	N	Ď	SD	(n)
Factor 1Humana must respect nature and not (exceed E	arth's	carryin	a capaci	ty	
We are approaching the limit of the number of						
people the Earth can support	*20.1	30.0	20.3	22.9	6.7	497
The balance of nature is very delicate						
and easily upset	*26.9	49.5	15.1	6.2	2.3	469
When humans interfere with nature it						
produces disastrous results	*23.0	52.8	11.3	10.4	2.6	470
To maintain a healthy economy we will have						
to develop a "steady-state" economy where						
industrial growth is controlled	*16.0	50.6	19.4	10.7	3.2	478
Humans must live in harmony with nature in						
order to survive	*35.1	57.5	5.1	2.1	.2	473
The Earth is like a space ship with only						
limited room and resources	*29.4	48.5	12.1	8.1	1.9	472
There are limits to growth beyond which						
our industrialized society cannot expand	*20.9	50.9	20.3	6.6	1.3	468
Mankind is severely abusing the						
environment	*35.7	46.4	10.8	6.8	.2	474
Reliability= .83						
items are reverse-scored						
Factor 2Numens do not rule over nature						
Mankind was created to rule over the		3/ 7	40 F	70 /	45.0	/ 74
rest of nature	8.7	20.5	18.5	50.6	15.9	4/1
Plants and animals exist primerily to	E /	71. 4	33 4	77 3	1/ 9	147
De used by numeros Numeros have a right to modify the	3.4	24.0	22.1	33.2	14.0	907
numere neve a right to modify the	2 2	10 2	18 1	42 5	16.0	440
Numers need not adapt to the natural	3.2	17.3	10.1	-3.3	10.0	407
environment because they can remake it						
to suit their needs	2.3	5.5	10.4	53.9	27.7	469
					2	
Reliability= .70						
······································						

Shortage is serious (5)

This scale reflects the belief that the natural resource shortage is serious. Frequencies for the items are given in Table 12.

Table 12. Shortage is serious (5)

Itens			-				
	SA	٨	Ň	D	SD	(n)	
 (P) We are entering a period of scarcity and shortage of most natural resources (A) If we continue our high levels of resource 	*17.9	48.0	18.5	13.9	1.7	475	
to have a high level of living like ours (R) The potential for a resource shortage is	*19.0	53.9	14.3	10.4	2.3	469	
more serious than people think	*19.0	51.9	17.1	10.5	1.5	468	
Reliability= .75 "items are reverse-scored							
(P) = designed by Padmanabhan (1981) (A) = adapted from Padmanabhan (1981) (R) = designed by the researcher							

Consumers must conserve (6)

Items in this scale reflect the belief that consumers must conserve natural resources. All items were designed by Padmanabhan (1981). The frequencies for the items are given in Table 13.

Table 13. Consumers must conserve (6)

Items		Регсе	ntage r	espondi	ng	
	SA	A	N	Ď	SD	(n)
We must enjoy life with the natural resources we now have and let the future take care of						
itself	1.7	5.9	9.3	55.8	27.2	471
We should turn to conserving natural resources						
only if it does not change our life style	.4	3.6	11.3	66.0	18.6	467
Fear of natural resource shortages today						
should not discourage us from using natural	• •					
resources and enjoying life today	2.4	50.0	16.5	30.0	7.9	407
Pelishilityz 78						

Individuals can help (7)

This scale reflects whether people think that individuals can help alleviate a resource shortage. All items in this scale were adapted by the researcher from Padmanabhan (1981). Table 14 gives the frequencies for the items.

Table 14. Individuals can help (7)

Items							
	SA	A	Ň	Ď	SD	(n)	
Individuals can do much to alleviate the	· · · · ·						
natural resource shortage	*21.6	67.7	8.3	2.1	.2	468	
Individuals should make every effort to							
conserve natural resources	*33.7	61.8	3.6	.9	.0	466	
If individuals tried to conserve natural							
resources, it would really make a difference	*25.5	66.6	7.1	.6	.2	467	
Reliability= .70							
items are reverse-scored							

Beliefs and attitudes--Intermediate level

These scales are part of the intermediate level of beliefs and

attitudes.

Concern over conserving Virginia's forests (8)

Items in this scale concern over the conservation of Virginia's forest resources is measured. All items were designed by the researcher. The frequencies for the items are given in Table 15.

Items		Perce	ng			
	SA	A	N	D	SD	(n)
It is more important to harvest from Virginia's forests that it is to worry about conserving						
forest areas for rare plants and animals. The positive benefits of economic growth in forest industries in Virginia far outwards	5.4	11.9	17.3	37.2	28.2	479
any negative environmental consequences.	5.1	13.5	21.6	35.3	24.6	468
in Virginia's forests. No matter how they are harvested, Virginia's forests will grow back and be able to supply good quality						
timber. With new and better technology, Virginia's forests will always be able to meet the	2.5	8.2	13.7	48.1	27.5	476
growing need for wood in Virginia. In Virginia, the selection of a harvesting practice should not be based solely on cost. The impact that the practice will have on wildlife habitat, scenic beauty and future generations should be considered equally	6.7	31.7	24.2	27.5	9.9	476
important. The benefits of conservation laws in Virginia	33.6	50.3	9.5	4.2	2.3	473
THE OUTWEIGH ANY REGATIVE IMPACTS THEY MAY have on human well-being.	10.0	35.9	33.5	16.9	3.6	468
Reliability= .75						

Table 15. Concern over conserving Virginia's forest resources (8)

<u>Society must control resources; society's rights over individual</u> rights (9)

This scale is composed of items which measure the beliefs of NIPF landowners as to whether society or individuals should control natural resources. Frequencies for the items are given in Table 16.

Items		Percentage responding					
	SA	٨	N	Ď	S D	(n)	
(A) The State of Virginia must ultimately control what landowners do with their	 		<u> </u>				
private forest land in the state (P) Where natural resources are privately owned, society should have NO control	2.1	9.5	14.9	33.1	40.4	475	
over what the owner does with them (A) More emphasis should be placed on an	7.4	17.8	24.8	42.7	7.2	471	
society's natural resource rights (P) Society must ultimately control what	6.0	18.0	30.8	36.6	8.6	467	
citizens do with the nation's natural resources	9.2	29.3	25.7	25.1	10.7	467	
Reliability= .75							
(P) = designed by Padmanabhan (1981) (A) = adapted from Padmanabhan (1981)							

Table 16. Society's rights over individual rights re: natural resources (9)

Beliefs and attitudes--specific level

These scales are located at the specific level of beliefs and attitudes and are all items designed by the researcher.

NIPF's do not have the right to do what they want with forest land (10)

These items reflect the belief that NIPF landowners do not have the right to do what they want with their forested land. All statements were designed by the researcher. Frequencies for the items are found in Table 17.

Table 17. NIPF's can't do what they want (10)

Items		Percentage responding						
	SA	A	N	Ď	SD	(n)		
A person who owns forested land in Virginia has the right to do what they want with it to make a profit regardless of any long term consequences to the land Persons who own forested land in Virginia have the right to do what they want with it for their enjoyment, regardless of any long term consequences to the land	8.1	13.3	13.7	37.1	28.0	483		
Reliability= .84								
Items in this scale measure NIPF landowners beliefs regarding profits and conservation on their forested land. Frequencies for the items are found in Table 18.

	Table	18. Cor	nservation	versus	profits	on	NIPF	land ((11	Ľ)
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Item		Perce	ntage r	espondi	ng	
	SA	A	N	Ď	S 0	(n)
Making money on my private forest land, now, is more important to me than managing it so that it will continue to produce many years				<u></u>		. <u> </u>
into the future On my forested property. I feel I have the	6.6	7.5	3.9	32.2	39.8	482
right to use whatever harvesting practices I want	30.3	26.6	16.3	17.9	8.9	485
I believe in managing my forested land for future generations only if it does not lessen						
the profits I make If I have an outbreak of pests or tree disease	6.9	15.4	19.2	40.7	17.7	479
means to control them	21.8	40.0	23.7	8.5	2.1	485
Reliability= .67						

Moral obligation to protect forest land for future generations (12)

Variable 12 is composed of items measuring whether NIPF landowners believe they have a moral obligation to protect forest land for future generations. All statements were designed by the researcher. Table 19 lists the frequencies for the items.

Table 19. Moral obligation to protect forest land for future (12)

Items		Perce	ntage ro	spondin	19		
	SA	A	N	'D	SD	(n)	
I have a moral obligation to maintain my forested land so that future generations			<u></u>		· / · _ ·	<u> </u>	
can use it I am willing to accept lass profit from my	43.7	36.5	8.3	3.2	1.9	497	
forested land if the method of harvesting							
will be more environmentally-sound I own forested land so that I can protect it	28.7	46.4	16.0	5.3	3.5	487	
for future generations	25.8	40.0	23.7	8.5	2.1	485	
Reliability= .69							

Other causal variables

While some of the "other causal variables" reflect beliefs and attitudes, they tend to relate more to specific aspects of forestry--why forested land is owned, reasons for not harvesting and reasons for not seeking forestry assistance.

Reasons for ownership (13)

Respondents were provided twelve statements and asked to indicate how important each of these were to them as reasons for ownership. Scores were recoded so that a response of "very important" carried the most weight and "not important" the least. A factor analysis was performed on the 12 items to reduce the number of variables by determining the commonality of meanings among the items. Three factors emerged. For the first, "conserve", reasons for ownership were related to nature and the outdoors -- for scenic beauty, preserving nature, viewing wildlife outdoor recreation but not to lease the land for hunting. The second, "amenity", was related more to the usefulness of the property--as a homesite, to provide firewood, to act as a buffer from adjacent properties and for conservation easements. The third factor, "econland", reflected economic issues of forest land ownership -to use the land to produce commercial timber or as a real estate investment. Negative items in the factors were recoded only to determine Cronbach's alpha. Respondents who responded to at least one of the items per factor were included in the analysis. Those who did not respond to any of the items in a factor were considered missing and excluded from the analysis. An additional single item, where land was owned for hunting, will be used as a separate item. The factors and their reliabilities are reported in Table 20.

Table 20. Reasons for ownership (13)

Factor	Very important	Somewhat important	Not important	(n=503)
FACTOR 1Conserve				
Naintaining scenic beauty	52.3	25.6	22.1	
Preserving nature Non-wildlife recreation (hiking comping)	22.3 23 1	23.3	24.J 54 D	
Viewing wildlife	39.2	28.0	32.8	
Lease land for hunting	3.8	7.5	65.0	
Reliability = .71				
FACTOR 2Amenity				
First or second homesite	25.8	23.5	50.7	
Producing firewood for personal use	23.1	30.2	46.7	
Buffer from adjacent property	23.5	20.1	56.4	
Conservation essement	16.1	22.9	61.0	
Reliability= .64				
FACTOR 3Econland				
Real estate investment	47.7	31.2	21.1	
Producing commercially saleable wood	38.2	29.0	32.8	
Reliability= .48				
<u>Single_itemHuntland</u>				
Wildlife for hunting	31.9	26.0	42.7	

Knowledge about forestry and forest management (14)

Virginia NIPF landowners were given ninety-eight (98) statements regarding forestry and forest management practices in Virginia. References used to design the knowledge statements included Nicol (1982), Kingsley and Birch (1980), Nelson (1987) and the Virginia Department of Forestry. Similar to the approach adopted by Nelson (1987), scientific terminology was kept to a minimum. In place of jargon, similar words were substituted to retain the concept of the question and to facilitate its understanding. For example, instead of regeneration the word "regrowth" was used, "tolerate only a small amount of shade" replaced intolerant, and "drier areas" was used to describe a xeric site. Five trees species found in Virginia were used as dimensions of the knowledge statements: tulip poplar (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), white pine (*Pinus strobus*) and oak (*Quercus* sp.). Oak in general was used rather than specific species of oak. Again, this followed the technique adopted by Nelson (1987). Since the same species of oak are not found in all counties in Virginia, statements referring to oak were given at the general level and were not related to a particular species of oak. In terms of the other four species of trees, not all are found in each county included in the sample. For example, there is no sweet gum in the Mountain counties of Warren and Highland. White pine is not found in the Coastal Plain and loblolly is only found in the Coastal Plain and one of the Piedmont counties, Prince Edward. In order to maintain economy in printing the questionnaire, all species were used for the knowledge statements. However, for developing knowledge scores for each level, this was taken into consideration. Although statements were given about five different species, only those relevant for the county in which the respondent lived were scored. Thus, any responses by Virginia NIPF landowners for statements relating to species not found in their particular county were not counted in their scores. This means that in Warren and Highland counties, both in the Mountain area of Virginia, statements pertaining to loblolly and sweet gum were not counted. In Madison county, a county from the Piedmont area of Virginia, only statements pertaining to sweet gum were excluded. In Prince Edward county, a more southern county in the Piedmont area, all statements were relevant. For Gloucester and Greensville counties, counties found in the Coastal Plain, statements relating to white pine were not included. There were five areas of forestry and forest management designed to test three levels of knowledge, simple, intermediate and complex, held by the respondents (Tables 21-25). Knowledge statements were given in a grid-type format with the type of knowledge being tested, tree species or harvesting practices, at the top and the statements along the left. Under each species, respondents were asked to respond either "Yes", "No" or "DK (Don't know)" to the statement at the left of the grid. For statements

about pine in general, respondents were given three choices for a response, "true", "false", and "don't know".

The first area of knowledge is related to general statements about pine. The Virginia Department of Forestry feels that there is a prejudice against growing pine in the Upper Coastal Plain, the Piedmont and the Mountain areas of Virginia, stemming from lack of knowledge about pine regeneration (personal communication, Jim Starr, Chief of Forest Management, Virginia Department of Forestry). Kaiser (1985) found that in the South, many NIPF landowners held the belief that after pine forests are harvested, natural regeneration would suffice to produce the same quality stock of pine which existed prior to harvesting. To test this hypothesized lack of knowledge, part of the knowledge section was devoted to pine in general. These statements tested for simple and intermediate levels of knowledge. Frequencies for these statements can be found in Table 21; correct answers are indicated by an ^A

The second area of knowledge is statements relating to five tree species found in Virginia. These statements test simple, intermediate and complex knowledge. The frequencies for responses to these statements can be found in Table 22; correct answers are indicated by an ^A. At the simple level, statements related to characteristics of the trees, such as "seeds are called acorns", or "stays green all year". The intermediate level statements determined how much the respondent might know about growth characteristics of trees, such as "often sprouts new, young trees from the stump after cutting" and "the favorite food of gypsy moths". At the complex level of knowledge more involved statements were given about the characteristics of the five species, such as "prefers drier sites" or "young trees tolerate a small amount of shade".

The third area of knowledge is definitions of harvesting practices. Respondents were asked to define, by multiple choice,

statements as they related to four specific harvesting practices--clear cutting, diameter cutting, selective cutting and seed tree. This tests intermediate levels of knowledge. The frequencies for responses to these statement can be found in Table 23; correct answers are indicated by an A .

The fourth area of knowledge is statements which ask about the effects of the four harvesting practices, clear cutting, selective cutting, seed tree and diameter cutting, on forests in general (intermediate level), and the effect of these practices on specific species (complex level). Again, respondents could answer "Yes", "No", or "DK" to indicate whether they thought the statements were relevant to the particular harvesting practice. At the intermediate level, statements such as "often allows a lot of sunlight to reach the forest floor" or "often results in trees in an area being different ages and sizes", were given. At the complex level, statements such as "promotes the best yellow poplar reproduction" and "promotes the best white pine reforestation" were given to test NIPF landowner knowledge of the effect of harvesting practices on regeneration. Frequencies for these responses can be found in Table 24. Correct answers are indicated by an A.

The fifth area of knowledge is statements related to the effects of the four harvesting practices on wildlife and scenic beauty. This tested the complex level of knowledge with statements such as, "often improves an area for game wildlife" and "can improve the scenery in one year". Table 25 lists the frequencies for the responses; correct answers are indicated by an ^A.

Statement	Percen	tage resp	onding		-
	True	False	Don't Know	(n)	
SIMPLE LEVEL To ensure a quality stand of pine, it is necessary to do some site preparation, such as burning and applying herbicides, prior to replanting the pine	53.8^	14.3	31.9	476	
Thinning loblolly pine stands result in better quality, more well-developed trees	76.6 ^A	1.5	21.9	474	
Thinned loblolly pine can be sold as pulpwood	72.5^	1.7	25.8	476	
<u>INTERMEDIATE LEVEL</u> Most of the time after a pine stand is cut, it will naturally grow back to the same quality stand that existed before cutting	10.4	59,1*	30.5	472	
All types of young pines will grow from stumps of pine which have been cut	1.3	81.1^	17.6	477	
After pines are harvested, hardwoods can begin growing in the light and space that result	66.1*	7.4	26.5	472	
A indicates the correct response					

Table 21. Knowledge statements about pine.

Statements	Yes	Yellow I No	ž	3 "	Yes	No No	DX DX PI	3	Yes	No	ž	(n)	Yes	No	Pine DX	(n)	Yes (B	Ŗ	(n)
SINPLE LEVEL Stave green all veer	1.0	92.5^	6.6	306	93.7*	1.4	5.0	4 3	0	89.8	9.5	391	95.4^	1.1	3.4	437	1.8	95. 5	2.8	398
Seeds are in cones Seeds are called acorns	10.8 1.9	75.5 ⁴ 13	24	368	90.3^ 2.2	1.6	5.0 5.1	36 56	.5 5	88.Z	15.6 11.2	<u>8</u> 8	92.8^ 1.7	2.3	5.0	452 363	2.9 95.5^	92.0 [′]	, , , , , , , , , , , , , , , , , , ,	448 448
INTERMEDIATE LEVEL Often sprouts new, young trees from the stump			>			2		Ř	r 3	•	2			\$	2	Ż	5	,		ż
The favorite food of gypsy moths	12.6	46.0*41	*	374	11.6	57.0	51.4	379	11.0	42.1	46.9	373	8. 8	59.2^	31.8	373	69.T	7.9	22.4	429
COMPLEX LEVEL Young trees tolerate only a small amount of shade	26.4^	27.9 45	5.7	383	42.6*	22.1	35.3	399	19.3^	30.1	50.7	379	38.7	25.9	35.4	390	26.4^	38.8	34.8	394
Young trees tolerate a moderate amount of shade	45.2	10.74	1	394	36.0	24.5	39.5	394	42.0	12.2	45.7	376	41.4^	20.6	38.0	384	55.3	10.5	\$34.2	399
Preters to grow in drier areas	17.7	34.9 47		384	39.7	20.4	\$ 39.9	384	14.3	36.8	48.9	378	42.9*	18.6	38.5	392	42.9*	20.4	36.7	392
A indicates the correct res	sponse																			

Table 22. Forestry knowledge, by level of complexity

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Table 23. Definitions of harvesting practices.

Statements	P	ercentage res	ponding		
	Clear cutting	Selective cutting	Seed	Diameter cutting	3
INTERMEDIATE LEVEL An area of at least five acres where all trees, large and small, are harvested at the same time	%.T	5.1	0.2	0.0	452
Usually the oldest and largest trees are harvested, either in small groups or individually	2.0	86.8^	1.5	9.6	456
At least eight trees per acre are left in a cut-over area	4.3	9.7	83.1^	2.9	53
All trees over a certain size in an area are harvested	4.7	16.9	1.1	77.4^	451
A indicates the correct response					

Statements								Per	centage	respor	and a					
	Yes C		uttin PX	ົ້	Yes	No	r cuti) D	Yes Se	lectiv No	동 문 문		Ĩ			ĵ.
INTERMEDIATE LEVEL Often allows a lot of sunlight to reach the forest floor	88_1^	1_9	10_0	421	37_0	20.3	A 33_1	· 341	33.3	39_0	27.6	351	64.3 ^A	9.2	26.5	¥7
Often allows only weak sunlight to reach the forest floor	2.2	82.5^	15.4	325	54.24	18.2	27.1	358	69.9^	9.1	21.3	30	10.1	59.7	30.2	318
Often results in all trees in an area being a similar age and size	71.5^	10.8	17.6	369	34.5	40.9	^ 24.0	362	25.0	51.7	23.3	¥	36.1^	33.3	30.6	330
orten results in trees in an area being different ages and sizes	6.2	74.3^	19.5	338	57.0^	18.1	24.9	338	74.0^	6.6	19.3	393	31.1	38.1	30.8	351
COMPLEX LEVEL Promotes the best YELLOW POPLAR reproduction	13.4^	19.6	67.0	373	17.0	13.2	^ 69.S	342	26.8	10.4	62.7	365	18.84	12.5	68.7	351
Promotes the best LOBLOLLY PINE reforestation	55.0^	7.6	37.4	393	7.1	38.9	^ 54.0	324	26.8	35.8	49.7	330	32.0^	18.0	50.0	356
Promotes the best WHITE PINE reforestation	44.47	8 .	47.5	385	6.5	33.8	^ 59.7	325	15.9	27.9	56.2	ä	31.4^	14.4	54.2	36
Promotes the best OAK regrowth	13.1^	34.9	52.0	341	30.2	14.1	× 5.7	341	48.2	6.2	45.5	369	19.2	24.94	55.9	338

Table 24. Effects of the four harvesting practices on specific species.

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A indicates the correct response

Statements	2								Percen	age	espon	ding*					
CONPLEX LEVEL	Yes Cle	Ne c	DX	ຼົ	Yes	No	× X	(j) Eina	Yes	No	동 문론	Ĵ	Yes		전 못 한	n T	
Often improves an area for game wildlife (deer, turkey, quail, rabbit, etc.)	45.2 ^A 3	56.0	18.8	6 0	49.3	36.0	^ 18.i	365	65.5 ⁴	9.9	^ 24.0	406	38.7	24.5	36.8	367	
Often improves an area for non-game wildlife such as songbirds	23.7	12.04	¥ 3	388	37.4*	14.3	6	ž	48. 1^	10.9	^ 41. 1	387	32.3	20.5	^ 47.1	365	
Can improve the scenery in one year Can improve the scenery after 10 or	5.9 7	J.0^	19.1	371	36.9	28.7	×	369	62.7	13.3	^ 24.0	413	18.3	47.4	× %	2 371	
Len improve the scenery after in or More years	45.5^ 2	28.9	25.6	394	55. 3 ^	10.6	¥	1 369	66. 5^	5.7	27.8	385	52.0	16.5	31.	5 381	
* more than one correct response is possib	•																

Table 25. Statements relating to harvesting practices on wildlife and scenic beauty.

A indicates the correct response

To measure the scale "knowledge about forestry and forest management" in the hypothesized model, it was necessary to create a score for the responses given about knowledge of forestry and forest management. As indicated earlier, statements were offered in the questionnaire about five different species of trees, to which the respondent was asked to indicate "yes", "no", or "don't know". To account for statements being answered by a respondent from a county which does not have all five species of trees, any answers relating to ineligible species were excluded from the overall knowledge score computation for the respondent in that county. This proved a reliable measure (Cronbach's alpha = .94). In all counties, unless the response was determined to be ineligible for the county due to the tree species, responses which were left blank or marked as "don't know" could not receive any credit for correct responses but were included in the denominator as possible points. Blanks were assumed to be indications that the respondent did not know the correct answer. However, respondents who skipped all the questions were not included in the analysis.

Three different levels of knowledge were identified--simple, intermediate and complex. Then, an overall knowledge score was computed by dividing the number of correct answers by number of total possible points, where responses to simple statements could earn 1 point, responses to intermediate statements could earn 2 points and responses to complex statements could earn 3 points.

The knowledge score will be used as an interval variable in the model. However, Table 26 provides an idea of the mean scores for the different levels of knowledge, simple, intermediate and complex, held by the respondents. The mean score for overall knowledge is also listed.

Table 26. Mean knowledge scores by level of complexity.

Knowledge levels	Nean score
Simple	.80
Noderate	.62
Complex	.36
Overall	.48

Aspects of forest management (15, 16, 17 and 18)

Questions relating to different aspects of forest management were drawn partially from the literature (Kingsley and Finley, 1975; Birch and Powell, 1978; Birch, 1979; and Carpenter et al., 1982). Others were designed in consultation with members of the professional forestry staff at the Virginia Department of Forestry. One question had to do with respondent's participation in forest land-use programs. Since the same questionnaire was used for all counties, forest land-use was defined so that only those whose counties had the program would respond. Respondents were also asked if they seek professional forestry assistance; if not, their reasons for not seeking professional forestry assistance; and their reasons for not harvesting. The questions were designed to gather information about issues facing NIPF landowners and how these issues may affect their decisions to harvest. Frequencies for the various aspects of forest management are presented in Tables 27 through 31.

Participate in forest land-use programs (15)

This item indicates whether respondents who live in counties with forest land-use programs participate in these programs. Only three of the six counties surveyed had forest land-use programs. This program enables NIPF landowners who have a minimum of 20 forested acres, and a forest management plan prepared by a professional forester, to apply for a land tax credit in counties who have the program. Table 27 list the frequencies for those in the forest land-use counties who do and do not participate in these programs.

Item	Percentage Yes	responding No	(n= 266)	
Participate in forest land-use	57.8	42.2		

Table 27. Participation in forest land-use programs (15)

Seeks professional forestry assistance (17)

Seeks professional forestry assistance is a dichotomous variable which asks if the respondent sought assistance from persons with professional forestry training. Frequencies for the variables are reported in Table 28.

Table 28. Sought professional forestry assistance (16)

Item	Percentage Yes	responding No	(n= 490)	-
Have sought professional forestry assistance	54.1	45.9		-

Reasons for not seeking professional forestry assistance (17)

In the questionnaire, respondents could choose from nine reasons as to why they did not seek professional forestry assistance. Given that nine items would complicate the measurement model, a factor analysis was done on the items to see if there were communalities among items so that the number of variables in the model could be reduced. Three factors were identified--1) "not aware of forestry assistance"; 2) "no interest in seeking forestry assistance"; and, 3) "I had no time to seek assistance or already received assistance". The third factor was dropped due to poor response rate (less than 10%). Frequencies for the factors are listed in Table 29.

Factors with items	Percentage responding	(n)
FACTOR 1Not aware of forestry assistance		
I never thought about getting forestry advice or assistance	26.2	139
I didn't know forestry advice or assistance was available	11.1	59
I didn't think I could afford the service	4.5	24
I didn't know how to contact anyone for forestry advice		
or essistance	7.3	39
Reliability= .68		
FACTOR 2No interest in seeking forestry assistance I am not interested in any forestry advice I have enough knowledge about forestry menagement	7.9 5.1	42 27
Reliability= .35		

Table 29. Reasons for not seeking professional forestry assistance (17)

Reasons for not harvesting (18)

Respondents were given 21 statements representing feelings about harvesting, which included reasons for not harvesting. A factor analysis was performed on the 21 items to determine if there were communalities among the items so that the number of variables in the model could be reduced. Five factors emerged: harvesting has adverse effects on nature; my timber resources are too inadequate to harvest; I distrust loggers and foresters; I will harvest when I need the money; and, I am opposed to timber harvesting. Each of the factors will be used as individual scales in the measurement model and take the place of "reasons for not harvesting" in the hypothesized model. An additional single item--I don't know whom to contact about harvesting" will be used as a separate item. The frequencies are listed in Table 30.

Table 30.	Reasons	for	not	harvesting	(18)

Factors with items	Регс	entage	responding
	Yes	No	(n)
FACTOR 1Harvesting has adverse effects on nature			
I think harvesting would adversely affect hunting on my land	35.8	64.2	626
I think scenic beauty is adversely affected by harvesting	69.0	31.0	451
think harmating destroys wildlife habitat	46.5	57 5	440
I think hervesting tigher interferes with the forestle natural	W .2		
growth process	22.5	77.5	440
Reliability= .72			
FACTOR 2Wy timber resources are too inadequate to harvest			
I don't think I have enough land to harvest trees	22.7	77.3	431
I don't think there is a market for the timber	18.6	81.4	424
think my timber is of too noor quality to harvest	14 2	85 8	431
T think the timber on my land is too low a volume per sone	1415	03.0	431
to the constant of my tand is too tow a votule per acre	25 F	7/ E	/ 39
to narvest	25.5	14.3	420
I think the Land is too steep to harvest	9.0	91.0	443
The land had been harvested when I acquired it	47.5	54.7	437
Reliability= .54			
FACTOR 3I distrust loggers and foresters			
I distrust loggers	45.6	54.4	439
I distrust foresters	11.2	88.8	428
Reliability= .43			
FACTOR 4I will harvest when I need the money			
I am saving the trees to harvest for income in my retirement	27.0	73.0	434
I am holding the trees in case of an emergency and I need the money	30.7	69.3	437
Reliability= .48			
FACTOR 51 am opposed to timber harvesting			
I am opposed to timber harvesting	11.8	89.9	435
I only cut firewood for personal use and don't consider			
that hervesting	44.9	54.9	452
Reliability= .43			
Single itemi don't know whom to contact about harvesting		-	
I don't know whom to contact about harvesting	30.0	70.0	430

Outcome variable

Have harvested (19)

The outcome variable for the hypothesized model (Figure 2) is whether NIPF landowners have harvested. The frequencies for this item are listed in Table 31.

Table 31. Percent of respondents who have harvested

Item	Percent responding Yes	No	(n=495)
Have harvested	55.6	44.2	

Constructing the final model

The final model was the result of several iterations: 1) the construction of scales from the original 73 items identified for the hypothesized model; 2) the combining of scales into constructs; and, 3) the combining of constructs into "super constructs". The combining of items into scales, scales into constructs and constructs into "super-constructs" was based on similarity. By similarity it is meant that items or constructs are comparable and are parallel³.

After the initial 73 variables were identified, they were placed into the scales proposed in the hierarchical model, resulting in 40 constructs. These 40 constructs were correlated on PACKAGE and a matrix of their correlations was produced (Table 32). Using the correlation matrix, constructs were developed by combining similar scales. Then, the final iteration involved combining any similar constructs into "super-constructs". The resulting path model has variables from the different levels of the iterations--items, scales, constructs and superconstructs.

³Parallelism is the extent to which items have identical patterns of correlation with other variables. Thus, when items are combined according to their content and their patterns or correlations, little information is lost by merging.

Table
32.
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live in a county with forest land-use program live in mountain region	108	ώw	17	51	÷.			v =	28	ī .	ż.,	4	N'n		75	1 .0	6 18	**	v ⊒	
live in coastal region total forested acres	11	*•	46	4		**		• •	40		_ē	ē _	=.	* #	÷ 4		-+	÷.	- in	
read conservation/environmental publications	12	1	12	1				11	ŝ	-		=		5				4	iu	
join conservation/environmental organizations resource shortage is real	113		88	58	. :	NN	18	NO	7 00	i	-			18	10 17	53	18	5.	97	
humans respect nature, not exceed carrying cap.	115			4	*		4	•	•		*			1	5	8	58	8	5	
humans are not over nature	116		5 13		- N	- -		, 1 0	. 18	- 0		÷		- 10	53	2 22	28	ā¥8	% 8	
consumers must conserve	118	-17	3	N		7	12	N	=		, in	: <u>-</u>			\$	2	8	5	10	
individuals can nelp conserve concern over conserving Va.'s forest resources	120	ż,	2.2	1 8 v	س	±.,	=_	Ci a	**	32	-	33	Ň.+	<u>.</u>	32	85	ax	51	26	
society's rights vs indiv rights re: natural res.	3121	÷	38	:=		# #	. 3	:0	:4				**	*~	38	38	23	28	28	
issues of conservation vs. profits	123	-26	46	39	-17	2	18	5	10		÷.	ż.	•	27	67	N	2	2	8	
moral obligation to protect forests for future	124	3	; ±		÷				ŝ		:	:			18	3	15	3	22	
own land for amenities it provides	120	-	2	÷ 7	÷ż	س	÷.	س ت	≓.	- م 5		12	~	==	38	R	-	a 0	20	
own land for economic reasons	127		44		÷	4	4.6	÷	1.5	ż		1	;	ŝ	:	. N	ż	ŝ	3.6	
score for knowledge about forestry	129	. ÷		* *	- ÷	-	ż ż	28		10	¥.,	5 -	22			÷-		33		
participate in a forest land-use program	130			.~	Ň	. =			5	in	1		5.00	1				-		
not aware of professional forestry assistance no interest in seeking professional for. assist.	132		3.	÷.,		ż.	÷.	÷.,	÷.,	12	12	ů á	-10	4	ż.		120	4.	18	
sought forestry assistance	13	5~		5	5 Å	. 5	54	**		-1	- 5	37	5N	13	, in	2	5.5	2÷	o ú	
inadequate timber resources to harvest	135	N	ż,	ż.	5	Ň.	~		_ .	.	÷.	N	•	÷.		3	N	=!	÷.	
don't know whom to contact re: harvesting	136		5							12	1					10	N			
will harvest when money is needed	138	.	ż,	20		÷.	÷.,	÷.	4.	÷.		ů,	ż.		ż.		ż.	4.	ы .	
opposed to harvesting	139	w	4	ŝ					:=	N	Ň	*		=	:=	2	7	2	5	
have harvested	140	N	-16	÷		4	÷	-19	-	-16		12	-		÷	12	-19	÷	\$	

concern over conserving Va.'s forest resources society's rights vs indiv rights re: natural res. NIPF rights to do what they want with own forests issues of conservation vs profits occupation live now harvesting adversely affects nature inadequate timber resources to harvest don't know whom to contact re: harvesting don't trust foresters and loggers moral obligation to protect forests for future own land for conservation/environmental reasons own land for amenities it provides own land for economic reasons own land for hunting score for knowledge about forestry resource shortage is real humans respect nature; not exceed carrying cap. humans not over nature age education consumers must conserve resource shortage is serious grew up live in a county with forest land-use program live in mountain region live in coastal region total forested acres have harvested opposed to harvesting will harvest when money is needed participate in a forest land-use program sought forestry assistance no interest in seeking professional for. assist. not aware of professional forestry assistance individuals must conserve read conservation/environmental publications join conservation/environmental organizations retired income

*585**588855555 ÷., 119 がな **およりないちのののないのないないない。** ក្ខនុន្តទ 120 1 ສຸຊຸຊຸ C \$ 5 ដ់តន់ 121 122 20 ż \$ 28888 S Ś⊒ 눲 Ň 30 82529202 124 누구 μą 22 ชี ż 2948288888888888 70 126 ະ່ວ -17 8 よる 5255252238 でい 1 337 **** : 127 3 붋 ż 8 **** -1280-10 ,19 128 -21 ; 5 ż 8 10 പ്പ **2*2*2*2*2 525 5. 128 ដ * 25 -19 4 N 34 ផ្ល 328 75 ÷ 131 <u>....</u> :5 ÷ 12 **់ដ**ត ů Ś ÷* ដ់ ÷ : ÷ å ដ ž 55 5 -12 20 12 ផ់ភ្ល Åğ ż \$ え み ដ 4 Чģ 4 to Ř รี่ . สีนสีล Ř S ~ 223 33003B 2320 - 33 ~ 72088233544 우부역 3 34 4 ~~~~ \$2×28 ÷. Ŕ ភូន 137 10 10 10 2 4050 12% 5297500 17 33 ø **0** M ដង់ង 1.3.4.1 ÷ ŝ អ់ដង់ង š ដ ů ふち 3 ÿ ដំដុំ รัชธ 284852483 22332223334 8 5 0 5 ī

Twenty-four final variables resulted from the construction process for the model. However, some of the assumptions made for the hypothesized model did not hold during construction of the final path model. Where it was originally assumed that the beliefs constructed at the different levels in the hierarchy would remain separate and distinct, such as abstract beliefs at the general level, issues related to Virginia forests at the intermediate level and issues for Virginia NIPF landowners regarding their forested land at the specific level, this did not occur. This was due to the similarity and parallelism which was found to exist among variables. Some beliefs from the intermediate level combined with those in the general level. Some belief and non-belief items combined to form variables such as "information about forestry and forest management". However, while the content of the different levels did deviate, the overall assumptions did not. Beliefs were found to be hierarchically arranged, from general to specific. (For further discussion, see Results).

The 24 variables which are used in the path model, fell into four basic categories--socio-demographics, information, beliefs and attitudes, and outcomes. They will be discussed under these categories and titled and numbered as they appear in the model. All departures from the hypothesized model, in terms of constructing the new variables, will be addressed. A list of the variables and their reliabilities are found in Table 33.

number	les name	Reliabilities
1	aget	
2	education & income	.74
3	occupation*	
4	live now*	
5		
~	live in county w/land-use program#	
7	live in country w/tend use program"	
-	tive in mountain region*	
0	live in coastal region#	<i>(</i> 7
y	reads pub/joins organiz related to nat. res.	.63
10	exceeding Earth's carrying capacity, potential shortage	.92
11	resources are finite, conservation is necessary	.90
12	individuals can alleviate shortage	.02
14	own land for eachetic reasons	.07
15	own land for according reasons	.09
16	own land to hunt*	
17	no interest in eaching forestry secietance	75
18	don't know whom to contact about harvasting.	
10	hervesting adversely affects nature	73
20	indevente timber resources to bervest	54
21	distruct loggers and foresters	
22	will harvest when money is needed	-48
23	opposed to timber harvesting	.43
24	have harvested	

Table 33. 24 variables for the causal model

* indicates single item variables

Socio-demographic variables

Three socio-demographic items were dropped from the model, due to their weak correlations (less than r=.21) with other scales or items in the model, outside of correlations which one might expect (see Table 32). They were "retired" $(104)^4$, "participate in forest land-use program" (130) and "total forested acres" (111). "Retired" correlated strongly with age (r=.51) and weakly to moderate with income (.28), which one would expect as older persons tend to be retired and have less income. "Participate in forest land-use program" correlated strongly (r=.56) with "live in forest land-use county", which was expected. However, "participate in forest land-use program" correlated weakly to moderate (r=.25) with "sought assistance", which was surprising. This explains only 6% of the variance for seeking professional forestry

⁴ The numbers in parentheses reflect the item or scale number from the correlation matrices in Table 32--Correlations for the hypothesized model.

assistance. One of the requirements for participating in a forest landuse program is to have a forest management plan prepared by a professional forester. Total forested acres did not correlate above r=.17 with any other scales or items.

yde

Age (101) represents the age in years of the respondent (variable 1 in Table 33).

Education and income

The only socio-demographic items which were combined to form a single construct were education (102) and income (103). They formed a "socio-economic" construct (variable 2 in Table 33), because they are each a component of socio-economic status. They were also strongly correlated (gamma=.57, p < .00000) and separately they showed little difference in strength when correlated with other variables in the model. The higher scores indicate higher education and higher income and the lower scores, lower education and income.

Other socio-demographic items remained as single items. Occupation

Occupation (105) categorizes current and former occupations (if retired). Professional and technical positions were rated highest and service employees and laborers ranked at the lower end of the spectrum. Farmers and related occupations ranked in the middle of the index. It will become variable 3 (Table 33).

Live now and grew up

Live now and grew up, items 106 and 107 respectively, are indices composed of where people live now, or where they grew up. The values ranged from urban (medium or large city with 50,000 or more inhabitants) at the higher end to rural (in open country or on a farm) at the lower end of the index. These become variables 4 and 5, respectively (Table 33).

Live in a county with forest land-use; live in a mountain or coastal region

Whether respondents live in a county a forest land-use program (108) and, whether they live in a mountain (109) or coastal (110) region, were dichotomous items with a "yes" response receiving the high score. These become variables 6, 7 and 8, respectively (Table 33).

Access to environmental/conservation information

Reads publications or joins organizations related to natural resources

Environmental and/or conservation-type publications read (112) or environmental and/or conservation-type organizations joined (113) were combined because they both dealt with ways to receive information about natural resources and were strongly correlated (gamma = .647, p <.00000). This construct (variable 9, Table 33) measures whether Virginia NIPF landowners subscribe to magazines about tree production, outdoor recreation or wildlife conservation and/or joined organizations having to do with forestry, outdoor recreation or wildlife conservation. High scores indicate that NIPF landowners do subscribe and/or belong and low scores indicate that they do not.

Has information about forestry

A new construct was created called "has information about forestry" (variable 13, Table 33) and measures the extent to which the NIPF landowner had knowledge of forestry and forest-related services and whether forestry assistance was sought. This construct departed from the hypothesized model in that the items used to create it were considered to be "other causal variables" which were hypothesized to independently influence whether NIPF landowners made the decision to harvest. Additionally, one of the components of the model "not aware of forestry assistance" is a non-belief scale which resulted from a factor analysis of a causal variable "reasons for not seeking assistance". The construct created includes the score for knowledge about forestry and forest management (129), whether the NIPF landowner was aware of

forestry assistance (131) and whether the NIPF landowner had sought forestry assistance (133). It functions as an "information" variable, relating to whether one has information and awareness of forestry and forestry-related services. In interpreting this construct, high scores indicate a knowledge of forestry and forest management, having an awareness of forestry-related services and having sought professional forestry assistance. Low scores indicate low knowledge, not having sought assistance and lack of awareness of forestry-related services. Don't know whom to contact about harvesting

"Don't know whom to contact about harvesting" (136), is a nonbelief item and was the result of a factor analysis on "reasons for not harvesting". While the other factors that emerged were related more to beliefs and attitudes, this factor clearly has to do with lack of information. It is used in the model as a single variable (variable 18, Table 33). Those who did not know whom to contact about harvesting received a high score and those who did, a low score.

Belief and attitude variables

Beliefs and attitudes for the model include beliefs and attitudes originally hypothesized at the general, intermediate and specific levels in the hypothesized model (Figure 2) as well as new items and scales created through factor analyses on "reasons for ownership", "reasons for not seeking assistance" and "reasons for not harvesting".

A basic departure from the hypothesized model occurred with the combining of some of the original belief and attitude scales. It was originally hypothesized that different levels of beliefs would be observed. The first regarded resources in general; next, forest resources in Virginia; and, finally, issues specific to the individual Virginia NIPF landowners. This, however, did not occur. Rather, the links between some of the beliefs and attitudes (again based on parallelism) were so similar, both within and between the different levels, that in the interest of simplifying the model and because these

constructs were basically functioning as equivalents in terms of content, they were combined.

Exceeding Earth's carrying capacity, potential for shortage

Two general level beliefs from the hypothesized model, "humans must respect nature and not exceed Earth's carrying capacity" (115) and "the potential for a resource shortage is serious" (117), combined to form a new construct, "exceeding Earth's carrying capacity, potential for shortage is serious" (variable 10, Table 33). The construct represents the belief that humans must respect nature and live within the limits imposed by the availability of Earth's natural resources or face natural resource shortages. High scores representing the most concern about the seriousness of the resource shortages to low scores representing the least concern.

Individuals can alleviate the resource shortage

A general level belief from the hypothesized model, "individuals can help conserve" (119) and a specific level belief, "I have a moral obligation to manage my forest land for the future" (124) were combined to form a construct called "individuals can alleviate the resource shortage" (variable 12, Table 33). This construct represents the belief that individuals can do something to alleviate the resource shortage and make a difference by having conservation take priority over current lifestyles and profits. High scores representing a strong belief that individuals can do something to a low score indicating less of a belief. Resources are finite; conservation is necessary

This variable is the result of two steps: 1) the creation of a construct from three scales for the hypothesized model, and 2) the combining of these three constructs to form a "super construct". It is also a departure from the hypothesized model in that scales within and between levels combined.

The first step was the development of the three new constructs (NC). One is the combination of two beliefs at the general level in the

hypothesized model---"the resource shortage is real" (114) and "consumers must conserve" (118) to form a single new construct (NC 1) called "the shortage is real, consumers must change lifestyles". Another is the combination of a scale from the intermediate level "society's rights over individual rights" (121) and two specific level belief scales, "conservation versus profits on NIPF forest land" (123) and "NIPF do not have the right to do what they want forested land" (122), to form a new construct called "society's rights over individual's rights re: natural resource use" (NC 2). The third construct was created by combining of a general level belief scale from the hypothesized model, "humans do not rule over nature" (116), and an intermediate level scale, "concern over conserving Va.'s forest resources" (120), to form new construct "humans are not over nature; conservation must be considered" (NC 3).

Table 34 below gives the correlations between the three new constructs, NC 1, NC 2, and NC 3.

Table 34. Correlations between the three new constructs

shortage is real, consumers must change lifestyles (NC1)	NC 1 100	NC 2 94	NC 3 83	
society's rights over individ. rights re: nat. res. use" (NC 2)	94	100	92	
humans are not over nature; conservation must be considered" (NC 3)	83	92	100	

Based on the correlations and the content of three new constructs, they were determined to be similar enough in content to combine them and create a "super construct" called "resources are finite; conservation is necessary". The content of this "super construct" basically addresses that the natural resources shortage is a real issue, as resources are finite, and that conservation efforts must take priority over an individual's rights to do what they want with natural resources (variable 11, Table 33). High scores represented the most concern about resources being finite and the need to conserve with lower scores indicating less of a concern. Due to several factor analyses, several new belief and attitude variables were created from the more general categories "reasons for owning forested land", "reasons for not harvesting" and reasons for not seeking assistance".

The following three scales are a result of the factor analysis on "reasons for owning forested land" which appeared as a single variables in the hypothesized model (Figure 2).

Own land for aesthetic reasons

Two of the scales created from a factor analysis of "reasons for owning forested land, "own forest land to conserve it" (125) and "own forest land for the amenities it provides" (126), were combined as they both dealt with non-economic or aesthetic reasons for ownership, were strongly correlated (gamma=.63, p <.00001) and separately they showed little difference in strength when correlated with other variables in the model. The construct created is called "own land for aesthetics reasons", variable 14 (Table 33). High scores indicate this was a very important reason for ownership while low scores indicate that it was not an important reason for ownership.

Own land for economic reasons

The scale "own land for economic reasons" (127) indicates the importance of economic reasons for ownership, such as producing commercial timber or as a real estate investment. High scores indicate this was a very important reason for ownership while low scores indicate that it was not an important reason for ownership. It will remain the same in the model and will be variable 15 (Table 33).

Own land to hunt

"Own land to hunt" (128) indicates the importance of owning forested land for hunting. High scores indicate this was a very important reason for ownership while low scores indicate that it was not an important reason for ownership. In the model it will be variable 16 (Table 33).

The following belief scales resulted from the factor analysis on "reasons for not harvesting";

Harvesting adversely affects nature

The scale "harvesting affects nature" (135) measures the perceptions of NIPF landowners about the adverse effects of harvesting on nature--scenic beauty, wildlife habitats, etc. High scores indicate a strong perception that harvesting has adverse effects on nature, low scores, less of a perception. This is variable 19 in the model (Table 33).

Inadequate timber resources

"Inadequate timber resources" indicates whether the NIPF landowner has a concern over the adequacy of his/her timber resources for harvesting--whether it is too low a volume per acre, too low quality, etc. High scores indicated more of a concern that timber resources are inadequate and low scores, less of a concern. This is variable 20 in the model (Table 33).

Distrust of loggers (and sometimes foresters)

This scale represents the distrust held by Virginia NIPF landowners primarily of loggers and, sometimes foresters. Higher scores indicate more distrust than lower scores. This is variable 21 in the model (Table 33).

Will harvest when money is needed

"Will harvest when money is needed" indicates if a Virginia NIPF landowner, whether or not they have already harvested, will harvest when money is needed, i.e., for emergencies or to fund retirement. High scores indicate a tendency to harvest when income is needed and low scores, less of a tendency. This is variable 22 in the model (Table 33).

Opposed to harvesting

This variable measures the strength of the opposition Virginia NIPF landowners have toward harvesting. High scores indicate an opposition to harvesting, while low scores indicate less of an opposition.

Outcome variable

Have harvested

The outcome variables for the model is "have harvested"--whether an NIPF landowner has harvested timber from his or her property. This is a dichotomous variable with "yes" indicating having harvested and "no" indicating not having harvested. This will be variable 24 (Table 33) for the model.

The final 24 variables were then correlated on PACKAGE and a matrix of their correlations was produced for the causal model (Table 35).

Table 35. Correlations between the 24 variables in the causal model.

advantion/income occupation live now greatup tive in county with forest land-use program live in coastal region reads pub./joins organiz related to net. res. exceeding carrying cap. potential for short. resources are finite, conservation is necess. individuals can alleviate shortage has info. re: forestry and forestry services own forest land for economic reasons own forest land for economic reasons own forest land to hunt no interest in seeking forestry assistance don't know whom to contact about harvesting harvest loggers and foresters harvest when money is needed opposed to harvesting have harvested	836
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CHAPTER FIVE RESULTS AND DISCUSSION

The causal model

Path analysis is not a method for <u>discovering</u> cause, but rather, a method applied to a causal model formulated by the researcher on the basis of knowledge and theoretical considerations. Because of this, it was first necessary to construct a causal model (Figure 4) before running the analysis. Once the analysis is done, a path model is used to graphically illustrate the results. Formulation of the causal model was based on the theoretical perspectives in Chapter 2, the literature reviewed in Chapter 3 and the content of the 24 variables in Table 33.

While the specific content of the belief and attitude scales in the causal model departed from those in the hypothesized model, the same basic theoretical assumptions used to construct the hypothesized model was applied for the causal model. The basic assumptions were that NIPF landowners in Virginia make decisions about managing their forested land based on their beliefs and attitudes about forestry and forest management; that these beliefs and attitudes are hierarchically arranged from general to more specific; and, that they are influenced by nonbelief variables, external to the hierarchical belief chains.

The departure from the hypothesized model relates to the content of the constructs. Originally it was hypothesized that beliefs and attitudes would be hierarchically arranged according to NIPF landowner beliefs about the level of the resource--the environment as a whole at the most general level, to issues concerning Virginia's forests at the intermediate level, to issues related to the NIPF landowners forested land at the most specific level. This did not occur. The constructs actually resulted in two sets of beliefs and attitudes, hierarchically arranged, with a common general level belief. The first set addressed beliefs and attitudes related to the availability of resources. They did not specifically address Virginia forests nor the





NIPF landowner's private forest land. Rather, at the most general level, they addressed concerns over exceeding Earth's carrying capacityand the potential for a resource shortage. The next level addressed what needed to be done about the potential shortage and who might do it. The more specific level addressed what could be done. The second set of beliefs and attitudes also began with concern over exceeding the carrying capacity of the resource base but the hierarchy focused more on beliefs and attitudes surrounding the cause of, and a reaction to, exceeding the carrying capacity of the resource base than on what might be done. This set also was arranged from general to most specific.

There are four basic components to the causal model--sociodemographic variables, information variables, beliefs and attitude variables, and outcome variables. These four components will be discussed in terms of their interaction with each other.

The most general belief "exceeding Earth's carrying capacity, potential for shortage is serious" $(10)^5$ was placed at the top of the hierarchy for both sets of hierarchical belief chains.

For the first hierarchical chain, which relates to beliefs about conservation, placing variable 10 at the top of the hierarchy is based on the assumption that unless it is accepted at the most general level that humans must live within the Earth's carrying capacity or face natural resource shortages, then there would be little concern about the need for conservation. After all, if one does not believe that it is necessary to live within Earth's carrying capacity or that humans will face resource shortages, they would have no reason to believe in conservation. This belief must be accepted before other beliefs in this hierarchy can be considered, making the relationship of this belief with the intermediate level beliefs (variables 11 and 12, respectively) ones

⁵Number in parentheses indicates the variable number in the causal model.

of logical necessity. If it is accepted, it will allow for consideration of conservation--the intermediate levels in the belief hierarchy (10 --> 11, 10 --> 12).

Those who believe that humans are exceeding Earth's carrying capacity, and there is potential for a shortage (10) appear to be divided on what can be done. One group tends to think about it in more general terms (that resources are finite and conservation is necessary) (11). The other appears to take more responsibility by addressing how they, as individuals, can impact the resource shortage (12).

Assuming they have accepted that the carrying capacity of the Earth is being exceeded (10), the group that now thinks in broad terms about what can be done, will be more likely to believe that resources are finite and conservation is necessary (10 --> 11). Level of education and income (2) function as a causal alternative variable and can influence whether the intermediate belief (11) is accepted. Those with a high level of education and income will be more likely to believe that resources are finite and conservation is necessary (2 --> 11).

If NIPF landowners accept that resources are finite and conservation is necessary (11), they will then be able to move to the most specific level in the hierarchy which expresses their attitude about harvesting when money is needed (22). Those who accept that resources are finite and conservation is necessary will be less likely to harvest when they need the money (11 --> 22). This is a relationship of logical implication, as it is not necessary to believe in resource conservation to decide to harvest when money is needed.

Level of education and income (2) acts as a causal alternative variable and can also influence whether NIPF landowners will harvest when they need money (22). Those with a higher level of education and income will be less likely to harvest when money is needed (2 --> 11). For those with a lower level of education and income, their forested

resources may be "money in the bank" and they see it as a source of funds should they need it.

Whether NIPF landowners believe that resources are finite and conservation is necessary (11) also influences whether they have an interest in seeking forestry assistance (11 --> 17). Those who do believe in resources being finite are less likely to have an interest in seeking forestry assistance. This is a relationship of logical implication as it is not necessary to believe in resources being finite in order to have a lack of interest in seeking forestry assistance. Occupation (3) and living in a mountain region (7) both act as causal alternative variables and influence whether NIPF landowners have an interest in seeking forestry assistance (17). NIPF landowners with more professional positions are more likely to have an interest in seeking forestry assistance (3 --> 17). Those who live in mountain areas are less likely to seek assistance (7 --> 17).

Having an interest in seeking forestry assistance (17) is part of the hierarchical chain which influences whether NIPF landowners are opposed to harvesting (23). Those who do not have an interest are more likely to be opposed to harvesting (17 --> 23). This is a relationship of logical implication.

Returning back to the most general belief, the second group who accepts that Earth's carrying capacity is being exceeded (10), and thinks about what can be done in more specific terms, will be more likely to believe that they, as individuals, can alleviate the resource shortage (10 --> 12). This is a relationship of logical necessity as one would not consider what they could do in terms of conservation if they did not believe there was potential for a resource shortage. If individuals do accept that there is potential for resource shortage, they will be more likely to believe they can help alleviate it (10 --> 12). One way they might believe they can alleviate the resource shortage is by having an opposition to harvesting (23). NIPF landowners

who believe individuals can alleviate the resource shortage are more likely to be opposed to harvesting (12 --> 23). This is a relationship of logical implication as it is not necessary to accept that individuals can alleviate the shortage before being opposed to harvesting. Whether NIPF landowners own their land for aesthetic reasons (14) is also influenced by their belief that they can conserve and alleviate the shortage (12). Those who believe they can alleviate the shortage are more likely to own their land for aesthetic reasons (12 --> 14). This is a relationship of logical implication as one can own land for aesthetic reasons without believing that they can conserve. Age (1) acts as a causal alternative variable and influences whether respondents own their land for aesthetic reasons (1 --> 14).

The second belief hierarchy relates more to the cause of, and a reaction to, exceeding the Earth's carrying capacity than to what might be done. It also begins with the general level belief that by "exceeding the Earth's carrying capacity, the potential for shortage is serious" (10). In terms of belief hierarchies, those who believe that humans are exceeding Earth's carrying capacity (10) are more likely to believe that harvesting adversely affects nature (10 --> 19). Whether harvesting adversely affects nature (19) also influences whether NIPF landowners are opposed to harvesting (23). There are two paths from whether harvesting adversely affects nature to opposition to harvesting. With one group, there is direct relationship between the belief that harvesting adversely affects nature and an opposition to harvesting (19 --> 23). Those who believe harvesting adversely affects nature are more likely to be opposed to harvesting. With the second group, a distrust of loggers and foresters (21) acts as an intervening variable between their belief about the adverse effects of harvesting on nature (19) and their opposition to harvesting (23). Those who believe that harvesting adversely affects nature are more likely to distrust loggers
and foresters (19 --> 21). Those who distrust loggers and foresters are more likely to be opposed to harvesting (21 --> 23). All these relationships among beliefs and attitudes are logical implication (10 --> 19; 19 --> 23; 19 --> 21 and 21 --> 23).

An opposition to harvesting (23) influences why NIPF landowners own their forested land. Those who are opposed to harvesting are more likely to own their land for aesthetic reasons (23 --> 14), while those who are not opposed to harvesting are more likely to own their land for economic reasons (23 --> 15). These are both relationships of logical implication.

Another component of the model relates more to the influence of socio-demographic variables on other variables and to the influence of information variables on attitudes and beliefs. It begins with the influence of age and where one grew up on level of education and income. Older persons are less likely to have a higher level of education and income (1 --> 2). Where one grew up (5) also affects level of education and income (2). The more urban the area where one grew up, the higher the level of education and income one has (5 --> 2).

Occupation (3) is influenced by level of education and income (2). The higher the level of education and income one has, the more likely they are to hold a professional position (2 --> 3).

Where one lives now (4) is influenced by where they grew up (5) and their level of education and income (2). Those who grew up in urban areas are more likely to now live in urban areas (5 --> 4). Those with a higher level of education and income are more likely to live in urban areas (2 --> 4).

Whether one owns their land for hunting (16) is influenced by socio-demographics (occupation (3) and level of education and income (2)); whether they live in a county with a forest land-use program (6); and information, whether they read publications and/or join organizations related to natural resources (9). Those who have more professional positions are less likely to own their land for hunting (3 --> 16). The higher the level of education and income, the less likely the NIPF landowner is to own his/her land for hunting (2 --> 16). Those who live in forest land-use counties are less likely to use their land for hunting (6 --> 16). NIPF landowners who read publications and/or join organizations related to natural resources are more likely to own their land for hunting (9 --> 16).

Whether NIPF landowners read publications and/or join organizations related to natural resources (9) is influenced by their level of education and income (2). The higher the level of education and income, the more likely s/he is to read publications and/or join organizations related to natural resources (2 --> 9).

Other information variables--whether one reads publications and/or joins organizations related to natural resources (13); sociodemographics--where one lives now (4); and, belief and attitude variables--whether one believes Earth's carrying capacity is being exceeded (10) or whether one has an interest in seeking forestry assistance (17), influences whether they are more likely to have information about forestry (13). Those who read publications and/or join organizations related to natural resources are more likely to have information (9 --> 13). Those who live in more urban areas are less likely to have information about forestry (4--> 13). Those who believe that humans are exceeding Earth's carrying capacity are less likely to have information about forestry (10 --> 13). And, NIPF landowners with an interest in seeking forestry assistance are more likely to have information about forestry (17 -->13).

Information variables influence beliefs and attitudes. Having information about forestry (13) directly influences whether NIPF landowners believe their timber resources are inadequate for harvesting (20). Those who have information about forestry are less likely to believe they have inadequate timber resources (13 --> 20). However,

whether one knows who to contact about harvesting (18) functions as an intervening variable in the indirect relationship between the amount of information one has about forestry and forestry related services (13) and their belief in the adequacy of their timber resources (20). Those who have more information about forestry are more likely to know who to contact about harvesting (13 --> 18). Those who know whom to contact about harvesting are less likely to believe their timber resources are inadequate (18 --> 20).

Whether one believes their timber resources to be inadequate (20) influences their opposition to harvesting (23). Those who believe their timber resources are adequate, are less likely to be opposed to harvesting (20 --> 23). The relationship between the belief that one's timber resources are inadequate and their attitude opposing harvesting is one of logical implication.

An opposition to harvesting is influenced by several variables not yet mentioned. Whether one read publications and/or joins organizations related to natural resources (19) influences whether one is opposed to harvesting (23). Those who read these type of publications and/or join like organizations are more likely to be opposed to harvesting (9 --> 13). Those who live in a Coastal region are also more likely to be opposed to harvesting (8 --> 23).

All three types of variables, belief and attitude (opposition to harvesting (23)), socio-demographic (level of education and income (2)), and information (whether one has information about forestry (13)), influence whether NIPF landowners have harvested (24). NIPF landowners who are opposed to harvesting are less likely to have harvested (23 --> 24). Landowners with a higher level of education and income are less likely to have harvested (2 --> 24). Those landowners who have more information about forestry are more likely to harvest (13 --> 24).

The path analysis

Once the causal model was developed and causal relationships among variables determined, a path analysis was performed with PATHPAC (Hunter and Hunter, 1979) based on the assumptions made in constructing the causal model. Although several strong correlations were observed between variables in the correlation matrix (Table 35) use to construct the causal model, correlations do not specify the direction of causality within the path model. A path analysis is necessary to analyze the direction of causality and to distinguish between direct and indirect effects. PATHPAC uses the path coefficients to generate a predicted correlation matrix which is subtracted from the observed correlation matrix to provide a residual, or error, matrix to predict the goodness of fit for the proposed model. The path model (Figure 5) displays the results of the path analysis.

The data seemed to fit the model well. If the null hypothesis says that the data fits the model, and the alternate hypothesis is that the data departs from the model, then a probability of >.05 leads to support of the null hypothesis. The probability for the model is = .429 (df =216), which is greater than .05. This supports the null hypothesis that the data fits the model. The overall chi square was used to derive a standard z-score using the following formula:

chi square - df
$$\sqrt{2(df)}$$
 = z

(chi square minus the degrees of freedom, divided by the square root of 2 times the degrees of freedom = z). The p-value was then extracted from the normal probability distribution of z.

The statistics required to assess goodness of fit for the model are presented in Tables 36-39. Table 36 contains the original correlations between the scales as corrected for attenuation. Table 37

contains the path coefficients. Table 38 contains the predicted correlations and Table 39 contains the errors in fit for the model. Any paths of < .10 were considered too weak and dropped from the model.

The causal model fits the assumptions made for its construction. Beliefs and attitudes were found to be hierarchically-arranged and to flow from most general to most specific. Socio-demographic and information variables influenced beliefs and attitudes, as well as each other. Results also supported the premise that beliefs and attitudes which are specific and relevant to the behavior under consideration are better predictors than more general, abstract concepts.

One area in which the assumptions for the hypothetical model deviated in the path model related to relationships of logical necessity between the beliefs and attitudes. The predicted relationships for logical necessity held only in <u>some</u> cases. These findings are supported by the content of the variables, their correlations and the direction of causality indicated by the path model, and are discussed later in this section.

As expected, if the correlation of the most general belief (humans are exceeding Earth's carrying capacity of the resources base, variable (10) is considered having a direct influence on the final outcome variable--the decision to harvest (variable 24), this belief does not prove to be a good predictor of the behaviors. Using the original correlations for the model (Table 36) one can observe that the correlation between variable 10, the most general belief, and variable 24, the outcome variable, is -.13. However, when beliefs are considered as a series of hierarchical concepts, from most general to more specific, the influence of the general abstract beliefs is observed as indirect, explaining the low correlations. As hypothesized, the correlations between the more specific beliefs and behaviors are the best predictors. (The correlation between variable 23 "opposition to harvesting" and variable 24 "have harvested" is -.34). These findings



Figure 5. Path model with path coefficients for Va. NIPF landowner decisions regarding harvesting

Table 36. Original correlations' for the path model

occupation live now grew up live in forest land-use county live in mountain region distrust loggers and foresters opposed to harvesting have harvested 3 don't know whom to contact about harvesting reads publications/join orgs. re: nat. res. resources are finite, conservation is nec. individuals can alleviate resource shortage exceeding carrying capacity education and income ş own land for economic reasons harvesting affects nature inadequate timber resources harvest when money is needed has information about forestry no interest in seeking forestry assistance own land to hunt land for aesthetics 48 -16 -16 :0 5 2 : 1 りびはひはなり 8 UI :10 よひれ 5 3 0 2222228 ដង់ 8 27 -13 @ -19 -10 N in No 8 ក្ខដ្ឋនុន្ត -19 5 3 320 38 10 ÷;;;;; o <u>⊐ 8</u> . ż ដូ ż 8528g°? 324 N -27 7 33888 \$ اما 61-. ਹ ਛੇ -18 :0 6 ż ; 2 2 2 °555822235 5 0 N # 5 ø ង់ដុង ង្កដុនខ្ម = ನ 3 ទទ -19 32238842286 12 1 0 Q 522 :5 8 ЧŅ 22 чŖ đ : : : : : : : នៃនភភង 무구유 88 -10 -24 :5 ; Ź Å Ň 7 22.5 2-17 -16 ដដ ぇ N 8. 8250274730548 52459 ü ************** ಷ 20×4288855 - 2 19 よなに កុនុកឧទ្<u>ទ</u>ភកុខុខុ R 32 8 2 382838428 Ľ ų えびはい 나업 **迟**路 Ċ 2 + 10 + 2 + 2 + 3 -- 2; ; ÷2~ ĸ 2 29222232333 552422224 녚 * 82888324452455486666444 3

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are consistent with other results reported in the literature (Crespi, 1971; Liska, 1974; Heberlein and Black, 1976; Weigel and Newman, 1976; Padmanabhan, 1981; and Heberlein, 1981).

#### The path model

### The belief hierarchies

Those who have accepted that Earth's carrying capacity is being exceeded, will be more likely to believe that resources are finite and conservation is necessary (10 --> 11 = .65) Level of education and income function as a causal alternative variable and can influence whether the belief that resources are finite and conservation is necessary is accepted. Those with a higher level of education and income will be more likely to believe that resources are finite and conservation is necessary (2 --> 11 = .39).

Those who accept that resources are finite and conservation is necessary will be less likely to harvest when they need the money (11 --> 22) = -.39.

Level of education and income act as a causal alternative variable and can also influence whether NIPF landowners will harvest when they need money. Those with a higher level of education and income will be less likely to harvest when money is needed (2 --> 22 = -.33). For those with a lower level of education and income, their forested resources may be "money in the bank" and they see it as a source of funds should they need it.

Occupation (3) and living in a mountain region (7) both act as causal alternative variables and influence whether NIPF landowners have an interest in seeking forestry assistance (17). NIPF landowners with less professional positions are more likely to lack interest in seeking forestry assistance (3 --> 17 = -.32). Those who live in mountain areas are more likely to lack interest in seeking assistance (7 --> 17 = .21). Having an interest in seeking forestry assistance (17) is part of the hierarchical chain which influences whether NIPF landowners are opposed to harvesting (23). Those who have no interest in seeking assistance are more likely to be opposed to harvesting (17 --> 23 = .22).

Returning back to the most general belief, another group who accepts that Earth's carrying capacity is being exceeded, will be more likely to believe that they, as individuals, can alleviate the resource shortage (10 --> 12 = .73). One way they might believe they can alleviate the resource shortage is by having an opposition to harvesting (23). NIPF landowners who believe individuals can alleviate the resource shortage are more likely to be opposed to harvesting (12 --> 23 = .24).

Whether NIPF landowners own their land for aesthetic reasons (14) is also influenced by their belief that they can conserve and alleviate the shortage (12). Those who believe they can alleviate the shortage are more likely to own their land for aesthetic reasons (12 --> 14 = .48). Age (1) acts as a causal alternative variable and influences whether respondents own their land for aesthetic reasons (14). Older persons are less likely to own their land for aesthetic reasons (1 --> 14 = -.30).

As discussed previously, the second belief hierarchy relates more to the cause of, and a reaction to, exceeding Earth's carrying capacity of the resource base than to what might be done. It also begins with the general level belief that by "exceeding Earth's carrying capacity, the potential for shortage is serious" (10). Those who believe that humans are exceeding Earth's carrying capacity are more likely to believe that harvesting adversely affects nature (10 --> 19 = .21). Whether harvesting adversely affects nature (19) also influences whether NIPF landowners are opposed to harvesting (23). There are two paths from whether harvesting adversely affects nature to opposition to harvesting. With one group, there is direct relationship between the belief that harvesting adversely affects nature and an opposition to harvesting (19 --> 23). Those who believe harvesting adversely affects nature are more likely to be opposed to harvesting (19 --> 23 = .50). With the second group, a distrust of loggers (and foresters) (21) acts as an intervening variable between their belief about the adverse effects of harvesting on nature (19) and their opposition to harvesting (23). Those who believe that harvesting adversely affects nature are more likely to distrust loggers and foresters (19 --> 21 = .42). Those who distrust loggers and foresters are more likely to be opposed to harvesting (21 --> 23 = .18).

An opposition to harvesting (23) influences why NIPF landowners own their forested land. Those who are opposed to harvesting are more likely to own their land for aesthetic reasons (23 --> 14 = .32), while those who are not opposed to harvesting are more likely to own their land for economic reasons (23 --> 15 = -.68).

## Socio-demographics, information and beliefs

Another component of the model relates more to the influence of socio-demographic variables on other socio-demographic variables, and to the influence of information variables on attitudes and beliefs. It begins with the influence of age and where one grew up on level of education and income. Older persons are less likely to have a higher level of education and income (1 --> 2 = -.28). The more urban the area where one grew up, the higher the level of education and income one has (5 --> 2 = .37).

Occupation (3) is influenced by level of education and income (2). The higher the level of education and income one has, the more likely they are to hold a professional position (2 --> 3 = .60).

Where one lives now (4) is influenced by where they grew up (5) and their level of education and income (2). Those who grew up in urban areas are more likely to now live in urban areas (5 --> 4 = .31). Those with a higher level of education and income are more likely to live in urban areas (2 --> 4 = .29).

Whether one owns their land for hunting (16) is influenced by socio-demographics--occupation (3); level of education and income (2); whether they live in a county with a forest land-use program (6); and, information--whether they read publications and/or join organizations related to natural resources (9). Those who have more professional positions are less likely to own their land for hunting (3 --> 16 = -.22). The higher the education and income level, the less likely the NIPF landowner is to own his/her land for hunting (2 --> 16 = -.18). Those who live in forest land-use counties are less likely to use their land for hunting (6 --> 16 = -.26). NIPF landowners who read publications and/or join organizations related to natural resources are more likely to own their land for hunting (9 --> 16 = .29).

Whether NIPF landowners read publications and/or join organizations related to natural resources is influenced by their level of education and income. The higher the education and income level, the more likely s/he is to read publications and/or join organizations related to natural resources (2 --> 9 = .40).

Other information variables--whether one reads publications and/or joins organizations related to natural resources (13); sociodemographics--where one lives now (4); and, belief and attitude variables--whether one believes Earth's carrying capacity is being exceeded (10) or whether one has an interest in seeking forestry assistance (17), influences whether they are more likely to have information about forestry (13). Those who read publications and/or joins organizations related to natural resources are more likely to have information (9 --> 13 = .38). Those who live in more urban areas are less likely to have information about forestry (4 --> 13= -.25). Those who believe that humans are exceeding Earth's carrying capacity are less

likely to have information about forestry (10 --> 13 = -.24). And, NIPF landowners who do not have an interest in seeking forestry assistance are less likely to have information about forestry (17 --> 13 = -.30).

Information variables influence beliefs and attitudes. Having information about forestry (13) directly influences whether NIPF landowners believe harvesting adversely affects nature (19) and whether their timber resources are inadequate for harvesting (20). Those who have information about forestry are less likely to believe that harvesting adversely affects nature (13 --> 19 = -.30). They are less likely to believe they have inadequate timber resources (13 --> 20 = -.31). However, whether one knows whom to contact about harvesting (18) functions as an intervening variable in the indirect relationship between the amount of information one has about forestry and forestry related services (13) and their belief in the adequacy of their timber resources (20). Those who do not have information about forestry are more likely not to know whom to contact about harvesting (13 --> 18 = -.29). Those who do not know whom to contact about harvesting are more likely to believe their timber resources are inadequate (18 --> 20 = .20).

Whether one believes their timber resources to be inadequate (20) influences their opposition to harvesting (23). Those who believe their timber resources are adequate, are less likely to be opposed to harvesting (20 --> 23 = .23).

Whether one read publications and/or joins organizations related to natural resources (19) influences whether one is opposed to harvesting (23). Those who read these type of publications and/or join like organizations are more likely to be opposed to harvesting (9 --> 23 = .27). Those who live in a Coastal region are less likely to be opposed to harvesting (8 --> 23 = -.22).

## Outcome variable

All three types of variables, belief and attitude (opposition to harvesting (23)), socio-demographic (level of education and income (2)), and information (whether one has information about forestry (13)), influence whether NIPF landowners have harvested (23). NIPF landowners who are opposed to harvesting are less likely to have harvested (23 --> 24 = -.23). Landowners with a higher level of education and income are less likely to have harvested (2 --> 24 = -.24). Those landowners who have more information about forestry are more likely to have harvested (13 --> 24 = .30).

### Logical necessity vs logical implication

Originally, it was hypothesized that the relationships between the beliefs and attitudes in the model would be ones of logical necessity. This did not occur. The only relationships of logical necessity which were observed were between a belief that humans are exceeding Earth's carrying capacity of the resources base (10) and two other beliefs: that resources are finite and conservation is necessary (11) and that individual can conserve and alleviate the resource shortage (12). All other relationships between beliefs and attitudes in the hierarchy were ones of logical implication.

Determining whether the links in the belief hierarchies are related because of logical necessity, logical implication, or other factors provides a method for observing what dimensions may be missing and need to be measured in order to have a more complete understanding of a particular hierarchy. Further, it provides information about which beliefs may the most difficult to change. Because relationships of logical necessity require acceptance of belief A before belief B can be considered, trying to influence the acceptance/rejection of belief B will also mean working with belief A. This can be illustrated with the relationships of logical necessity in the path model. First, before one can think about conservation, one must first accept that there is a

reason to conserve, i.e, humans are exceeding the carrying capacity of the Earth's resource base. Thus, if the goal is to get people to accept the need to conserve, it may be that educational efforts must first focus on why they need to conserve.

In relationships of logical implication, this is not so. Regardless of whether belief A is accepted, belief B can be considered. Thus, because Belief A is not logically necessary for Belief B, efforts to change B may focus directly on B. In the path model, the belief "harvesting adversely affects nature" is influenced by whether people believe humans are exceeding the carrying capacity of the Earth's resource base. However, it is not necessary for one to believe the carrying capacity is being exceeded in order to believe harvesting adversely affects nature. Forestry education efforts, for example, could focus directly on "harvesting adversely affects nature" without having to deal with whether people believe carrying capacity is being exceeded.

#### CHAPTER SIX

#### CONCLUSIONS

#### The importance of social dimensions in forestry research

Understanding the social dimensions of human relationships with the environment is critical for natural resource management. As this study of private forest landowners in Virginia illustrates, it is not only the physical and biological dimensions of forest resources which influence Virginia NIPF landowners to make certain forest land management decisions, in particular, the decision to harvest. When social dimensions, e.g., the role of beliefs and attitudes, knowledge levels of forestry and forest management and socio-demographic factors are considered, a more complete picture emerges of the decision process which contributes to harvesting decisions made by NIPF landowners in Virginia.

Within the context of social dimensions, this research also illustrates that the study of beliefs and attitudes alone are inadequate to determine what might influence Virginia NIPF landowners to harvest. Other variables such as the level of education and income they have and whether or not they have information about forestry and forest management also have a direct influence on whether NIPF landowners in Virginia decide to harvest.

Research focusing on the hierarchical nature of belief systems held by private forest landowners in Virginia, allows us to draw more of a distinction about what leads to their decision to harvest or not harvest. In would be inadequate to merely study general level beliefs to predict who might harvest. For example, Virginia NIPF landowners who hold the general level belief that we are "exceeding the Earth's carrying capacity" are less likely to have information about forestry and forest management. Having this knowledge directly influences who harvests, not the general level belief. Those who hold this general level belief are also more likely to believe that harvesting has an

adverse effect on nature. But as the path model also illustrates, those who have information about forestry and forest management are less likely to believe harvesting has an adverse effect on nature. From this one scenario alone, it is possible to begin to design forestry education programs which target uninformed beliefs about "harvesting adversely affecting nature".

## Implications of the research for forestry

Studies on private forest landowners have not focused on the interaction of belief systems and other social dimensions of resource decision-making. Thus, while there is significant literature about characteristics of private forest landowners, there has been little attempt to understand how their belief systems and socio-demographics interact to affect their forest-land management decisions. Having a broader understanding of Virginia private forest landowners and the factors which influence their forest land-use decision-making has implications for three interrelated areas.

## Forest policy

Traditionally, forestry programs provided by the Commonwealth of Virginia have focused on commercial production of timber on NIPF lands to support forest industry. Little attention, until recently, has been given to programs which support managing NIPF lands for non-market objectives. Not all NIPF landowners are interested in commercial production of timber. Some are more concerned about maintaining the aesthetic quality of the resource by preserving nature and protecting scenic beauty and wildlife habitat. Aesthetic reasons for forest management need to be considered as having equal importance as those associated with economic production of timber. The Virginia Department of Forestry is currently involved in introducing the Virginia Forest Stewardship Program to NIPF landowners in the state. The program is geared to meeting the aesthetic objectives of these landowners. However, unlike traditional programs which relied solely on Department of Forestry personnel, these new programs require inter-agency cooperation, such as wildlife habitat management advice offered by the Department of Game and Inland Fisheries. This, in itself, has implications because it will require a shift in institutional infrastructure for agencies which are currently charged with delivering services to NIPF landowners in the Commonwealth. Any programs which are initiated will require adequate infrastructure through which they can be carried out.

A pilot project is being developed by the Virginia Department of Forestry which has two purposes. The first is to disseminate information to NIPF landowners about a new program which focuses on nonmarket reasons for ownership, and the second is to gather data on the number of requests for this type of program. The policy issues this project will raise are both institutional within the Virginia Department of Forestry and at the state level. Will the current infrastructure of the department be able to support the project if the demand is high? If not, will the administration of the Virginia Department of Forestry be willing to make changes to support it, changes which might break with tradition? For example, could all reforestation efforts currently being undertaken by the Department and all prescribed burns be contracted to private consulting foresters? What if the Department of Forestry is not willing to make institutional changes and thus cannot support the demand of NIPF landowners who have aesthetic management objectives? If this is the case, should the Department really consider itself concerned with all the forest resources of the Commonwealth, or just those associated with commercial production of timber? What type of policy changes might be necessary at the level of state government? More positions? A larger operating budget?

# Forestry education outreach

The second area in which this research has implications, is related to the development of more effective and relevant forestry education/assistance programs for NIPF landowners. Much more attention must be paid to reaching the NIPF landowner and increasing their levels of knowledge about forestry and forest management as well information on the availability of professional forestry assistance. As the path model indicates, uninformed beliefs about forestry and forest management are related to lack of information.

Information provided by this survey will assist the Virginia Department of Forestry in developing the most effective approaches to working with Virginia NIPF landowners to change their uninformed beliefs and attitudes about forest management and to change behaviors associated with harvesting. Forestry education materials for NIPF landowners can be produced which focus on the non-market objectives of owning forested land, while at the same time discussing the role harvesting can play to maintain the aesthetic quality of the forest. Until very recently, almost all the brochures which are available for NIPF landowners in Virginia focused on practices associated with commercial production of timber, with little attention being paid to dispelling uninformed beliefs. As Richmond and Baumgart (1981) indicate, demonstrating that attitudes and beliefs towards the environment are ordered in some way allows for sequencing of educational material, a technique which could be used for forestry education programs.

## Forestry curricula

The third implication of the research is in regard to the role of colleges and universities with a forestry curricula. Schools of forestry can play an important role in the process of educating NIPF landowners by better preparing their students for interaction with this group. Social components should be included within the curricula geared towards more effective communication and interaction with NIPF

landowners. Traditionally, forestry education curriculums, like forestry research, have focused on the biological and physical dimensions of the resource. Yet foresters must also have a understanding of, and sensitivity to, the social dimensions which drive forest-land management decision-making. Given the beliefs and attitudes held by private forest landowners, it will be important for forestry curricula to address the role of social dimensions in forest management. As this research illustrates, the social dimension is pervasive and new approaches must be developed to deal with the issues which are raised. What type of policy changes would be necessary in schools of forestry to prepare their students to deal more with the non-market issues related to forestry than the traditional biological issues? Will they offer courses in sociology, communication and other more social science oriented classes?

#### Further research

While the results of this study illustrate the potential for using an integrated approach to gaining an understanding of why people behave towards forestry resources the way they do, there is a need for further research in three areas--forestry, human ecology and attitude theory.

# Forestry and human ecology

It is difficult to separate further research needs in the area of forestry without combining them with human ecology as the research efforts must focus on social dimensions surrounding forest resources. This includes methods to identify NIPF landowners--who they are, where they are, and how to reach them. Without this information, one can only plan general forestry outreach programs, which tend to reach those who, most probably, already have an interest in forestry assistance. By not knowing who or where the NIPF landowners are, it limits the ability of forestry professionals to design educational outreach programs which target specific groups of NIPF landowners who may be most likely to hold

a certain set of beliefs. In a marketing strategy prepared for the Virginia Department of Forestry, Hodge (1992) found that there was a direct correlation between beliefs held and the amount of forested acreage owned. Yet, in Virginia, the exact number of NIPF landowners and the size of their forested holdings are unknown. Before forestry education programs can be disseminated to forest landowners to dispel uninformed beliefs, more information must be gathered as to who owns what size parcel.

Further research also needs to explore the relationship between information people have about the physical environment, and how this affects their belief systems and their decision-making processes about forest resources. NIPF landowners in Virginia have uninformed beliefs about the effects of harvesting on nature and about the adequacy of their own forested resources, both of which are influenced by the levels of information they have about forestry. In turn, these beliefs lead to an opposition to harvesting. If the NIPF landowner had more information about forestry and the positive effects of harvesting, one wonders if they would still hold the same beliefs. Would they choose different management strategies (as opposed to no management) of their forested land?

Research in human ecology and forestry could also focus on the issue of whether harvesting is done "sustainably". First, however, a definition for "sustainability" must be determined. In terms of NIPF lands in Virginia, what is sustainable forest land management? Gale and Cordray (1991) came up with eight definitions to answer the question "what should forests sustain"? Several of these definitions, e.g., "community stability", "human benefit sustainability", "self-sufficiency sustainability" and "ecosystem type sustainability", seem relevant for Virginia given the diversity of her forest resources. Therefore, any research on sustainable harvesting in Virginia would first necessitate a clear definition of the word. Copious information about the harvest

would also be needed such as the site index, the type of trees, the specific harvesting practices used on the different species harvested, the conditions under which the harvest was done (were best management practices followed) and any other relevant information.

Another area for further research is how information, for all natural resources, can be disseminated so that people make informed, as opposed to reactionary choices about natural resources. How much of an infrastructure will it take? Will society be willing to assume the costs?

#### Attitude theorists

For attitude theorists, this research illustrates the need for more research on the hierarchical structure of attitudes and beliefs as they relate to natural resource issues. By having more of an understanding how beliefs and attitudes are related either by logical necessity or logical implication, one will have a clearer idea of missing dimensions in attitude hierarchies.

Further research also needs to focus on non-belief variables such as information and socio-demographics that may act influence relationships between beliefs in order to identify ways to change uninformed beliefs. APPENDICES

QUESTIONNAIRE AND COVER LETTERS

APPENDIX A

DEPARTMENT OF PORESTRY

Dear Virginia Forest landowner:

Forests cover over 15.4 million acres in Virginia, 75% of which are privately owned. These forests and their management play a vital role in Virginia. They provide timber, and they are places of great scenic beauty. People enjoy Virginia forests for hunting, fishing, canoeing, hiking and "getting away from it all".

Because so much of Virginia's forests are privately held, the opinions and preferences of Virginia's private forest landowners are very important for the management of forests in the state. I am conducting this study to learn more about Virginia's private forest landowners. This is not a test but a way of measuring what Virginia private forest landowners believe about forests and forest management practices. Your response is voluntary but very important as the information you provide will help shape future forest management programs in Virginia. In order for the results to truly represent Virginia private forest landowners, it is important that the questionnaire be completed and returned by as many forest landowners as possible.

The results of the survey will be used to plan forestry programs for private forest landowners in Virginia. There will be a range of programs to assist you in managing your forest land according to your own needs. These programs might include assistance in managing for gypsy moths, increasing wildlife on your property, or planning a timber harvest, just to name a few.

Your name was drawn from a random sample of owners of forested land in <u>PRINCE EDWARD</u> county. For this survey, "forested land" means any *land that is forested, cut-over or scrub.* If you do not own more than 20 acres of land that is forested, cut-over or scrub in <u>PRINCE EDWARD</u> County, please check this box and return this letter in the envelope provided; you may discard the questionnaire.

In the following pages, you will find questions about forest resources owned by Virginians. Most of the questions give you answers from which to choose; if none of the choices represents your opinion, please write your answer in the blank labeled "other". Please try to answer each question in the way which best represents your opinion or belief. All answers are important, even those you indicate as "don't know". You may also be asked to skip around questions which don't apply to you. In that case, either an arrow or a phrase such as "(GO TO QUESTION 16) will direct you to the next appropriate question.

This questionnaire should be answered <u>only</u> by the person who makes the decisions about how this land is managed. If the person who makes decisions about this forested land cannot answer the questionnaire please check this box and return this letter in the envelope provided; you may discard the questionnaire.

You may be assured of complete confidentiality. I am doing this forestry research as part of my program of graduate study in forestry and am a long-time resident of Charlottesville. I am the only person who will have access to your name. The questionnaire has an identification number. This is so that I may check your name off of the mailing list when I receive your envelope. Your name will never be placed on the questionnaire.

Please return the survey in the envelope provided. I would be happy to answer any questions you might have. Please write me at Route 2, Box 211, Charlottesville, VA., 22901 or call me at collect at (804) 823-4001.

Sincerely,

Sandra J. Hody

Sandra S. Hodge Forestry Researcher

MSU is an Affirmative Action/Equal Opportunity Institution

### MICHIGAN STATE UNIVERSITY

#### DEPARTMENT OF PORESTRY

Dear Virginia private forest landowner:

About three weeks ago I wrote to you seeking information on private forest landowners in Virginia. As of today, I have not received your completed questionnaire. (If you did respond to the earlier mailing, please call me collect at 804-823-4001 or write me, so that I can be certain I received it and so that I will not bother you again.)

I have undertaken this study because of the belief that information on the opinions and preferences of private forest landowners need to be considered when planning forestry programs in Virginia. Your response is very important as the information you provide will help shape future forest management programs in Virginia.

I am writing to you again because of the significance each questionnaire has to the usefulness of the study. Your name was drawn through a scientific sampling process to select private forest landowners in Virginia. In order for the results of this study to be truly representative of all private forest landowners, it is essential that each person return the questionnaire. In the event that you have misplaced the questionnaire, a replacement is provided.

For this survey, "forested land" means any land that is forested, cut-over or scrub. If you do not own at least 20 acres of <u>forested land</u> in the county mentioned at the top of the first page of the questionnaire, please check this box and return this letter in the envelope provided. You may discard the questionnaire.

This questionnaire should be answered <u>only</u> by the person who makes the decisions about how this land is managed. If the person who makes decisions about this forested land cannot answer the questionnaire please check this box and return this letter in the envelope provided. You may discard the questionnaire.

You may be assured of complete confidentiality. I am doing this forestry research as part of my program of graduate study in forestry and am a long-time resident of Charlottesville. I am the only person who will have access to your name. The questionnaire and letter has an identification number. This is so that I may check your name off of the mailing list when I receive your envelope. Your name will never be placed on the questionnaire.

Your cooperation is greatly appreciated.

Cordially. Sandra S. Hodge

Sandra S. Hodge Forestry Researcher

MSU is an Affirmative Action/Equal Opportunity Institution

Virginia Private Forest Landowner Survey



Questions in this survey relate primarily to forested land you own in ______ county. However, if your forest land is located on the border of another county or state and you own parcels in the other county or state that <u>adioin</u> your forested land in ______ county, please answer these questions for those parcels of land also. By parcel we mean those pleces of land for which you receive a separate tax bill. Remember, forested land refers to land with timber, or that is cut-over or scrub land.

In this first section, I would like you to give me a little information about yourself and your background.

1. Is the area you live in now ....? (Please check the most appropriate answer)

	A large city (over 500,000 people)
2.	What is your age?
3.	Are you 🔄 male or 📋 female?
4.	Please circle the highest grade you finished in school.
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 Grade School High School Bacheler's Degree Mesters PhD., M.D. er JD
5.	How would you describe the area in which you <u>spent most of the first 15 years</u> of your life? (Please shack the most appropriate answer).
	A large sity (over 500,000 people)
6.	A large eity (over 500,000 people)

_

7. What is your ourrent household income range (before taxes)?

Below \$5,000 per year	
\$5,000-\$9,999	
\$10,000-\$19,999	
\$20,000-\$29,999	
\$30,000-\$39,999	
\$40,000-\$49,999	
\$50,000-\$59,999	
\$60,000-\$69,999	
\$70,000 and above	

8. The following chart concerns information about your forested land, as described at the top of page 1. If you own more than five parcels give information about the five most important parcels. By parcels we mean those pieces of land for which you receive a separate tax bill. Remember, forested land refers to land with timber, or that is cut-over or scrub land. Please fill in the blanks where necessary or check the best answer.

	PARCEL 1	PARCEL 2	PARCEL 3	PARCEL 4	PARCEL 5
1. Total number of forested acres					
2. Who owns this land? (Check the appropriate o	stegory below for	each parcel)			
Sole owner					
Husband and wife					
Family partnership					
Family corporation					
Non-family partnership					
Non-family corporation					
Other (please specify)					
3. How did you acquire each parcel of your forest	id land?				
Purchesed from relative					
Purchesed from non-relative					
Inheritance					
Gift					
Other (please explain)					
4. How long have you owned it?					
5. Where do you live in relation to each parcel of	your forested land	17			
On the property					
Within 25 miles					
Within 50 miles		•			
Further than 50 miles					
6. What type of trees do you have on each parcel	of your forested	land?			
Mixed pine and hardwoods but mostly pine					
Mixed pine and hardwoods but mostly hardwoods					
Pine (grows naturally)					
Pine (planted)					
Other (please describe)					
7. What is the average slope (steepness) for each	of your percels o	f forested lend?			
O to 5%					
5 to 10%					
over 10%					

9. Do you plan to change ownership of any of your forested land in the next 10 years? Please check one.

No Yes = = = =	> How	will the r	new owner	acquire it?	Please check one.	
		Purchase				

L	Gift
	Inheritance
	Other (Please explain)
	• •

- 10. Which of the following would be your best estimate of the ourrent market value of your forested land? (Please <u>do not</u> include the value of your residence if it is on the forested property.)
- 11. Do you own other forested land in Virginia (other than that which you mentioned above?)

No		
Yes = = = >	How many acres?	

12. Other than the forested land you own in Virginia, do you own any other land in the United States?

Yes = = = > How many acres? ____

What type of land is it? (Check all that apply.)

- 13. Owners of forested land in Virginia have different reasons for owning their land and many different ways of using it. Please indicate how important to you is each of the following uses for your forested land. Circle one answer next to each use which best represents how you feel.
  Vom Semantat Not

		very	acmewnat	NOT
	USE	Importent (I)	Important (SI)	Important (NI)
<b>∨A.</b>	Wildlife for hunting	VI	SI	NI
∕ B.	Maintaining scenic beauty	VI	SI	NI
<b>√</b> C.	Real estate investment	VI	SI	NI
D.	Leasing land for hunting	VI	SI	NI
Æ.	Producing commercially saleable wood	VI	SI	NI
<b>∽F</b> .	Producing firewood for personal use	VI	SI	NI
,∕G.	Viewing wildlife	VI	SI	NI
н.	Non-wildlife related outdoor recreation			
	(hiking, non-motorized trail biking,			
	horseback riding, camping, etc.)	VI	Si	NI
Х.	Preserving nature	VI	SI	NI
J.	First or second home site	VI	SI	NI
Κ.	Conservation easement	VI	SI	NI
L.	For a buffer from adjacent properties	VI	SI	NI
M.	Other (Please explain)	VI	SI	NI

In the next set of questions, we are interested in how you feel about your forested land. Please circle the answer next to each statement which best indicates how you feel. The choices are:

SA = Strongly Agree; A = Agree; N = Neither agree or disagree; D = Disagree; SD = Strongly Disagree.

14.	Making money from my forested land, now, is more important to me than managing it so that it will continue to produce many years in the future.	SA		N	D	SD
15.	On my forested property I feel I have the right to use whatever harvesting practices I want.	SA		N	D	SD
√ 1 <b>6</b> .	I have a moral obligation to maintain my forested land so that future generations can use it.	SA		N	D	SD
17.	I am willing to accept less profit from harvesting my forested land if the method of harvesting will be more environmentally-sound.	SA		N	D	SD
_y 18.	I believe in managing my land for future generations only if it does not lessen the profits I can make.	SA		N	D	SD
. <b>.</b> 19.	If I have an outbreak of insect pasts or tree diseases in my forest, I would not hesitate to use any means to control them.	SA		N	D	SD
20.	I own forested land so that I can protect it for future generations.	SA	A	N	D	SD

21. Please indicate whether or not <u>each</u> of the following statements represents how you feel about harvesting trees from your property. Circle "YES" or "NO" for each statement that applies. (By harvesting we mean outting any amount of live or dead trees).

1 .	I have never thought about harvesting trees from my property	YES	NO
8	I think the price offered or current market value for timber is too low	YES	NO
√ C	I don't think the trees are ready for harvest	YES	NO
D	I think harvesting would adversely affect hunting on my land	YES	NO
Ε	I think scenic beauty is adversely affected by hervesting	YES	NO
√F	l distrust loggers	YES	NO
VG	I distrust foresters	YES	NO
<b>√H</b>	I don't know who to contect about hervesting	YES	NO
1	I am opposed to timber hervesting	YES	NO
1 <b>J</b>	I think harvesting destroys wildlife habitst	YES	NO
κ,	I don't think I have enough land to harvest trees	YES	NO
Х	The land had been harvested when I acquired it	YES	NO
м	I am saving the trees to harvest for income for my retirement	YES	NO
N	I am saving the land for my heirs	YES	NO
0	I am holding the trees in case of an emergency and I need money	YES	NO
P	I think hervesting timber interferes with the forest's natural growth process	YES	NO
Q	The land is too steep to hervest	YES	NO
R	I don't think there is a market for the timber	YES	NO
S	I think my timber is of too poor quality to hervest	YES	NO
т	I think the timber on my land is too low a volume per acre to harvest	YES	NO
JU	I only out firewood or timber for personal use and don't consider this harvesting	YES	NO

22. During the time that you have owned it, have you harvested trees from your forested property?

	YES	(Piease skip	to	Question	23	on the	next	page)	
_									

YES (Please skip to Question 23 on the next page)
 NO = = = > Do you plan to harvest trees for commercial timber from any of your forested property?

NO YES > How soon do you expect this to occur?	
In the next 4 years	
Within 5 to 10 years	
Possibly at some future date (after 10 years)	

Which of the following reasons listed as A through U in Question 21 is the most important reason you have not harvested trees from your forested property? Please write the letter here ____

If you have not harvested, please skip to Question 26 on page 6.

23. What was the main reason you harvested trees from your forested land? Please check only one.

i needed the money	
I was offered a good price for the timber	Ō
I needed to clear some land	
The timber was mature	
I needed some of the timber for my own use	
General forest management (thinning, salvaging timber from disease or fire)	
Other	

24. Answer this question <u>only if you have harvested</u>. The following questions concern who may have helped you choose the trees you harvested, which harvesting practices you may have used on your different parcel(s) of forested land, and why you used them. Please answer these questions for <u>all the forested parcels</u> you identified in question 8 on page 2.

	PARCEL 1	PARCEL 2	PARCEL 3	PARCEL 4	PARCEL 5			
1. Who selected the trees to be harvested? (Please check all that apply)								
I selected the trees								
County forester (Virginia Dept. of Forestry)								
Private consulting forester								
Industry forester								
Timber buyer or logger								
A friend, relative or neighbor who is not any of the above								
Not sure								
Other (Please specify)								
2. Which of the following harvesting practices have you	used on your fo	prested land? (F	lease check al	I that apply)				
Cleer cut								
Seed tree								
Selective cut								
Diameter out		_						
Not sure								
3. For each percel that you checked above, please indicat	e why the her	resting practice	e were used.	(Check all that	apply.)			
To provide or improve wildlife habitat								
To provide fuelwood								
To improve the scenery (removing dead trees, etc.)								
To improve the area for recreation								
To selvage timber killed by insects, disease or fire								
To thin the trees to improve the forest land								
To provide timber for a commercial sale					•			
The people doing the harvesting thought it was the best practice to use								
Other (please specify)								

~

25. When you harvested, what products did you get? Please check all that apply.

Sewloge	. 🗆
Veneer logs	. 🗆
Pulpwood	. 🗆
Posts, poles, or pilings	. 🗆
Christmas trees	. 🗆
Don't know what products were hervested	. 🗆
Other	. 🗆
(please explain)	

28. Are you aware of the Forestry Incentives cost-sharing program (FIP) for reforestation in Virginia?

No
Yes> Have you ever used the Forestry Incentive cost-sharing program for reforestation in Virginia?
□ No

27. Are you aware of the Reforestation of Timberlands cost-sharing program (RT) for reforestation in Virginia?



In the following questions, we are interested in the kinds of advice you may have received about managing your forested land. Please answer these questions whether <u>trees have been harvested from your property or not</u>. By forestry advice we mean advice, from persons who have professional forestry training, about the management of your forested land.

28. During the time that you have owned your forested land, have you sought advice from persons with professional forestry training, about the management of your forested land?

YES (Continue with Question 29.)

NO = = = > Even though you did not seek it, have you ever received advice from persons with professional forestry training, about the management of your forested land?

VES

Please skip to Question 31 on the next page

29. If you have sought forestry advice, please complete the following box. Next to each agency or person who provides forestry advice, there are three columns. Please answer YES or NO in each column, for each agency or person listed. The columns ask if you sought advice, if you followed it and how satisfied you were.

AGENCIES OR PERSONS PROVIDING PROFESSIONAL FORESTRY ADVICE		Have you ever sought advice from any of these persons?		Did you follow all or some of the advice?		How satisfied were you with the advice provided? (Circle one answer for each agency from which you sought advice.)			
	percenter				Satisfied	Satisfied	Dissatisfied	Dissatisfied	
Soll Conservation Service personnel	Yes	No	Yes	No	VS	55	SD	VD	
Cooperative Extension Service personnel	Yes	No	Yes	No	vs	55	SD	VD	
Virginia Department of Forestry personnel	Yes	No	Yee	No	VS	SS	SD	VD	
Industrial Landowner Assistance Program forester	Yes	No	Yes	No	VS	<b>SS</b>	SD	VD	
Private consulting foresters	Yes	No	Yes	No	VS	55	SD	VD	
Commercial logger/timber buyers	Yes	No	Yes	No	VS	SS	SD	VD	
Virginia Department of Game and Inland Fisheries personnal	Yes	No	Yee	No	vs	55	SD	VD	
Family, friends or neighbors who are not any of the above	Yes	No	Yes	No	vs	SS	SD	VD	

30. What did you seek this forestry assistance or advice for? Please check all that apply.

Timber stand management (thinning, improvement outs, pruning, herbicide application, prescribed burning, etc.)
Timber sales (timber marking, sales assistance, timber valuation, etc.)
Seneral forest management (planning, surveying, insect and disease control) $[$
Reforestation and planting
Mildlife management
Assistance in preparing a forest management plan [
Dther

(Please specify)___

If you have sought advice, skip to question 32 below.

31. If you <u>have not sought</u> advice from persons with professional forestry assistance training about the management of your forested land during the time you have owned it, please check the reasons below which best represent why you have not sought such advice. Check all that apply.

I never thought about getting forestry advice or assistance	
I have enough knowledge about forest management	
I didn't know forestry advice or assistance was available	
I know my land is too steep to manage	
I didn't think I could afford the service	
I didn't know how to contact anyone for forestry advice or assistance	
I had to make a quick decision and I didn't have time to seek advice or assistance	
I received professional forestry advice without seeking it	
I received my information from another source (Please specify)	

In the section which follows, the statements or questions are designed to explore your knowledge about forestry and forestry management in Virginia.

32. Each statement below refers to one, two, three, four or all of the trees listed below which are commonly found in Virginia forests, which are listed next to the statement. For each statement, please circle one enswer--YES, NO or DK (Don't Know)--in each of the columns with the tree names to indicate whether you believe that statement applies to that particular tree. (See the example below).

	TREES								
STATEMENTS	Yellow Popler	Lobiolly Pine	Sweet Gum	White Pine	Oak				
Example: Tree name begins with "O"	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Stays green all year	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Seeds are in cones	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Seeds are called acorns	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Young trees tolerate only a small amount of shade	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Young trees tolerate a moderate amount of shade	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Often sprouts new, young trees from the stump after outting	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
Prefers to grow in drier areas	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
The favorite food of gypsy mothe	Yes No DK	Yes No DK	Yes No DK	Yes No DK	Yes No DK				
33. Definitions are given below for different forest management practices. After each definition, four practices will be listed. Please circle the one practice next to each statement which you feel best fits the definition.

₽.	An area of at least five acres where all trees, large and small, are hervested at the same time.	clear outting	selective cutting	seed tree	diameter outting
Ь.	Usually the oldest and the largest trees are harvested, either in small groups or individually.	clear outting	selective cutting	seed tree	diameter outting
c.	At least eight trees per acre are left in a out-over area.	clear cutting	selective outting	seed tree	diameter cutting
d.	All trees over a certain size in an area are harvested.	clear outting	selective cutting	seed tree	diameter cutting

34. In the box below, <u>such</u> statement refers to one, or more than one, of the harvesting practices listed beside it. Under <u>each</u> practice listed indicate whether you believe that practice applies to the statement or not. Please do not guess at the answers. If you believe it applies, circle "Yes"; if you <u>do not</u> believe it applies, please circle "No". If you don't know, please circle "DK".

PRACTICES						
STATEMENTS	Clear cutting	Diameter outting	Selective cutting	Seed Tree		
Often allows a lot of sunlight to reach the forest floor	Yes No DK	Yes No DK	Yes No DK	Yes No DK		
Often allows only weak sunlight to reach the forest floor	Yes No DK	Yes No DK	Yes No DK	Yes No DK		
Often results in all trees in an area being a similar age and size	Yee No DK	Yes No DK	Yes No DK	Yes No DK		
Often results in trees in an area being different ages and sizes	Yes No DK	Yes No DK	Yes No DK	Yes No DK		
Promotes the best YELLOW POPLAR reproduction	Yes No DK	Yes No DK	Yes No DK	Yes No DK		
Promotes the best LOBLOLLY PINE reforestation	Yes No DK	Yes No DK	Yes No DK	Yes No DK		
Promotes the best WHITE PINE reforestation	Yes No DK	Yes No DK	Yes No DK	Yes No DK		
Promotes the best OAK regrowth	Yes No DK	Yes No DK	Yes No DK	Yes No DK		

35. The following statements are about pine. Circle the enswer next to each statement indicating whether you believe the statement to be true or false. If you don't know the answer, please circle don't know.

Most of the time after a pine stand is out, it will naturally grow back to the same quality stand that existed before outting.	TRUE	FALSE	DON'T KNOW
All types of young pines will grow from stumps of pines which have been out.	TRUE	FALSE	DON'T KNOW
To ensure a quality stand of pine it is necessary to do some site preparation—such as burning and applying herbicides—prior to replanting the pine.	TRUE	FALSE	DON'T KNOW
After pines are harvested, hardwoods can begin growing in the light and space that result.	TRUE	FALSE	DON'T KNOW
Thinning lobicity pine stands results in better quality, more well-developed trees.	TRUE	FALSE	DON'T KNOW
Thinned lobiolly pine can be sold as pulpwood.	TRUE	FALSE	DON'T KNOW

36. The statements below are concerned with your views on how some of the harvesting practices used in Virginia affect wildlife and scenery. Next to each statement you will find four harvesting practices—clear outting, diameter outting, selective outting, and seed trees. Indicate for <u>each</u> of these practices whether you believe the statement is applicable. More than one practice can apply for each statement. If you believe it applies, circle "Yes"; if you <u>do not</u> believe it applies, circle "No". If you don't know, circle "DK".

	PRACTICES											
STATEMENTS		Clear cutting		Diameter outting		Selective cutting			Seed trees			
Often improves an area for game wildlife (deer, turkey, quail, rabbit, etc.)	Yes	No	DK	Yes	No	DK	Yes	No	DK	Yes	No	DK
Often improves an area for non-game wildlife such as songbirds	Yes	No	DK	Yes	No	DK	Yes	No	DK	Yes	No	DK
Can improve the scenery in one year	Yes	No	DK	Yes	No	DK	Yes	No	DK	Yes	No	DK
Can improve the scenery after 10 or more years	Yes	No	DK	Yes	No	DK	Yes	No	DK	Yes	No	DK

The next statements are about differences in Virginia forests today as compared to 10 years ago. Please check the box next to the one answer in each question that you believe is the best answer.

37. Compared to 10 years ago, the total amount of forested land that exists today in Virginia is

More than 10 years ago	
Similar to 10 years ago	
Less than 10 years ago	
Don't know	

38. Compared to 10 years ago, today the amount of Virginia forests planted in pine is

More than 10 years ago	
Similar to 10 years ago	
Less than 10 years ago	
Don't know	

39. Compared to 10 years ago, the amount of wood being harvested from Virginia forests today is

Greater than	10 years ago		 	 🗆
Similar to 10	years ago	• • • •	 	 🗆
Less than 10	years ago	• • • •	 	 🗆
Don't know .			 	 🗆

40. Compared to 10 years ago, the deer population in Virginia today has

Increased from 10 years ago	]
Remained about the same as 10 years ago	]
Decreased from 10 years ago	]
Don't know	ן

The following questions concern your feelings about all forests in Virginia in general, not just your own forested land. For each of these questions, please circle the one response which best indicates how you feel about forested land in Virginia. The choices are

SA = Strongly Agree; A = Agree; N = Neither agree or disagree; D = Disagree; SD = Strongly Disagree

J ₄₁ .	A person who owns forested land in Virginia has the right to do what they want with it to make a profit regardless of any long-term consequences to the land.	SA	A	N	D	SD
42.	It is more important to hervest timber from Virginia's forests than it is to worry about conserving forest areas for rare plants and animals.	SA	•	N	D	SD
43.	The positive benefits of economic growth in forest industries in Virginia far outweigh any negative environmental consequences.	SA	A	N	D	SD
44.	Too much controversy occurs about harvesting in Virginia's forests. No matter how they are harvested, Virginia's forests will always grow back and be able to supply good quality timber.	SA	•	N	D	SD
√45.	With new and better technology, Virginia's forest resources will always be able to meet the growing need for wood in Virginia.	SA		N	D	SD
46.	In Virginia, the selection of a hervesting practice should not be based solely on cost. The impact that the practice will have on wildlife habitat, scenic beauty and future generations should be considered as equally important.	SA	•	N	D	SD
47.	The benefits of conservation laws in Virginia far outweigh any negative impacts they may have on human well-being.	SA	A	N	D	SD
48.	More money should be invested in research to increase timber yields from Virginia's forest resources, and less on trying to conserve them.	SA	•	N	D	SD
49.	The State of Virginia must ultimately control what landowners do with their private forest land in the state.	SA		N	D	SD
50.	Persons who own forested land in Virginia have the right to do what they went with it for their own enjoyment, regardless of any long-term consequences to the land.	SA	A	N	D	SD

We are interested in your preference regarding different aspects of Virginia's forests. For each of the questions below, please check the one box which indicates your preference.

51. When compared with today, what amount of forests with a mixture of trees (hardwoods and pines), would you like to see in Virginia, 10 years from now?

	A greater amount of mixed forests than there are today	
	Similar amounts of mixed forests as there are today	
	Less mixed forests than there are today	
52.	When compared with today, what amount of pine forests would you like to see in Virginia, 10 ye	ers from now?
	A greater amount of pine forests than there are today	
	Amounts similar to the pine forests that exist today	
	Less pine forests than there are today	
53.	When compared with today, what amount of timber from Virginia forests would you prefer to be	harvested in the next ten years?
	Large increase in harvesting	
	Moderate increase in hervesting	
	Same amount as is now harvested	
	Moderate decrease in hervesting	
	Large decrease in hervesting	

54. Ten years from now, how many deer would you like to see in Virginia, as compared to today?

More deer	
Similar numbers of deer	
Less deer	

We are interested in how Virginia private forest landowners feel about the environment in general. Please indicate your answer by circling one choice next to each statement which best describes your feelings. The choices are:

SA = Strongly Agree; A = Agree; N = Neither agree or disagree; D = Disagree; SD = Strongly Disagree.

55.	We are approaching the limit of the number of people the Earth can support.	SA	•	N	D	SD
56.	The belance of nature is very delicate and easily upset.	SA	•	N	S	SD
57.	Humans have the right to modify the natural environment to suit their needs.	SA	•	N	D	SD
58.	Mankind was created to rule over the rest of nature.	SA	•	N	D	SD
59.	When humans interfere with nature it often produces disastrous results.	SA	•	N	D	SD
60.	Plants and animals exist primarily to be used by humans.	SA	A	N	D	SD
61.	To maintain a healthy economy we will have to develop a "steady-state" economy where industrial growth is controlled.	SA		N	D	SD
62.	Humans must live in harmony with nature in order to survive.	SA	•	N	D	SD
63.	The earth is like a space ship with only limited room and resources.	SA	<b>A</b>	N	D	SD
64.	Humans need not adapt to the natural environment because they can remake it to suit their needs.	SA	•	N	D	SD
65.	There are limits to growth beyond which our industrialized society cannot expand.	SA		N	D	SD
66.	Mankind is severely abusing the environment.	SA	A	N	D	SD

67. This question concerns the types of activities in which forest landowners and their families participate. For the activities you have participated in over the last 12 months, please check one or both boxes after each activity, to indicate whether you did this on your own forested property, on other forested property in Viroinia, or both. Give the approximate number of days you did each activity. If you haven't done any, check NONE at the end of the list.

Activity	My Forest	<u>Virginia Forests</u>	of Days		
a. Fishing	ם		· ·		
b. Canoeing		🗖	· ·		
c. Boating		🗖	· ·		
d. Deer hunting		🗖	· ·		
e. Quail hunting		🗖			
f. Squirrel hunting		🗖	• •		
g. Turkey hunting			••		
h. Camping		🗖	••		
i. Picnicking					
j. Backpacking					
k. Horseback riding		🗖			
I. Walking/Hiking		🗖			
m. Off-road vehicle use		🗖			
n. Observing or photographing nature	• · · · · · <b>D</b> · · · · ·	🗖			
o. Picking berries or mushrooms		🗖			
NONE = = = = > If you checked	l "none" go on to qu	estion 68.			

Which ONE leisure activity from those which you checked above is most important to you? Please write the letter here.

The next set of statements relate to how Virginia private forest landowners relate to <u>natural resources</u>. By natural resources we mean forests, water resources and deposits of minerals, oil, coal, etc. Please indicate your answer by circling one choice next to each statement which best describes your feelings. The choices are

SA = Strongly Agree; A = Agree; N = Neither Agree nor Disagree; D = Disagree; and SD = Strongly Disagree.

68.	We are entering a period of scarcity and shortage of most natural resources.	SA	<b>A</b>	N	D	SD
69.	Where natural resources are privately owned, society should have <u>no</u> control over what the owner does with them.	SA		N	D	SD
70.	More emphasis should be placed on an individual's economic rights than on society's natural resource rights.	SA	•	N	D	SD
71.	Society must ultimately control what citizens do with the nation's natural resources.	SA	•	N	D	SD
72.	We must enjoy life with the natural resources we now have and let the future. take care of itself.	SA	•	N	D	SD
73.	We will have plenty of natural resources if we just invent new processes for finding and developing them.	SA	•	N	D	SD
74.	The government is working to conserve natural resources.	SA	•	N	D	SD
75.	The "searcity of natural resources" is just a threat invented by environmentalists.	SA		N	D	SD
76.	Individuals can do much to alleviate the natural resource shortage.	SA		N	D	SD
77.	The government, not individuals, is largely responsible for causing natural resource shortages.	SA	•	N	D	SD
78.	We should turn to conserving natural resources <u>only</u> if it does <u>not</u> change our life style.	SA		N	D	SD
79.	Feer of natural resources shortages should not discourage us from using natural resources and enjoying life today.	SA	•	N	D	SD
80.	Government will never do anything in the society's interest unless they are pressured.	SA		N	D	SD
81.	If we continue our high levels of resource use, future generations will <u>not</u> be able to have a level of living like ours.	SA	•	N	D	SD
82.	The government would protect natural resources even if there were no "environmental protests".	SA	•	N	D	SD
83.	Individuals are largely responsible for causing natural resource shortages.	SA	<b>A</b>	N	D	SD
84.	The concern about the "environment" is just a passing fad.	SA	•	N	D	SD
85.	The potential for a natural resource shortage is more serious than most people think.	SA	•	N	D	SD
86.	Government will act in the public interest to protect natural resources which are threatened.	SA		N	D	SD
87.	Individuals should make every effort to conserve natural resources.	SA		N	D	SD
88.	Corporations, not individuals, are largely responsible for causing natural resource shortages.	SA	•	N	D	SD
89.	If individuals tried to conserve natural resources, it would really make a difference.	SA	•	N	D	SD
90.	Individuals can depend upon the government to "plan ahead" to prevent natural resource shortages.	SA	•	N	D	SD
91.	If corporations tried to conserve natural resources, it would really make a difference.	SA		N	D	SD

92.	Do you receive any of the following magazines about tree production, outdoor recreation or conservation? If so, check all that apply.
	Tree Farm News
	or wildlife conservation
93.	NO, I don't read or receive any of them
	National Wildlife Federation
94.	I don't belong to any of these groups
95.	Are you currently employed? (Check one)
	Yes> What is your cooupstion No
96.	If you are not currently employed, are you retired?
	No Yes> What was your occupation?
	(Lidese Ini IV (Le Disuk)

Thank you for your time in completing this survey. If you have any additional comments about the survey or your private forest land, please write them below. Please enclose the questionnaire in the envelope provided and return it to:

Sandra S. Hodge Forestry Researcher Route 2 Box 211 Charlottesville, Virginia 22901 APPENDIX B

FACTOR ANALYSIS FOR NEP ITEMS

# APPENDIX B

# FACTOR ANALYSIS FOR NEP ITEMS

PC Extracted 2 factors. Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization. Varimax converged in 3 iterations.

Rotated Factor Matrix:

	FACTOR	1	FACTOR	2
NEP9	.7639	4	.1217	9
NEP2	.6878	6	.2144	2
NEP7	.6856	4	.0860	)2
NEP12	.6702	9	.3254	9
NEP11	.6685	6	.1046	59
NEP8	.6544	7	.1028	39
NEP1	.6498	2	.1529	0
NEP5	.5270	3	.1875	8
NEP4	.0571	9	.8354	0
NEP6	.0732	1	.8127	0
NEP3	.2650	5	.6376	52
NEP10	.3427	8	.5359	4

Factor Transformation Matrix:

		FACTOR 1	FACTOR 2
FACTOR	1	.86056	.50935
FACTOR	2	50935	.86056

### NEP variables

- FACTOR 1: Mankind must respect nature and live within Earth's carrying capacity
- NEP1 We are approaching the limit of the number of people the Earth can support.
- NEP2 The balance of nature is very delicate and easily upset.
- NEP5 When humans interfere with nature it often produces disastrous results.
- NEP7 To maintain a healthy economy we will have to develop a "steadystate" economy where industrial growth is controlled.
- NEP8 Humans must live in harmony with nature in order to survive.
- NEP9 The Earth is like a space ship with only limited room and resources.
- NEP11 There are limits to growth beyond which our industrialized society cannot expand.
- NEP12 Mankind is severely abusing the environment.

FACTOR 2: Man rules over nature

- NEP4 Mankind was created to rule over the rest of nature.
- NEP6 Plants and animals exist primarily to be used by humans.
- NEP3 Humans have a right to modify the natural environment to suit their needs.
- NEP10 Humans need not adapt to the natural environment because they can remake it to suit their needs.

APPENDIX C

73 ORIGINAL VARIABLES USED TO CONSTRUCT MODEL

# Initial 73 variables for the model

ω A A U 32 32 30987654321 20 18 15 17 10 12 14 900 - 1 0 5 A W N H The Earth is like a space ship with only limited room and resources. There are limits to growth beyond which our industrialized society cannot expand. The concern about the "environment" is just a passing fad. We are approaching the limit of the number of people the Earth can support. We must enjoy life with the natural resources we now have and let the future take care of The potential for a natural resource shortage is more serious than most people think. We are entering a period of scarcity and shortage of most natural resources. Plants and animals exist primarily to be used by humans. Humans need not adapt to the natural environment because they can remake it to suit their needs. Mankind was created to rule over the rest of nature. Humans must live in harmony with nature in order to survive. When humans interfere with nature it often The balance of nature is very delicate and easily upset. The "scarcity of natural resources" is just a threat invented by environmentalists. Organizations joined relating to natural resource issues Grew up Age Fear of natural resources shortages today should not discourage us from using natural resources We should turn to conserving natural resources <u>only if</u> it does <u>not</u> change our life style. level of living like ours. If we continue our high levels of resource use, future generations will not be able to have a Humans have a right to modify the natural environment to suit their needs. Mankind is severely abusing the environment. growth is controlled. When humans interfere with nature it often produces disastrous results. To maintain a healthy economy we will have to develop a "steady-state" economy where industrial developing them. We will have plenty of natural resource if we just invent new processes for finding and Publications read relating to natural resource issues Total forested acres County with forest land-use program Live now itself. Live in coastal region Live in mountain region Occupation Retired Education Income

ພ 5 0

and enjoying life today.

Individuals can alleviate the natural resource shortage. Individuals should make every effort to conserve natural resources.

- 38 If individuals tried to conserve natural resources, it would really make a difference.
- It is more important to harvest timber from Virginia's forests than it is to worry about
- ω 9 negative environmental consequences. conserving forest areas for rare plants and animals. The positive benefits of economic growth in forest industries in Virginia far outweigh any
- 41 5 harvested, Virginia's forests will grow back and be able to supply good quality timber. With new and better technology, Virginia's forests will always be able to meet the growing need Too much controversy occurs about harvesting in Virginia's forests. No matter how they are
- 42 In Virginia, the selection of a harvesting practice should not be based solely on cost. The impact that the practice will have on wildlife habitat, scenic beauty and future generations for wood in Virginia.
- should be considered equally important.
- **4**3 The benefits of conservation laws in Virginia far outweigh any negative impacts they may have on human well-being.
- 44 less on trying to conserve them. More money should be invested in research to increase timber yields from Virginia's forests and
- 45 The State of Virginia must ultimately control what landowners do with their private forest land in the state.
- 46 Where natural resources are privately owned, society should have <u>no</u> control over what the owner does with them.
- 47 More emphasis should be placed on an individual's economic rights than on society's natural resource rights.
- **4**9 Society must ultimately control what citizens do with the nation's natural resources.
- profit regardless of any long-term consequences to the land. Persons who own forested land in Virginia have the right to do what they want with it for their A person who owns forested land in Virginia has the right to do what they want with it to make a
- 50 own enjoyment, regardless of any long-term consequences to the land.
- 51 Making money from my forested land, now, is more important to me than managing it so that it
- 5 S N will continue to produce in many years in the future. On my forested property, I feel I have the right to use whatever harvesting practices I want. I believe in managing my forested land for future generations only if it does not lessen the
- 54 means to control them. If I have an outbreak of pests or tree disease in my forest, I would not hesitate to use any profits I can make.
- ບ ບ ບ I am willing to accept less profit from I have a moral obligation to maintain my forested land so that future generations can use it. I am willing to accept less profit from my forested land if the method of harvesting will be
- 57 I own forested land so that I can protect it for future generations. more environmentally-sound.
- 58 Own land to conserve it
- Own land for amenities is provides
- **6**0 **Own land for economic reasons**
- 61 Own land to hunt on it
- **Knowledge score**

- Own land for economic reasons Own land to hunt on it Knowledge score Participate in land-use program Not aware of forestry assistance No interest in seeking forestry assistance Sought assistance

- Harvesting affects nature Inadequate timber resources Don't know whom to contact about harvesting Distrust loggers and foresters Will harvest when money is needed
- 77766666660 77766876620 7720687665560
- Opposed to harvesting Have harvested

APPENDIX D

CORRELATION MATRIX FROM SPSS WITH 73 ORIGINAL VARIABLES USED TO CONSTRUCT MODEL CORRELATION MATRIX FROM SPSS WITH 73 ORIGINAL VARIABLES USED TO CONSTRUCT MODEL

Notes for the matrix

- 1. All correlations are pair-wise deletions.
- 2. The n's for the sample correlations vary between 300 and 483, with a median of 392. Rounding this to 400, the criterion for significance are r < p.05 = .098; r < p.01 = .128; r <p .001 = .169.</p>

٦ ٨	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	N -	
p.05 = .0		1.000	
998; r < p.		219	2
.01 = .128;	1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	306	ы
гф.00		510	*
1 = .169.		539	J
		293	6
	- 1000 -	321	7
		.029	09
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