Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Forest Economics 12 (2006) 109–130
Journal of FOREST ECONOMICS
www.elsevier.de/jfe

The national environmental policy act's influence on USDA forest service decision-making, 1974–1996

Brooks A. Kaiser*

Gettysburg College, Department of Economics, Box 391, 300 North Washington Street, Gettysburg, PA 17325, USA

Received 2 April 2004; accepted 28 March 2006

Abstract

This paper uses new data from Forest Service Environmental Impact Statements and Environmental Assessments to examine Forest Service preferences and choices shaped by NEPA-required interaction with the public. This paper presents the first empirical inquiry using actual harvest plans. The agency and public are players in a game with rules determined by NEPA. Impacts on Forest Service production are estimated using a nested multinomial logit model. Findings indicate that NEPA has little short run impact on the provision of environmental amenities, as the agency control of the process results in systematic decisions that reflect rather than change agency preferences.

JEL Classification: Q230
Keywords: Environmental impact statements; National forest timber sales; Renewable resources and conservation: Forestry; Renewable resources and conservation: Government policy; Environmental management: Forestry

*Tel.: +1 717 337 6668; fax: +1 717 337 6638.
E-mail address: bkaiser@gettysburg.edu.

1104-6899/$ - see front matter © 2006 Elsevier GmbH. All rights reserved.
doi:10.1016/j.jfe.2006.03.002

Introduction

Government agencies such as the US Forest Service are often responsible for the direct or indirect provision of non-market amenities. While government intervention provides an opportunity to correct for underprovision of public goods or to neutralize externalities, the intervention may reflect agency biases if the agency's goals do not equalize marginal social benefits with marginal social costs (Culhane, 1981; Nelson, 1995; Sabatier et al., 1995). This intervention is particularly complicated in the case of jointly produced outputs.

Under the Department of Agriculture, the Forest Service controls 192 million acres of forested lands. The agency is charged with managing these lands for multiple uses, both commodity and amenity, and since 1970 has been subject to the requirements of the National Environmental Policy Act (NEPA [Public Law 91-190; 91st Congress, S. 1075. January 1, 1970]). The agency frequently has been accused of preferring commodity interests, which return revenues to the Treasury and local communities, over non-market amenities including watershed quality, wildlife habitat, and aesthetic quality (Smith, 1979; Jones and Taylor, 1995; Sedjo, 2000). NEPA, which requires all federal actions that will have significant impact on the human environment to prepare an Environmental Impact Statement (EIS), was passed into law to provide input into federal decisions from exactly this sort of non-fiscal concern.

This paper investigates the effectiveness of the law at the ground level, where actual environmental impacts will occur, by examining tradeoffs in proposed timber harvest projects. As such, it lies at the intersection of forest policy and economics, asking whether, given the incentives of NEPA as operationalized by the agency of the Forest Service, we have improved the allocation of resources given society's preferences. To uncover whether the policy improves outcomes, we must investigate the economic incentives of the agency and a diverse public, and use economic theory of revealed preference to measure levels and change in non-market outcomes.

Economists and political scientists have examined Forest Service preferences often, though rarely with project-level data. Some have investigated the complexities of multiple use management (Clawson, 1975; Bowes and Krutilla, 1985). Others have focused on the agency's structure to determine whether decision-making power is independent of hierarchical control, influenced by interest groups, or consolidated at the national level (Culhane, 1981; Jones and Callaway, 1995; Sabatier et al., 1995; Stegner and Fort, 1995; Sedjo, 2000). Still others have discussed the agency's incentives and preferences in light of its responsibility as a social planner (Nelson, 1995; Martin et al., 1996). The role of public appeals also has been studied to identify their potential for changing the agency's choices (Farnham and Mohai, 1995; Farnham et al., 1995; Jones and Taylor, 1995; Jones and Callaway, 1995; Tobias, 1992).

This paper presents the first empirical inquiry into these choices when they directly impact the land: at the microeconomic level of the individual project. It is also the first analysis with a theory that explains the role of the appeals process in changing the choices of the agency in a format that allows empirical testing, without relying on

survey data. Using new data collected from Forest Service Environmental Impact Statements (EISs) and Environmental Assessments (EAs) pertaining to proposed timber harvests, this paper empirically examines a vital aspect of Forest Service decision-making: how the actions of the agency are shaped by NEPA's requirement for public interaction. The project level data also moves the discussion from a purely policy debate to one that reveals the underlying economic impacts of policy choice, as reflected in relative values for non-market goods.

The model and analysis investigate the agency's informational and strategic advantages under NEPA to determine the scope of Forest Service influence over the final economic outcomes. I test whether the regulation constraints are binding on the agency's actions using discrete choice analysis of the Forest Service's decisions. Responses from a diverse general public and changes in policy over the last twenty-five years are expected to influence these decisions and the non-market values they generate. The manner of this influence is the subject of this paper. Though the new data set can, to a certain extent, address the actual values revealed by Forest Service choices, this research is left for elsewhere (see Kaiser, 1998) and the focus here remains on the ability of policy to change these values, regardless of what they may be.

Section 2 introduces the new data set, which is described more completely in Appendix A. Section 3 describes a multi-stage bargaining process between the Forest Service and the public that serves as the model for empirical investigation, and provides a theoretical interpretation of the difference between Forest Service proposals and choices in light of agency preferences. A nested discrete choice model is used to determine the effect the appeals process has on the Forest Service's choices. This model follows from McFadden (1974) and Maddala (1983). Section 4 discusses quantitative evidence from the data set and elsewhere to determine NEPA's true impact and presents econometric results from the nested model within this context. Section 5 concludes with a discussion of NEPA's influence on the provision of non-market amenities from our national forests.

Background and methods

Regulations

The Multiple Use Sustained Yield Act of 1960 (MUSYA) and several other federal statutes require that the Forest Service manage National Forests for various market and non-market uses. To substitute for missing markets and to integrate the multiple uses of forestry, the Forest and Rangeland Renewable Resources Act of 1974 (RPA), the National Forest Management Act of 1976 (NFMA) and the NEPA have placed structure on these complicated decision-making processes.

In particular, NEPA requires EISs when there may be significant impact to the human environment, and in practice the Forest Service prepares either an Environmental Assessment (EA) or a larger scale EIS to justify its decision for

virtually every timber harvest project. Both EISs and EAs delineate the proposed project and at least one alternative, which is to do nothing (the no-action alternative). NEPA provides further structure by mandating a period of public review and an opportunity for public appeal. The main distinction between the EA and the EIS is the length of time given for comment and appeal and the amount of public oversight.

Data and its implications

The Forest Service generally selects the initial project area using linear programming models (mainly FORPLAN) to allocate the forests' amenities on a grand scale.[1] Then they develop alternatives to this initial proposal based on different "purposes and needs" which might be met using the resources present. Each alternative is considered an optimal solution to a joint maximization problem for a subset of the environmental amenities capable of being produced from the project area. For the projects there are as many as eight stated purposes that may be met by any project alternative. These are: timber provision and community stability, wildlife habitat, recreational amenities, watershed protection, wilderness, visual or aesthetic quality, salvage and forest health, and fire protection.

One benefit of this data set is that it characterizes forests in a much broader sense than has been possible in most studies of environmental valuation (Smith, 1993). This stems in part from the management of the lands by a single agency, and in part from the fact that the local aspects of the amenities can considered separately from the greater structure of the NEPAs regulatory influence because the documentation provides more than one possible outcome for the same location. Furthermore, because the data document bundles that are not chosen as well as those that are, revealed preferences can be uncovered in a relative manner without direct budget constraints. This is especially important in the case of the Forest Service, where budget appropriations are considerably removed from an individual timber sale. Table 1 summarizes the variables used.

Each alternative is characterized by the combination of stated goals that it will meet, and whether an alternative is the original proposed action of the project, the chosen action, the no-action alternative that documents the status quo, or an unselected alternative action. The appeals record for the chosen action is known.

The ratio of the volume for a given harvest alternative to the maximum volume for that project serves as an indicator of the alternative's relative position in the balance between commodity production and environmental amenities. Systematic correlation across chosen and proposed alternatives may reveal possible strategic action by the Forest Service. This is because if the original proposal is different than the choice

[1]The Forest and Rangeland Renewable Resources Act of 1974 (RPA) requires a national inventory of National Forest renewable assets. This inventory and the potential economic benefits that might be derived from it are estimated at the Regional Level and provide overarching guidance for multiple-use management. Since the estimates are made at such a high level of aggregation, they say little about the environmental choices made directly on the ground Nelson (1995). Public Lands and Private Rights: The Failure of Scientific Management. Lantham, MD. Rowman & Littlefield Publishers, Inc.

Table 1. Data summary

Variable category	Variables	
Time periods	Ecosystem management (1992–1996) NFMA (˜1987–1992)* Pre-NFMA finalization (1974–∼1986)*	
Environmental impacts	Stated purposes Timber	Indicator variables Harvest level Expected sale value
	Wildlife	Big game winter habitat Old growth Spotted owl habitat Miles of net road opened Percent helicopter harvest
	Recreation	Miles of net road opened Percent classified roadless
	Watershed	Miles of net road opened Percent helicopter harvest
	Wilderness	Percent classified roadless
	Visual quality	Harvest techniques Volume per acre
	Salvage Fire protection	Harvest techniques Prescribed burn Harvest techniques
Agency variables	Alternative type (proposal, choice, no action, unselected) Appeals record (not appealed, appealed/won, appealed/lost by forest service) Forest region (regions 1,2,4,6) Document type (EA or EIS) Ratio of proposed harvest to maximum harvest alternative	

*Forests finished their NFMA Forest Plans at different dates. Appropriate dates used for each forest.

offered to the public, then the proposal may have been a "straw-man" created to make the chosen action more palatable to environmental groups, when considering it in light of the starting proposal. This possibility and its implications are explored at length below, as they weigh heavily on the effectiveness of the law.

Structure and model

This paper argues two main points. (1) First, that the Forest Service has adopted strategic behavior in response to the appeals provisions of the NEPA that allow it to avoid most constraints on its choices; and (2) that this strategic behavior negates the

short run promise of NEPA as a mechanism for increasing the consideration of environmental amenities in timber harvest provisions. As the data set covers 25 years, other ongoing work allows us to address how long run changes have evolved from the requirements for environmental documentation and public appeal opportunities.

Providing national forest outputs under NEPA

The agency's choices over forest outputs must incorporate the threat of appeals inherent in the legal structure of the NEPA. The agency is constrained by the fact that its decisions must pass a period of public appeal, during which members of the general public have an opportunity to reject the values implicitly set by the Forest Service's decisions. As such, the appeals process is a potential shift in decision-making power from the agency to the general public (Mohr, 1990; Nelson, 1995). Modeling the decision-making process as a multi-stage interaction between the agency and the public, we can determine the potential impact of the threat of appeal on the agency-imposed valuations for forest commodities and amenities.

The process appears to place more power in the hands of the agency because it has the ability to dismiss appeals, which are the bargaining chips of the public. Appeals, however, can lead to costly legal battles. It is expected, then, that the agency internalizes this threat at an early stage of the process. The real power of the Forest Service lies in the very aspect of the agency that is most likely to cause their choices to differ from those of the public; forest resource managers, through training and daily experience with the amenities in question, have greater knowledge of the scientific management possibilities and potential outcomes, and may view expressed differences in public opinion as uneducated and insubstantial (Martin et al., 1996). The process is described in Fig. 1.

In the first broad stage, the Forest Service develops a project and alternatives to this project and describes them according to their environmental impacts and the stated purposes they meet in providing various forest products and amenities.[2] An informal signal is gathered from the public when a draft is made available for comment. This first stage ends with the agency presenting a choice of alternative for implementation to the general public.

In the second broad stage, interested members of the public review and have the opportunity to appeal the decisions reached in the first stage. Thus, they either accept or reject the agency's choice. In the final stage, a project alternative is implemented or, in the case of an appeal, the agency determines the result of the appeal – either implementing an action or upholding the appeal. If in the third stage the public wins an appeal, then the Forest Service maintains the status quo temporarily. The agency then returns to the first stage, develops a new alternative or simply makes a new offer based on the original project.

[2]The scope is generally determined to fit within the goals set in the zoned Timber Management Plan (pre-NFMA) or in the multiple-use Forest Plan (post-NFMA). For a more detailed quantitative analysis of the different time periods involved, see Kaiser, 1998.

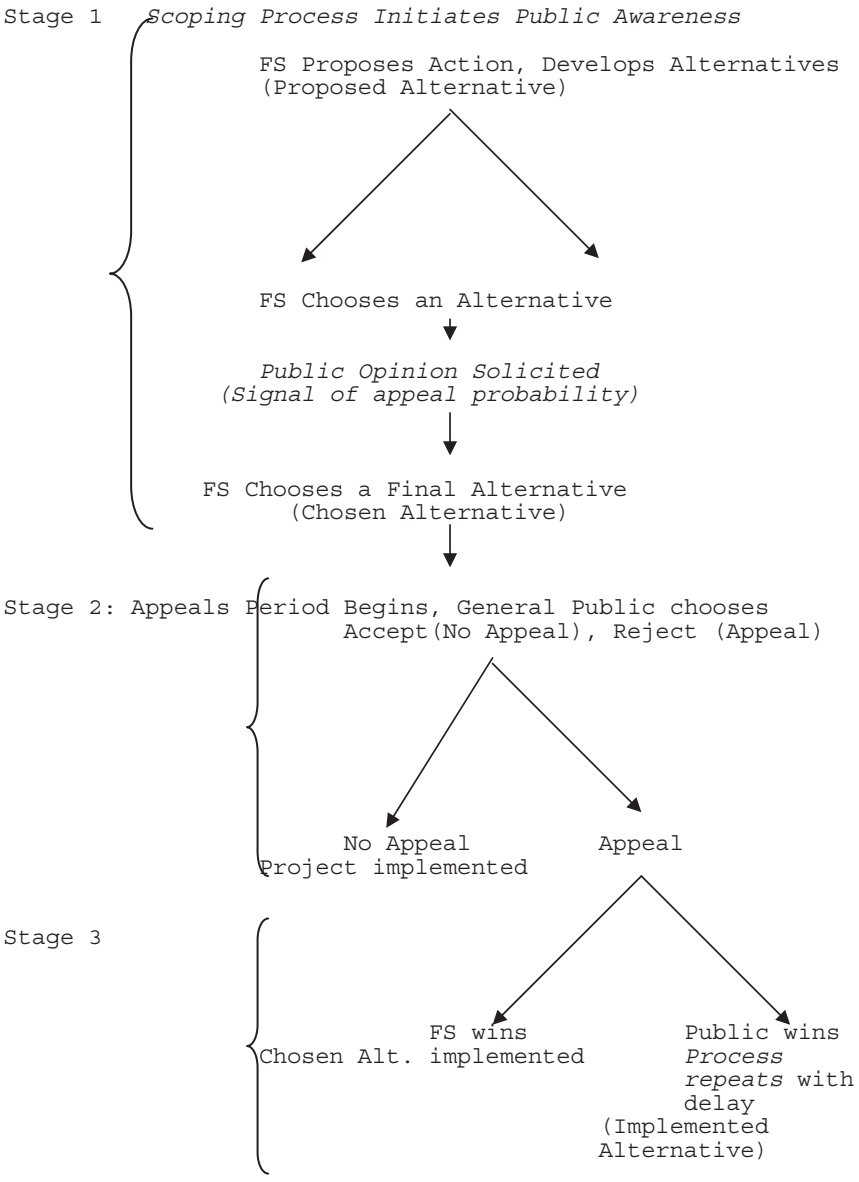

Fig. 1. The decision making process.

The Environmental Assessment/Environmental Impact Statement process leads to improved information about the true costs of an action and may change agency choices. Without NEPA, the Forest Service would not incur the additional cost of the analysis. Once the cost of the analysis is no longer optional, however, the new information may reveal a choice preferable to the original proposal. The second

influence on the agency's choice is the direct input from the public. Every EA or EIS must allow time for public review and comment. Furthermore, once a choice is determined, any member of the public may appeal the decision during a mandatory waiting period before project implementation.

If we consider the rules of NEPA as the process described in Fig. 1, then the threat of appeal should force the Forest Service to internalize the vast and diverse preferences of the public for the multiple uses of the land as best it can, because any dissatisfied individual may submit a costly appeal. Thus the Forest Service should anticipate costly appeals and act to avoid them by creating a choice that the public will accept. I hypothesize that the agency internalizes the threat of appeal during Stage 1, by incorporating the informal signals received from the general public into the choice of action.

I test this hypothesis by investigating whether differences between proposed and chosen actions are cosmetic or substantial in terms of environmental and fiscal impacts. I consider how outcomes where the proposed action is the chosen action (45% of projects) differ from those where the proposed action is not the chosen action. This comprehensive comparison allows investigation of which environmental amenities impact Forest Service decisions most, and how the differences illuminate the Forest Service's preferences given the expected threat of appeal.[3]

Nested model of forest service choices

To analyze the impact of the appeals stage on the decision-making process, I develop a nested discrete choice model that allows identification of the environmental and financial aspects of choices that generate public appeals of agency decisions. I assume the Forest Service anticipates the potential for appeals of its projects, and that it acts to maximize its utility subject to these concerns in every stage of the planning. With this model I directly analyze the effect of the appeals process on the agency's choices. To do this, I calculate the probabilities of appeal and of the Forest Service winning appeals as steps in deriving the agency's expected utilities from a choice of alternatives given the threat of appeal.

The Forest Service is a utility maximizing agency where utility is a function of the outcomes from projects. The possible outcomes are described in a matrix of changes

[3]The public's preferences cannot be modeled uniformly. The goal of this exercise is not to determine a set of preferences of the public. Rather it is to characterize NEPA as a regulation intended to adjust the choices of the Forest Service (or any federal agency) by strengthening its incentives and its ability to behave as a benevolent dictator. It is evident that the agency works to balance competing interests for resource use and that maintaining a perception of net benefits for a majority of users is an expected outcome of Forest Service decisions. McClaran and King (1999) describe survey data of 521 non-Forest Service participants in preparing Forest Plans. These participants were more likely to see their local forests as effective than satisfactory, in the sense that 55% were satisfied with the job done by the agency while 63% felt the agency was very or somewhat effective at forest management. 51% of respondents believed that their net benefits from Forest amenities and products would increase with implementation of the Forest Plan. The agency appears to satisfy the median active constituent. The perceived faith in the agency's scientific management capability gives the Forest Service some power in the NEPA requirements because they will control the development of feasible alternatives in the first stage.

in environmental quality (e.g. increased sedimentation expected, acres of lost habitat) and harvest capital inputs (e.g. acres clearcut, acres shelterwood cut, acres cable logged) used for the ith alternative of the jth project, X_{ij}. Thus utility is measured as $U_{ij} = X_{ij}\Theta + \varepsilon_{ij}$, where ε_{ij} is independently and identically distributed with the extreme value distribution, and Θ is a vector of unknown parameters. The extreme value distribution is chosen as a necessary and sufficient condition to assure the independence of irrelevant alternatives (IIA) axiom (McFadden, 1973). Then i is the chosen alternative for project j if $E[U_{ij}] > E[U_{mj}] \forall m \neq i$, where $E[U_{ij}]$ is the expected utility from the implementation of the ith alternative of the jth project. The expectation accounts for the likelihood of appeal.

A straightforward nested multinomial logit model (McFadden, 1974; Maddala, 1983) is used to calculate the probability of choosing an action conditional on the probability of appeal. Defining R_{ij} as the probability of an appeal, itself conditional on the expectation by the public of winning the appeal, P_{ij} as the probability of the Forest Service winning an appeal, and L_f as the cost of an appeal to the agency, one can write the Forest Service's expected utility as

$$E[U_{ij}^{f}] = X_{ij}\Theta_f(1 - R_{ij}) + (X_{ij}\Theta_f - L_f)(R_{ij}P_{ij}) + (X_{nj}\Theta_f - L_f)R_{ij}(1 - P_{ij}) + \zeta_{ij}, \tag{1}$$

where Θ_f is a vector of unknown parameters which represents the preferences of the agency and L_f is the unknown cost of an appeal to the forest service. Thus the payoff to the agency is determined as the expected value over the chosen alternative, if there is no appeal (which occurs with probability $1 - R_{ij}$), and the outcome of an appeal, which is the chosen alternative net of appeal costs with probability $R_{ij}P_{ij}$ and the status quo net of appeal costs with probability $R_{ij}(1 - P_{ij})$.

I simplify by placing the Forest Service's non-stochastic portion of expected utility in matrix form and setting $C_{ij} = [\{X_{ij}(1 - R_{ij} + P_{ij}R_{ij}) + X_{nj}R_{ij}(1 - P_{ij})\} - R_{ij}]$ and $A' = [\Theta_f \cdot L_f]$, where A' is the transpose of A, a vector of unknown parameters. Here, the utility of choice i for project j is determined explicitly by the expectation that they will be able to implement it, which occurs with probability $1 - R_{ij} - P_{ij}R_{ij}$. Failure to implement the chosen alternative results in the outcomes of the status quo, X_{nj}.

Then, as a Random Utility Model (McFadden, 1974; Maddala, 1983), where ζ_{ij} is assumed an i.i.d. error with the extreme value distribution, the Pr(alternative i is chosen for project j) can be expressed:

$$\Pi_{ij} = \frac{e^{C_{ij}A}}{\sum_m e^{C_{mj}A}}. \tag{2}$$

The parameters in A are estimated to determine the characteristics of an alternative that effect the probability the action is chosen to examine the impact the appeals process implicitly has had on the Forest Service's decisions. A formal discussion of this nested bargaining model is described in Appendix B.

Similarly, I calculate the probability that alternative i is the proposed alternative. The results from the chosen alternatives reflect the agency's preferences and the difference between the two sets of results reflects the extent of maneuvering

undertaken so that the vocal portion of the general public perceives that their preferences and the Forest Service's choices align. The inclusive values reflect the cost of appeals to the Forest Service in the form of delays or the need for a new analysis. If informal bargaining between the agency and the public accounts for an important level of the differences between the influences on the chosen alternatives versus the proposed, then the inclusive values, or costs, should be significantly higher for the proposed than the chosen cases. This is due to the nature of the discrete choice model; if the agency is anticipating correctly the expected probabilities of appeal and appeal-wins, then the inclusive value will not appear statistically significant in the top level of the nested regression.

Results

Evidence on signaling, information and appeals

NEPA may change initial agency choices through two channels. First, information about the environmental state of the land may be enhanced by the closer inspection required during the development of the assessment, causing a change from an initial proposal to the chosen action. Second, informal signals received during the draft review stage regarding the threat of public appeal may also cause a change in the chosen action. Table 2 illustrates that the threat of appeal appears at least as important as the gathering of new information. Of appealed choices, 33% represented the original proposal, while of non-appealed choices, 55% represented the original proposal. This, in combination with the fact that the more visible EISs have only 21% of their proposals as the chosen action while EAs have 59%, indicate that the threat of appeal does increase the tendency to deviate from the originally proposed action.

Additional evidence that the agency attempts to internalize the threat of appeal comes from investigating the frequency with which the proposal is the chosen action. First, there is a high negative correlation (−0.42) between the frequency with which the proposal is chosen and the EA/EIS document page length. This indicates that increased levels of information are likely to increase the likelihood of a change in choice from the proposal. In contrast, higher volume sales do not show this same strong negative relationship to cases where the proposed action is the chosen action; the correlation coefficient between initially proposed harvest volumes and cases where proposals equal chosen alternatives is only −0.14.[4] This indicates that the proposal is more sophisticated than a straightforward straw-man set up to portray the agency as simply moving toward environmental amenities through the NEPA process by creating a higher-volume proposal that is then rejected. That greater page length, but not greater harvest levels, has a significant correlation with whether the proposal is the chosen alternative seems to indicate that more information in readers'

[4]There is a positive correlation of 0.28 between the number of pages in a document and the proposed harvest level.

Table 2. Frequency with which the Proposal is the chosen alternative

	Percentage Proposed = chosen (%)	N. Obs.
All projects	45	118
Time periods:		
Ecosystem management (1992–)	29	49
Pre-ecosystem management (1974–1992)	57	69
Type of documentation:		
EAs	59	75
EISs	21	43
Appeals record:		
Appealed	33	54
Not appealed	55	64
Choices presented:		
Number of alternatives is $\leqslant 4$	70	56
Number of alternatives is >4	23	62

hands may be of greater import than higher levels of potential environmental impact from higher volume harvests.

Forest service strategic incentives

Appeals

The Forest Service should be incorporating the threat of appeal into their decisions because appeals are costly to the agency. Direct costs of appeal are much higher for the agency than for the general public. A single letter can initiate an appeal, but the average cost of processing appeals is much higher. Every one of 96 completed Forest Plans has been appealed, some several times, totaling over 800 appeals. The simplest 574 of these appeals had been resolved by 1989 at a cost of approximately $50,000 each (McClaran and King, 1999). Appeal costs for individual timber harvests are generally substantially lower, though no aggregate figures are available. For an appeal to be successful, it must be that either a law has been broken, or the appropriate authority can be convinced of the merits of the appeal. The agency handles the first round of appeals internally, through a hierarchical system of review. This provides a direct opportunity for Forest Service control over the outcomes. Checks exist, however. All levels of the court system can and do get involved at various stages.[5]

[5]The use of the courts by appellants has been increasing over time; there were only 5 court decisions involving the Forest Service in 1977 but 35 in 1992 (Jones and Taylor, 1995). The most frequent basis for an appeal is that the project's EA or EIS does not adequately document the effects of the sale. In this sample of 118 projects, approximately one-half were appealed. Of these appeals, the Forest Service upheld its original decision in about 70% of the cases. This figure was higher than that for decisions made in the courts, but does not necessarily indicate that the agency was cavalier in their refusals of appeals. Of the 134 NFMA and NEPA suits brought to the courts between 1971 and 1992, the agency won 78 cases, or 58% (Jones and Taylor, 1995).

None of the decisions in this sample were taken to court; though this exclusion was not intentional, it is possible that the subset of cases that do go to court have commonalities not identified here. Without court interventions, there were three outcomes to appeals: (1) the Forest Service dropped the project altogether; (2) the Forest Service conducted a new environmental assessment and issued a new decision, where in the meantime (often at least a year) the no-action alternative was the outcome; or (3) the appeal was denied and the project proceeded.

Strategic role of the proposal

In addition to the possibility that the proposed action is created to strategically enhance the acceptability of the chosen action, feedback from the public through the appeals process should enable the agency to make choices that are more appeal-proof in the future. This is because appeals reveal the preferences of the portion of the general public that has been vocally dissatisfied with the agency's decisions as a socially benevolent dictator. I address the level of agency manipulation by investigating if the agency succeeds in cutting down on the number of appeals or improving its win-ratio of appeals over time. Appeals by time period for this data sample are shown in Table 3.

The number of appeals increases from 30% in the earliest period to around 50% for later periods, but the percentage of Forest Services losses of those appeals (column 4) falls, from 57% for 1974–1986 to 20% for 1992–1996. Multiplying the percentage of actions appealed (column 3) by the percentage of appeals the agency loses (column 4), one sees in the that the Forest Service has held its own or even reduced (from 17% to 10%) the percentage of lost appeals from all projects (column 5). The 20% rise in appeals begins with the completion of a majority of the Forest Plans. The number of appeals increased due to greater awareness and involvement on the part of the public, but the agency successfully accommodated these appeals and lowered their overall rate of losses conditional upon appeal.

The implication of this finding of improved outcomes for the agency in spite of an increased appeals rate is that the public's valuations for such non-market goods may be very susceptible to agency suggestion. The theoretical and practical attempts to define and measure non-use and indirect use values strongly support this possibility (e.g. Cummings et al., 1986; Smith, 1993). McClaran and King (1999) highlight another susceptibility. They show that appeals levels for Forest Plans can be reduced by increasing the perception of fair procedures as well as the personal benefits accrued to potential appellant groups.

Several key pieces of evidence give additional support to systematic development of chosen alternative that reflect agency preferences. Harvest volumes of the proposed actions represent on average 89% of the volume harvested in relation to the maximum volume suggested by any alternative for that project, which is statistically significantly higher than the figure for all timber harvesting alternatives (75% of maximum volume) and for the chosen actions (80% of maximum volume). As an isolated fact, this significant difference between the proposals and chosen

Table 3. Appeals and appeal outcomes by time period

Time period[a]	N. Obs.	Number of appeals	Percentage of actions appealed (%)	Percentage forest service loses (%)	Percentage appealed and lost (%)
1974–1986	23	7	30	57	17
1987–1991	46	22	48	36	17
1992–1996	49	25	51	20	10
All years	118	54	46	31	14

[a]The time period divisions are based on consistent forest service policy. By 1986, most Forests were operating under their Forest Plans (required under NFMA), and in 1992 the agency formally adopted ecosystem management as the general policy.

actions suggests only that there is a move from timber toward environmental goods as the process moves from proposal to choice.

Turning, however, to exploit the slight difference between EAs and EISs, i.e. the EAs receive less publicly scrutiny, we see that EAs more frequently select the original proposal as the chosen action (59% of the time vs. 21% of the time). Again, this alone might suggest that public input reduces timber harvest in favor of environmental amenities. The actual harvest volume of the alternatives where the proposal is the chosen alternative and the harvest volume for those where the proposal differs from the chosen alternative are not significantly different from each other, however. Furthermore, while the probability that an action is the proposed action is positively and statistically significantly influenced by the ratio of the alternative's volume to the maximum volume of any of the project's alternatives, the probability that an action is chosen is not.

Additionally, the proposed and chosen volumes are actually slightly lower on average (insignificantly so) for the case where the proposed action is the chosen action (7406 MBF) versus the case where it is not (9039 MBF proposed; 8092 MBF chosen). One might initially believe that this is due to the correlation between EAs and the likelihood that a proposed action is the chosen action. This is misleading, however. The average volume for a proposed EA action is 7258 MBF, while for an EIS action it is 10553 MBF. The average volume for a chosen EA action is 6710 MBF, while it is 9656 MBF for an EIS action. These are 7.6% and 8.5% drops in volume from the proposal to the chosen action, respectively; the consistency, combined with the rest of the evidence, suggests that the agency successfully internalizes the threat of appeal. Finally, though appeals have increased over time, the agency's success at winning appeals has increased even more. Strategically, the agency appears to be getting what it wants.

Econometric results: probabilities of chosen and proposed alternatives

A measurable difference exists between the environmental impacts that affect the proposal stage and those that affect the chosen stage. Is the agency successfully

internalizing the threat after receiving a signal of how the public will respond to the project? Using the probability of an appeal, R_{ij}, calculated in stage 2 of the nested logit estimation, we estimate the effects of expected environmental impacts on the probability that an action is the proposed action and the probability that an action is the chosen action. We find that there are significant differences in what drives the probabilities in each case. The chosen alternatives appear to successfully incorporate the threat of appeal while the proposals do not. Table 4 illustrates.

A Hausman test of equality rejects the hypothesis that these environmental impacts have the same influence on the chosen alternatives that they do on the proposed alternatives.

The "expected cost of appeal," determined through the inclusive values from the probability of appeal given that an alternative had been chosen, is positive and significant in both cases. This may at first thought seem counter to the hypothesis that the agency is internalizing the threat of appeal at all. However, the sign is expected to be positive because the "no-action" alternative is always available, and will have the lowest probability of appeal by environmentalists, the most vocal public group. What attests to the significant level of accommodation of appeals between the proposal and the final choice is that the magnitude is significantly lower (0.74% elasticity for the chosen alternatives versus 1.16% for the proposed alternatives). The agency has significantly reduced the impact of expected appeals as it moves from proposal to choice.

In addition to the role of the cost of appeal, the probability that an action is chosen is statistically significantly affected by the number of acres harvested. Higher

Table 4. Influences on probability alternatives are chosen or proposed

Variable	Pr(chosen)		Pr(proposed)	
	Coeff.	Elast.	Coeff.	Elast.
Probabilities that actions are chosen or proposed				
Big game winter habitat	1.74 (0.84)	−0.082**	0.12 (0.96)	−0.005
Percent old growth	1.29 (0.83)	0.268	−0.73 (1.19)	−0.155
Net roads opened	−0.10 (0.06)	0.181	−0.02 (0.04)	0.034
Percent helicopter logged	0.66 (0.59)	0.040	−2.65 (0.96)	−0.182***
Percent roadless area	−0.83 (0.86)	−0.077	5.20 (1.84)	0.476***
Acres harvested	0.0015 (0.0006)	0.476**	−0.0011 (0.0006)	−0.349*
Alternative vol./max. vol. for project	0.49 (0.62)	0.224	3.69 (0.82)	1.549***
"Cost of Appeal" to forest service	2.10 (0.86)	0.739**	3.47 (1.46)	1.16**
No. obs.	118		118	

Hausman test of equality (χ^2) rejects hypothesis of equality.
*, **, *** indicate significance at 90%, 95%, 99% respectively.
Standard errors in parentheses.

acreage levels increase the probability an action is chosen. Since higher acreage levels are not combined with higher volume harvested, this significance indicates a move toward less intense, more environmentally cautious harvesting. The probability that an action is chosen is also negatively influenced by more big game winter habitat, indicating the recreational value. The amount of roadless area and the ratio of the chosen alternative's volume to the maximum volume did not affect the probability that the alternative is chosen.

The probability that an action is proposed, however, is positively and statistically significantly affected by the percent of the area classified roadless and the ratio of the alternative's volume harvested to the maximum volume under any of the alternatives for the project and negatively and statistically significantly impacted by the relative amount of helicopter logging proposed and the number of acres to be harvested. Thus, in the chosen alternatives, we see a move away from harvesting roadless areas, and toward less intensive logging over a larger number of acres. This larger amount of land harvested is presumably at lower intensity levels, since average volumes are not significantly different for the two sets of alternatives, and are nominally higher for proposals. This should have significant positive effects on watershed values, aesthetic values, and many types of wildlife habitat in particular.

As the added expense of helicopter logging is undertaken in order to protect watershed values, the shift from the proposed actions' lack of helicopter logging to the chosen ones' neutral effect also suggests watershed values carry significant weight in agency choices.[6]

Similarly, big game winter habitat is not an important consideration at the proposal stage, but it statistically significantly reduces the probability of an action being chosen, indicating that management of this recreational and wildlife support becomes more important after public involvement in the process.

The relative position of the volume level becomes less significant from the proposal to the chosen alternative as well. The higher the alternative's volume as a percentage of the maximum volume suggested for the project, the higher the probability the alternative is the proposed one. The elasticity for this relationship is very high and significant, with a 1.5% increase in probability from a 1% increase in the relative volume. This relationship does not hold for the chosen alternatives, the elasticity is only 0.2% and insignificant.

Conclusions

Using a new data set of environmental impacts and timber harvest levels for 118 EISs and EAs and the 568 alternative actions suggested within them, this paper

[6]In calculating the probabilities of appeal and of the FS winning an appeal, helicopter logging provides an intriguing area for further research. Though the results are not statistically significant, it appears that alternatives with a higher percentage of helicopter logging are appealed more frequently and the appeals are lost by the agency more frequently. Since appeals in this data are brought by non-loggers, this suggests that the more costly system of logging may be put forward mainly for marginal lands and when challenged, the agency foregoes the alternative, due perhaps to the environmental consequences but perhaps to the higher cost.

models the Forest Service's decision-making process for timber harvests as a multi-stage event in order to identify the factors of both the regulatory and natural environment that impact the provision of market and non-market forest outputs.

Overall, I find that the agency positively values environmental goods and that these values increase from the initial proposal to the chosen action, so that at first glance, one might believe that NEPA successfully increases preferences for non-market amenities. Results show that lower levels of degradation in certain environmental amenities have greater influence in explaining the probability that an alternative is chosen than that one is proposed.

The NEPA system, however, is susceptible to agency biases in such a way that the agency's preferences prove to be represented in the outcomes even after the apparent compromises with the public. The chosen alternatives here therefore reflect the desired outcomes of the Forest Service, and the net effect of NEPA appears to be more to make people aware of the preferences that determine the valuations made in their name rather than to change these values. From this, I infer that people, presented with a mechanism to promote their voice in decision-making where markets are lacking, may be relatively incapable individually of placing economically rational valuations on public non-market amenities in cases lacking well-defined budget constraints or scientific certainty as to the impacts of these actions. This has significant consequences for determining how we should evaluate the meaning of results from economic valuation methods that focus on "top-down" scientific expertise versus those where "broad-based" valuation opinion provides the basis when we seek to measure values for non-market amenities. In this particular case, the finding that greater page length, but not greater harvest levels, has a significant correlation with whether the proposal is the chosen alternative suggests that more public information will impact outcomes more than higher levels of potential environmental impact from higher volume harvests.

Even if one is not convinced that the chosen alternatives fully endogenize the NEPA process so that the preferences reflect those of the agency exactly, given the evidence above, the proposed actions may be treated safely as lower bound agency preferences for environmental amenities.

The agency is not, as some critics claim, captured solely by one set of interests (namely timber). Culhane (1981) argues that multiple constituencies affect agency decisions and the analysis here extends support for this argument by demonstrating the change in expected outcomes from the proposal to the implementation of a timber sale. The agency tends to propose actions that are timber-biased in order to accommodate the threat of public appeals. Through the NEPA process, watershed impacts are given greater priority, and provisions for several other amenities, including roadless areas and big game habitat are increased across the board. Uneven aged harvesting, with a host of environmental benefits over the more financially profitable clearcutting, is used much more frequently than it is initially proposed. Preliminary evidence suggests also that the agency declares that it is shifting toward increased provision of non-market amenities before they provide it though on-the-ground decisions; the 1992 adoption of an ecosystem management

framework provides greater change than the earlier requirements of integrated forest plans under NFMA.

It is useful to keep in mind that local knowledge of the threats to appeals is gained through the first stage of the NEPA process and the agency has the opportunity to incorporate this knowledge before offering a choice of action to the public. The successful internalization of appeals indicates an agency whose preferences are not so misaligned with the vocal members of the public that cases move systematically to the courts rather than to apparent compromise.

The agency's control over the process, however renders the true impact of NEPA as one of identification rather than compromise or change. Through the law, the agency has more clearly defined the preferences it holds for environmental amenities and the public has become more aware of these preferences through the required documentation and submission for public scrutiny. Over time, this knowledge on both parties' parts has enhanced the levels of environmental amenities provided alongside timber harvests, reducing the delay and waste of unsuccessful appeals. The regulatory impact of the NEPA is thus one of indirect enhancement through incentives to provide higher levels of information about these missing markets for environmental amenities rather than to require direct enhancement immediately.

This paper quantitatively documents the challenge that individuals face knowing their own preferences for such complicated goods and services. In light of this challenge, the long-term efficacy of this regulation in adapting to public input may greatly improve Federal agency's abilities to manage complex resources, in spite of the law's susceptibility to agency bias. One chief benefit of the new data collected here is that it adds to the knowledge of these preferences at the individual amenity level and the way in which they have differed across time and across levels of interaction. This should improve the level of public debate about the relative values of public forest resources.

Acknowledgments

Many thanks to Robert Porter, Louis Cain, Ronald Braeutigam, Paul Freesma, Paul Culhane, and many participants at various workshops and conferences for support and useful criticism. Many thanks to the many U.S. Forest Service members, particularly Susan Stewart, Kevin Elliot, and Jamie Hansen-Murray who assisted my data gathering and understanding of the agency.

Appendix A. Data

Data overview

The data provide information on the expected environmental impacts and stated preferences for management goals, along with information on the initial conditions of each area and different methods of evaluating impacts, for 118 EISs or EAs

developed by the Forest Service for proposed timber harvest projects. The resulting data set consists of 568 alternative plans for Forest Service land use, and 118 decisions. There are about 150 National Forests in the United States, divided into 10 regions. The documents included in this sample come from 5 regions in the Western U.S. and 22 forests in 6 states. Because forest level EAs are not widely nor systematically distributed to libraries or National Forest Service offices, documents on timber sale preparations were randomly selected during several on-site visits to Forest Service district offices.[7] The sample for Idaho is the most complete. It includes virtually all EISs for the state for timber sales from 1974 to 1996. This creates a subset of data within a limited geographical and political area that nonetheless covers 2 regions and several forest ecosystem types.

The entire data set represents 918 million board feet (MMBF) of timber harvested from project areas totaling over one million acres of National Forest land. Overall, the volume of timber proposed to be harvested in these projects represents anywhere from 0.5% of a Forest Service region's harvest from national forests in a year (the case for most observations in the 1970s and 1980s) to 40% or more for the Northern Region (Region 1) in the 1990s. For the 1990s, the sample represents 5–10% of the Intermountain (Region 4) Region's harvest and 5–15% of the western half of the Pacific Northwest (Region 6).

All of the quantifiable data from each document was recorded, for a total of some 200 variables.[8] Here, the variables that were most consistent and most indicative of the forest environmental quality, the financial benefit of the harvest, and political or strategic decisions, are described. They reflect the multidimensionality of the products available from the land while retaining a manageable conceptuality for the impacts of each element.

Data descriptions

Environmental quality data

A ranked index of big game winter habitat and the percent of harvest that is old growth are representative of two common types of wildlife habitat. Old growth is also a political concern. It has become a rallying point for environmentalists interested in preserving the biodiversity associated with old growth, whereas in the past old growth has been considered a most profitable harvest because of the size and quality of the logs. Miles of net roads opened and the percent of the harvest to be logged by helicopter are both indicators of wildlife habitat. Many species of wildlife use the roads for traveling, and open roads increase the likelihood of contact between humans (particularly hunters) and animals, and road construction and helicopter logging affect fish habitat.

[7]For example, at the Willamette NF headquarters, the timber sale preparation files are contained in a rotating 12-shelf file. I chose sales by randomly spinning to a shelf and grabbing a folder. The Northwestern University Transportation Library is a repository for completed EISs, so many of the EISs came from this source. The EAs are not filed federally, hence the need for individual visits.

[8]Several missing observations occur as a result.

In addition, roads opened and helicopter logging are both indicators of water quality. Helicopter logging has the least impact on soils and preserves water quality better than other logging techniques because the soil erosion from creating and using new roads is chiefly avoided. It is also significantly more costly.

The percent of the harvest area that is currently classified as roadless serves as an indicator of forest health and recreational opportunities. Roadless areas are not generally actively managed for forest health, but have not generally been logged and may display increased value to those who prefer unmanaged habitat; similarly recreational opportunities are more limited to those that require active engagement in the natural system and as such will appeal to fewer individuals overall. They tend to be located in places with low populations where local recreational pressures are also low. It is also a potential indicator for wilderness, in the sense that wilderness areas will be selected from areas that are currently roadless.

The total acreage of the harvest serves as an indicator of the size of a project, and frequently also indicates the intensity of the suggested harvest within alternatives for a project. Larger acreage is likely to mean less clearcutting and more uneven aged harvesting, which leaves standing cover for wildlife, soil protection, and natural re-seeding, as well as frequently being more aesthetically pleasing. Volume harvested per acre is used to indicate the intensity of a harvest.

The agency's commitment to ecosystem management is in part measured by the use of prescribed burning. Prescribed burning is a technique where the standing timber is burned in a controlled fire attempting to mimic natural processes. Thus, the revenue from present and near-future harvest is foregone in order to promote the welfare of the entire ecosystem.

Economic and choice data

The number of alternatives in the documents used here ranges from 2 to 9, though most documents (62%) have 3 to 5 alternatives. The number of alternatives is determined in the scoping process and reflects the range of possible actions.

Each alternative is characterized by the combination of stated goals that it will meet, and whether an alternative is the original proposed action of the project, the chosen action, the no-action alternative that documents the status quo, or an unselected alternative action. The appeals record for the chosen action is known.

The estimated value of the sale (dollars per thousand board feet (MBF)) indicates the financial potential of an alternative. This financial parameter is chosen over the estimated total sale volume because it separates most clearly distinctions between harvest size (already captured with acreage) and harvest value. The ratio of the volume for a given harvest alternative to the maximum volume for that project serves as an indicator of the agency's relative position in the balance between commodity production and environmental amenities, and may reveal possible strategic action by the Forest Service.

Appendix B. The nested model of forest service choice

The nested model is presented here, in reverse chronological order in order to illuminate the expected payoffs from the bargaining between the public and the agency.

Probability the FS wins an appeal

In the third and final stage, the Forest Service either wins or loses the appeal if there is one. The probability of the agency winning thus forms the base of the nested model. Since the Forest Service hears the appeals, the probability of the *i*th alternative from the *j*th project winning an appeal is relative to the penalty of losing the appeal, or the project's status quo. Using the above definitions of utility for the Forest Service but accounting for a change in Forest Service weights based on the input from the public:

$$P_{ij} = Pr(X_{ij}\Theta_w + \eta_{ij} > X_{nj}\Theta_w + \eta_{nj}),$$

where η_{ij} is assumed to be i.i.d. with the extreme value distribution and X_{nj} is the status quo of the project alternatives' environmental impacts, and Θ_w is a vector of unknown parameters representing the weights of the respective environmental amenities and harvest techniques in the probability that an action is won by the Forest Service given an appeal. Note that differences between Θ_w and Θ for individual assets reflect the agency's responsiveness to certain public interests signaled by appeals and the threat of appeals.

Using the extreme value distribution for η_{ij}, the probability that an action will be won by the Forest Service, given an appeal, can be written

$$P_{ij} = \frac{e^{(X_{ij}-X_{nj})\Theta_w}}{\sum_m e^{(X_{mj}-X_{nj})\Theta_w}}. \tag{B.1}$$

I calculate this probability of the agency winning an appeal based on the chosen alternative's impacts, X_{cj}, and the actual outcome of the appeal. If the agency wins the appeal, the impacts are identical to the Forest Service's chosen action except for the financial return, which I discount one year by the raw lumber producer price index. If the Forest Service loses the appeal, the outcome, possibly that of no-action, is eventually determined through another, successful, impact statement process, likely to take years. In the short run it is considered to be the no-action alternative, or the status quo set of impacts, X_{nj}. I estimate Θ_w for those projects which were appealed and then use it to calculate the probability of winning the appeal, P_{ij}, for any alternative and project.[9]

[9]For 9 of the 54 appeals in the data set, there is a new EA/EIS presented and eventually accepted. Using these implemented alternatives instead of the no-action alternative does not significantly change the results, and the results shown here use the short-run no action alternative for consistency. The shortest time frame for a new choice is one year, the longest is eleven years, the mean number of years between documents is 3.67 years, and the median is 4 years.

Conditional probability of appeal

Continuing in reverse chronological order, in the second stage members of the public evaluate the agency's offer and decide whether or not to accept it. An appeal will occur if a member of the public's utility from the impacts of the chosen alternative plus some error is lower than the expected utility of an appeal, minus its cost to the appellant, L_e. The expected utility is derived from the probability of winning the appeal, P_{ij}. The probability of appeal is thus:

$$R_{ij} = Pr(X_{ij}\Theta_e + \tau_{ij} < P_{ij}X_{ij}\Theta_e + (1 - P_{ij})X_{nj}\Theta_e - L_e + \tau_{mj}). \tag{B.2}$$

$P_{ij}X_{ij}\Theta_e + (1 - P_{ij})X_{nj}\Theta_e + \tau_{mj}$ is the expected benefit of appeal to the appellants, where Θ_e is a vector of unknown parameters reflecting the preferences of the vocal members of the public, R_{ij} is the probability of an appeal given the Forest Service's chosen alternative, and τ_{ij} is assumed to be i.i.d. with the extreme value distribution. The expected benefit of appeal is the expected utility under risk neutrality given the probability of the Forest Service winning an appeal, with the preferences for the goods provided under the chosen alternative as the payoff to the Forest Service winning the appeal and the preferences for the goods provided under the status quo as the payoff from the agency losing the appeal.

This probability of an appeal of alternative i, if selected, can be expressed as:

$$R_{ij} = \frac{e^{P_{ij}X_{ij}\Theta_e + (1-P_{ij})X_{nj}\Theta_e - L_e}}{e^{P_{ij}X_{ij}\Theta_e + (1-P_{ij})X_{nj}\Theta_e - L_e} + e^{X_{ij}\Theta_e}}. \tag{B.3}$$

Conditional probabilities of choice and proposal

The first stage consists of several events. First, the Forest Service proposes a project. Second, the agency must develop, under NEPA and NFMA, a set of alternatives, including the no-action alternative, to the original proposal. The Forest Service then prepares an EA or EIS documenting the expected impacts of implementation of each of the alternatives. The agency sends a draft document of the impacts to self-identified interested parties in the general public, generally environmental and recreation groups, local and national government offices, and local landowners or businesses. In this draft the Forest Service documents a preferred alternative. Individuals return their comments and the Forest Service then prepares a final statement. This too is sent out for public comment, and the agency has another opportunity to change its mind about the final decision. Finally, the agency chooses the alternative they intend to implement and announces this choice in a Decision Notice (for an EA) or Record of Decision (for an EIS). The Forest Service, anticipating the probability of appeal and the probability of winning an appeal, selects its alternative for implementation based on the expected utility of its choice, given these probabilities. The agency will choose alternative i, then, to maximize its expected utility:

$$E[U_{ij}^{\mathrm{f}}] = X_{ij}\Theta_{\mathrm{f}}(1 - R_{ij}) + (X_{ij}\Theta_{\mathrm{f}} - L_{\mathrm{f}})(R_{ij}P_{ij}) + (X_{nj}\Theta_{\mathrm{f}} - L_{\mathrm{f}})R_{ij}(1 - P_{ij}) + \zeta_{ij}, \tag{1′}$$

where Θ_f is a vector of unknown parameters which represents the preferences of the agency and L_f is the unknown cost of an appeal to the Forest Service. Thus the payoff to the agency is determined as the expected value over the chosen alternative, if there is no appeal (which occurs with probability $1 - R_{ij}$), and the outcome of an appeal, which is the chosen alternative net of appeal costs with probability $R_{ij}P_{ij}$ and the status quo net of appeal costs with probability $R_{ij}(1 - P_{ij})$.

References

Bowes, M.D., Krutilla, J.V., 1985. Multiple use management of public forestlands. In: Kneese, A.V., Sweeney, J.L. (Eds.), Handbook of Natural Resource and Energy Economics, vol. II. Elsevier Science Publishers, BV.

Clawson, M., 1975. Forests for Whom and for What? Resources for the Future, Washington, DC.

Culhane, P., 1981. Public Lands Politics. Resources for the Future, Washington, DC.

Cummings, R., Brookshire, D., Shulze, W., 1986. Valuing Environmental Goods: An Assessment of the Contingent Valuation Method. Rowman and Littlefield, Totowa, NJ.

Farnham, T.J., Mohai, P., 1995. National forest timber management over the past decade: a change in emphasis for the Forest Service? Policy Studies Journal 23 (2), 268–280.

Farnham, T.J., Taylor, C.P., Callaway, W., 1995. A shift in values: non-commodity resource management and the forest service. Policy Studies Journal 23 (2), 281–295.

Jones, E.S., Callaway, W., 1995. Neutral bystander, intrusive micromanager, or useful catalyst? the role of congress in effecting change within the forest service. Policy Studies Journal 23 (2), 337–350.

Jones, E.S., Taylor, C.P., 1995. Litigating agency change: the impact of the courts and administrative appeals process on the forest service. Policy Studies Journal 23 (2), 310–336.

Kaiser, B.A., 1998. Forest service valuations for environmental amenities under the National Environmental Policy Act. Ph.D. Dissertation, Northwestern University.

Maddala, G.S., 1983. Limited-Dependent and Qualitative Variable in Econometrics. Cambridge University Press, Cambridge.

Martin, W.E., Shields, D.J., Tolwinski, B., Kent, B., 1996. An application of social choice theory to U.S.D.A. forest service decision making. Journal of Policy Modeling 18 (6), 603–621.

McClaran, M.P., King, D.A., 1999. Procedural fairness, personal benefits, agency expertise, and planning participants' support for the forest service. Natural Resources Journal 39 (2), 443–457.

McFadden, D., 1973. Conditional logit analysis of qualitative choice behavior. In: Zarembka, P. (Ed.), Frontiers in Econometrics. Academic Press, New York.

McFadden, D., 1974. The revealed preferences of a public bureaucracy. Bell Journal of Economics 7, 55–72.

Mohr, E., 1990. Courts of appeal, bureaucracies, and conditional project permits: the role of negotiating non-exclusive property rights over the environment. Journal of Institutional and Theoretical Economics 146, 601–616.

Nelson, R.H., 1995. Public Lands and Private Rights: The Failure of Scientific Management. Rowman & Littlefield Publishers, Inc, Lantham, MD.

Sabatier, P., Loomis, J., McCarthy, C., 1995. Hierarchical controls, professional norms, local constituencies and budget maximization: an analysis of U.S. Forest Planning Decisions. American Journal of Political Science 39, 204–242.

Sedjo, R.A. (Ed.), 2000. A Vision for the U.S. Forest Service: Goals for its Next Century. RFF Press, Washington, DC.

Smith, A.L., 1979. The forest service, NEPA, and clear cutting. Natural Resources Journal 19, 423–432.

Smith, V.K., 1993. Nonmarket valuation of environmental resources: an interpretive appraisal. Land Economics 70, 1–26.

Stegner, T., Fort, R., 1995. A test of congressional dominance over administrative agencies: the case of the U.S. Forest Service. Social Science Quarterly 76 (4), 839–852.

Tobias, C., 1992. Fact, fiction and forest service appeals. Natural Resources Journal 32 (2), 649–651.