

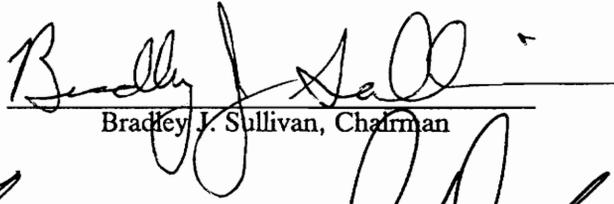
**Public Participation and Its Relationship
to Conflict in National Forest Planning**

by

Kevin L. Gericke

Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of
Master of Science
in
Forestry

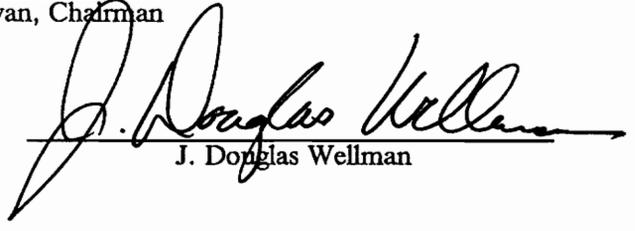
APPROVED:



Bradley J. Sullivan, Chairman



W. David Klemperer



J. Douglas Wellman

April, 1990

Blacksburg, Virginia

C. 2

LD
5655
V855
1990
6474
C.2

**Public Participation and Its Relationship
to Conflict in National Forest Planning**

by

Kevin L. Gericke

Bradley J. Sullivan, Chairman

Forestry

(ABSTRACT)

Since the passage of the National Environmental Policy Act, the Forest and Rangeland Renewable Resources Planning Act and the National Forest Management Act, the Forest Service has been required to give individuals and organizations access to the decision-making process. However, the Forest Service has been confronted with a greater than anticipated level of dissatisfaction with the Land Management Plans. Because the appeals of the plans are an expense to the Forest Service, both in monetary terms and the frustration which has been generated, the relationship between the participation process and the number of appeals has come under question.

This study proposes that, because public participation and the resolution of appeals are expenses to the Forest Service, the relationship between the two should be analyzed in a cost-benefit analysis framework. However, before an optimal level of public participation can be determined, the relationship between public participation and conflict must be analyzed.

Through survey and econometric techniques, the public participation process which occurred during round one of planning and the significance of a number of variables to the probability for conflict were observed. The study described the public participation process which occurred on the National Forests. The results suggest a positive relationship between public participation and the number of existing appeals. Further research is needed, however, to determine the number of appeals which were either avoided or generated due to the public participation process.

Acknowledgements

Many people have, both knowingly and unknowingly, assisted in this project. I am indebted to my Chairman, Dr. Jay Sullivan, for his willingness to listen to my ideas and to help me put them into words. I am also grateful for his insight into the research process and his support during my times of frustration. I would also like to thank Dr. Dave Klemperer for his role as advisor my first semester here, as well as his questioning which helped to provide a strong theoretical foundation for the project. To Dr. Doug Wellman, a man with an ability to understand the Forest Service bureaucracy in a very practical manner, I extend many thanks. He made the initial contact with me in 1988 and his thoughts and ideas on history and politics have been of immeasurable value.

I am very grateful to the numerous Forest Service personnel who gave of their valuable time to assist in the project: Terry Seyden, of the Jefferson National Forest, who assisted in the initial stages of the project; Jim Furnish, of the Washington Office, who helped me to understand the appeals process and regulations, as well as spending a great deal of time collecting data for me; and to each of the personnel on the national forests who responded to a very difficult survey.

I am deeply grateful to many friends for their support during these last few years: to Gwen Hirsch and Gregg Oberlander, many thanks for keeping me from losing my mind, for making me understand the value of a little relaxation every now and then, as well as for your valuable friendship; to Julie Anderson and Ann Mason, for spending many long hours on the telephone listening to what I am sure was pointless frustration and for sending me your love over many miles; to Mary Lyons, for making sure I never lost sight of my ultimate goal and for letting me know the value of

nature; and, especially, to Stephanie Simek, for her endless support and willingness to listen at any hour of the day or night, for holding me together when I wanted to give up, as well as for her incessant demands for a smile which helped me realize that things were never as bad as I thought.

I would like to extend my deepest appreciation to my family, especially to my mother and father, for without their constant love and support this project would never have reached its fruition.

Table of Contents

Introduction	1
Literature Review	4
Definition of Public Participation	5
Historical Perspectives	6
Legal Mandates for the Forest Service	7
The Controversy	9
Empirical Studies	11
Analysis Framework	14
Analysis Methods	21
The Survey	21
The Logit Model	31
Results and Discussion	40
Descriptive Analysis	40
Table of Contents	v

Number of Appeals and Response Time	41
Public Notification	41
Position of Employees Involved	45
Importance of Public Participation Techniques	45
Time Spent on Public Participation	51
Demographic and Resource Attribute Variables	56
Costs of Public Participation and Appeals	56
The Logit Model	61
Model #1	62
Model #2	64
Model #3	64
Model #4	67
Summary of the Logit Models and Recommendations	69
Conclusions	73
Appendix A. The Survey	75
References Cited	81
Vita	85

List of Illustrations

Figure 1. Cost Plus Net Value Change	17
Figure 2. Public Participation Framework	18
Figure 3. Urbanized Areas of the United States	29
Figure 4. Logistic Distribution Function	32
Figure 5. Frequency of Appeals of Land Management Plans	42
Figure 6. Frequency of Person Years Resolving Appeals	43
Figure 7. Frequency of Use of Public Notification Techniques	44
Figure 8. Importance of Field Trips, Demonstrations, and Open Houses	47
Figure 9. Importance of Public Hearings and Large Group Discussions	48
Figure 10. Importance of Small Group Discussions, Task Forces, Working Groups, Workshops, and Seminars	49
Figure 11. Importance of Telephone Contacts and Mailings	50
Figure 12. Importance of Informal Public Participation	52
Figure 13. Frequency of Time Spent in Public Participation	53
Figure 14. Average Percent of Total Time Spent per Group of Public Participation Techniques	54
Figure 15. Average Percent of Total Time Spent per Stage of the Planning Process	55
Figure 16. Frequency of Acreage of the Forests	57
Figure 17. Frequency of the Percent of Acreage Classified as Wilderness	58
Figure 18. Frequency of Average Volume of Timber Sold by the Forests From 1980 - 1988	59
Figure 19. Frequency of Average Recreation Visitor Days on the Forests From 1977 - 1986	60

List of Tables

Table 1. Public Notification Techniques	24
Table 2. Groups of Public Participation Techniques	25
Table 3. Stages of the Planning Process	27
Table 4. Dependent Variables for the Logit Models	36
Table 5. Independent Variables for the Logit Models	38
Table 6. Logit Model #1	63
Table 7. Logit Model #2.	65
Table 8. Logit Model #3	66
Table 9. Logit Model #4	68

Introduction

The increasing pressure for public participation, which the Forest Service is currently experiencing, is the result of more than 200 years of defining the role of individuals in the American government. During these years, numerous laws have been passed which attempt to clarify the role. The passage of the Forest and Rangeland Renewable Resources Act (RPA) in 1974, as amended by the National Forest Management Act (NFMA) in 1976, was of particular importance to the Forest Service. These acts directed the Secretary of Agriculture to develop land management plans for units of the National Forest System (1974, Sec. 6), and to consider the desires of the public in the development of the plans (1976, Sec. 6(d)). These plans are to “guide all natural resource management activities and establish management standards and guidelines for the National Forest System” (36 CFR Ch. II, 219.1(6); 1988).

The land management plans were to be completed by September 30, 1985 (1976, Sec. 6(c)), and ordinarily revised on a ten-year cycle, or at least every fifteen years, unless otherwise directed by the Secretary of Agriculture (36 CFR Ch. II, 219.10(g); 1988). However, as of August 7, 1989, 96 of the 123 administrative units in the National Forest System had completed, and filed with the Environmental Protection Agency as required by the National Environmental Policy Act (NEPA) of 1969, a Final Land Management Plan. Of these 96 plans, 49 had cleared the administrative appeals process by August, 1989 and are currently being implemented in their entirety.

One of the many probable reasons for the delay in the development and implementation of the plans is the ambiguous role of citizens in the development of the plans. The NFMA and the accompanying guidelines in the Code of Federal Regulations outline the definition of public participation, the timing of public participation activities, and the process whereby the publics may express dissatisfaction with the final plans. However, the actual process of incorporating the publics' opinions in the decisions of the Forest Service has sparked a heated debate over the management of the national forests. This is evidenced both by the large number of written works on the issue, and, of great importance to the Forest Service, the large number of appeals which the plans have generated.

As the first round of planning draws to a close and the second round begins, there is a need to understand this controversy. This is because, in an era of unprecedented deficits and the subsequent efforts to reduce monetary waste in government spending, the Forest Service must face the reality of the large costs of developing the plans. There are many arguments about the direction which the planning process has taken, including: the planning costs are the result of a process gone awry; the process was not necessary for proper management; the planning policy was implemented before the existence of the technology necessary to implement it; and the process is needed and has produced the desired management decisions. Regardless of which side of the controversy one stands, the fact remains that a large sum of the taxpayers' money has been spent in the development of the plans.

This work will focus on only one of the many issues involved in public forest land management planning: the role of public participation. It has been noted that public participation is required by various acts and regulations relating to the planning process. However, the relationship between the public participation conducted by the Forest Service and the appeals of the plans has not been fully developed. The purpose of this work is to add to the increasing understanding of this relationship.

The objectives of this study are:

1. To describe the use of public participation in the Forest Service planning process;

2. To determine the relationship between public participation and the appeals of the Land Management Plans.

To accomplish this, a survey was conducted of the national forests which had completed a Final Land Management Plan as of August 7, 1989. The purpose of the survey was to gather information on the types of public participation used and the amount of time spent conducting public participation. Additional information was collected on the number of appeals filed on each plan, the amount of time spent responding to the appeals, the cost of responding to the appeals, and the costs of public participation. Because the public participation process and its associated costs have not been fully documented by the Forest Service, limitations exist in the results of this study. This study represents, however, an attempt to understand the significance of public participation in the planning process.

Before public participation and its relationship to appeals can be fully comprehended, the nature of the process must be examined. Therefore, this paper proceeds in the following manner. The first section lays the foundation for the study of public participation by briefly discussing the philosophical nature of public participation, the history of public participation in American government, and the legal mandates for public participation in Forest Service planning. A review of empirical studies of public participation in the Forest Service is also included in this section. The second section presents the basic framework for the study. The third section discusses the methods for the analysis. The fourth section presents and discusses the results of the study, as well as further research needs and recommendations. The last section provides concluding remarks.

Literature Review

To properly examine the public participation process (also called public involvement, citizen participation, etc.) in Forest Service planning is a formidable task. As Spiegel and Mittenhal (1968, p.3) said, "... the more one explores the endless ramifications of citizen participation, the more one appreciates the old adage of 'having a tiger by the tail'." This is because the issue of public participation deals with a number of topics: planning, interest group theory, history, economics, public administration, and philosophy, to name a few. This section only briefly covers the expanse of literature available concerning public participation. First, to provide a basic understanding of public participation, a definition of public participation and a brief sketch of its history are presented. This is followed by a discussion of the legal mandates for public participation in the government and in the Forest Service. Finally, the controversy over public participation in the Forest Service and a review of the studies of public participation in the Forest Service are presented.

Definition of Public Participation

The first question which should be answered when discussing public participation is: what is public participation? There are a variety of responses to this question. For example, Arnstein (1969, p.216) says public participation is “the means by which they [the have-nots] can induce significant social reform which enables them to share in the benefits of the affluent society.” Strange (1972, p.461) states “participation is understood to be the process by which the citizens organize into interest groups and lobby, bargain, and otherwise respond to the established program agencies.”

One reason for the varying definitions is the lack of consensus of what is meant by ‘public’. Because the involvement of citizens is a fundamental premise of democracy, the existence of a single public interest, or the ‘Silent Majority’, has been proposed. In other words, if a democracy is to represent the desires of the majority, public participation should seek to determine the underlying majority opinion. However, many authors (Beard, 1956; Reidel, 1972; Wildavsky, 1964; Fairfax, 1975; Behan 1978, 1988; USDA Forest Service, n.d.) have noted that due to its silence there is a great deal of difficulty in determining the desires of the ‘Silent Majority’. Only those individuals and groups vocalizing their desires in some manner can be responded to in the planning process.

Public participation is not an end in itself, but a process allowing citizens and organizations to influence policy decisions (Arnstein, 1969; Strange, 1972; Langton, 1979; Culhane, 1981; Society of American Foresters, 1984; USDA Forest Service, n.d.). For this study, public participation is defined as a process through which 1) interested parties may express their values and preferences and 2) these values and preferences may be responded to by the agency in some form. This study also assumes that each interested party represents a public; i.e., public participation does not seek the opinion of a single entity, ‘the public’, but rather the opinions of many ‘publics’ (USDA Forest Service, n.d., p.5). As defined by the Forest Service (n.d., p.1), the goals of this process are:

1. To help the Forest Service reach better decisions;

2. To inform the public of Forest Service activities, plans, and decisions;
3. To encourage public understanding about and participation in the planning and decision process by providing information;
4. To be aware of and be responsive to the values of the publics we serve, and to evaluate how these publics will be affected by decisions;
5. To ensure that the Forest Service understands the needs and concerns of the people;
6. To broaden the information base upon which agency decisions are made.

Historical Perspectives

Another portion of the controversy about public participation questions the effectiveness of public participation in assisting decision makers in the development of 'good' management directives. A major factor in this controversy is the changing institutions which govern the United States. In particular, the development of the bureaucracy has provoked many questions about the role of the public in government.

To accomplish the duty of governing the citizenry in a democratic society, the government must transform the desires of the people into workable laws. However, the many divisions of power in the government often make this a difficult task, as there is little chance the majority opinion of all citizens in the country can be determined (Beard, 1956, p.160). Through the history of the United States, a bureaucratic organization of technical experts has evolved. This structure has gained an increasing amount of legislative power. This is because Congress has found it difficult to deal with the abundance of complicated issues facing society. Therefore, more power has been given to the structure of technical experts (Reich, 1962). Yet the bureaucracy is held accountable to the people for its actions only through the interpretation and enforcement of legislative acts such as the Freedom of Information Act of 1966. That is, agency personnel are not held responsible in the same manner as elected officials.

Many publics have made repeated attempts to wrest power from the bureaucracy in an effort to obtain access to the bureaucratic structure and to make the bureaucracy responsible for its actions (Strange, 1972; Fairfax, 1975; Langton, 1978; Collins, 1980; Kweit and Kweit, 1981). Kweit and Kweit (1981) observe three different periods where the call was made for changes in the bureaucracy and its accountability: during the westward expansion, during the Progressive era (the end of the nineteenth and beginning of the twentieth centuries), and during the current era which started during the New Deal age. As a result of the first two eras, access to voting was expanded to a wider range of citizens. The third, current, period has experienced the enactment of numerous laws mandating public participation in the actions of the burgeoning bureaucracy. Two of the most notable laws are the Administrative Procedures Act of 1946 and the Economic Opportunity Act of 1964. A number of judicial decisions have also been made which broaden the definition of 'standing to sue' (e.g., *National Welfare Rights Organization v. Finch*; *Scenic Hudson Preservation Conf. v. FPC*). The broadened definition of 'standing to sue' states that an organized interest group may act on behalf of their members in demanding certain actions even though the organizations may not suffer direct injury.

Public participation has evolved as an element of the democratic ideals of this country. Many laws and policies have been developed during this evolution to ensure that people get an opportunity to participate in making the decisions which affect their lives. However, the implementation of public participation still proves to be a difficult task. The necessity of laws which require public participation in a democracy shows that the implementation of public participation is still a controversial issue.

Legal Mandates for the Forest Service

The Forest Service has not been excluded from the demands for public participation. Originally created during the Progressive era, the intention of the Forest Service was to provide scien-

tific forest management of the nation's forests. However, the Forest Service has come under attack by different individuals and organizations demanding that the agency use their resource preferences as the basis for management (Fairfax, 1975; Frome, 1983; Wondolleck, 1988; Tipple and Wellman, 1989). During the formative years of the Forest Service, the responsibility of management was handed over primarily to the district rangers and forest supervisors (Torrence, 1980). The agency believed the local officials knew the land they were to manage better than any other personnel, and they knew the people whose livelihoods depended upon the forests.

Their [the supervisor's] ability to sense public opinion and apply their knowledge, and that of the Rangers under their orders, not seldom made all the difference between local hostility and cooperation (Pinchot, 1947, p.280).

Due to several factors, including urbanization and technological advances, the range of interested publics has extended beyond the locale of the district ranger's office. Tipple and Wellman (1989, p.26) note, "The arena of forest resource management has changed from a small arena to a large coliseum." The Forest Service is now required through numerous acts to allow for public participation in its decisions (the National Environmental Policy Act of 1969, the Forest and Rangelands Renewable Resources Planning Act of 1974, and the National Forest Management Act of 1976, to name a few). One of the most important of these acts, which has generated lively and sometimes intense discussions among academic scholars, Forest Service professionals, and individuals, is the National Forest Management Act (NFMA). This act requires public participation in the development of land management plans, which describe proposed actions, their probable effects, and alternative actions for each administrative unit of the National Forest System. Section 6(d) of the NFMA states:

The Secretary shall provide for public participation in the development, review, and revision of land management plans including, but not limited to, making the plans or revisions available to the public ... for a period of at least three months, during which period the Secretary shall publicize and hold public meetings ... that foster public participation in the review of such plans or revisions.

It can be seen that, even though public participation is required, the specific details of its implementation are not fully developed in the legislation. The guidelines for implementing NFMA provide vague directions for public participation when they state (36 CFR Ch. II, Sec. 219.6(c); 1988), "public participation ... shall be used early and often throughout the development of the plan." The questions of who is to participate and how public comments should be utilized are not

specifically answered in the act or the accompanying guidelines. Krutilla and Haigh (1978, p.376)

note of RPA and NFMA:

... the laws are at most only a framework for establishing the general direction for the Forest Service and the constraints within which it must operate. This leaves the task of implementing the general intent of Congress to the discretion of the Forest Service.

The public is also allowed the opportunity to appeal the decisions made through the planning process (36 CFR Ch. II, Sec. 211.18, 1988; 36 CFR Ch. II, Sec, 217, 1989). This delays the implementation of that part of the plan in question, until the appeal is resolved. The expense of these delays was not anticipated by the Forest Service. Each plan was originally expected to cost \$1 million. Yet many plans have cost well over \$3 million (O'Toole, 1988, p.176). Because of the cost, the effectiveness of public participation in developing the plans has been of concern to the Forest Service. This is evidenced by the focus on public participation by one of the technical teams of the Forest Service's Land Management Planning Critique.

The Controversy

The literature reveals a wide spectrum of beliefs about the effectiveness and importance of public participation in the Forest Service planning process. Some argue that the current public participation processes are ineffective because of the complexity of the issues, the polarization of interest groups, the high costs of public participation, and a mistrust of the Forest Service commitment to public participation.

O'Toole (1988, p.178) claims that, due to the length of the plans and the complexity of the FORPLAN models, "real public participation in most plans develops into a contest to see which interest group can generate the most form letters." Others believe that, because of the complex issues, the Forest Service develops alternatives first, and then solicits public comment which tends to make people think they are voting rather than participating (Torrence, 1980; Fairfax, 1975).

O'Toole (1988, p.180-182) argues that the current public participation process places interest groups in a 'prisoners' dilemma' situation. The prisoners' dilemma is often used as an example of game theory. It is a case in which two people have the choice of cooperating or not cooperating. But, neither is certain of what the other's choice will be, and the rewards depend upon which choices are made. In the prisoners' dilemma, noncooperation is often advantageous in the short run, yet cooperation is advantageous in the long run (Axelrod, 1984). O'Toole states that many conflicts are not resolved because interest groups tend to become polarized during the planning process. "Many environmental battles are fought on a 'last stand' basis - this is the last chance to save a particular roadless area ... - so there is no perceived opportunity for repeated transactions" (O'Toole, 1988, p.181-182).

Some have argued the Forest Service does not have a real commitment to public participation. "We've [the timber industry] also become increasingly suspicious that the public involvement process is largely a 'window dressing' for decisions the Forest Service has already made" (Ludeman, 1985, p.316). Reich (1962, p.10) claims there is a "tendency of professional managers to develop a point of view...that makes them less receptive to attitudes beyond their own perspective."

There is general agreement that public participation can be quite costly. However, the lack of a fully developed method of analyzing public comments has raised concern about the cost-effectiveness of public participation. "The costs are high and the means for utilizing the fruits of the effort are unclear, leading some to ask whether the agency effort is matched by the benefits" (Dana and Fairfax, 1980, p.310).

The argument that public participation is an effective process in Forest Service planning centers on the premise that the public's values can be expressed and responded to before the decisions are made, thereby reducing the number of dissatisfied constituents (Behan, 1978; Gruenfeld, 1978; USDA Forest Service, n.d.; Behan, 1988).

If the process directly involves affected parties as meaningful members in what is inherently a negotiation process, the contents of the final 'agreement'-the forest plan-should come as no surprise (Wondolleck, 1988, p.19).

The argument also suggests that, since the Forest Service is to manage for the public interest, the only way an agency can grasp the preferences of its constituents is by involving them in the planning process (Fairfax, 1975; Krutilla and Haigh, 1978; Convery, 1979; Palmer, Row, and Randall, 1983; Henning, 1987).

Empirical Studies

These discussions, however, have not advanced the understanding of the effectiveness of public participation in a definitive manner, due to their philosophic nature. There have been only a few quantitative studies of public participation. This is due, in part, to the very nature of the subject: humans. The quantification of peoples' desires and their satisfaction is still difficult. The different conclusions of the empirical studies of public participation raise many questions and point out the need for further research.

Ostheimer (1977) analyzed several issues on the Coconino National Forest (AZ) to determine those aspects of public participation which appeared useful in resolving conflicts. He discovered that the issues which were resolved to the satisfaction of the constituents used public participation, and the publics' views were incorporated into the solutions. He cited the development of the San Francisco Peaks Land Use Plan as a case in which the publics' opinions were actively sought and used. This resulted in a multiple-use plan in which the publics' input indicated the direction the plan should pursue. He also cited cases, such as a National Forest land exchange, in which public input was solicited but not responded to in the land exchange plan, resulting in unresolved conflicts.

Culhane (1981) conducted a study to determine the influence of interest groups on Forest Service and Bureau of Land Management public land management policies. Interviews and surveys of local land agency officials and their constituents in three western regions of the United States. In this study, four models were examined which used the subject of land management policies as the dependent variable. These policies were: grazing used as a proportion of carrying capacity;

timber sold as a proportion of allowable cut; wilderness areas approved as a proportion of areas considered; and mining, oil, and gas leases/permits approved as a proportion of applications. The independent variables were the interest groups' (livestock industry, forest products industry, conservationists and recreationists, other economic users, and other interest groups) access to decision makers, the groups' value preferences, the groups' power (defined by membership, budget, and staff size), and the power and value preferences of supervisors and district level employees. Culhane concluded that, because the desires of the interest groups were reflected in the resulting policies, agency officials were responsive to their clientele groups.

Twight (1983) claimed that, because of its ideological commitment towards utilitarian values, the Forest Service is not influenced by the public. He used the battle over the Olympic National Park to support his claim. Twight used a historical analysis to show that the Forest Service displayed an ideological commitment to sustained yield forestry, while attempting to maintain its ownership of certain lands in the Olympic National Forest. This was despite growing pressures from the Park Service, preservationists, and other constituents to protect the area. Ultimately, he claims, the agency commitment to sustained yield forestry resulted in the transfer of the land in question to the Park Service, becoming Olympic National Park.

Mohai (1987) examined the RARE II decisions to determine the relationship between the results of the public participation process and wilderness designations. He discovered that the designation of roadless areas was positively correlated to the number of signatures on letters favoring wilderness. Thus, the evidence was used to support the claim that the agency was responsive to public participation. He continued, however, to suggest an agency bias towards utilitarian values because the Forest Service used a signature count in making wilderness designations, as opposed to content analysis of the letters. He supported this claim by noting that the majority of form letters favored non-wilderness and the majority of personal letters favored wilderness; yet all were given equal weight with the signature count.

Twight and Lyden (1988) suggest an organizational commitment of the Forest Service towards a single constituency. They analyzed surveys of 400 district rangers to determine attitudes towards RPA policy issues and alternatives, perceptions of the public's views, and a number of

other conservation value questions. The responses suggested a strong organizational commitment among the rangers toward commodity production. Twight and Lyden claimed that since the majority of the rangers were closely aligned with the timber industry, the agency has yet to develop a strong multiple-use commitment.

Blahna and Shepard (In Press) conducted a study of thirteen national forests around the country. Surveys, conversational interviews, site visits, and a review of the plans were conducted to determine the amount of public participation, the timing of public participation, and the degree of conflict generated from each forest. They found that the substantive public participation was conducted after the release of the draft plan and that one-way communication was used throughout most of the planning. They observed that the forests which “discussed contentious issues in public forums designed to reach consensus on the issues were most likely to have plans that were approved” (Blahna and Shepard, In Press, p.1).

These studies, by presenting different conclusions, show there are still many unanswered questions about public participation in the Forest Service. Two important questions which have yet to be answered are: “What is the relationship of public participation to the conflicts over the Land Management Plans, and are the benefits worth the expense?”

Analysis Framework

In a 1987 article, Behan suggests that a possible solution to the problems of public resource management would be to shift the focus of land agencies from resource scarcity to capital scarcity. He notes that traditional forest management is based on the belief that natural resources are scarce and the aim of this management is to achieve maximum biological productivity. Behan argues that capital is the scarce production factor, as opposed to the land and the resources. Thus, he claims that the problem of public forest management should be expressed in terms of maximizing the output of the national forests (market and non-market) with a finite budget, a standard efficiency problem. Behan notes that the agency has, to a certain extent, already moved in the direction of capital-scarce management:

The federal land management agencies are not simply waiting for the new crop of capital-scarce professional to arrive; they are adopting economic management in response to external criticism and in response to the professional growth and development of their own journeyman managers (Behan, 1987, p.190).

Cost-benefit analysis is a technique which enables a decision-maker to identify and evaluate the economic efficiency of an alternative designed to attain a certain goal (Sassone and Schaffer, 1978; Sugden and Williams, 1978; Campen, 1986; Randall, 1987). The goal of cost-benefit analysis is:

to identify the alternative that will make the most efficient use of society's scarce resources in promoting social objectives ... (Campen, 1986, p.22).

However, this entails the difficult task of the valuation and measurement of change in society's welfare. Two assumptions assist in this task: "That it is a good thing that individuals should have what they want and that they themselves know best what they want" (Little, 1957, p.258). To accomplish the valuation of society's welfare, one defines society's welfare "to be a function of the well-being of each of the individuals in society" (Campen, 1986, p.28).

To define a social welfare function, one must be able to make interpersonal comparisons of the gains and losses of the alternatives, comparing individuals' utilities. However, the ability to do this does not exist. The Pareto superiority (or Pareto efficiency) criterion has been proposed as a method of comparing alternatives. The theory of Pareto superiority states, "Economic state 1 is to be judged *socially* superior to Economic state 2 if at least one person individually judges 1 superior to 2, and no one judges 2 superior to 1" (Sassone and Schaffer, 1978, p.8). This criterion does not require the measurement of individuals' utilities. That is, as long as at least one person prefers Economic state 1 to state 2, the indifference of all other people towards the two states will not alter the superiority of state 1. However, there are very few, if any, real-life alternatives which do not leave at least one person worse off than with a different alternative. Because of this limitation, the *potential Pareto criterion* (or Kaldor-Hicks criterion) has been proposed. This criterion states:

Economic state 1 is judged to be socially superior to Economic state 2 if those who gain by the choice of 1 over 2 could compensate those who lose so that, if compensation were made, the final result would be that no one would be worse off than he would be in state 2 (Sassone and Schaffer, 1978, p.9).

The *potential Pareto superiority* criterion is a method to analyze the net potential gains of alternatives. In spite of the argument that the criterion does not require actual compensation, *potential Pareto superiority* forms the basis of cost-benefit analysis.

Cost-benefit analysis is not new to the Forest Service. For example, in the development of forest fire policy, the values of the resources protected and the costs of protection are considered when allocating scarce capital to fire prevention programs. This idea was originally developed by Sparhawk (1925, p.693) who stated:

The best measure by which to judge the sufficiency of any fire organization is the net result accomplished. This net result may be measured in terms of the cost of protection plus losses incurred in spite of protection; and the smaller the sum, the more efficient the protection.

This idea is expressed in Figure 1. As money is spent on the pre-suppression (prevention) of forest fires, the number of fire occurrences decreases. Subsequently, suppression costs decrease.

Net value change is:

expressed on a cost basis as a positive value for fires that reduce resource outputs [fires which are detrimental] and as a negative value for fires that increase outputs above the no-control level [fires which are beneficial] (Bellinger, et al., 1983, p.373).

There is a point beyond which further pre-suppression costs are not offset by lower suppression costs and net value change. Thus, efficiency is obtained at the minimum point of the cost plus net value change curve.

Nagel and Neef (1978) described the legal process in a similar framework. "The legal process tends to be epitomized by U-shaped or valley-shaped cost curves and by hill-shaped benefit curves" (Nagel and Neef, 1978, p.407). That is, if the courts are overly lenient, providing too much due process, many guilty persons will be set free, resulting in high costs to society. However, if the courts are too strict, there is a tendency to convict many innocent persons. Nagel and Neef extend this framework to laws and rules. For example, "If environmental protection standards become too strict, we suffer unduly high cleanup costs, but if the standards are too lenient, we suffer unduly high pollution costs" (Nagel and Neef, 1978, p.407). They conclude that the optimum policy or the optimum degree to which a policy should be interpreted should maximize the net benefits.

Given that each forest has a limited budget, and that millions of dollars are spent producing each land management plan, one might assume the Forest Service would like to develop plans using the optimal amount of public participation. The previously mentioned studies of Ostheimer (1977), Culhane (1981), Twight (1983), Mohai (1987), Twight and Lyden (1988), and Blahna and Shepard (In Press) used a number of different measures to describe public participation. However, the relationship between the costs and benefits of public participation in Forest Service planning has yet to be fully determined.

At issue here is the question of whether the framework developed by Sparhawk, Nagel, and Neef can be used to describe public participation and the subsequent conflict over the land management plans. This framework is, essentially, a cost-benefit analysis. The public participation framework might be described by Figure 2.

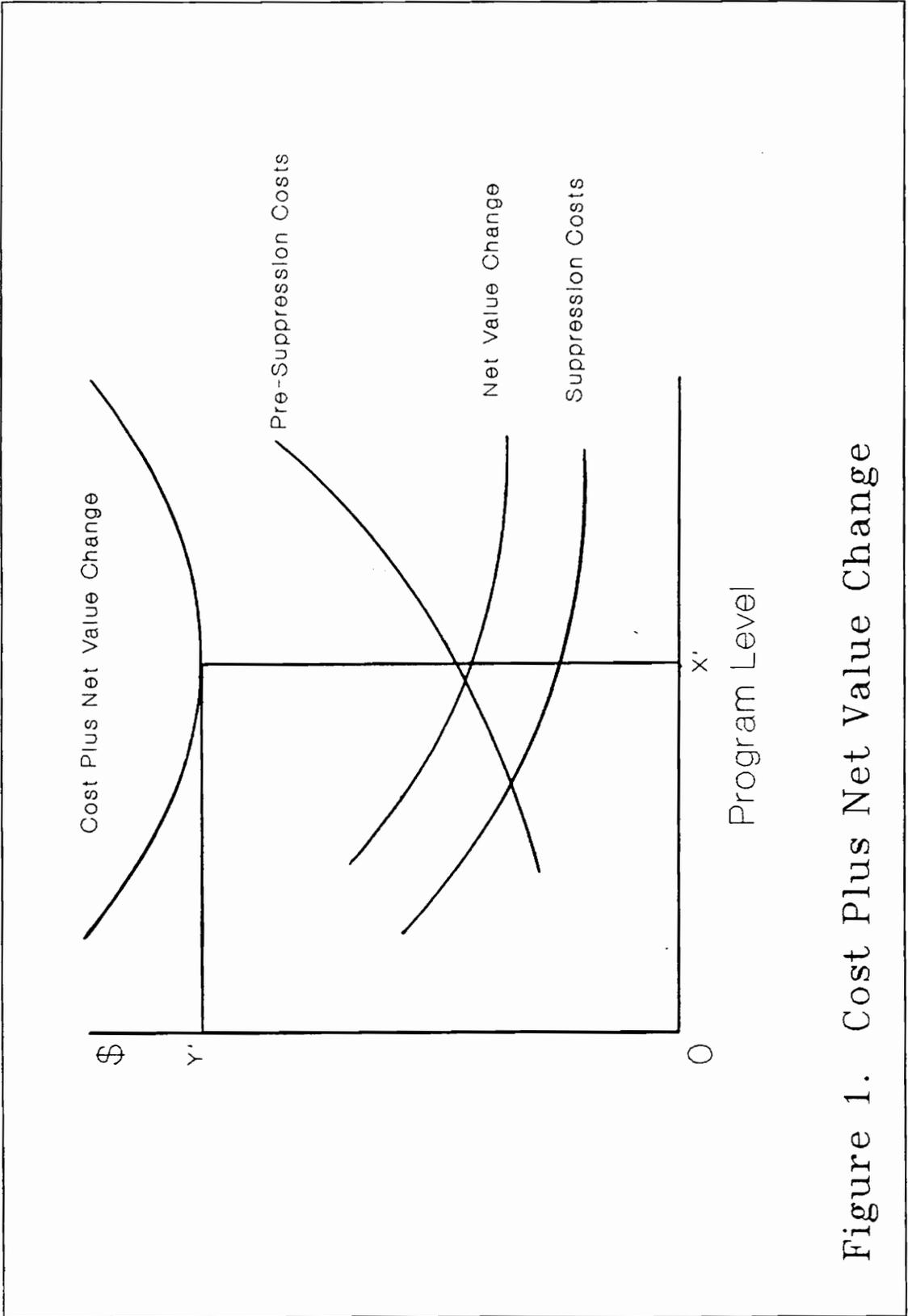


Figure 1. Cost Plus Net Value Change

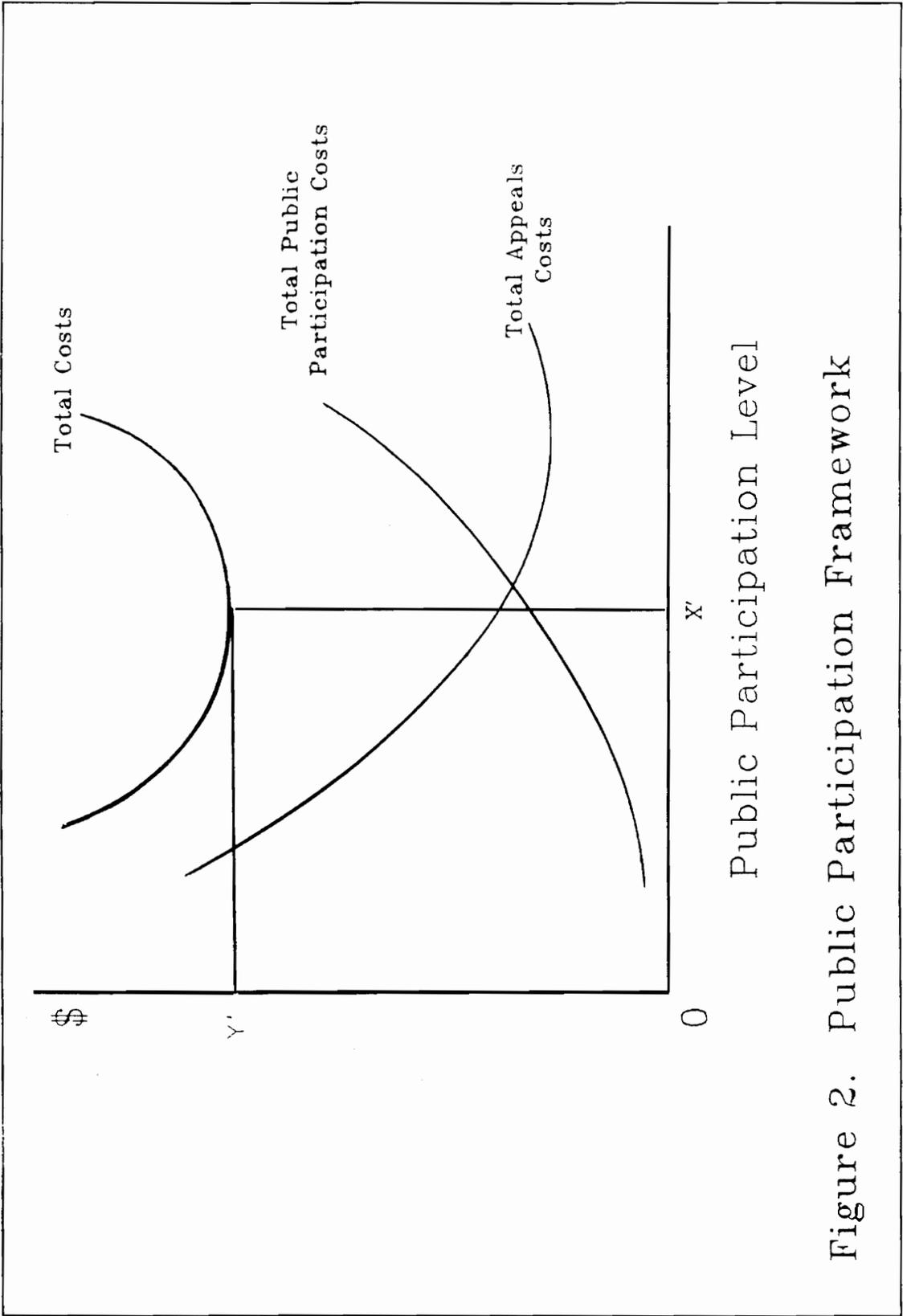


Figure 2. Public Participation Framework

One might expect that, as the level of public participation increases, the cost of public participation increases. For example, the cost of conducting one or two small meetings would be less than the cost of many meetings in many different localities with extensive public notification. If public participation is helpful in avoiding conflict, one would expect that as public participation increases, the number of dissatisfied publics would decrease. Subsequently, the number of appeals filed, and their associated costs, would decrease. It is conceivable that, because of the conflicting nature of many publics' preferences (e.g., wilderness and timber), a certain minimum level of conflict should be expected. That is, due to conflicting resources, not everyone can have everything they desire. It is also conceivable that the increase in public participation beyond a certain point would serve to increase the dissatisfaction of the publics. Several reasons for this argument are that the public participation process would polarize the publics such that compromises could not be made, or that more publics would be involved in the planning process, requiring more complex or infeasible solutions. It might be easier to develop an alternative which satisfies two publics rather than an alternative which satisfies the preferences of fifty publics.

From the Forest Service perspective, the optimal level of public participation would be the level, x' , where total costs are minimized. The level may or may not coincide with the point where total public participation costs equal total appeals costs, depending on the shape of the curves. From the perspective of society, x' may or may not provide the maximum social welfare. This is because this framework does not include the benefits to society from the resource allocation at x' . It is conceivable that, at a point other than x' , the benefits to society from a different resource mix would be greater than the increased costs to the Forest Service of appeals and public participation. The proposed framework is not an analysis of whether public participation results in a "good" or "bad" plan in the biological or economic sense. Instead, it provides an analysis of whether or not public participation produces a plan which minimizes the total costs of public participation and appeals.

The purpose of this study is not, however, to provide a cost-benefit analysis of public participation, i.e., an analysis which determines which level of public participation makes optimal use of the finite capital resource. Before a cost-benefit analysis of public participation can be accom-

plished, the relationship between the characteristics of the forests and public participation, on the one hand, and the 'success' or 'failure' of a forest plan, on the other, must be understood. This is analogous to the determination of a yield model in timber management. This study represents an initial attempt to quantify this relationship.

Analysis Methods

The Survey

The data needed to determine the relationship between public participation and conflict was collected through the use of a survey (Appendix A) as well as other published information. The survey was sent, in December 1989, to each of the national forests which had completed a Final Land Management Plan as of August, 1989. A postcard reminder was sent in January, with the mailing of another survey the following week. Included with the survey was a copy of the research abstract, explaining the purpose of the survey. Given the incomplete records and difficulties in measuring public participation, it was believed that, by including the abstract and assuring confidentiality, the respondents would provide the most accurate answers to the questions. The purpose of the survey was to obtain information from each forest on:

1. The techniques used to notify the publics about participation in the planning process;
2. The position of the employee most directly involved in the design and implementation of a variety of public participation techniques;

3. The forest's perception of the importance of public participation techniques in planning;
4. Estimates of the amount of time spent on different public participation techniques in the first eight stages of the planning process.

The following information was collected from published materials and personnel in the regional and Washington offices of the Forest Service:

5. Size of the forest;
6. Region of the forest;
7. The proximity of the forest to population centers;
8. Percent of the forest in wilderness areas;
9. The average annual volume of timber sold between 1980 and 1988;
10. The average annual recreation visitor days (RVD) between 1977 and 1986;
11. The number of appeals filed for each plan;
12. Estimates of the time spent by the Washington Office resolving the appeals;
13. Estimates of the cost of public participation;
14. Estimates of the cost of resolving the appeals.

The reason for the consideration of each question on the survey, as well as the other characteristics included in the study, follows:

1) The implementing regulations for the NFMA state “Formal public participation activities will begin with a notice to the news media and other sources” (CFR, Ch II, 219.6 Sec. c; 1988). There are, however, a variety of techniques available to inform the publics about participation opportunities, reaching a diversity of audiences. The survey listed eleven different techniques, as well as an opportunity to write in ‘other’ techniques (Table 1). These techniques covered all possible media outlets (newspaper, magazine, radio, television) as well as mailings and other printed matter such as posters and pamphlets. This variable was considered because each forest has the flexibility to choose among these techniques depending on their budget and the publics which require notification. Each forest will have contacted different audiences depending on which techniques were used. The range of audiences notified is believed to have a great influence on who participates and who does not. Therefore, public notification is a factor which should be considered when analyzing public participation. The analysis noted both the total number of techniques which each forest used and the number of forests which used each technique.

2) The position of the employee involved in designing and implementing public participation activities is believed to be a reflection of the forest’s perception of the importance of public participation. Several factors to be considered when making the decision of who will handle the public participation are the location of the employee (whether on the ranger district or in the supervisor’s office) and the salary of the employee. Therefore, if a forest perceives public participation as very important, one might expect the forest to delegate high level personnel to the task.

3) There are numerous public participation techniques available for each forest to use. These range from one-directional communication to interactive techniques. The Forest Service *Public Participation Handbook* (n.d.) lists 23 different activities. This study used groups of techniques (Table 2) which target different publics, employ diverse communication styles (i.e., formal, informal, interactive, etc.), and elicit varying responses from the public. These techniques were believed to be the most commonly used; however, each respondent had the opportunity to describe other techniques used.

Table 1. Public Notification Techniques

1. Classified ads in local and regional newspapers
2. Other paid ads in local and regional newspapers
3. Paid ads in out-of-state newspapers
4. Paid ads in magazines
5. Articles in newspapers or magazines
6. Newsletters, brochures, posters, and pamphlets
7. Public service announcements on radio or television
8. Paid ads on radio or television
9. Television documentary
10. Radio or television talk shows
11. Mailings to those on the forest's mailing list

Table 2. Groups of Public Participation Techniques

Group	Label	Techniques
A	Site Visits	Field trips, On-Forest Demonstrations, Open Houses
B	Large Meetings	Public Hearings and Large Group Discussions
C	Small Groups	Small Group Discussions, Task Force and Working Groups, Workshops, and Seminars
D	Phone/Mail	Telephone Contacts and Mailings to Those on Mailing Lists
E	Informal	Informal Contacts as a Part of Day-to-Day Operations

The respondents were asked to rank the relative importance of the activities from 1 to 5, where 1 indicated the most important public participation technique and 5 represented the least important technique. It is believed that the importance of informal public participation will be reflected in the amount of controversy over Forest Service decisions. This is because agency personnel are in contact with the public daily. If the forest is not responsive to the needs of its constituents, these publics might have a tendency to appeal agency decisions.

When we answer a visitor's question, work with a contractor, or help a hiker locate a landmark on a map, we are involved in public participation because those persons, during the course of contact, form mental impressions about the Forest Service and its people.... A dozen years from now, these persons may decide to support or oppose a Forest Service program based on the impressions they formed during that contact (USDA Forest Service, n.d., p.3).

For this reason, this question was used primarily to determine the perceived importance of informal public participation.

4) The amount of time spent on various public participation activities was used in the survey rather than the costs of the activities, primarily for the ease of calculation for which it offered the respondents. Because accurate records of all public participation activities and their associated costs have not been maintained by all forests, the estimate of the number of person-years in public participation was believed to provide more useful information than the anticipated rough estimates of costs. In an effort to determine the timing of public participation, and to ease the respondents' difficulty in making estimations, the respondents were directed to make the estimates of time according to the stages of the planning process (Table 3).

As most forests have not reached either of last two stages of the planning process, only the first eight stages were included on the survey. The amount of time spent in informal public participation was not sought because that is an activity which each forest can do with minimal cost and because of the difficulty in calculating the estimate of time of informal public participation which can be done every day, by every employee.

When calculating these estimates, the respondents were directed to consider the time of the principal agency employees, secretarial work, preparation time, travel time, the time of the activity,

Table 3. Stages of the Planning Process

Stage	Description
1.	Identify Issues, Concerns, and Management Opportunities
2.	Develop Planning Criteria
3.	Develop an Inventory of Resources
4.	Analyze the Management Situation
5.	Develop Management Alternatives
6.	Estimate the Effects of the Alternatives
7.	Evaluate Alternatives in a Draft Land Management Plan
8.	Select an Alternative and Prepare a Final Land Management Plan
9.	Implement the Plan
10.	Monitor and Evaluate the Plan

and the time needed to analyze responses. It should be stressed that these are *estimates only* and any generalizations using these estimates are made cautiously.

5,6,7) The demographic variables of size (USDA Forest Service, 1988), region, and proximity to population centers were used to factor out the effects of variables beyond the control of the forests from the effects of the public participation techniques used. The proximity to population centers was measured using the Bureau of the Census (1980) classification of urbanized areas (Figure 3). This involves three classes of population centers: (a) 50,000-99,999 people; (b) 100,000-249,999 people; (c) 250,000 or more people. For each forest, the shortest distance (as the crow flies) from any boundary to each class of population center was recorded. A population-weighted distance measure was used to account for both population size and distance:

$$\frac{\{(.25 \times A) + (.5 \times B) + (1.0 \times C)\}}{3}$$

Where:

A = miles to population centers of 50,000-99,999 people

B = miles to population centers of 100,000-249,999 people

C = miles to population centers of 250,000 or more people

The scaling constants (.25, .5, 1.0) were arbitrarily determined such that the distance measure would place more importance on the larger population centers. This was done for the purpose of this study because it is believed a small number of publics can be satisfied with less difficulty than a large number. The weighting also recognizes the fact that forest resource values decline with distance due to transportation costs.

8,9,10) The percent of the forest acreage classified as wilderness (USDA Forest Service, 1988), the average timber volume sold from 1980 to 1988, and the average number of recreation visitor days (RVDs) from 1977 to 1986 were used as indicators of the resource attributes on each forest. This

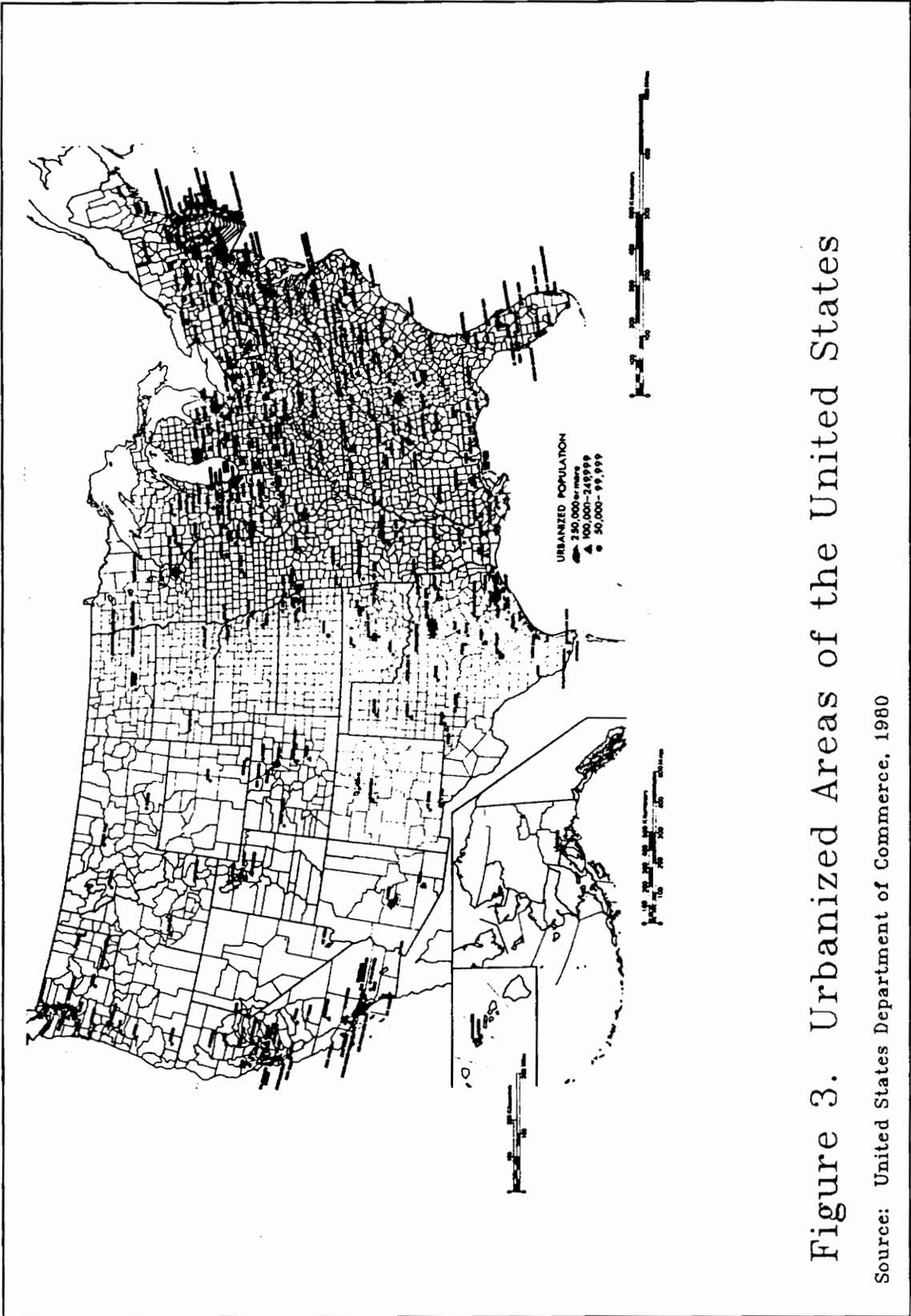


Figure 3. Urbanized Areas of the United States

Source: United States Department of Commerce, 1980

study focused only on the timber and recreation resources, realizing there are numerous resources from each forest. It is assumed however, these two resources are of great importance to most publics, because it appears most conflicts on the national forests revolve around the issue of “to cut or not to cut how much, and where.” This is due to the often conflicting motives of the timber industry and recreation users. The difference in the time frames for the calculation of average timber and average RVD was due to the lack of complete data for identical periods of time. This difference is not believed to have a great deal of significance as the time frames are long enough to account for major trends which occurred during the planning process.

11,12) The number of appeals, and the estimated time the Washington Office has used to date to respond to them, are a measure of the success or failure of the public participation efforts. The appeals process is one means through which the publics may express dissatisfaction with a forest plan. The number of appeals filed was used as an indication of a forest’s ‘success’ or ‘failure’ in developing a plan which satisfies the publics. Because the appeals are resolved with varying levels of difficulty, the amount of time spent by the Washington Office is also an indication of the degree of conflict over a forest plan. An appeal can be filed with the Chief of the Forest Service within 45 days after the publication of the Record of Decision for the Final Land Management Plan. The appeal is then reviewed to determine if a precedent exists which suggests whether or not the plan should be upheld. A decision is then made which either affirms the plan or, with varying degrees of severity, remands the plan. If the appellant disapproves of the decision, then the appellant has a means of recourse in civil court. This study assumes the Forest Service acts judiciously in deciding whether or not to affirm a plan, in an effort to avoid the expense of going to court. The appeals process takes time, however, which is an expense to the Forest Service. Therefore, if the Washington Office spends a large amount of time resolving an appeal, it is believed this represents a great deal of conflict, as opposed to an appeal which requires little time to resolve. The estimates of time include the time of personnel involved, travel time, and the time of additional public participation.

13,14) A sample of the respondents was called to determine an estimate of the cost of public participation. The Washington Office also made estimates as to the cost of resolving the appeals to date.

The Logit Model

There are numerous methods available to analyze the relationship between different variables. Because of the inaccuracy of the estimates of the time spent in public participation and the limited number of forests available for study, the application of standard regression techniques was not deemed appropriate. It was believed that, due to these limitations and the fact that levels of conflict are difficult to measure, an analysis technique of a more qualitative nature was needed. The *probability* of high or low degrees of conflict for a forest was viewed as the appropriate means to determine the relationship between public participation and appeals. By using this type of analysis, this study attempts to determine if there are certain factors and a certain amount of time in public participation which make a forest plan more or less susceptible to high probabilities of conflict. The logit model is a regression technique which is used to observe the probabilities of a binary-choice variable (i.e., high or low degrees of conflict).

The logit model, which is based upon the cumulative logistic probability function (Figure 4), is specified as:

$$P_i = F(Z_i) = F(\alpha + \beta X_i) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(\alpha + \beta X_i)}} \quad \begin{array}{l} \forall i = 1, \dots, n \\ n = \text{sample size} \end{array} \quad (1)$$

P_i is the probability that a certain effect will occur given the existence of the independent variable X_i (Pindyck and Rubinfeld, 1981). X_i can be a single characteristic or a matrix of several characteristics. In this case, P_i is considered as the probability of a high degree of conflict over a forest

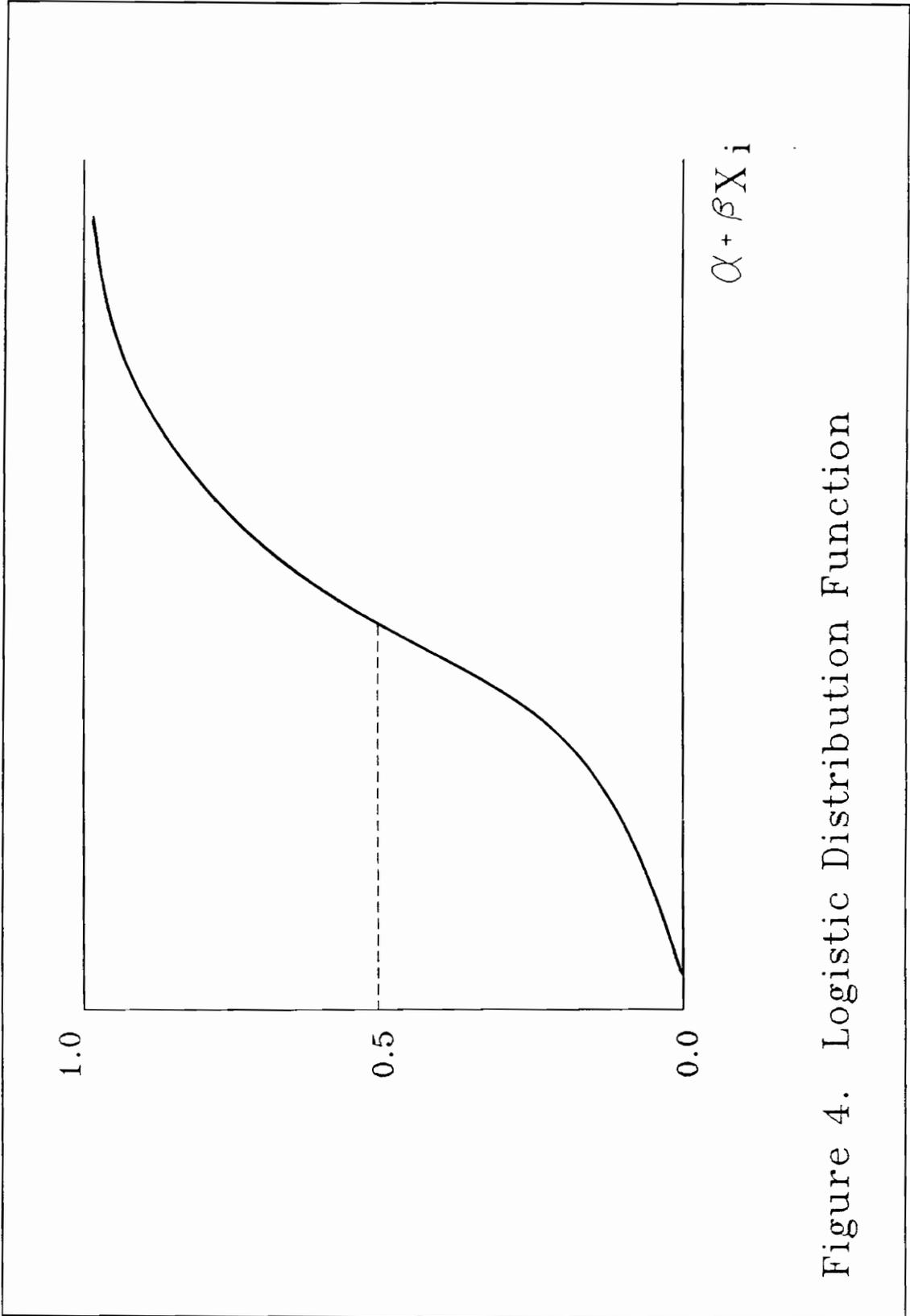


Figure 4. Logistic Distribution Function

plan, given the characteristics of the forest and the amount of time spent in public participation by the forest, X_i . Many references are available for a full discussion of the logit model (Kennedy, 1979; Wonnacott and Wonnacott, 1979; Pindyck and Rubinfeld, 1981; Kmenta, 1986). Thus, the procedure for using the logit model will be presented only briefly here.

The estimation of equation (1) can be accomplished, first, by multiplying both sides of the equation by $1 + e^{-z_i}$ to get:

$$(1 + e^{-Z_i})P_i = 1$$

Dividing by P_i and subtracting 1 gives:

$$e^{-Z_i} = \frac{1}{P_i} - 1 = \frac{1 - P_i}{P_i}$$

However, $e^{-z_i} = \frac{1}{e^{z_i}}$. Thus:

$$e^{Z_i} = \frac{P_i}{1 - P_i}$$

The odds ratio of having a high degree of conflict on the forest is e^{z_i} . That is, e^{z_i} is the ratio of the probability of a high conflict plan to the probability of a low conflict plan.

If the natural logarithm of both sides is taken:

$$Z_i = \log \frac{P_i}{1 - P_i}$$

From equation (1):

$$\log \frac{P_i}{1 - P_i} = Z_i = \alpha + \beta X_i \quad \begin{array}{l} \forall i = 1, \dots, n \\ n = \text{sample size} \end{array} \quad (2)$$

This allows one to predict the probability of an event's occurrence based on the entire real line, as opposed to the interval (0,1) which is an advantage the logit model has over a linear probability

model (Pindyck and Rubinfeld, 1981). Because the greatest slope of the logistic distribution is at $P = 1/2$, the greatest impact on the probability, the dependent variable, will occur at the midpoint of the distributions of the independent variables (Pindyck and Rubinfeld, 1981). This means that, for those forests on the extremes of the distributions of the independent variables, a change in the variables will only have a slight impact on their probability of 'success' or 'failure'. However, for the average forest, a change in these variables will influence their probability to a greater extent.

Because of the difficulty of directly observing the probabilities, given the imprecise nature of conflict and public participation, an estimate of the probability P_i is determined, \hat{P}_i .

$$\hat{P}_i = \frac{r_i}{n_i} \quad \begin{array}{l} \forall i = 1, \dots, n \\ n = \text{sample size} \end{array}$$

where:

r_i is the number of high conflict forests with identical X_i

n_i is the total number of forests with identical X_i

Thus:

$$\log \frac{P_i}{1 - P_i} \sim \log \frac{\hat{P}_i}{1 - \hat{P}_i}$$

and:

$$\hat{Z}_i = \log \frac{\hat{P}_i}{1 - \hat{P}_i} = \log \frac{\frac{r_i}{n_i}}{\frac{n_i - r_i}{n_i}} = \log \frac{r_i}{n_i - r_i} = \hat{\alpha} + \hat{\beta} X_i + \varepsilon_i \quad \begin{array}{l} \forall i = 1, \dots, n \\ n = \text{sample size} \end{array} \quad (3)$$

To develop the logit model, the observations for each variable had to be classified into one of several groups. This has the advantage of overcoming the measurement error encountered with the estimation, as ranges of the observations are dealt with rather than the individual observations (which are only estimates). This is also, however, an important limitation of the logit model. One

must have a large enough number of observations within each group to provide a reasonable estimate of the true probability (Pindyck and Rubinfeld, 1981).

The grouping of the variables proceeded as follows. The observations of each variable were classified into two groups. Only two groups were considered because of the small sample size and the fact that, as one increases the number of groups, there are fewer observations in each group. Due to the wide distribution within the observed variables, all variables except region were grouped according to the median, as opposed to the mean, to ensure that a large enough number of observations would be in each group. The region variable was coded as 0 for the western regions (#1-6) or 1 for the eastern regions (#8-9). The other variables were each coded as below the median (0) or above the median (1) for each forest. For example, if X_i was acreage, then forests below the median acreage were assigned a 0 for that X_i .

Because of the difficulty in defining the 'success' or 'failure' of a forest plan, four different measures were used as dependent variables (Table 4). Model #1 used the total number of appeals filed to determine a forest's 'success' or 'failure'. Models #2 and #3 standardized the number of appeals according to the acreage of the forests and the distance to population centers, respectively. The number of appeals per acre was used, assuming that the larger forests would generate more conflict, on average, due to the greater amount of resources for which the public express demand. The number of appeals per mile to population centers was used, assuming that the closer the forest is to population centers, the more conflict will be generated. This is because the resources are more local and the demand is expected to be greater for local resources. For example, a timber-based community might place a greater value on the local timber reserve than the timber from several states away, because of high transportation costs. Or, in our urbanized society, recreation on forests close to home is expected to have a greater importance than that on forests on the other side of the country with all other forest attributes being equal. Finally, Model #4 used a ratio, $\frac{x_i}{y_i}$, where:

x_i = the percent of the total amount of time spent by the
Washington Office dealing with the appeals of forest i ;

y_i = the percent of the total appeals on forest i which the Washington
Office has issued a decision.

Table 4. Dependent Variables for
the Logit Models

Model #	Variable
1	Number of Appeals
2	Number of Appeals per Acre
3	Number of Appeals per Mile
4	$\frac{\% \text{ of total time spent by Washington Office resolving appeals}}{\% \text{ of appeals resolved}}$

Because not all appeals have been resolved, it was believed the amount of time spent by the Washington Office should have been scaled by the percent of the appeals resolved. This measure was used assuming that a 'successful' forest would require a smaller amount of time to resolve a greater number of appeals than an 'unsuccessful' forest.

It should be noted at this point that the dependent variables of the four models used will not measure the amount of conflict which was avoided through the use of public participation. Instead, what the measures in Models #1 - #3 reflect is the number of dissatisfied publics relative to other forests. The ratio used in Model #4 is a measure which reflects the relative level of difficulty in resolving appeals. However, this might be misleading in that the allocation of time spent by the Washington Office is dependent upon the timing of the filing of the final plan. Again, it should be stressed that the dependent variables in no way attempt to reflect the number of publics which were satisfied through the use of public participation. Instead, they provide a measure of the relationship between public participation and the number of dissatisfied publics at this time, 3½ years after the plans were to be completed.

For each of the four dependent variables, the observations were coded as 0 (below the median) or 1 (above the median). Once the independent variables for each forest were coded 0 or 1, the calculation of r_i and n_i was done using MINITAB Version 7 for each model. Due to the limited number of forests available for observation, the forests could not be grouped according to all independent variables simultaneously. That is, a grouping of all forests with below the median public participation, below the median volume of timber sold, above the median acreage, below the median percent wilderness, etc. would have resulted in a small number of forests in that group, as well as all other groups. This would not have provided reliable estimates of the true probability of conflict. Instead of one equation using all independent variables, 15 equations, using a smaller number of variables in each, were used (Table 5). The 15 equations were modelled using each of the four dependent variables; i.e., 60 estimations were conducted. In determining the subsets of variables to use in each equation, the variable of primary interest, the time spent in public participation, was paired with each of the remaining variables. The time spent in public participation was also grouped with the resource attributes as a group, and the demographic variables as a group.

Table 5. Independent Variables for
the Logit Models

equation	Independent Variables Considered	Label
a	Time spent in public participation, Importance of informal public participation	TIME INF
b	Time spent in public participation, Number of public notification techniques used	TIME PN
c	Time spent in public participation, Average timber volume sold	TIME TMBR
d	Time spent in public participation, Average number of RVDs	TIME RVD
e	Time spent in public participation, Percent acreage in wilderness	TIME WILD
f	Time spent in public participation, Acres of forest	TIME ACRE
g	Time spent in public participation, Population-weighted distance	TIME MILE
h	Time spent in public participation, Region	TIME RGN
i	Time spent in public participation, Average volume of timber sold, Average number of RVDs	TIME TMBR RVD
j	Time spent in public participation, Importance of informal public participation, Number of public notification techniques used	TIME INF PN
k	Time spent in public participation, Acres of forest, Population-weighted distance	TIME ACRE MILE
l	Time spent in public participation, Acres of forest, Percent acreage in wilderness	TIME ACRE WILD
m	Average volume of timber sold, Average number of RVDs	TMBR RVD
n	Average volume of timber sold, Percent of acreage in wilderness	TMBR WILD
o	Acreage of forest, Population-weighted distance	ACRE MILE

Also, several equations without the time spent in public participation were considered. This was done to determine if the public participation variable could be eliminated, and provide a better estimated equation.

To calculate r_i , the number of forests with all possible combinations of 0 or 1 for the independent variables under consideration, which had a value of 1 (greater than the median) for the dependent variable, was tabulated. For n_i , a tabulation was made for the forests with all possible combinations of 0 or 1 for the independent variables under consideration. For example, consider equation a, Model #1, where the independent variables under consideration were the time spent in public participation (TIME) and the number of public notification techniques used (PN); and the number of appeals was used to determine the dependent variable, \hat{Z}_i . Each forest was coded with a 0 or 1, depending on whether the forest was below or above the median, respectively, for the independent and dependent variables. To calculate n_i , the number of forests for each of the possible combinations of independent variable codes (0-0, 0-1, 1-0, 1-1) was tabulated. To calculate r_i , the number of forests in each of these four combinations with a greater than the median number of appeals was tabulated. These figures were then used to calculate \hat{Z}_i . An ordinary least squares analysis was then conducted for each equation using \hat{Z}_i as the dependent variable and the codes (0 or 1) of the independent variables under consideration.

Results and Discussion

The results of this study will be presented in two steps. First a description of the public participation conducted during the planning process and the characteristics of the forests are given. This is followed by a presentation of the logit model estimation for public participation.

Descriptive Analysis

Of the 96 national forests which had completed a Final Land Management Plan and filed it with the EPA by August 1989, 57 responded to the survey (60% response rate). A principle reason given for not responding to the survey was that the person most knowledgeable about public participation during the planning process was no longer employed at the forest. It is commonly known that Forest Service employees move to different forests frequently. This factor caused an impact on the study because no complete records on public participation have been maintained. Therefore, because the planning process occurred over a long period of time, many forests could not respond as the information requested was not available.

Number of Appeals and Response Time

For all 96 forests which were contacted, a total of 811 appeals have been filed, for an average of 8.6 appeals per plan. Of these, 579 have been resolved, requiring an estimated 23.71 person years of time by the Washington Office. The largest number of appeals on a single plan was 96, while several forests had only 1 appeal, the least number. Of the 57 respondents to the survey, there was an average of 7 appeals for each plan (Figure 5). For each of these forests, an average of .21 person years has been used to date resolving the appeals (Figure 6). On average, 80% of the appeals on each of these forests have already been resolved.

Public Notification

Each of the possible public notification techniques (see Table 1, p.24) was used by at least one forest, yet several were more used more frequently than others (Figure 7). Virtually all forests used mailings to the organizations and individuals on the forest's mailing list. Articles in newspapers and magazines were the next most commonly used technique (91% of the forests). This was followed by newsletters, brochures, posters, and pamphlets (84%), public service announcements on radio or TV (63%), paid advertisements (not classified) in local and regional newspapers (47%), and classified ads in local and regional newspapers (33%). Of the remaining techniques, 9% of the forests developed television documentaries about the planning process, 7% placed paid advertisements in out-of-state newspapers, 4% placed paid advertisements on radio or television, and only 2% (1 forest) placed a paid advertisement in a magazine. Other techniques to inform the public about participation opportunities were listed by 39% of the forests. Of these, the most common was informal networking of the "spit and whittle" type, to cite one respondent. Other commonly used techniques were presentations to interest groups and civic organizations, as well as regular open houses.

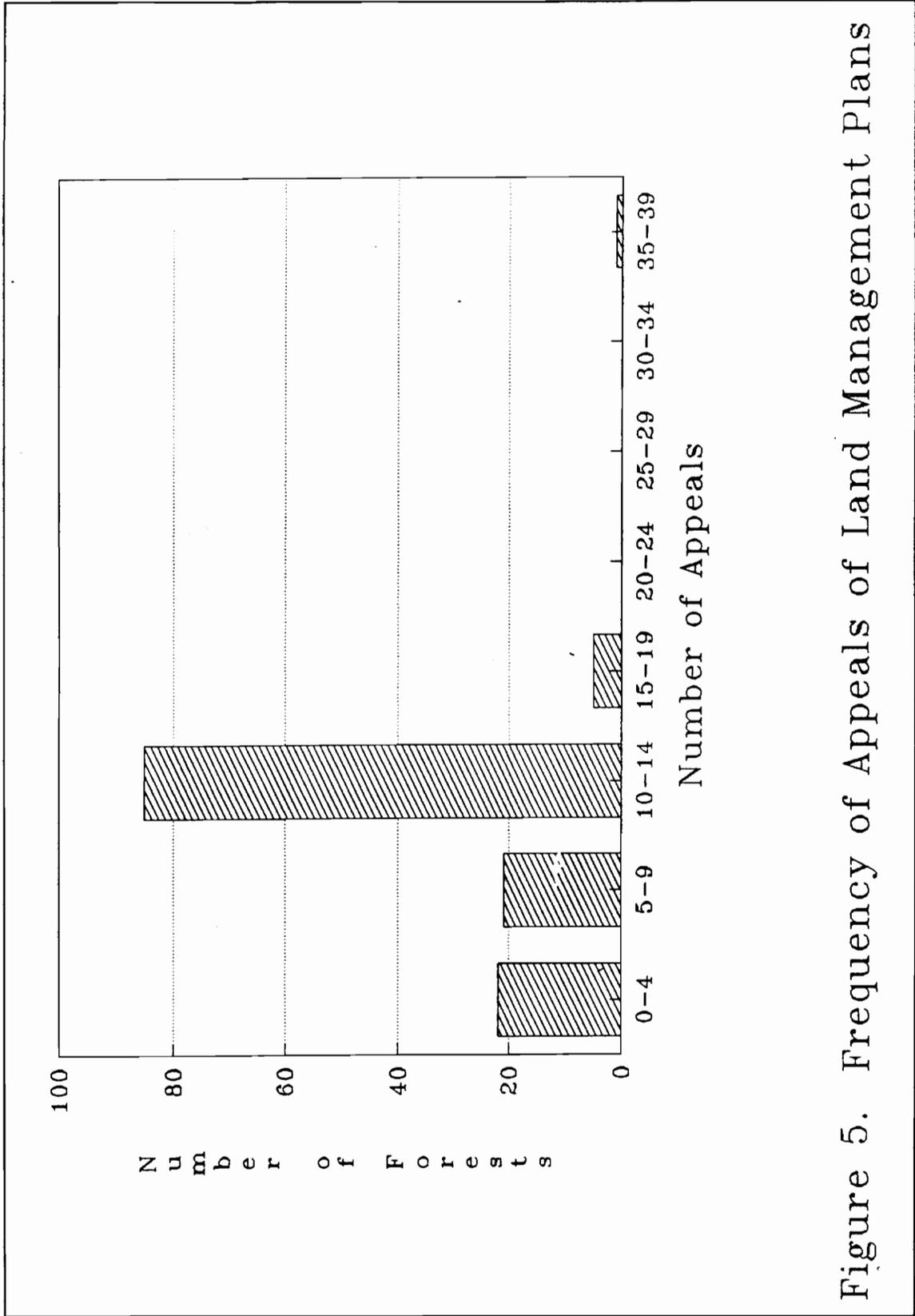


Figure 5. Frequency of Appeals of Land Management Plans

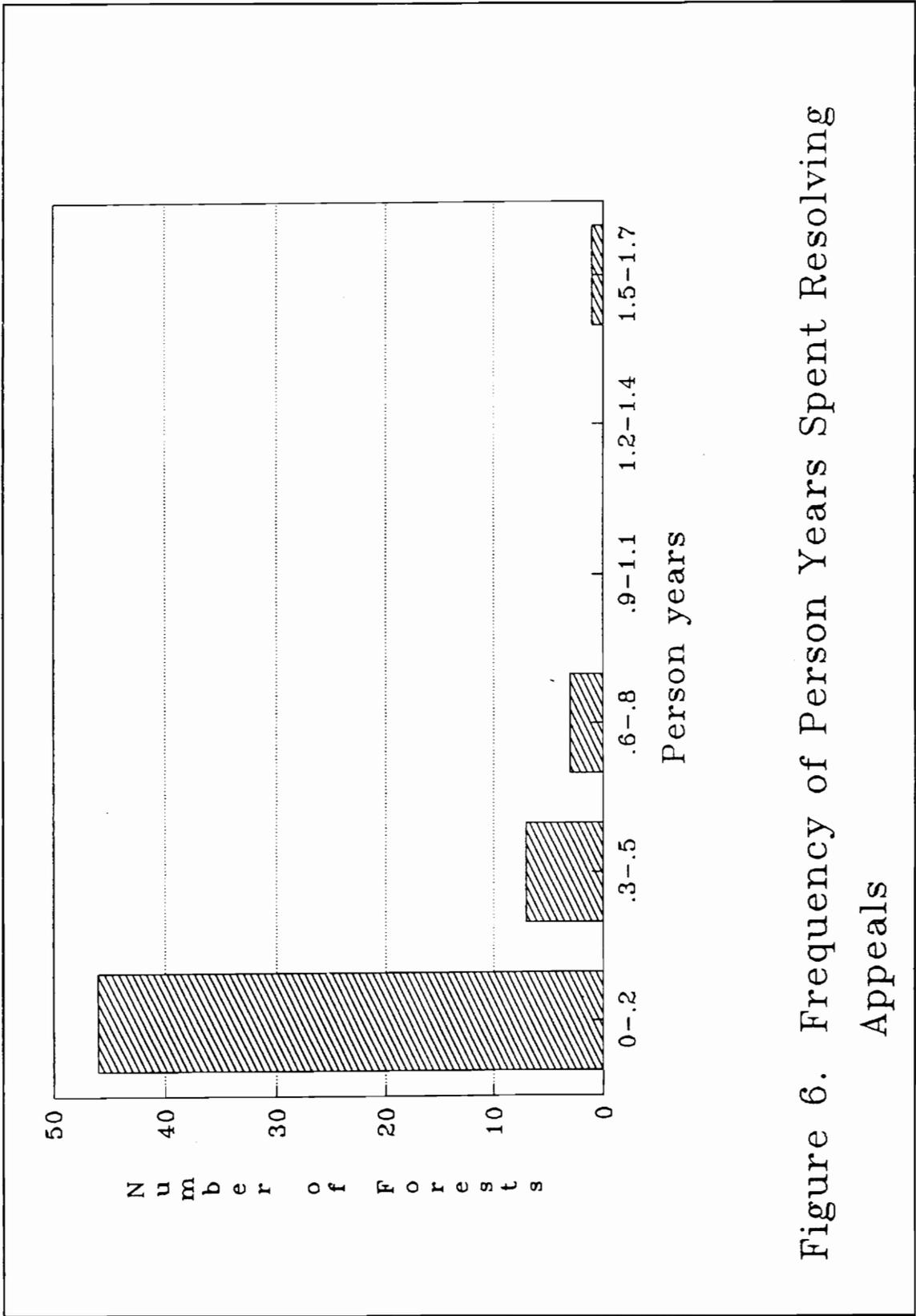


Figure 6. Frequency of Person Years Spent Resolving Appeals

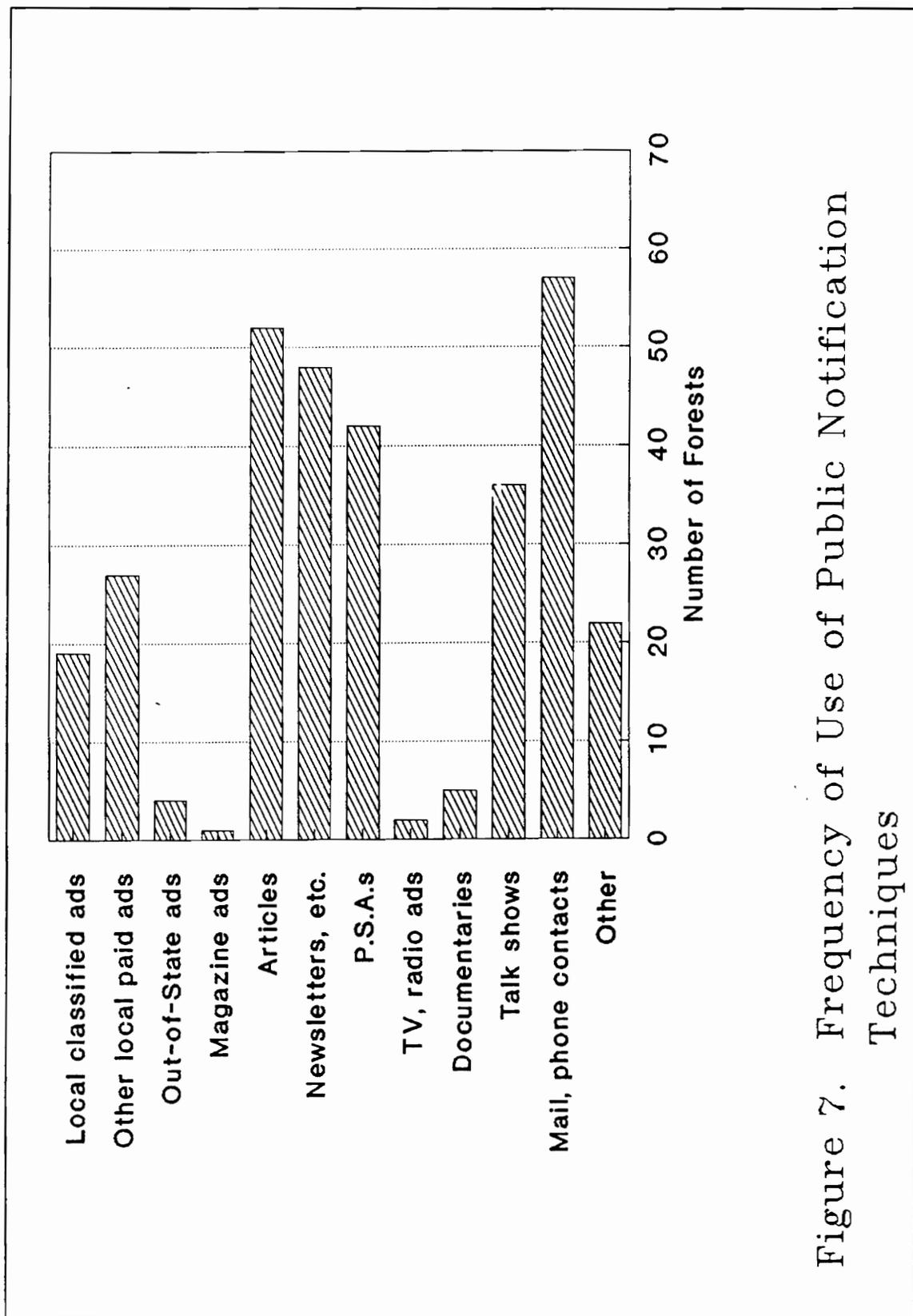


Figure 7. Frequency of Use of Public Notification Techniques

The responding forests used an average of 5 public notification techniques. Twenty-one of the 44 forests (48%) which used *more* than 5 techniques had a lower than average number of appeals of the plan. Eight of the 13 forests (62%) which used *less* than 5 techniques had a lower than average number of appeals. It appears that those forests which used few public notification techniques had fewer appeals than forests which used many techniques.

Position of Employees Involved

The task of identifying a single employee who was most directly involved in the design and implementation of each group of public participation activities (see Table 2, p.25) proved impossible. This was due to the long time period involved in the planning process. Also, it was mentioned by several respondents that 1) at different stages of the planning process, different employees were involved in public participation activities and 2) often the employee who designed an activity was not the same employee who implemented it. Because of this, most respondents indicated several positions for each group of techniques. However, certain trends could be observed.

For group A (on site visits), the District Rangers and members of the planning staff were most directly involved. For Group B (large meetings), the Forest Supervisors and members of the planning staff were most directly involved. For Groups C (small groups) and D (phone/mail), members of the planning staff were most directly involved.

Importance of Public Participation Techniques

Possible responses to the question of the importance of public participation techniques (Table 1, p.24) ranged from 1 to 5, where 1 indicated the most important public participation technique and 5 was the least important. On average, the forests ranked Group C (small groups) as the most important group of public participation techniques. Group B (large meetings) was ranked, on av-

erage, as the least important group of public participation techniques. The remaining groups of techniques were each ranked, on average, as having an importance of 3, an average level of importance. The importance of each group is presented in further detail below.

The importance of Group A (on site visits) had an average rating of 3 (Figure 8). This group was ranked as 4 by the largest percentage of the forests (32%). This was followed by a rating of 3 by 26% of the forests. Seven of the 19 forests (37%) which responded with a rating of 4 or 5 had a less than average number of appeals. Twenty-two of the 38 forests (58%) which responded with a rating of 1, 2 or 3 had a less than average number of appeals. It appears that the forests which perceived Group A as important had fewer appeals than forests which perceived this group as unimportant.

The importance of Group B (large meetings) had an average rating of 4 (Figure 9). The majority of the forests (68%) ranked this group as 5, the least important group of techniques. This was followed by a rating of 4 by 21% of the forests. Four of the six forests (67%) which responded with a rating less than 4 had a less than average number of appeals. Twenty-five of the 51 forests (49%) which responded with a rating of 4 or 5 had a less than average number of appeals. It appears that forests which perceived this group as important had fewer appeals than forests which perceived this group as unimportant.

Group C (small groups) had an average rating of 2 (Figure 10). This group of techniques was ranked as 1, most important, by 44% of the forests. This was followed by a rating of 2 by 33% of the forests. Twelve of the 25 forests (48%) which ranked this group as *most important* had a less than average number of appeals. Seventeen of the 32 forests (53%) which responded with a rating of 2 or more had a less than average number of appeals. It appears that forests which perceived this group as unimportant had fewer appeals than forests which perceived this group as most important.

The importance of Group D (phone/mail) had an average rating of 3 (Figure 11). A rating of 4 was given by 28% of the forests. This was followed by a rating of 3 by 21% of the forests and a rating of 2 by 21% of the forests. Thirteen of the 20 forests (65%) which responded with a rating of 1 or 2 had a less than average number of appeals. Sixteen of the 37 forests (43%) which responded with a rating of 3 or more had a less than average number of appeals. It appears

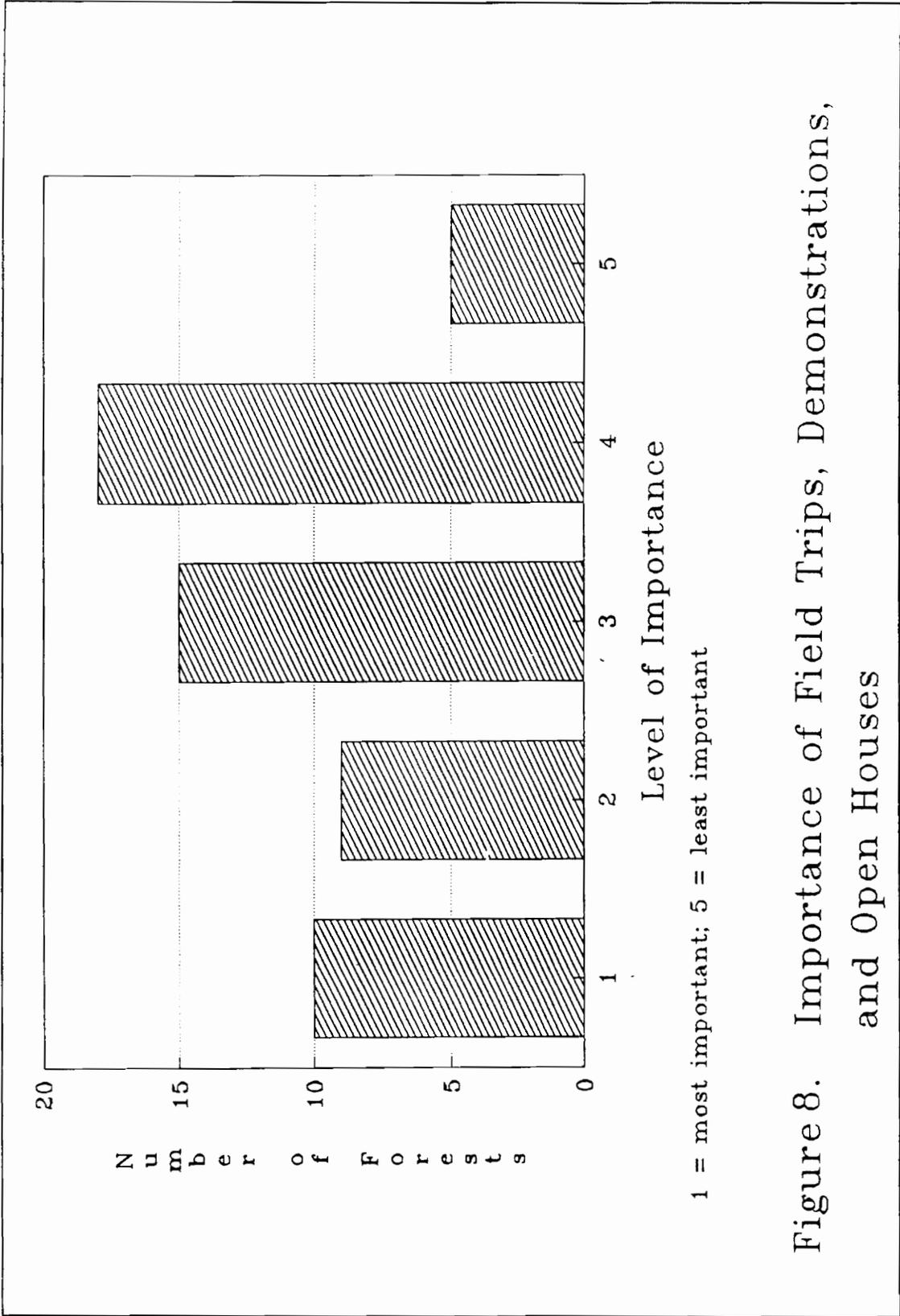
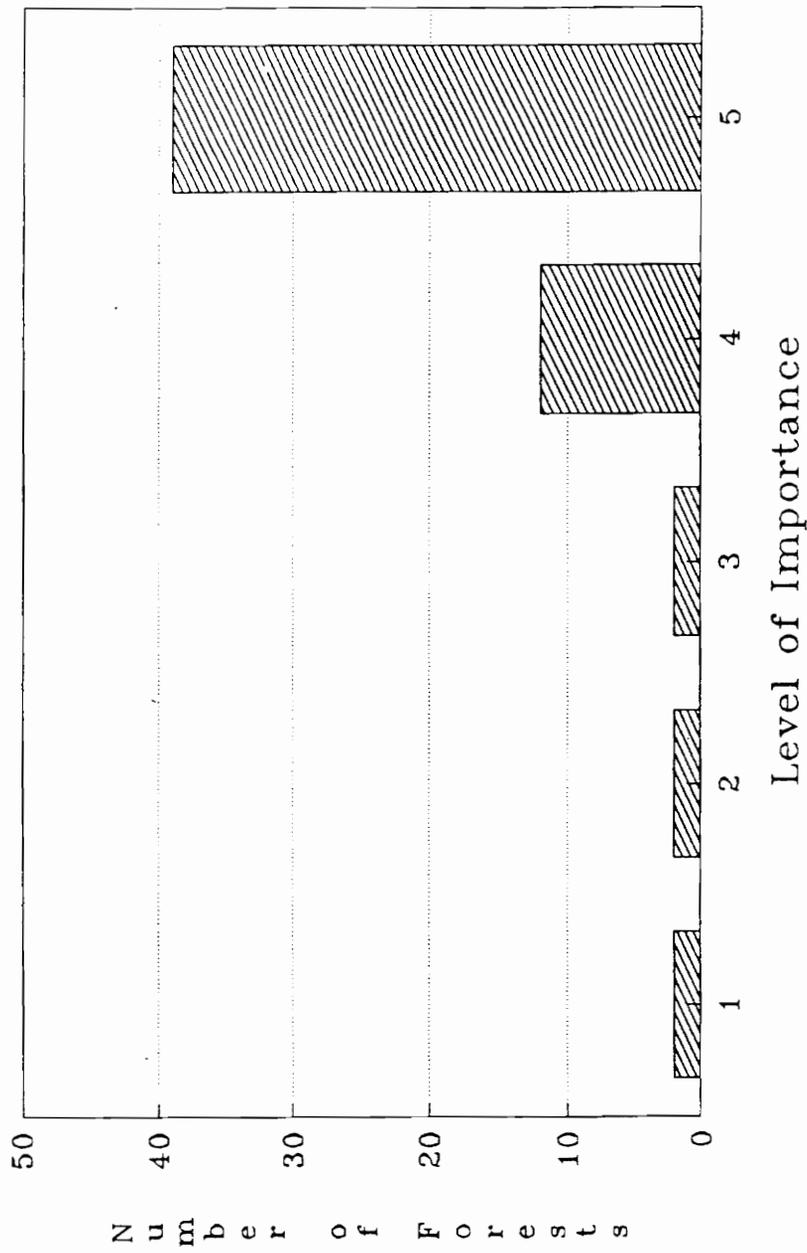
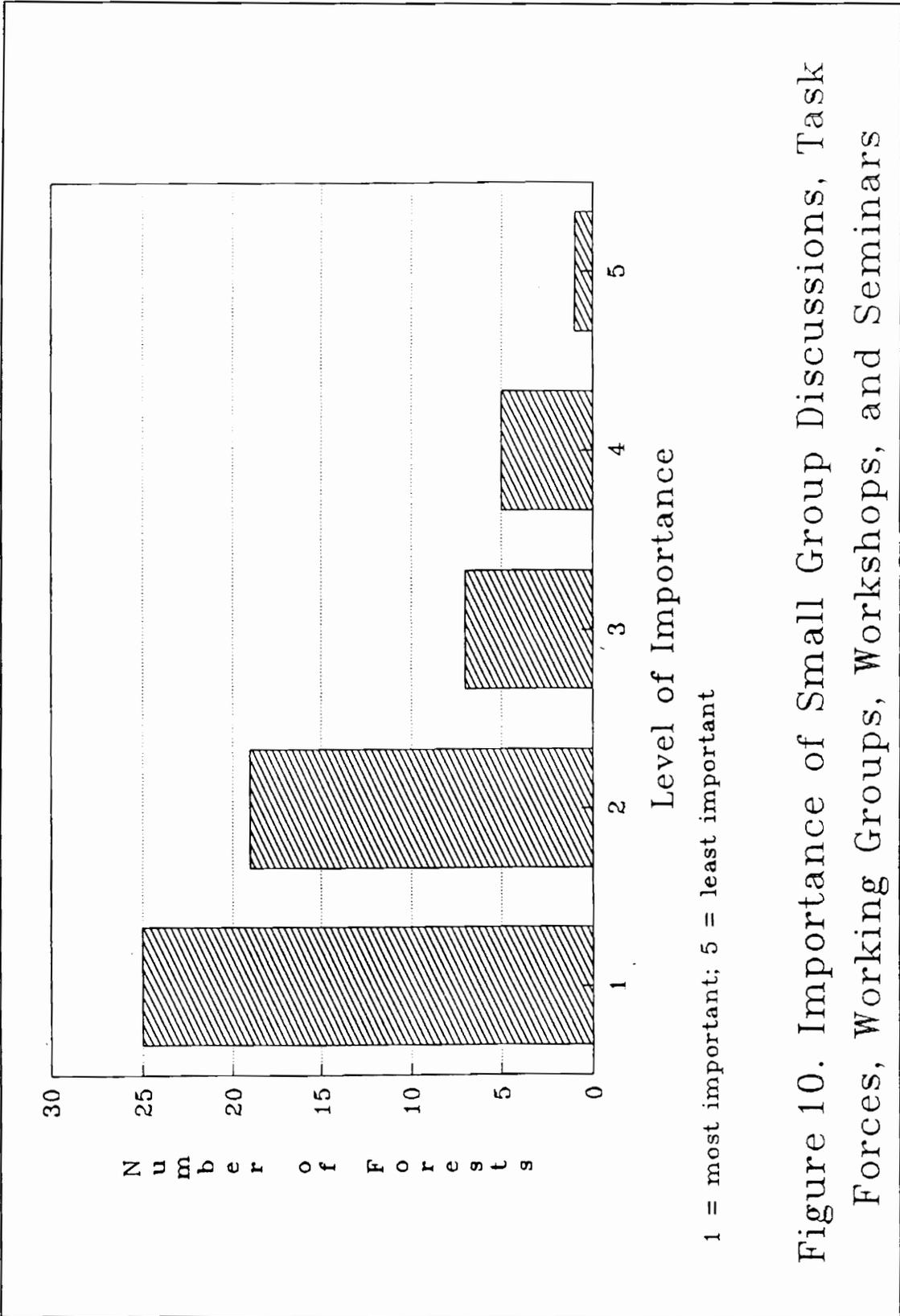


Figure 8. Importance of Field Trips, Demonstrations, and Open Houses



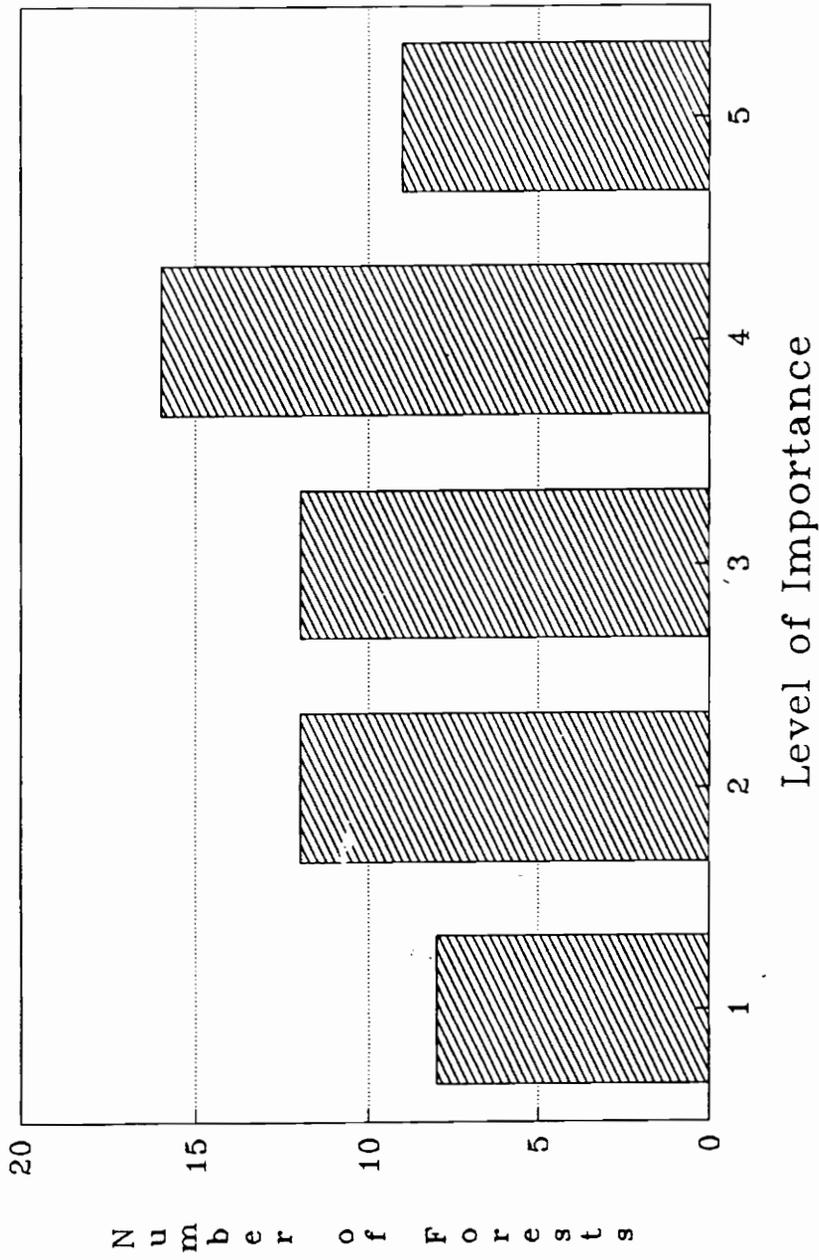
1 = most important; 5 = least important

Figure 9. Importance of Public Hearings and Large Group Discussions



1 = most important; 5 = least important

Figure 10. Importance of Small Group Discussions, Task Forces, Working Groups, Workshops, and Seminars



1 = most important; 5 = least important

Figure 11. Importance of Telephone Contacts and Mailings

that forests which perceived this group as important had fewer appeals than forests which perceived this group as unimportant.

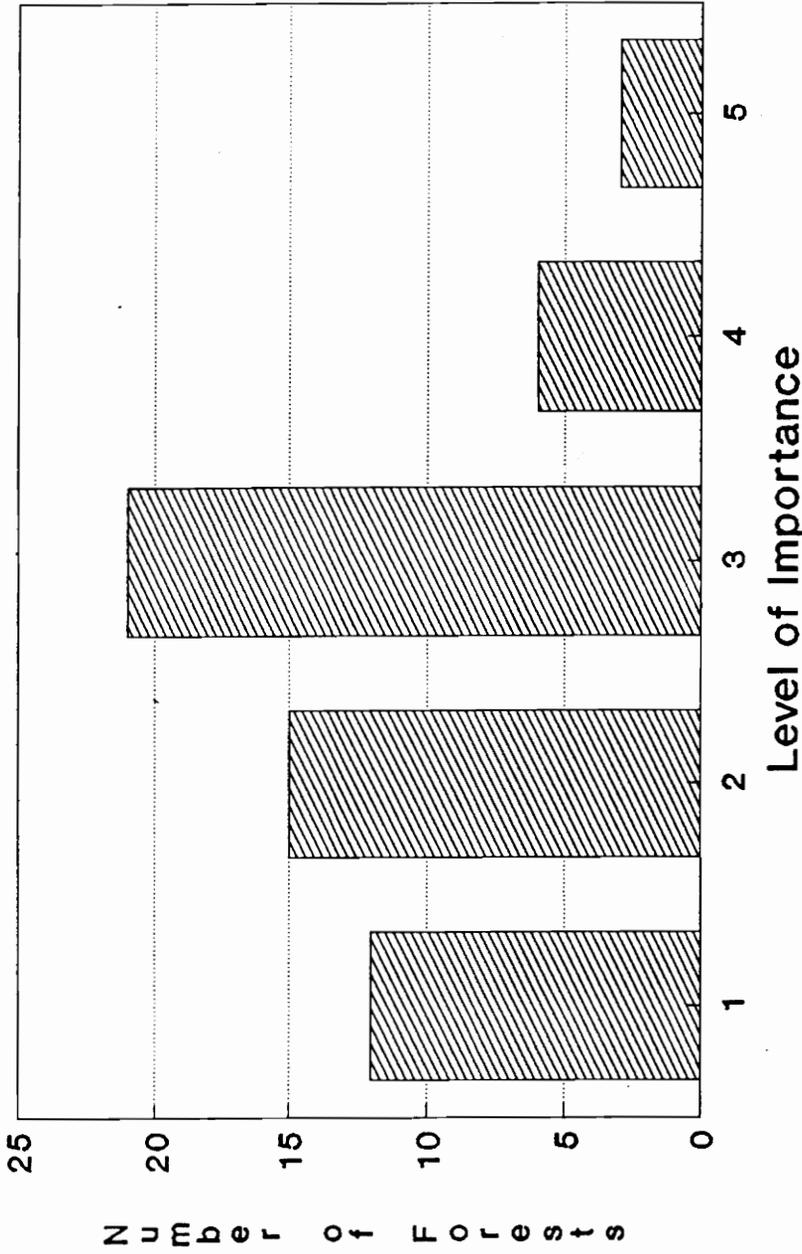
The importance of Group E (informal) had an average rating of 3 (Figure 12). The greatest percentage of the forests (37%) ranked the importance of informal public participation as 3. This was followed by a rating of 2 by 26% of the forests and a rating of 1 by 21% of the forests. Twenty-five of the 48 forests (52%) which responded with a rating of 1, 2, or 3 had a less than average number of appeals on the plan. Four of the nine forests (44%) of the forests which did not perceive informal public participation as an important technique (*a rating of 4 or 5*) had a less than average number of appeals. It appears that forests which perceived this type of public participation as important had fewer appeals than forests which perceived informal public participation as unimportant.

Time Spent on Public Participation

The average amount of time spent in public participation was 16.89 person-years per forest (Figure 13). Yet most forests (75%) used less than 16.89 person-years. Group C (small groups) was the most frequently used technique (Figure 14). An average of 43% of the time spent in public participation by each forest was used in this group. On average, approximately 34% of the total time was spent in Group D (phone/mail), 13% of the total time was spent in Group A (on site visits) and 10% of the total time was spent in Group B (large meetings).

The public participation was not conducted in equal amounts of time during the planning process (Figure 15). An average of 21% of the total time of public participation on each forest was spent in stage 1 (identifying issues, etc.). An average of 38% of the total time was spent in stages 7 and 8 (evaluation and selection of alternatives). The remaining 41% of the total time was spent in stages 2 through 6. This is consistent with the findings of Blahna and Shepard (In Press).

Twenty-four of the 43 forests (56%) which used *less* than 16.89 person-years in public participation had a less than average number of appeals. Five of the 14 forests (36%) which used *more*



1 = most important; 5 = least important

Figure 12. Importance of Informal Public Participation

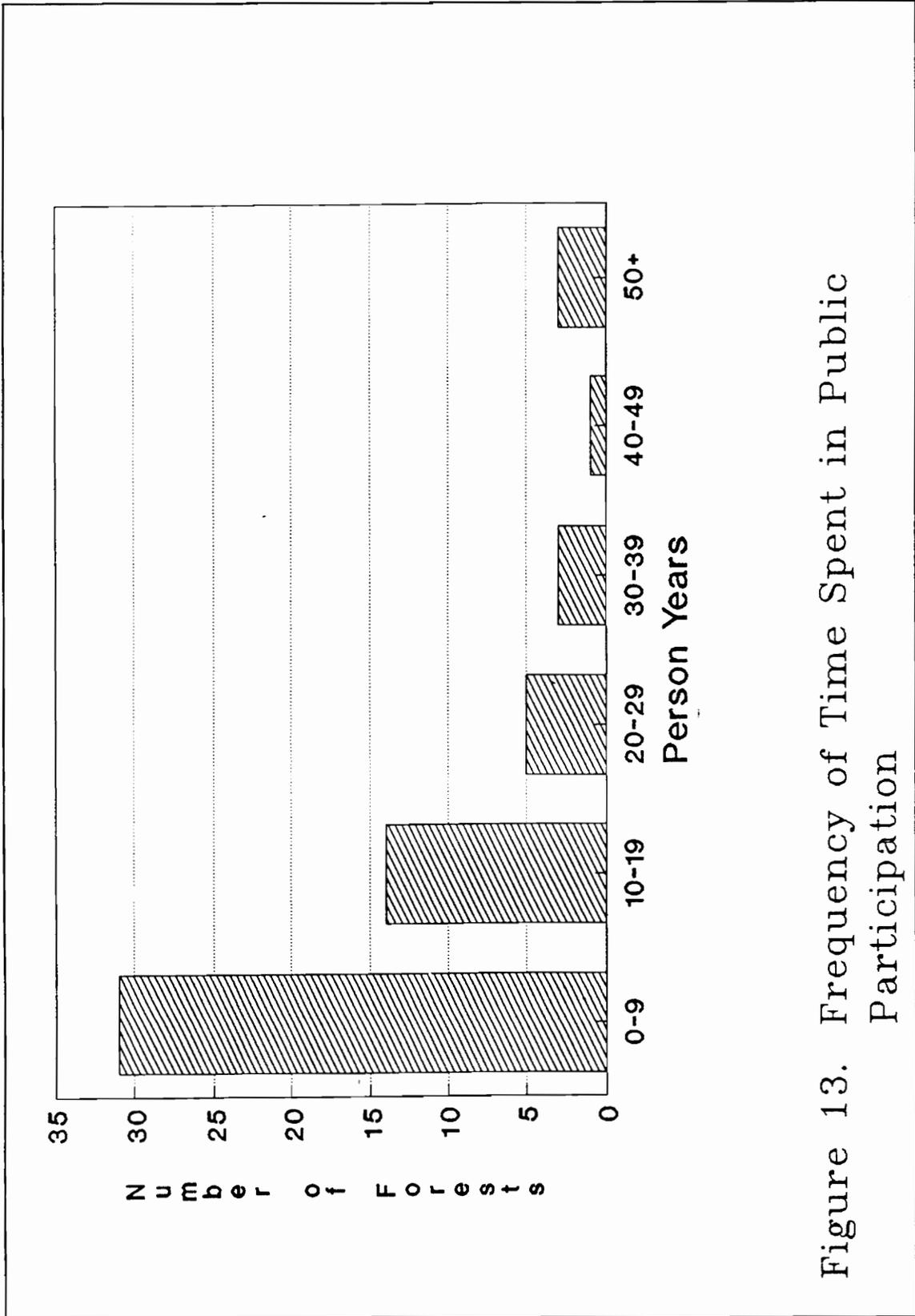


Figure 13. Frequency of Time Spent in Public Participation

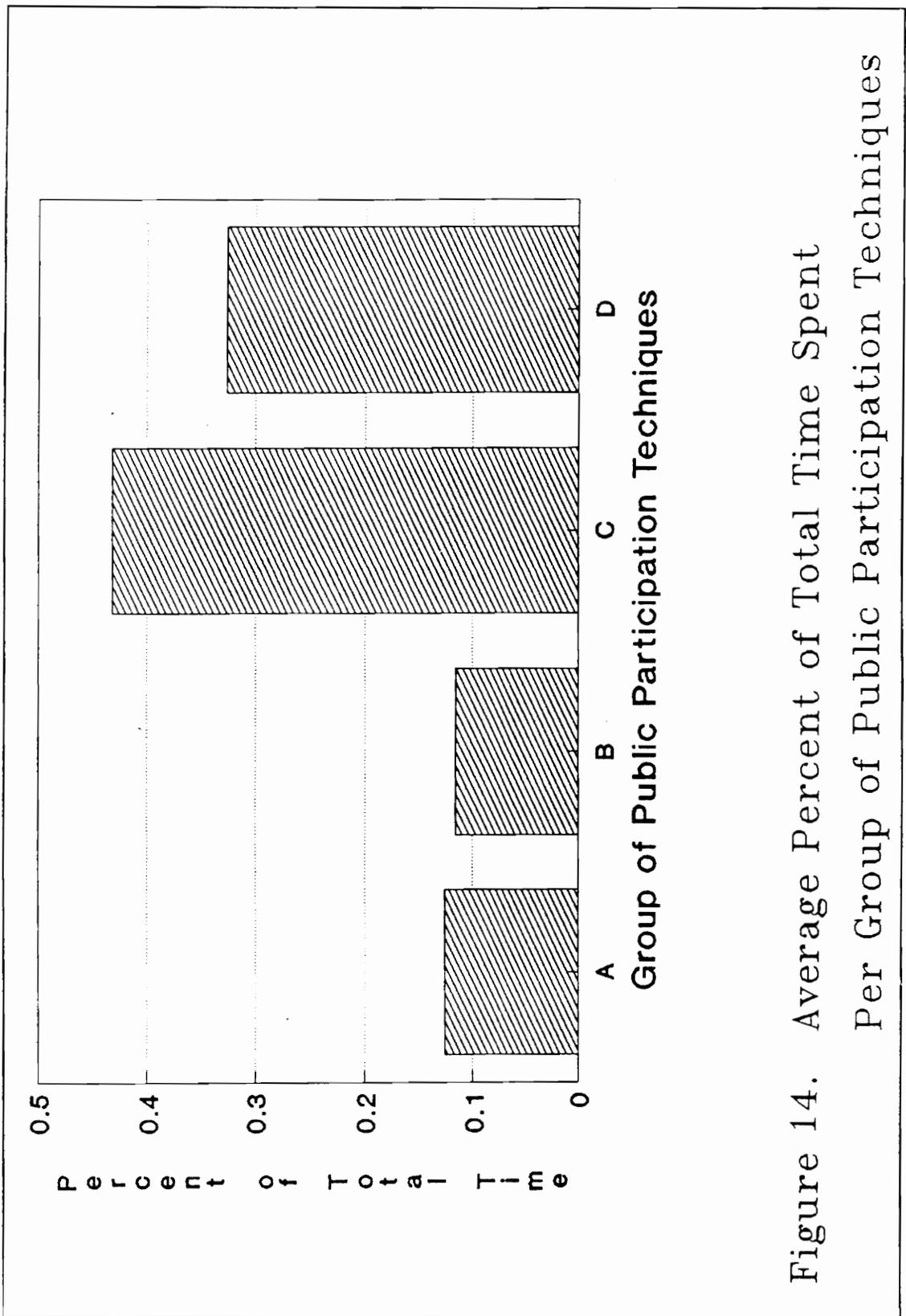


Figure 14. Average Percent of Total Time Spent Per Group of Public Participation Techniques

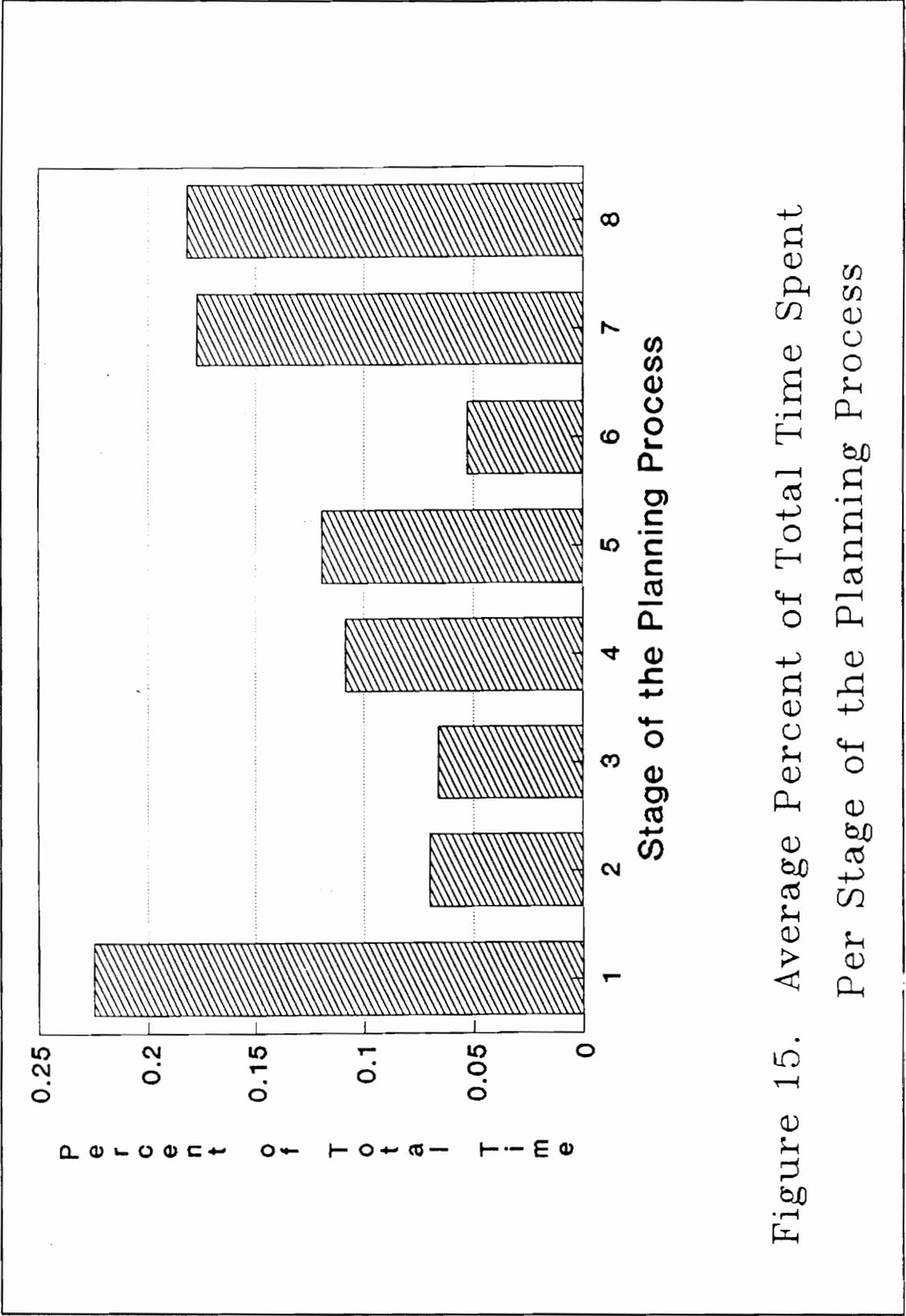


Figure 15. Average Percent of Total Time Spent Per Stage of the Planning Process

than 16.89 person-years had a less than average number of appeals. It appears that the forests which spent little time in public participation had fewer appeals than forests which spent a great deal of time in public participation.

Demographic and Resource Attribute Variables

The average acreage of the responding forests was 1,439,900 (Figure 16). Of this acreage, an average of 12.6% was classified as wilderness (Figure 17). Of the responding forests, 40 were from the western regions 1-6 and 17 were from the eastern regions regions 8-9. The responses from region 10 were received after this analysis was conducted. From the responding forests, an average of 55.37 MMBF were sold between 1980 and 1988 (Figure 18) and there was an average of 1,809,000 RVDs between 1976 and 1986 (Figure 19).

Costs of Public Participation and Appeals

Of the 57 responding forests, 14 randomly selected forests were contacted again to determine an estimate of the cost of public participation. The average response was an estimated \$32,000 per person year (standard deviation = \$35,000), or an average of \$540,000 per forest since the planning began. The respondents indicated that the largest proportion of the cost of public participation was the salary of the people involved. The additional costs of travel, audiovisuals, etc. did not add significantly to this figure.

To calculate the estimate of the appeals cost, a factor of \$50,000 per person year was applied to the estimate of time spent by the Washington Office. The estimated total cost to the Washington Office by resolving the appeals for the 57 responding forests was \$567 million. An estimated total of \$901.5 million has been spent to date responding to the appeals of all forests which filed before August, 1989.

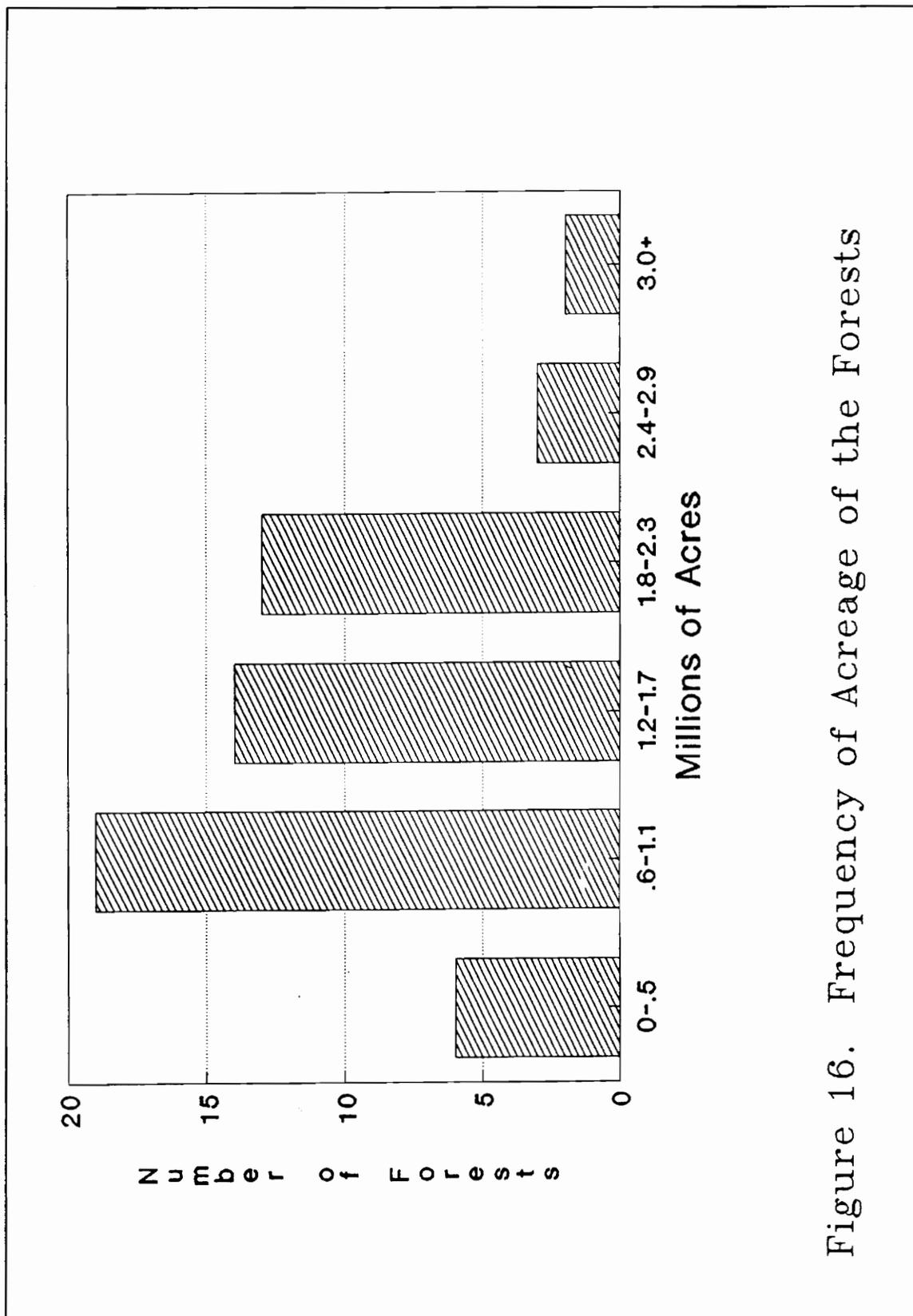


Figure 16. Frequency of Acreage of the Forests

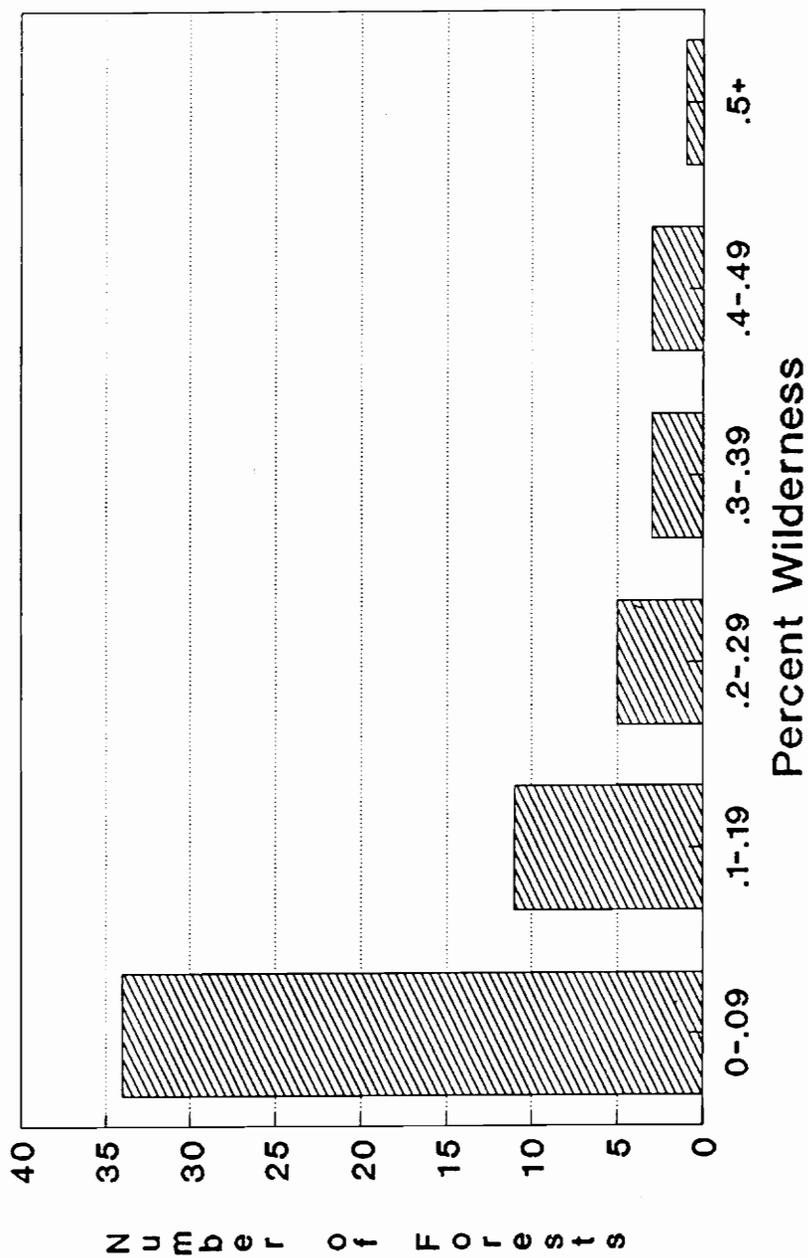


Figure 17. Frequency of the Percent of Acreage Classified as Wilderness

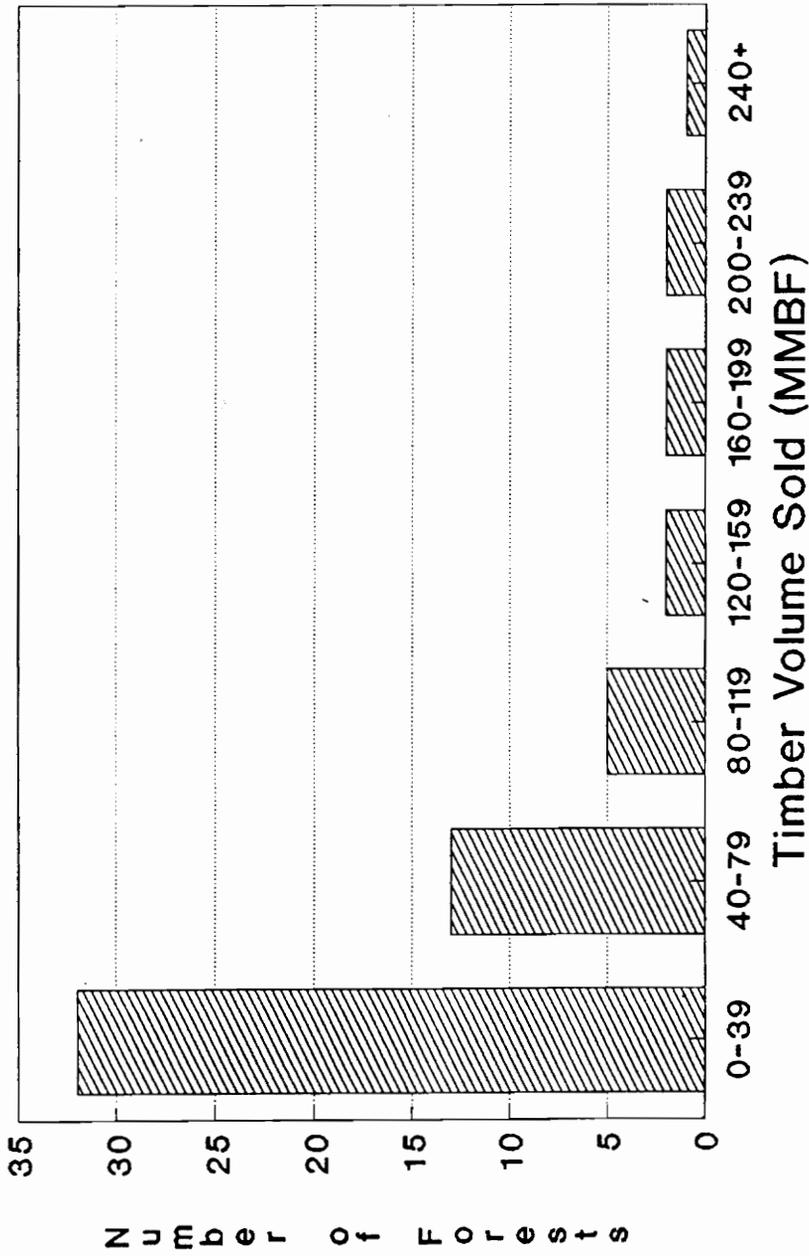


Figure 18. Frequency of Average Volume of Timber Sold by the Forests From 1980 - 1988

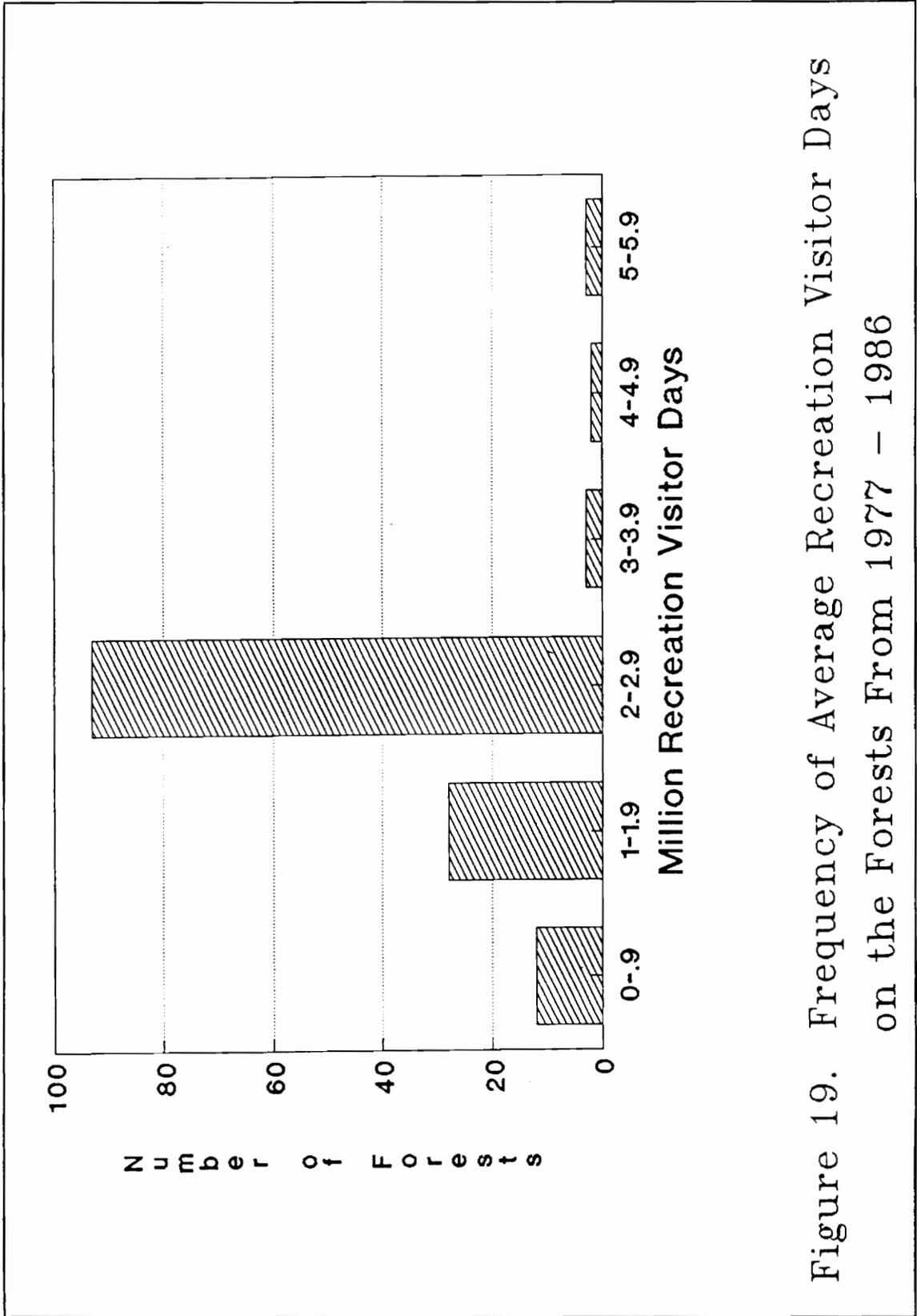


Figure 19. Frequency of Average Recreation Visitor Days on the Forests From 1977 - 1986

The Logit Model

Based on the descriptive analysis of the time spent in public participation, it might be concluded that, if a forest decreases the amount of time spent in public participation, then the level of conflict would be reduced. This is because more than half of the forests which used *less* than 16.89 person-years in public participation had less than 7 appeals.

The purpose of the second part of this study is to determine the statistical relationship between these variables. The variables were modelled in 15 equations (Table 5, p.38) using four different dependent variables. To determine the statistical significance of the equations in this analysis, several criteria were observed. First, the R^2 , which measures the proportion of the variability in the dependent variable that is explained by the variability in the independent variables of each equation was noted. However, due to the small number of observations in the estimation of the logit model, the adjusted R^2 , (R^2_a), was believed to be a better measure than the R^2 . The estimated coefficients were observed to determine the relationship (positive or negative) between the independent variables and the dependent variable. The test of the null hypothesis that the coefficients are equal to 0 was done with a t-test with (n-2) degrees of freedom and a critical level of 90% (critical t-value = 2.920 for equations with 2 independent variables; 1.943 for equations with 3 independent variables). Thus, the variable contributed significantly to the equation if the t-statistic for the coefficient was greater than 2.920 or 1.943; or less than -2.920 or -1.943. The variables which appear most significant in the four models are the time spent in public participation (TIME), the importance of informal public participation (INF), the average number of RVDs (RVD), and the percent of the forest classified as wilderness (WILD). Each model is discussed in more detail below.

Model #1

Model #1 used the probability that a plan from a forest with identical characteristics had a high number of appeals (appeals for forest i was greater than the median number of appeals) to determine dependent variable, \hat{Z}_i (Equation 3, p.34). The estimated equations for each set of characteristics considered (Table 5, p.38) are presented in Table 6. The R^2 ranged from 0.00 (eqs. f,g,i,j,l,m,n) to .956 (eq. c) and .983 (eq. e). One or more variables were significant in eqs. a,c,e, and k. The variables which were significant in the equations were: the time spent in public participation (TIME), the importance of informal public participation (INF), the average volume of timber sold (TMBR), the acreage of the forest (ACRE), and the percent of the forest in wilderness (WILD). Each significant variable has a positive relationship with the dependent variable. There are several implications of these relationships.

First, it appears that the more important the responding forests perceived informal public participation, the smaller the probability of a large number of appeals. It also appears that among the responding forests, as more public participation is conducted, there is a higher probability that a large number of appeals will be filed. However, this does not necessarily suggest that public participation caused the conflict. It is possible that the level of public participation conducted by a forest was the result of a preconceived notion of the amount of conflict which the plan would generate.

Another implication is that, the greater the amount of conflicting resources which come from a forest (timber and wilderness) and the larger the forest, the greater the probability of large numbers of appeals. A simple explanation for this might be there are more resources at stake on these forests. When one considers conflicting resources, one realizes it is difficult to give the maximum desired amount to everyone.

Table 6. Logit Model #1

eq.	Estimated Equation	R ²
a	$\hat{Z}_i = -0.3670 + 0.3280 \text{ TIME} + 0.3880 \text{ INF}$ (-5.50) (4.26) (4.26)	0.920
b	$\hat{Z}_i = -0.4531 + 0.1823 \text{ TIME} + 0.5878 \text{ PN}$ (-1.94) (0.68) (2.18)	0.518
c	$\hat{Z}_i = -0.3670 + 0.3284 \text{ TIME} + 0.3284 \text{ TMBR}$ (-7.24) (5.77) (5.77)	0.956
d	$\hat{Z}_i = -0.3670 + 0.3284 \text{ TIME} + 0.3284 \text{ RVD}$ (-1.83) (1.42) (1.42)	0.404
e	$\hat{Z}_i = -0.5584 + 0.3954 \text{ TIME} + 0.6624 \text{ WILD}$ (-10.95) (6.71) (11.25)	0.983
f	$\hat{Z}_i = -0.6252 + 0.3748 \text{ TIME} + 0.8292 \text{ ACRE}$ (-1.07) (0.56) (1.23)	0.000
g	$\hat{Z}_i = -0.2950 + 0.3670 \text{ TIME} + 0.0790 \text{ MILE}$ (-0.27) (0.30) (0.06)	0.000
h	$\hat{Z}_i = -0.2286 + 0.4673 \text{ TIME} - 1.1489 \text{ RGN}$ (-0.99) (1.75) (-0.56)	0.316
i	$\hat{Z}_i = -0.4480 + 0.3497 \text{ TIME} + 0.2908 \text{ TMBR} + 0.2585 \text{ RVD}$ (-1.07) (0.83) (0.69) (0.61)	0.000
j	$\hat{Z}_i = -0.5128 + 0.2736 \text{ TIME} + 0.2939 \text{ INF} + 0.5878 \text{ PN}$ (-0.87) (0.47) (0.50) (1.00)	0.000
k	$\hat{Z}_i = 0.0091 - 0.2118 \text{ TIME} + 1.2437 \text{ ACRE} - 0.5584 \text{ MILE}$ (0.02) (-0.56) (3.26) (-1.46)	0.583
l	$\hat{Z}_i = -0.5341 + 0.2908 \text{ TIME} + 0.6233 \text{ ACRE} + 0.4794 \text{ WILD}$ (-0.81) (0.44) (0.95) (0.73)	0.000
m	$\hat{Z}_i = -0.3909 + 0.3607 \text{ TMBR} + 0.3607 \text{ RVD}$ (-0.88) (0.70) (0.70)	0.000
n	$\hat{Z}_i = -0.7009 + 0.4210 \text{ TMBR} + 0.8599 \text{ WILD}$ (-1.02) (0.53) (1.08)	0.000
o	$\hat{Z}_i = -0.4509 + 0.8047 \text{ ACRE} - 0.0426 \text{ MILE}$ (-1.30) (2.02) (-0.11)	0.409

* Numbers in parentheses are t-values

Model #2

Model #2 used the probability that a forest with identical characteristics would have a high **number of appeals per acre** to determine the dependent variable \hat{Z}_i . This dependent variable was used to factor out the effects which the size of the forest might have on the number of appeals. In other words, by standardizing the variables by the number of acres, the question of whether or not a large forest would automatically have a higher probability for appeals could be analyzed. The estimated equations are presented in Table 7. The R^2 ranged from 0.00 (eq. m) to .979 (eq. d) and .997 (eq. a). One or more variables were significant in eqs. a,d,e,h,i,j,and n.

Again, the variables which proved significant were: the time spent in public participation (TIME), the importance of informal public participation (INF), the average volume of timber sold (TMBR), and the percent of the forest in wilderness (WILD). Each of the significant variables had a positive coefficient. Again, this model suggests that the more a forest conducts public participation, the higher the probability for appeals. Another implication of this model is the more important a forest perceives informal public participation, the lower the probability for appeals. This model also suggests that the more resources at stake on the forests, the higher the probability for appeals.

Model #3

Model #3 used the probability that a forest with identical characteristics would have a high **number of appeals per mile to population centers** to determine the dependent variable, \hat{Z}_i . This was done to factor out the effects which the proximity to population centers might have on the number of appeals. The estimated equations are presented in Table 8. The R^2 ranged from 0.0 (eq. f) to 1.0 (eqs. b,c,m). One or more variables were significant in eqs. a,b,c,d,i,j,m,and n. These variables were: the time spent in public participation (TIME), the number of public notification techniques

Table 7. Logit Model #2

eq	Estimated Equation	R^2
a	$\hat{Z}_i = -1.0334 + 1.0551 \text{ TIME} + 1.0551 \text{ INF}$ (-27.43) (24.26) (24.26)	0.997
b	$\hat{Z}_i = -0.5226 + 1.1322 \text{ TIME} - 0.1206 \text{ PN}$ (-1.48) (2.77) (-0.30)	0.658
c	$\hat{Z}_i = -0.5538 + 1.0874 \text{ TIME} + 0.0578 \text{ TMBR}$ (-1.62) (2.76) (0.15)	0.652
d	$\hat{Z}_i = -0.5564 + 1.0720 \text{ TIME} + 0.1320 \text{ RVD}$ (-7.05) (11.76) (1.45)	0.979
e	$\hat{Z}_i = -0.8220 + 1.1331 \text{ TIME} + 0.5941 \text{ WILD}$ (-5.03) (6.00) (3.15)	0.936
g	$\hat{Z}_i = -0.3279 + 1.0796 \text{ TIME} + 0.3375 \text{ MILE}$ (-0.73) (2.08) (-0.65)	0.477
h	$\hat{Z}_i = -0.5583 + 0.9626 \text{ TIME} + 0.4236 \text{ RGN}$ (-2.39) (3.57) (1.57)	0.815
i	$\hat{Z}_i = -0.6770 + 1.0499 \text{ TIME} + 0.1014 \text{ TMBR} + 0.2129 \text{ RVD}$ (-1.64) (2.54) (0.25) (0.52)	0.351
j	$\hat{Z}_i = -1.2193 + 1.0562 \text{ TIME} + 1.0358 \text{ INF} + 0.1399 \text{ PN}$ (-3.45) (2.99) (2.93) (0.40)	0.677
m	$\hat{Z}_i = -0.1603 + 0.2027 \text{ TMBR} + 0.2027 \text{ RVD}$ (-0.38) (0.41) (0.41)	0.000
n	$\hat{Z}_i = -0.3923 + 0.3302 \text{ TMBR} + 0.5659 \text{ WILD}$ (-4.06) (2.96) (5.07)	0.915

* Numbers in parentheses are t-values

Table 8. Logit Model #3

eq	Estimated Equation	R ²
a	$\hat{Z}_i = -2.0974 + 0.7145 \text{ TIME} + 1.4076 \text{ INF}$ (-5.34) (1.58) (3.11)	0.772
b	$\hat{Z}_i = -1.3263 + 0.9253 \text{ TIME} - 0.0555 \text{ PN}$ (-170.16) (102.81) (-6.17)	1.000
c	$\hat{Z}_i = -1.5404 + 0.8473 \text{ TIME} + 0.4418 \text{ TMBR}$ (****) (****) (****)	1.000
d	$\hat{Z}_i = -1.9965 + 0.8431 \text{ TIME} + 1.2363 \text{ RVD}$ (-22.77) (8.33) (12.21)	0.986
e	$\hat{Z}_i = -1.1391 + 0.9563 \text{ TIME} - 0.5100 \text{ WILD}$ (-2.95) (2.15) (-1.14)	0.566
f	$\hat{Z}_i = -1.4970 + 1.1080 \text{ TIME} - 0.2320 \text{ ACRE}$ (-0.95) (0.61) (-0.13)	0.000
h	$\hat{Z}_i = -1.9376 + 0.8506 \text{ TIME} + 1.6238 \text{ RGN}$ (-3.57) (1.36) (2.59)	0.685
i	$\hat{Z}_i = -2.2043 + 0.7886 \text{ TIME} + 0.4743 \text{ TMBR} + 1.2263 \text{ RVD}$ (-16.63) (5.95) (3.58) (9.25)	0.949
j	$\hat{Z}_i = -2.0127 + 0.7611 \text{ TIME} + 1.1304 \text{ INF} + 0.0091 \text{ PN}$ (-4.43) (1.68) (2.89) (0.02)	0.537
m	$\hat{Z}_i = -1.8756 + 0.5802 \text{ TMBR} + 1.2917 \text{ RVD}$ (-283.11) (75.84) (168.84)	1.00
n	$\hat{Z}_i = -0.7195 + 0.9281 \text{ TMBR} - 0.7946 \text{ WILD}$ (-15.76) (17.61) (-15.08)	0.994

* Numbers in parentheses are t-values

used (PN), the importance of informal public participation (INF), the average volume of timber sold (TMBR), the average number of RVDs (RVD), and the percent of the forest in wilderness (WILD). Each of the significant variables had a positive coefficient, except for PN (eq. b) and WILD (eq. n). This suggests that the more techniques used to notify the publics, the lower the probability for appeals. The model also suggests that the more public participation is conducted, the higher the probability for appeals. Again, the more important the forest perceives informal public participation, the lower the probability for appeals. As with Models #1 and #2, this model implies the more resources at stake on the forests, the higher the probability for appeals. A possible reason for the negative relationship of the percent of the forest in wilderness to the dependent variable is that the influence of the proximity to population centers was eliminated. That is, if a forest has a small percent of its acreage in wilderness, there is a tendency for greater conflict given the limited size of the resource on which demands are made.

Model #4

Model #4 used a ratio of the **percent of total time used by the Washington Office** resolving the appeals of an individual forest to the **percent of the total number of appeals resolved** to determine the dependent variable, \hat{Z}_i . This variable was used so that the relationship between public participation and the difficulty of the appeals could be examined. It is believed the greater the ratio, the greater the difficulty of the appeals for the forest. A forest which required a large percent of the time spent by the Washington office, resolving only a small percent of that forests appeals, indicates the presence of more difficult appeals than a forest which required a small percent of time to resolve all of that forest's appeals. The estimated equations from this model are presented in Table 9. The R^2 ranged from 0.00 (eqs. c,j,m) to .982 (eq. f) and .985 (eq. g). One or more variables were significant in eqs. d,e,f,g,h,k,l, and o. For Model #4, the significant variables were: the time spent in public participation (TIME), region (RGN), the average number of RVDs (RVD), the distance to population centers (MILES), the acreage of the forest (ACRE), and the percent of the forest in

Table 9. Logit Model #4

eq	Estimated Equation	R ²
a	$\hat{Z}_i = -0.4448 + 1.2951 \text{ TIME} - 0.0912 \text{ INF}$ (-1.03) (2.61) (-0.18)	0.617
b	$\hat{Z}_i = -0.4042 + 0.6750 \text{ TIME} - 0.1360 \text{ PN}$ (-1.73) (2.50) (-0.50)	0.601
c	$\hat{Z}_i = -0.4258 + 0.7339 \text{ TIME} - 0.3647 \text{ TMBR}$ (-0.80) (1.19) (-0.59)	0.000
d	$\hat{Z}_i = -0.1501 + 0.7703 \text{ TIME} - 0.9038 \text{ RVD}$ (-0.58) (2.57) (-3.01)	0.820
e	$\hat{Z}_i = -1.0247 + 0.7276 \text{ TIME} + 0.9996 \text{ WILD}$ (-5.46) (3.36) (4.61)	0.911
f	$\hat{Z}_i = -0.6142 + 0.6406 \text{ TIME} + 0.2351 \text{ ACRE}$ (-13.44) (12.14) (4.46)	0.982
g	$\hat{Z}_i = -1.2452 + 0.7856 \text{ TIME} + 1.3246 \text{ MILE}$ (-13.29) (7.26) (12.24)	0.985
h	$\hat{Z}_i = -0.2499 + 0.9435 \text{ TIME} - 1.5414 \text{ RGN}$ (-0.93) (3.05) (-4.98)	0.915
i	$\hat{Z}_i = -0.3253 + 0.9689 \text{ TIME} - 0.2412 \text{ TMBR} - 0.7317 \text{ RVD}$ (-0.49) (1.45) (-0.36) (-1.09)	0.056
j	$\hat{Z}_i = -0.5509 + 0.1517 \text{ TIME} + 0.0715 \text{ INF} + 0.3835 \text{ PN}$ (-0.80) (0.22) (0.10) (0.56)	0.000
k	$\hat{Z}_i = -1.1184 + 0.5863 \text{ TIME} + 0.4189 \text{ ACRE} + 1.1356 \text{ MILE}$ (-4.35) (2.28) (1.63) (4.42)	0.816
l	$\hat{Z}_i = -0.9729 + 0.7772 \text{ TIME} - 0.2098 \text{ ACRE} + 1.0916 \text{ WILD}$ (-7.62) (6.09) (-1.64) (8.55)	0.940
m	$\hat{Z}_i = 0.2907 - 0.1761 \text{ TMBR} - 0.8047 \text{ RVD}$ (0.42) (-0.22) (-1.00)	0.000
n	$\hat{Z}_i = -0.5817 - 0.0486 \text{ TMBR} + 0.9447 \text{ WILD}$ (-1.37) (-0.10) (1.93)	0.365
o	$\hat{Z}_i = -0.8377 + 0.0760 \text{ ACRE} + 1.2234 \text{ MILE}$ (-9.83) (0.77) (12.44)	0.981

* Numbers in parentheses are t-values

wilderness (WILD). Except for the region (equation h) and the average number of RVDs (equation d), each significant variable had a positive coefficient. This implies that larger forests close to population centers, with a large proportion of wilderness, tend to have a high probability of appeals which require more than average time to resolve. This may result from people's tendency to express a greater interest in local resources than in the resources on forests far away. Another implication of this model is that, forests which conduct a great amount of public participation tend to have a high probability for a large number of difficult appeals to resolve.

Summary of the Logit Models and Recommendations

Several similarities can be observed between the estimated equations for each model. Of particular importance is the frequency that the time spent in public participation, the importance of informal public participation, the average number of RVDs, and the percent acreage in wilderness appear as significant variables. Each of these variables showed a positive relationship for all models except the percent of the forest classified as wilderness (WILD) in Model #3 and the average number of RVDs in Model #4.

These similarities suggest that the more resources at stake on the forest, the higher the probability for appeals. An explanation for this relationship might come from the history of the planning process. It was out of a concern for timber practices and the increased demand for recreational opportunities on the forest that the planning process was originally created.

A second observation concerns the variable of time spent in public participation. For all equations, in all models, this variable showed a positive relationship to the dependent variable. This suggests that the more a forest conducts public participation, the higher the probability of having a large number of appeals. As stated in the discussion of Model #1, the more a forest conducts public participation, the greater the opportunity for different people to get involved. The effect of this is that a forest has to satisfy a larger number of people, because there are more people

who can appeal the plan. Again, a word of caution: these results do not suggest that if a forest conducted no public participation all conflicts would be avoided. This study did not obtain a measure of the number of appeals which were avoided. In addition, the possibility exists that those forests which sensed that their plan would generate a great deal of conflict could have conducted more public participation.

Another limitation of this study rests in the data about public participation which was gathered. Because accurate records were not kept, the observations were only estimates. A person has a tendency to forget the details of the planning which occurred in past years. Also, there could have been differences in the way respondents calculated the time of public participation. Some might have included the time of activities which other respondents did not. Also, the estimates of time spent in public participation and in dealing with appeals do not represent the effectiveness of the time. It is conceivable that a forest spent a small amount of quality time working with the public, while another forest spent a large amount of time not achieving anything.

Another limitation is the limited number of forests observed. Because of this, the use of the logit model presented limitations. When dealing with the public resource, many variables need to be considered. However, the relatively small data set allowed the consideration of only a limited number of these variables at a single time. Other variables of interest, such as the type of appellant or the issue which was being appealed, were not available.

This study attempted to observe the relationship of variables other than public participation which might have an effect on the conflict over the plans. If a significant negative relationship between the time spent in public participation and the four dependent variables was observed, it would be clear that the public participation process was actually successful in reducing conflict. However, in all equations where the time spent in public participation was significant, there was a positive relationship to the dependent variables. Therefore, the results of this study do not indicate that the Forest Service has been successful in avoiding conflict through the current public participation process, though it does not prove the Forest Service was unsuccessful in avoiding conflict.

One should remember, however, this is only the end of the first round of planning. Even though it does not appear that the efforts in public participation have paid off at the end of this round, the benefits of this public participation might be realized in future rounds of planning.

To fully understand the relationship between conflict and public participation, many issues must still be considered. One issue which might be considered is the relationship between the number of appeals avoided and the Forest Service investment in public participation. To determine how many appeals were avoided or generated due to public participation, one should analyze the behavior of all publics involved in the planning process. At what point in the process were their desires satisfied? Were there factors, such as income level, which caused people to drop out of the planning process, even though they were not satisfied with the plan? Why were the appellants not satisfied with the plan? To answer these questions, the Forest Service might conduct a comparative analysis to determine the differences between the appellants and the other publics who participated in the planning. The Forest Service might also conduct a study in which representative groups of interested publics design two plans, each group using a different level of public participation. The plans could be compared and the decision of the publics to appeal the plan which they helped develop could be analyzed. A study might be conducted to determine the effectiveness of the public participation. This is an issue not considered here, but should be as some forests might have been more effective in public participation than other forests.

Another issue which might be considered is the publics' trust in the Forest Service. Because the development of the plans took longer than anticipated, many of the publics became frustrated with the process; causing some publics to distrust the agency. Therefore, the publics might not be willing to cooperate with the Forest Service during the next round of planning. The agency might want to monitor the publics' trust before planning begins, as well as during the planning process. If this monitoring was done, the agency would be able to determine when the trust in the agency was waning and would be able to respond with appropriate actions.

The Forest Service should recognize that the perceptions of the public as a result of day-to-day contacts with agency personnel are important in the avoidance of conflict. The agency should also recognize that public participation provides not only an avenue for the exchange of informa-

tion, but a method through which the publics can become involved in the transformation of their desires into practical resource management plans. Therefore, the Forest Service should not eliminate public participation from its planning process. Instead, it should accept the fact that people are interested in the resources on the national forests and, if the agency works closely with these people on a day-to-day basis, cooperation might result and conflict might be avoided. The groups of public participation techniques used in the logit analysis are structured techniques. However, it appears the structured processes are not as helpful in reducing conflict as the unstructured contacts of informal public participation.

If the Forest Service is committed to meeting the multiple demands for the resources from its lands, it must realize that the publics are interested in participating in the management of the national forests. These publics are becoming increasingly aware of forest resource management and are requiring more than a “trust us, we’ll take care of everything” response.

Conclusions

Because of the increased demand for access by organizations and individuals to the decision making process, the Forest Service has had to accept a change in its planning process. Gone are the days when a Forest Supervisor could chat with the constituents at the local store and work out a deal which would provide the demanded resources. In this age of high-tech planning the face of public participation has changed. Because there are more publics who understand the issues involved with national forest planning than in years gone by, public participation has become more complicated. Planning in general has become more dependent upon computers and the advances they offer. Many sophisticated activities have also been developed to involve the publics. Yet the publics have appeared to keep pace. These publics know what resources they want and they have ideas as to how to achieve them.

Through the current planning process, the publics are given the opportunity to participate and express dissatisfaction with the final plans. However, the publics have expressed more dissatisfaction than was expected. This has initiated a process of questioning within the Forest Service. One issue which has been repeatedly pointed to as a possible answer to the problem of the unexpected conflict is the public participation process. Some believe this process has caused the uproar over the forests which is heard throughout the country. Others believe this process has been an effective tool in developing proper management directives.

The Forest Service is now in a position to evaluate this process, as the first round of planning is drawing to a close. If the Forest Service is to determine what level of public participation will produce a proper plan, at a minimal cost, the process needs to be analyzed in a cost-benefit framework. However, before this can be accomplished, the relationship between public participation and conflict must be determined.

This study attempted to describe what happened during the planning process. It also analyzed the relationship between public participation, characteristics of the national forests, and the level of conflict which the Forest Service is currently trying to resolve. It was found that there was a positive relationship between the amount of public participation conducted on the forests, the volume of timber sold, the average number of RVDs, the percent of the forest in wilderness, and the importance of informal public participation, and the number of appeals which the Forest Service is currently resolving and their difficulty. This suggests that:

1. the more resources which the publics perceive to be at stake on the forest, the more likely these publics are going to fight over the management decisions;
2. those forests which perceived informal public participation as an important technique had a low level of conflict; and
3. those forests which spent little time in public participation had a low level of conflict.

More research needs to be done, however, to determine if these factors actually caused the conflict or if the conflict was reduced through the use of public participation.

Appendix A. The Survey

Public Participation Survey

This survey is part of a research effort being conducted at Virginia Polytechnic Institute and State University. The objectives of this research are:

- 1) to describe the use of public participation in the Forest Service planning process;
- 2) to determine the relationship between public participation and appeals of Final Land Management Plans.

We are seeking information about your methods of notifying the public of how they could be involved in forest planning, and the types of public participation techniques used. **The responses from individual forests will be kept confidential.** Your cooperation in completing this survey is greatly appreciated.

* * * * *

Please Complete
(responses for office use only)

National Forest _____ Title of Respondent _____

Name of Respondent _____

* * * * *

PART I: Public Notification

The National Forest Management Act requires each Forest to notify the public of opportunities to participate in the planning process. This question relates to the methods your Forest has used to notify the public of these opportunities. When responding to the question, please disregard notices in the Federal Register as these notices are required of all National Forests.

Q-1. Please indicate which of the methods listed below your Forest has used to inform the public about participation in the planning process.

- Classified ads in newspapers (local and regional)
- Other paid ads in newspapers (local and regional)
- Paid ads in out-of-state newspapers
- Paid ads in magazines
- Articles in any newspaper or magazine
- Newsletters, brochures, posters, and pamphlets
- Public Service Announcements on radio or TV
- Paid ads on radio or TV
- Documentary (TV)
- Radio or TV talk shows
- Mail sent to those on the Forest's mailing list
- Other (please list)

PART II: Public Participation Techniques

To understand how each Forest has conducted its public participation and to determine its relationship to appeals, we would like information about:

- 1) the people most responsible for the public participation techniques;
- 2) the importance of public participation techniques.

Q-2. Please indicate the position of the employee most directly involved (on average) in the design and implementation for each group of techniques you used in the planning process (Forest Supervisor, District Ranger, technician, planning staff member, or public affairs officer, etc.).

Technique ¹	Position
A. Field Trips, On-Forest Demonstrations, Open Houses	_____
B. Public Hearings and Large Group Discussions	_____
C. Small Group Discussions, Task Force and Working Groups, Workshops, and Seminars	_____
D. Telephone Contacts and Mailings to those on mailing lists	_____

¹ Public Participation Handbook; USDA Forest Service, 1981.

Q-3. Of the groups of public participation techniques listed below, please indicate how the Forest has perceived the importance of their use in the entire planning process (mark the most important group as "1", the second most important as "2" and so on. Mark any method not used as "N").

- _____ A. Field Trips, On-Forest Demonstrations, Open Houses
- _____ B. Public Hearings and Large Group Discussions
- _____ C. Small group discussions, Task Force and Working Groups, Workshops, and Seminars
- _____ D. Telephone Contacts and Mailings to those on mailing lists
- _____ E. Informal Contacts with the public as part of day-to-day operations.

PART III: Time in Public Participation

To correctly measure the relationship between public participation and appeals, we would like information on the amount of time spent on public participation. We would like estimates of the time involved for your Forest's public participation process. The next question is structured in a chronological sequence to ease your calculation of these estimates.

Q-4. Given the four groups of public participation techniques listed below, estimate the number of person-years of time used for each group in the first eight stages of the planning process. In calculating the time used for each technique, please consider the time used by the principal agency employees and secretarial work, preparation time, travel time to activity, the time of the activity itself, and time used to analyze results of the activity.

Please make your estimates as accurate as possible. We recognize that the amount of time spent is difficult to estimate, but please do the best you can.

* * * * *

Public Participation Techniques²

- A. Field Trips, On-Forest Demonstrations, Open Houses
- B. Public Hearings and Large Group Discussions
- C. Small Group Discussions, Task Force and Working Groups, Workshops, and Seminars
- D. Telephone Contacts and Mailings to those on mailing lists

² Public Participation Handbook, USDA Forest Service, 1981.

Stages of the Planning Process	Group of Techniques	Person Years Used in Each Group
1. Identify Issues, Concerns, and Management Opportunities	A	_____
	B	_____
	C	_____
	D	_____
2. Develop Planning Criteria	A	_____
	B	_____
	C	_____
	D	_____

Stages of the Planning Process	Group of Techniques	Person Years Used in Each Group
3. Develop an Inventory of Resources	A	_____
	B	_____
	C	_____
	D	_____
4. Analyze the Management Situation	A	_____
	B	_____
	C	_____
	D	_____
5. Develop Management Alternatives	A	_____
	B	_____
	C	_____
	D	_____
6. Estimate the Effects of the Alternatives	A	_____
	B	_____
	C	_____
	D	_____
7. Evaluate Alternatives in a Draft Land Management Plan	A	_____
	B	_____
	C	_____
	D	_____
8. Select an Alternative and Prepare a Final LMP	A	_____
	B	_____
	C	_____
	D	_____

References Cited

- Arnstein, Sherry R. 1969. "A Ladder of Citizen Participation," *Journal of the American Institute of Planners* 35(July): 216-224.
- Axelrod, Robert. 1984. *The Evolution of Cooperation*. New York: Basic Books. 241p.
- Beard, Charles A. 1956. *An Economic Interpretation of the Constitution of the United States*. New York: The Macmillan Co. 330p.
- Behan, R. W. 1978. "Why the Majority is Silent: Some Thoughts to Ponder, about Public Involvement, While Waiting for the Sierra Club to Arrive," *Proceedings of the Joint Convention of the Society of American Foresters and the Canadian Institute of Forestry* pp. 168-173.
- Behan, R. W. 1987. "The Polemics and Politics of Federal Land Management," *Federal Lands Policy*. Foss, Phillip O., ed. New York: Greenwood Press. 205p.
- Behan, R. W. 1988. "A Plea for Consitutency-Based Management," *American Forests* 94(7/8): 46-48.
- Bellinger, M.D., H. Fred Kaiser and H. A. Harrison. 1983. "Economic Efficiency of Fire Management on Nonfederal Forest and Range Lands," *Journal of Forestry* 81(6): 373-375,378.
- Blahna, Dale J. and Susan Yonts-Shepard. (In Press). "Public Involvement and Conflict Over National Forest Management Plans: What Happened During Round One?," *Society and Natural Resources*.
- Campen, James T. 1986. *Benefit, Cost, and Beyond: The Political Economy of Benefit-Cost Analysis*. Massachusetts: Ballinger Publishing Co. 240p.
- 36 *Code of Federal Regulations (CFR)* Chapter II Part 211 (1988 ed.).
- 36 *CFR* Chapter II part 217 (1989 ed.).
- 36 *CFR* Chapter II part 219 (1988 ed.).

- Collins, W. P. 1980. "Public Participation in Bureaucratic Decision-Making: A Reappraisal," *Public Administration* 58(6): 465-477.
- Convery, Frank J. 1979. "The Case for Multiple Use," *Proceedings of the Society of American Foresters 1979 Convention*. Maryland: Society of American Foresters. pp. 44-48.
- Culhane, P. J. 1981. *Public Lands Politics: Interest Group Influence on the Forest Service and the Bureau of Land Management*. Maryland: Resources for the Future by Johns Hopkins University Press. 398pp.
- Dana, Samuel T. and Sally K. Fairfax. 1980. *Forest and Range Policy*. New York: McGraw-Hill Book Co. 458p.
- Fairfax, Sally K. 1975. "Public Involvement and the Forest Service," *Journal of Forestry* 73(10): 657-659.
- Frome, Michael. 1984. *The Forest Service*. Colorado: Westview Press. 364p.
- Gruenfeld, Jay. 1978. "Let's Talk and Listen More and Fight Less," *Proceedings of the Joint Conference of the Society of American Foresters and The Canadian Institute of Forestry*. pp. 18-19.
- Henning, Daniel H. 1987. "Wilderness Politics: Public Participation and Values," *Environmental Management* 11(3): 283-293.
- Kennedy, Peter. 1979. *A Guide to Econometrics*. Massachusetts: MIT Press. 175p.
- Kmenta, Jan. 1986. *Elements of Econometrics*. New York: Macmillan Publishing Co. 786p.
- Krutilla, John V. and John A. Haigh. 1978. "An Integrated Approach to National Forest Management," *Environmental Law* 8: 317-415.
- Kweit, Mary Grisez and Robert W. Kweit. 1981. *Implementing Citizen Participation in a Bureaucratic Society: A Contingency Approach*. New York: Praeger Publishers. 185p.
- Langton, Stuart. 1978. "What is Citizen Participation?," *Citizen Participation in America*. Langton, Stuart, ed. Massachusetts: Lexington Books. 125p.
- Langton, Stuart. 1979. "The Growth of Citizen Participation," *Citizen Participation Perspectives: Proceedings of the National Conference on Citizen Participation*. Langton, Stuart, ed. Massachusetts: Lincoln Filene Center for Citizenship and Public Affairs. pp. 1-13.
- Little, I. M. D. 1957. *A Critique of Welfare Economics*. New York: Oxford University Press. 302p.
- Ludeman, Wayne W. 1985. "Transactive Planning: A Timber Industry Viewpoint," *Proceedings of the Society of American Foresters 1985 Convention*. Maryland: Society of American Foresters. pp.315-318.
- Mohai, Paul. 1987. "Public Participation and Natural Resource Decision-Making: The Case of the RARE II Decisions," *Natural Resources Journal* 27(1): 123-155.
- Nagel, Stuart and Marian Neef. 1978. "Finding an Optimum Choice, Level, or Mix in Public Policy Analysis," *Public Administration Review* 38(5): 404-412.

- Ostheimer, John M. 1977. *The Forest Service Meets the Public: Decision-Making and Public Involvement on the Coconino National Forest*. Eisenhower Consortium Bulletin 5. Eisenhower Consortium for Western Environmental Forestry Research. 24p.
- O'Toole, Randal. 1988. *Reforming the Forest Service*. Washington, D.C.: Island Press. 247p.
- Palmer, Charles J., Clark Row, and Robert M. Randall. 1983. *The Role of Economics in National Forest Planning*. Paper presented at Midwest Forest Economists Conference, August 29-31, 1983. University of Wisconsin, Madison. 19p.
- Pinchot, Gifford. 1947. *Breaking New Ground*. New York: Harcourt, Brace and Company. 522p.
- Pindyck, Robert S. and Daniel L. Rubinfeld. 1981. *Econometric Models and Economic Forecasts*. New York: McGraw-Hill Book Company. 630p.
- Randall, Alan. 1987. *Resource Economics: An Economic Approach to Natural Resource and Environmental Policy*. New York: John Wiley and Son. 434p.
- Reich, Charles A. 1962. *Bureaucracy and the Forests*. California: Center for the Study of Democratic Institutions. 13p.
- Reidel, James A. 1972. "Citizen Participation: Myths and Realities," *Public Administration Review* 32(3): 211-220.
- Sassone, Peter G. and William A. Schaffer. 1978. *Cost-Benefit Analysis: A Handbook*. New York: Academic Press. 182p.
- Society of American Foresters. 1984. *Forestry Handbook*. Wenger, Karl F., ed. New York: Wiley and Son. 1335p.
- Sparhawk, W. N. 1925. "The Use of Liability Ratings in Planning Forest Fire Protection," *Journal of Agricultural Research* 30(8): 693-762.
- Spiegel, Hans and Stephen Mittenenthal. 1968. "The Many Faces of Citizen Participation: A Bibliographic Overview," *Citizen Participation in Urban Development, Vol I*. Washington D.C.: National Training Laboratories. pp.3-7.
- Strange, John H. 1972. "The Impact of Citizen Participation on Public Administration," *Public Administration Review* 32(Special Issue): 457-470.
- Sugden, Robert and Alan Williams. 1978. *The Principles of Practical Cost-Benefit Analysis*. Oxford: Oxford University Press. 275p.
- Tipple, Terence J. and J. Douglas Wellman. 1989. "Life in the Fishbowl: Public Participation Rewrites Foresters' Job Descriptions," *Journal of Forestry* 87(3): 24-27,30.
- Torrence, James F. 1980. "Public Involvement From a Federal Agency Point of View," *Proceedings of the Society of American Foresters 1980 Convention*. Maryland: Society of American Foresters. pp.36-38.
- Twight, Ben W. 1983. *Organizational Values and Political Power: The Forest Service Versus the Olympic National Park*. Pennsylvania: Pennsylvania State University Press. 139p.
- Twight, Ben W. and Fremont J. Lyden. 1988. "Multiple-Use vs. Organizational Commitment," *Forest Science* 34(2): 474-486.

- 16 United States Code (U.S.C.) 1601-1610; 88 Stat 476. *Forest and Rangeland Renewable Resources Planning Act*. 1974.
- 16 U.S.C. 1600; 90 Stat. 2949. *National Forest Management Act*. 1976.
- United States Department of Agriculture, Forest Service. 1988. *Land Areas of the National Forest System* FS-383. 87p.
- United States Department of Agriculture, Forest Service. n.d. *Public Participation Handbook, Vol 1-2*. 107p.
- United States Department of Commerce, Bureau of the Census. 1980. *Census of the Population, Vol 1, Chapter c part 1*. pp.1/10d-1/10e.
- Wildavsky, Aaron. 1964. *Politics of the Budgetary Process*. Massachusetts: Little, Brown, and Co. 216p.
- Wondolleck, Julia. 1988. "Obstacles and Opportunities for Resolving Forest Planning Disputes," *Forest Watch* 9(2): 14-19.
- Wonnacott, Ronald J. and Thomas H. Wonnacott. 1979. *Econometrics*. New York: Wiley and Sons. 580p.

Vita

The author was born in Irving, Texas on December 4, 1966. He was raised in Fort Lauderdale, Florida. He received a Bachelor of Science in Forest Management from Northern Arizona University in 1988. He has spent several summers as a technician for the Blodgett Forest Research Station, University of California, Berkeley. Before graduating from Northern Arizona University, he assisted in research on the markets for Pinyon pine products. He is currently completing a Master of Science in Forestry, and will continue for a Doctor of Philosophy in Forestry.

A handwritten signature in cursive script that reads "Kevin L. Grube". The signature is written in dark ink and is positioned in the lower right quadrant of the page.