# Passive-Use Values of Public Forestlands: A Survey of the Literature

This study was conducted on behalf of the
U.S. Forest Service

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## I. Introduction

The development of sound forest-management policies requires that consideration be given to the economic benefits associated with competing uses of forest resources. The benefits that may be provided under different management regimes include both use values (such as those provided by timber harvesting and recreation) and passive-use (or nonuse) values, including existence value, option value and quasi-option value. Many of these benefits are not revealed in market transactions, and thus cannot be inferred from conventional data on prices and costs. Recent developments in measurement techniques, however, have led to the estimation of these benefits for some forestlands. This report provides a survey of the state of economic research regarding the nonuse value of forests, and addresses the implications of these studies for the management of public forestlands in the Columbia River Basin.

The next section (Section II) provides an overview of nonuse or passive-use values, and discusses recent controversies over the measurement of such values. Specifically, we review the evidence as to whether the method commonly used in this context (the contingent valuation method) is sufficiently reliable to provide useful information regarding passive-use values. Section III then presents a survey of the existing studies, broken down into two categories: studies pertaining to forests in the Pacific Northwest, and studies involving other public forestlands. The literature surveyed in this section includes both published and unpublished materials, although our analysis places greater emphasis on published studies, since in most cases these have been subjected to peer review. The studies are summarized with respect to their basic methodology and the nature of their conclusions. We then turn in Section IV to the implications of the existing studies for the management of public forestlands of the Columbia River Basin. In this section both the potential magnitude of nonuse benefits and their distribution are examined. Finally, Section V provides a summary and our conclusions regarding the need to undertake further work in this area.

## II. Passive-Use Values and their Measurement

### A. The Categorization of Passive-Use Values

Economic benefits accrue whenever economic goods are produced and consumed. An economic good is something which contributes to one or more person's well-being. Different forest management regimes produce different types of economic goods. A timber-harvesting regime produces economic goods primarily in the form of wood products. On the other hand, if forestlands are managed for ecosystem preservation, a number of different types of economic goods will be produced. Among these are recreational opportunities, watershed protection, protection of biodiversity, and providing future generations with enhanced opportunities to decide how to use the resource. There are various ways in which these goods provide value, all of which can be characterized as either use value or passive-use value.

Use value is said to be obtained when someone gets enjoyment from some form of direct interaction with the resource. For example, people may engage in recreational activities such as hiking, hunting, wildlife watching or fishing in watersheds which are dependent on forest integrity. This type of value may also be obtained from scenic views or by benefiting from enhanced water purity.

The vast majority of empirical studies on the economic value of forest preservation have focused on recreational benefits. (For a thorough look at the literature on recreation studies, see Walsh, Johnson and McKean, 1989.) Such studies, however, will underestimate the economic value of preservation because they are designed to capture only a portion of the benefits. These studies fail to account for the economic value that accrues to people who do not use the resource in a conventional sense. Many people derive satisfaction in a passive manner.

Passive-use value can take three distinct forms: existence value, option value and quasi-option value. In the case of existence value, a person derives satisfaction simply from knowing that a resource (such as a species or pristine wilderness area) exists. There are several possible motives underlying existence value. These may include altruism, the desire to leave a bequest to future generations, or perhaps the capacity of people to derive satisfaction directly from the

knowledge of the existence of certain species or wild areas. Existence value has been identified in a variety of contexts, including natural resources, places of historic significance, and great works of art.

Another form of passive-use value is option demand. Resource preservation can give rise to option value when some people are uncertain about their future demand for visitation (use) 'of the resource. As a result, these individuals may be willing to pay to have the resource preserved, thus keeping open their option to visit it. Option value is analogous to an insurance premium that someone would be willing to pay to guarantee that the resource exists should they decide to visit it in the future. Option value, by this definition, represents a willingness to pay for resource preservation over and above any expected consumer benefit that the person would receive from future use of the resource. Although option value is related to use, in a formal sense it is a passive-use value since the benefit of keeping one's option open can occur in complete isolation from the resource, and occurs simply because of the fact that the resource exists.

A third type of passive-use value is quasi-option value. Quasi-option value arises because there is uncertainty about the future value of many natural resources. For example, some resources may have medicinal properties about which we are currently unaware. The case of the Pacific Yew is an historical example of this situation. Information about the value of such resources is revealed only with the passage of time and the accumulation of knowledge. As information accumulates, more accurate assessments of the value of natural resources can be made. If we take irreversible actions (such as ecosystem alterations which reduce biological diversity), we lose our ability to study the lost resource for potential use. In contrast, by preserving such a resource we afford ourselves the opportunity to obtain additional information about its potential uses, while maintaining the possibility of future development. This expected value of this opportunity is positive.

In addition to the distinction between use and passive-use value, a distinction can be drawn between market and non-market goods. When goods are traded in markets people register their economic valuation--that is, they "vote" with their dollars. Market price data thus provide

information which can be used to calculate the economic value consumers place on such goods. There are many goods, however, which are not traded in markets. For some of these goods no price-based valuation information exists. Many of the goods provided by natural resources fall into this category. One reason for this is that many environmental goods are "public" goods, as is explained below.

In the case of private, market-traded goods the value of a unit of the good is obtained only by a single consumer. For example, consumption of a slice of pizza by an individual consumer precludes the consumption of that slice by other consumers. In contrast, a person's consumption of a public good (such the existence of an intact ecosystem) does not preclude the consumption of that good by others. This characteristic, called non-rival consumption, renders the economically efficient provision of public goods incompatible with private markets.

This characteristic also implies that the economic value of a unit of the good is the sum of all consumers' values. In the case of a private good, such as a slice of pizza, it makes economic sense to produce it only if there is a person who values it sufficiently highly to pay for the cost of production. In the case of public goods, provision is economically efficient if the sum of all consumers' values is sufficient to cover the cost of production, since consumption is non-rival. The passive-use goods provided by the preservation of healthy forest ecosystems have the characteristics of public goods. The enjoyment of such a good by one individual does not diminish the ability of others to enjoy the same good.

This economic-theoretic framework has two very important implications. Goods which are public in nature are likely to be under-provided by private markets or by policy decisions which rely solely on market-produced data. An additional implication is that the value of each unit of the public good is the sum of values placed on it by each potential consumer. The total economic value of the passive-use goods is thus the sum of the values of each consumer places on these goods.

**B. The Contingent Valuation Method**

There are some significant methodological differences in the estimation of use value and passive-use value. Use value is typically associated with some potentially observable activity on the part of the consumer, most notably travel to a recreation site. The expenditures associated with engaging in recreation, for example, can be used in the estimation of what consumers are willing to pay to use the resource. Many studies of recreation demand have employed the travel-cost method (TCM) to estimate willingness to pay for forest preservation, in which travel costs (including the value of personal time) are used to estimate the strength of demand for visitation.

The problem confronting researchers in the estimation of passive-use value is that passive consumption for the most part does not generate observable behavior. Thus there are not the associated expenditures from which strength of demand can be inferred. The recognition that passive-use values are an integral part of economic value combined with the lack of observable economic behavior has led to a direct method for eliciting consumers' willingness to pay for natural-resource preservation. This technique is known as the contingent valuation method.

The contingent-valuation method (CVM) is widely applied to the problem of estimating the economic value of goods and services which are not traded in markets and for which no economic behavior is observable. These non-market characteristics are present when the "good" in question is in the form of an environmental amenity. As a result, contingent valuation is receiving increasing use for estimating the economic value of environmental goods. These applications include the estimation of economic damages from oil spills, the value associated with ecosystem preservation, and the benefits of reduced exposure to pollutants.

The contingent valuation method utilizes survey methodology to reveal the monetary values respondents place on goods. The CV researcher must provide respondents with a realistic portrayal of the policy options (e.g., management alternatives for a given area of forestland), and describe the cost burden to their household. The cost burden is defined both in terms of its magnitude and the vehicle through which these costs will be paid (e.g., higher prices for products, higher taxes, etc.). A valuation question then typically follows, in which respondents reveal either

directly or indirectly their willingness-to-pay (WTP) for the stated good. For example, with a valuation question in a dichotomous-choice (or referendum) format, the respondents reveal how they would "vote" in a referendum on the policy, given the policy's cost to their household. From such responses, a mean WTP can be estimated. Alternatively, the valuation question can have an open-ended or payment-card format. (See Mitchell and Carson, 1989, for an extensive discussion of these approaches.)

The credibility accorded to the results of contingent-valuation studies is evidenced, in part, by the increasing support for its use as a method for estimating the economic benefits associated with policy proposals. For example, it is included in the federal government's prescribed procedures for analysis (Water Resources 'Council, 1979, 1989 and Department of the Interior, 1986.) In addition, results from contingent-valuation studies were granted the status of rebuttable presumption in environmental-damage litigation cases by a U.S. Circuit Court of Appeals (State *of Ohio vs. the United States Department of Interior, 880* F.2d 432, D.C. Circuit, 1989). These policy developments provide for the use CVM as an estimation technique to establish compensable environmental damages under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The same now holds true for the Oil Pollution Act of 1990. Along with this increasing use has come increasing scrutiny.

In recent years economists, psychologists and survey researchers have vigorously debated the validity of using the contingent valuation method to estimate the economic value of goods which are not traded in markets. A recent analysis of CVM was conducted by a high-profile panel appointed by the National Oceanic and Atmospheric Administration (NOAA). This panel assessed the usefulness of the method and recommended research protocols to improve the tool's performance. The conclusions reached by the panel were used by NOM in its rulemaking under the Oil Pollution Act of 1990. The panel consisted of five distinguished researchers, and was co-chaired by two Nobel laureates in Economics, Kenneth Arrow and Robert Solow. One of the its members describes the task given to the panel as addressing the following question: "Is the contingent valuation method capable of providing estimates of lost nonuse or existence values that

are reliable enough to be used in natural resource damage assessments?" (Portney, 1994, p. 8).

Summaries of many of the issues can be found in surveys of the literature produced by Cummings, Brookshire, and Schulze (1986) and by Mitchell and Carson (1989). Recently Carson, et al. (1994) assembled a bibliography on CVM which contains 1,672 references. The studies referenced include applications of CVM as well as diagnostic research designed to assess its validity and reliability.

Much of the research on CVM has focused on the extent to which it is subject to random error (imprecision) or systematic error (biased results). The most serious concerns have related to the possibility of bias (systematic over- or underestimation). Most of the investigation has focused on the following categories of potential bias: (a) incentives for strategic responses, or strategic bias, (b) error based on the information which is conveyed, or information bias, (c) error due to the hypothetical nature of the CV market, or hypothetical bias, (d) the influence of cost information presented in the survey on respondents' stated monetary valuation, or starting-point bias, and (e) embedding bias. Surveys of this research can be found in Cummings, et al., (1986) and Mitchell and Carson (1989).

Among the most interesting methodological studies are those designed to compare CV results to the values generated in simulated markets in which actual (as opposed to hypothetical) monetary transactions are made. Some of the most revealing work in this area is that by Bishop and Heberlein on the exchange of hunting permits (Bishop and Heberlein, 1979, 1990 and Bishop, et al., 1983). Contingent values on willingness to pay were statistically quite close to those revealed in actual cash transactions. Contingent values generated from a sealed-bid auction were 33% higher than cash-transactions values. When the CV questions were in the dichotomous choice format (in which the respondent must agree or refuse to pay a specified price for the good), the CV results for willingness to pay exceeded the values from the simulated market by 13%. In neither case were the differences statistically significant.

Concern about how, a good's characteristics affect the reliability of CV estimates is addressed in research by Kealy, Montgomery, and Dovidio (1990). Their research examined

contingent values of two goods ". ..at polar extremes of the private/public good continuum: a brand-name candy bar and a contribution to a program to alleviate acid rain damage in a major recreational area (Kealy, et al., 1990, p. 259)." They hypothesized "...that contingent values for our public good would be less reliable and less accurate predictors of actual willingness to pay than those for our private good because the private good was more well defined and concrete, and because of respondents' greater familiarity with the private good (p. 259)." Their results, however, contradict this hypothesis. They found comparable reliability and predictive validity for both types of goods.

Recently the research agenda has been dominated by concerns over "embedding" bias in CVM results, a phenomenon which results in respondents exhibiting "insensitivity to scope". Insensitivity to scope would have been exhibited if, for example, respondent revealed the same willingness to pay for a policy which would preserve 1 million acres of forestland as for a policy which would preserve a 2 million acres which includes the original 1 million acres (the 1 million acre reserve being embedded in the larger 2 million acre reserve).

In a widely cited paper, Kahneman and Knetsch (1992) report the results of a CV study in which embedding is found. In a telephone survey respondents in different subsamples were asked what they would be willing to pay for "significant improvements" in "environmental services", "preparedness for disasters", and "availability of equipment and trained personnel for rescue operations". Kahneman and Knetsch consider these to be in descending order of inclusiveness, with environmental services being the most inclusive category and the following two to be successively more embedded. Their survey results show that for the group that was asked initially about their valuation of'environmental services (and subsequently asked about the values of the two remaining embedded services) the willingness to pay for environmental services was roughly equal to the willingness to pay for disaster preparedness (for the group that was subsequently asked about the value of the one remaining embedded service). It was observed that the value of the sum of the parts of an inclusive category may widely diverge from the value elicited for the inclusive category as a whole.

From these and other results, Kahneman and Knetsch offer the interpretation that CV results are arbitrary and do not reveal true economic value. Kahneman and Knetsch attribute the insensitivity to scope to respondents' desire to purchase "moral satisfaction" by contributing to a good cause, rather than being motivated by the desire to purchase a specific quantity of an economic good.

Smith (1991) takes issue with Kahneman and Knetsch, arguing that none of their conclusions follow from the results of their study. He argues that their CV study was flawed, in part because the Kahneman and Knetsch CV questions were ineffective in defining and framing the context of the good to be valued. This type of flaw could alone result in responses which would support the conclusion that CV results are arbitrary. As discussed by Mitchell and Carson (1989) and others, careful survey design is essential in order to mitigate embedding bias.

While the research by Kahneman and Knetsch stimulated additional discourse on the embedding issue, concern about this potential bias existed long before their study. Mitchell and Carson (1989) discuss the development of the evidence insensitivity to scope in the context of "part-whole" bias. Part-whole effects can result in insensitivity to scope in situations in which respondents are incapable of or have inadequate information for distinguishing the "part" of benefits provided by a particular policy from the "whole" of benefits which could be ascribed to a broader policy. While this leads to insensitivity to scope as described Kahneman and Knetsch, it is important to note that it results from respondent motivation that is very different from the simple desire to purchase moral satisfaction by contributing to a good cause. It is also important to note that in evaluating biases in the CVM, it is essential to be mindful of similar shortcomings of other estimation techniques, as well as the realities of market behavior. Part-whole bias is not unique to CVM, and exists for other estimation techniques as well. (For a discussion of how this applies to travel cost, hedonic price, and other methods, see Mitchell and Carson (1989), p. 47.)

Recent evidence pertaining to the embedding issue is discussed in Hanemann (1994). Some of the evidence reviewed by Hanemann is evidence contained in the meta-analysis by Walsh, Johnson and McKean (1992) on over 100 CVM recreation studies and in a study by Smith and

Osborne (1994) on 10 applications of CVM to air quality. Hanemann discusses at some length the evidence provided in a review by Carson (1994) of 27 papers testing for sensitivity to scope, and notes that only two failed to generate statistical evidence of sensitivity to scope, the one by Kahneman and Knetsch (1992) and the other by Boyle, et al. (1994). That is, only 2 of 27 papers found evidence of this type of embedding behavior. Hanemann notes that critiques of these two studies have pointed to methodological shortcomings which could explain their findings. In summarizing the evidence Hanemann claims, "At any rate, even if one regards these two studies as highly credible evidence that respondents were insensitive to scope, they certainly do not represent the majority finding in the contingent valuation literature regarding the variation of willingness-to-pay with scope" (Hanemann, 1994, p. 35).

Regarding estimation of passive-use values *per* se, the NOAA Panel's conclusions are the most comprehensive and authoritative statement to date. Given that the NOAA panel was considering the use of CVM for environmental damage litigation (in which a single party could be held liable for environmental damages) they were compelled to adopt very strict' standards by which to judge the method. After obtaining input critical of CVM, the panel noted, "…. some antagonists of the CV approach go so far as to suggest that there can be no useful information content to CV results. The Panel is unpersuaded by these extreme arguments" (Arrow, et al., 1993, 4610). After thorough review of the validity CVM for measuring passive-use values, the preponderance of evidence supports the usefulness of results from carefully performed CV studies. The NOAA panel concludes, "… . the Panel concludes that CV studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment, including lost passive-use values" (Arrow, et al., 1993, 4610).

Although the NOAA panel did express concerns regarding upward bias in CV results, they concluded that contingent valuation -studies have the potential to yield useful results. This conclusion, of course, does *not* imply that all CV studies are useful. The evidence clearly indicates that CV results are sensitive to study design. Each study must thus be judged on its own merits.

## III. Empirical Estimates of Nonuse Values

### A. Studies pertaining to Northwest Forests

The literature search failed to reveal any studies which attempt to value public forestlands in the Columbia River Basin. There are, however, three published studies and one unpublished study pertaining to the preservation of the spotted owl and its westside forest habitat (included either explicitly or implicitly, depending on the study). Moreover, the search revealed one study involving Columbia River Basin steelhead and salmon runs, the health of which are in part a function of forest conditions in the Basin, These studies, which attempt to estimate the total value derived from preservation (including both use and passive-use values), are summarized below in Table I and in the discussion which follows.

**Table I**
**Studies Pertaining to Northwest Forests**
(Mean Annual Willingness-to-Pay per Household)

| *Study* * | *Resource* | *Population Sampled* | *Est. WTP* |
|---|---|---|---|
| Hagen, Vincent, and Welle (1992a) | Preservation of spotted owl and old-growth forests (westside) | *U.S.* | $47.93 to $144.28 |
| Rubin, Helfand, and Loomis (199 1) | Preservation of spotted owl | Wash. state | $49.72 unadj. $34.84 adj. |
| Loomis and Gonzalez-Caban (forth.) | Reduced fire risk in critical spotted-owl habitat | Oregon | $77 for 3500 acres of critical habitat |
| Olsen, Richards, and Scott (1991) | Doubling the size of Columbia River Basin salmon and steelhead runs | Pacific NW | $26.52 nonusers $58.56 poss. us. $74.16 users |

*An unpublished paper by Brown, Layton and Lazo (1994), which was presented at the 1994 Western Economic Association meeting in Vancouver, B.C., reports on a study using a Washington state sample, which includes (among other innovations) alternatives with differing probabilities of owl survival. At probabilities of survival approaching 100 percent, their results appear to fall somewhere between the results of Hagen, et al. and Rubin, et al. The details of the study are not summarized here as the authors have not given permission to quote their paper.

*Overview and Critique of the Hagen, et al. and Rubin, et al. Spotted-Owl Studies*

Hagen, Vincent and Welle (1992a) employ contingent valuation to estimate the benefit of implementing the conservation plan presented in the "Thomas Report" (Thomas, et al., 1990). Respondent households were provided with information regarding the nature of the proposal (including the role of the spotted owl as an "indicator species" for the old-growth forest ecosystem) and the nature of the policy's costs, including a statement of the cost to the respondent's household (in the form of higher wood-product prices and higher taxes). They were also given a list of other public goods (such as fighting crime, improving education, assisting the elderly, etc.) which compete for scarce resources, so as to help them place this specific issue in context.

Following the provision of all background information, the respondents were asked if they would support the policy, given the stated costs. The stated cost to the household was varied throughout the sample, which allows the mean household willingness-to-pay be estimated by analyzing the relationship between the stated cost to the household and the probability of support. Additional background information was also provided (including the proportion of the habitat which is already protected in national parks and wilderness areas, and a map of the proposed habitat conservation areas). Following pre-testing of the survey instrument, the survey was mailed to a random sample of 1,000 U.S. households (which included households in all 50 states). The gross response rate for the study was 41 percent. Under different assumptions regarding the non-respondents, and after constructing confidence bounds on the results, estimated mean annual values were reported in the range of $47.93 to $144.28 per household. The need to make alternative assumptions regarding the non-respondents arose due to the response rate of less than 50 percent of the original sample. The non-respondents may be very different from those households who chose to respond. This response-rate problem is a major shortcoming of mail surveys, as pointed out by the NOAA panel on contingent valuation (Arrow, et al., 1993). The authors attempt to deal with this problem by making very conservative assumptions regarding the

non-respondents (including in the lower-bound case the assumption that all non-respondents have a WTP of zero).

Although passive-use values were not estimated separately, it can be expected that the preponderance of the total value would be motivated by passive considerations. Such an inference is based on the observation that direct uses of the spotted owl and its previously unprotected habitat are relatively limited, and by the finding that there was no statistically significant difference in mean values between the Washington-Oregon region and the rest of the nation (taken as a whole). This inference is also consistent with evidence from other studies (discussed below in Section III.B.) showing that passive-use values compose the majority of the total value of forest preservation.

Rubin, Helfand and Loomis (1991) report results from a contingent valuation study of residents of the state of Washington. This study was conducted in order to estimate the value of ensuring the preservation of the northern spotted owl, and focused on the preservation of the owl itself (rather than focusing on its role as an indicator of health of the old-growth forest). The valuation question used a payment-card format. From mailings to 1,200 randomly selected households, 253 surveys were returned for a gross response rate of 23 percent. The authors report an unadjusted mean annual willingness-to-pay of $49.72 per household. After making demographic adjustments for non-respondents, they arrive at an adjusted mean of $34.84. It should be noted that while the authors present figures for Oregon, California, and the rest of the U.S., such figures represent nothing more than speculation on the part of the authors, as their sample was confined to Washington state.

The above two studies have received significant attention, and have been of the subject of two critiques: by Mead (1992 and 1993) and by McKillop (1992). Each of these will be summarized, together with our response. The summary of and response to Mead draws heavily from Hagen, Vincent and Welle (1992b), which contains comments submitted under the NOAA review process.

Mead's approach to evaluating CV results is to examine the "reasonableness" of the findings of CV studies. Mead examines various CV studies with respect to several criteria: "internal plausibility" (the central issue being whether the estimated values are unreasonably high); variation in estimated values within individual studies; and consistency of the results across different studies of the same resource. Mead addresses all three of these issues in part by reviewing Hagen, Vincent and Welle (1992a), and making comparisons to Rubin, Helfand and Loomis (1991). Mead argues that these two studies demonstrate "the potential for drastically different estimates of the value of a given resource (despite using the same method) as well as the startling magnitude of reported nonuse values generated by CV." (Mead, 1992, p. 3) We dispute each of these points. First, the estimated values, when viewed in the proper context, are not of a "startling magnitude", but rather are very modest. Secondly, the results are not "drastically different" when one allows for fundamental differences in the methodology and in the definition of the resource.

How reasonable is Mead's contention that the results are of a "startling magnitude"? The Hagen, Vincent and Welle estimates, which are the higher of the two studies, place the average annual household WTP at $47.93 to $144.28, with a mid-range estimate of $86.32. Mead suggests interpreting these numbers using an opportunity cost approach. We do so from the perspective of the average American family. What do these numbers imply about the quantity of goods and services the average American family is willing to forego in order to protect old-growth forests and the northern spotted owl? Using the midrange estimate of $86.32, this works out to $1.66 per week per family, or about 24 cents per day. With an average household size of about 2.6 people, this works out to about 9 cents per person per day. This is the rough equivalent of each person foregoing the consumption of one average-sized candy bar every 6 days. Is this result "startling" or unbelievable? Is it unreasonable to suggest that the average American would be willing to make a sacrifice of this magnitude to preserve old-growth forests and the spotted owl? Richard Walsh, in his report for the Department of the Interior on this issue, finds the results plausible, stating that the values in the Hagen, Vincent and Welle study "...should not be

unexpected for unique resources such as a threatened species and old-growth (300 to over 1,000 year old) forest habitat." (Walsh, 1991, p. B6)

A separate issue is that of the variation in the estimates within a given study. The Hagen, Vincent and Welle study presents a range of estimates from $47.93 to $144.28 (a ratio of approximately 1:3). While it is true that this range reflects significant uncertainty about the actual value, *all* estimation techniques (not just CV) provide a *range* of estimates, the size of which is substantial in many cases. Even in the natural sciences, there is often significant measurement error. Kenneth Arrow has summarized this point as follows:

> I think you can see my attitude is very sympathetic; there are a lot of difficulties in CVM and there are a lot of difficulties in any kind of measurement which purports to do the same thing, for example give values appropriate for welfare judgments. Also, in my few brushes with actual environmental analysis or health analysis, it appears to me that in the errors produced by our technological colleagues -- our medical colleagues, our engineer friends -- errors on the order of one to ten are considered to be perfectly normal. . Let's talk about ratios of 3:1 or 5: 1; compared to the other sources of ignorance in most of these environmental fields or the technological ignorance, and basic science ignorance, is this something to worry about, is this one of the biggest sources of uncertainty inside the environmental assessment? (as quoted in Cummings, Brookshire and Schulze, 1986, p. 185)

It is important that CV analysis not be held to a higher standard than that applied to other types of analysis. Significant uncertainty is a fact of life. In would be arbitrary and capricious to reject CV analysis on these grounds, while at the same time allowing other types of analysis which do not (and cannot) meet the standards to which CV analysis is sometimes held.

Finally, Mead argues that "despite using the same method", the two studies yield "drastically different estimates of the value of the same resource". The Hagen, Vincent and Welle study used a national sample. The estimated average annual household willingness-to-pay (WTP) ranges from $47.93 to $144.28 in this study. The Rubin, Helfand and Loomis study used a Washington State sample. The average stated annual WTP in the Rubin, Helfand and Loomis study was $49.72, which (as noted above) was adjusted downward to about $35 to account for demographic variation. On the *assumption* that the WTP would be much lower elsewhere in the

country (they had no observations outside of Washington State), the national value was further adjusted downward, which (with adjustments to include zero bids) resulted in a much lower mean annual household WTP of $16.55 for the U.S. This substantial downward adjustment is the result of an unsubstantiated assumption which the authors could not test given their single-state sample.

The definition of the resource also differs in the two studies. In the Hagen, Vincent and Welle study, the resource that the respondents were asked to value included preservation of old-growth forests and the northern spotted owl. The policy description included a discussion of the spotted owl as an indicator species for old-growth forests, as well as other relevant information. In the case of the Rubin, Helfand and Loomis study, the resource was defined as the northern spotted owl. Mead suggests that "it is well understood" that preservation of the owl and old-growth forests are the same thing (Mead, 1992, p. 13, footnote 15). Our pre-test interviews showed that while this point was known by some, there were many individuals who knew very little about the issue (even in Washington State). This point is acknowledged by the authors of the Rubin, Helfand and Loomis study, who caution that their values may represent willingness to pay for spotted owls alone, rather than for old-growth forests in general (see Rubin, et al., 1991, p. 28).

The two studies were also conducted at different points in time. There is considerable inter-temporal variation within private markets, which we might expect to apply to public goods as well. As Walsh (1991) summarizes in his report to the Department of the Interior,

> It is reasonable that the two studies arrive at different estimates of willingness to pay for preservation. Contingent values are like market values in this respect; they depend on the institutions, supply and demand conditions, and expectations about both. Market prices at any moment in time reflect all of the information available at that time, and as a result show wide ranges and volatility. Consumers experience retail prices [that] are often no less variable than the three-year range in values between the two studies of preservation of the spotted owl and old-growth habitat. (Walsh, 1991, p. B6)

In short, given differences in the methodologies of the two studies, the differences in the findings are neither "drastic" nor difficult to understand.

Finally, it should be noted that Mead presents two specific criticisms regarding the information provided to the respondents in the Hagen, Vincent and Welle study. First, Mead asserts that the survey instrument did reveal information regarding the fact that much of the owl's habitat is already protected (Mead, 1992, footnote 13). This assertion is simply is inaccurate. The policy description provided to respondents stated the percentage of the proposed Habitat Conservation Areas which are already protected in National Parks and Wilderness Areas, thus making explicit that some old-growth forests are already protected. Mead also suggests (in footnote 13) that Hagen, et al., erred by failing to inform respondents that the reduced timber supply will be due to reductions both in old-growth and subsequent second-growth harvests from the same lands. However it was made explicit in the survey instrument that the policy would result in "higher prices for wood products as the result of a reduction in timber supply". The relevant fact from the household's standpoint is the cost impact of this harvest reduction (not the extent to which the resulting cost impact is due to foregone old-growth versus subsequent second-growth harvest reductions). While the stated cost of the policy to the household was varied throughout the sample, the vast majority were presented with a cost to their household that greatly exceeded the true cost (as based on Mead's own estimate).

A second critique of the spotted owl studies comes from McKillop (1992). McKillop's critique contains two parts: First, that the complexity of the spotted owl issue was not (and perhaps cannot) be properly presented to respondents in CV studies; and secondly, that CV results in general are subject to upward bias which renders useless the information that they provide. The latter of these, concerns (to which McKillop devotes only a few paragraphs) is addressed at length above in section II.B. of this report. The first of McKillop's concerns (relating to the complexity of the spotted owl issue and its portrayal in the survey instruments) is addressed here.

McKillop focuses on the more comprehensive of the two studies (Hagen, et al., 1992a), and provides a list of background points which he feels were improperly left out of the information provided to respondents. First, McKillop complains that respondents were not told

that the scientists who designed the conservation plan ignored the fact that owls are found in second-growth stands. The Thomas committee did consider the evidence in this regard, however, and developed a plan which it considered "scientifically credible". At the request of the Bush administration, the plan was subjected to review by an independent group of non-governmental biologists who agreed with its findings. We thus believe that the scientific information provided to the respondents is defensible.

Secondly, McKillop asserts that respondents were not told that logging was already prohibited in considerable areas of old growth. The assertion that this information was not provided is simply untrue. The respondents were told that some of the habitat areas are *already* protected (a point that was made clear in our report), and were moreover given a quantitative estimate of the share of the total habitat area that was previously protected.

Thirdly, McKillop complains that the information provided to respondents did not include a critique of the Endangered Species Act itself (as regards the powers it affords the US Fish and Wildlife Service and as regards ambiguity involving the definition of a species). The purpose of the study, however, was not to hold a referendum on the ESA. The relevant biological issue is whether the spotted owl does in fact serve as an appropriate indicator for the health of old-growth forests. McKillop's general criticisms of the ESA do not speak to this issue.

Finally, McKillop asserts that respondents were not informed about the cost of the plan to U.S. households or to ecosystems elsewhere. With respect to the first of these, McKillop is simply incorrect. All respondents were told the nature of the costs in general, and were told their share of these costs. The specific level of costs presented to respondents (which was varied in the sample) was in most cases greatly in excess of the actual costs as estimated by the two studies that McKillop cites. In order to measure the *benefits* of preservation using the dichotomous choice technique we needed to extend the range of stated household costs to a level many times that of the actual costs so as to test respondent sensitivity. To allow for the *possibility* that the benefits from preservation can in some cases exceed the actual costs per household, the range of costs presented to the households must extend far above the actual costs. In short, given the

dichotomous choice framework, overstating the costs is necessary to provide us with benefit estimates.

With regard to the costs to ecosystems elsewhere (as the result of substitution of nonwood products or wood from other areas), such costs should be taken into account in a fully-specified cost-benefit analysis. These costs (if they can be documented) should be added to the other costs of preservation, the resulting total costs being compared to the benefits of preserving forests in the Northwest. The latter is what the CV studies are attempting to quantify. It is in the use of these benefit estimates in cost-benefit analysis that the other side of the coin--the costs of preservation--must be taken into account. It should not merely be assumed, however, that the environmental costs of alternatives to old-growth timber are equally high or even significant. Given the importance of this issue (and its implications for the *net* benefits of preserving northwest forests) it is useful to consider what we currently. know regarding the effects of harvesting elsewhere.

In order to assess the environmental effects of harvest restrictions in western North America, Roger Sedjo and his colleagues employ a timber-supply model (TSM) to predict the regions most likely to be subject to expanded logging activity. He reports that, "....the TSM predicts that the harvest reductions in western North America will trigger harvest increases in parts of Europe (notably the Nordic countries and probably Russia), parts of Asia and Latin America, and other parts of North America (notably the U.S. South and eastern Canada)" (Sedjo, 1994, p. 5).

Sedjo goes on to provide some important insights regarding the sensitivity of the environment to expanded harvesting in several of these regions. With regard to the Nordic countries he finds, "Increased harvests of the forests in the Nordic countries may generate only modest additional environmental damage" (1994, p. 5). This is due in part to the fact that most of the forested terrain in the region is flat. These forests also contain very little old-growth, resulting in a minimal risk to biodiversity (and the associated passive-use values).

In making the projection that Latin America will become a major wood supplier Sedjo notes that this is ". . ..because it has established highly productive plantation forests" (1994, p. 3). In South America, the increased logging could occur in plantation forests or in old-growth stands. He goes on to observe, however, that

> (w)hile the risk to biodiversity is great where old-growth habitat is destroyed, the risk to native habitat from plantation forests can be small. Contrary to popular impression, plantation forests are usually established on degraded agricultural land, rather than on land cleared of native forests. Accordingly, the environmental effects of plantation expansion are usually negligible (1994, p. 5).

Sedjo also predicts that countries in Asia and Oceania are expected to expand timber exports. He notes, "In- Malaysia and Indonesia, timber from plantations and second-growth tropical forests could be for sale in major world markets within a decade" (1991, p. 3). Sedjo points out that it is more difficult to predict the environmental effects of increased logging in eastern Russia. Although greater uncertainty exists, he argues that, "Several natural features of the forests in eastern Russia suggest that damage resulting from logging is likely to be modest" (1994, p. 5).

This evidence runs counter to the often-repeated speculation that harvesting restrictions in the northwest will lead to widespread environmental damage elsewhere. While more study needs to be done, the currently available evidence in this regard does *not* suggest that the fundamental conclusions presented above regarding northwest forests are incorrect.

In sum, we believe that the studies of westside forests summarized above provide evidence that the preservation of public forestlands can yield substantial' passive-use value. While it is certainly an open question as to whether the magnitudes of the estimates are correct, it would be extremely difficult to explain away all or most of the estimated value on the basis of weaknesses in the contingent valuation method in general or these studies in particular.

*Additional Studies Pertaining to Northwest Forests*

In a new study involving the benefits of protecting critical owl habitat against the risks of fire, Loomis and Gonzales-Caban (forthcoming) employ a contingent valuation mail survey to

estimate the value to Oregon residents of reducing such risks. They estimate a willingness to pay of $77 per household for a reduction of 3,500 acres burned. Although their study was limited to Oregon, it is likely (given the results presented above) that the reduced fire risk would be valued nationwide. As with other forest preservation policies, it is likely that passive-use motives would account for an important proportion of this total-value estimate.

The magnitude of the estimate seems high given the estimates for preservation presented above. In part, however, this may reflect ambiguity in the interpretation of "critical habitat". Strictly interpreted, respondents may be have viewed such habitat as necessary for the continued survival of the species. If this is the case, then the numbers may not be difficult to reconcile with the more general studies discussed above. If the respondents did not have this interpretation, however, then the results would seem to indicate the presence of embedding (discussed above in section II.B.).

Olsen, Richards and Scott (1991) present the results from a contingent valuation study of the willingness of Pacific Northwest residents to pay to double the size of Columbia River Basin salmon and steelhead runs by the year 2000. This is of relevance to the valuation of public forestlands in the region since forest management in the Columbia River Basin--together with many other factors--has implications for the size of such runs. The study population consisted of Pacific Northwest households. (Pacific Northwest is not defined in their paper). Values were calculated for "users", "nonusers with some probability of future use" and "nonusers, with no probability of future use". The estimates of combined use and passive-use values for each of these groups (on an annual, per-household basis) are $74.16, $58.56, and $26.52, respectively.

While it is tempting to ascribe the difference between users and non-users as the increment provided by use value, this may not be correct. For resources for which there is prolonged, substantial use by users (such as recreational fishermen), there may arise a difference between the *passive-use* value of users and nonusers. This is based on the notion that passive-use value is formed as the result of an "appreciation" of the resource. Repeated use may enhance such an

appreciation for the resource beyond its ability to provide use benefits. In such cases, the higher total value accruing to users would be a function of both use value and higher passive-use value.

**B. Studies of Other Public Forestlands**

There have been a number of studies involving public forestlands outside of the Pacific Northwest. In contrast to the spotted-owl studies, many of these attempt to identify the share of willingness-to-pay which is due to passive-use value versus use value. This is methodologically very difficult. First, as explained above, one cannot simply interpret the difference in WTP between users and non-users as use value, since users may have a higher passive-use value for the good. Secondly, attempts to ask the respondents to separate out the shares of their total value that are attributable to the different components of value is also problematic. This is somewhat analogous to asking what share of a consumer's WTP for a bouquet of flowers is due to visual satisfaction versus olfactory satisfaction versus the satisfaction derived from giving (or receiving) the bouquet. While the consumer might recognize that all of these contribute to total satisfaction, assigning a quantitative share to each would be very difficult. Nonetheless, the attempts of these studies to identify the contribution of passive-use value may provide a rough guide to its relative importance. For many of these studies, a large majority of the estimated total value appears to be attributable to passive-use value. For others, there is roughly an even split between use and passive-use values. In all cases, passive-use value contributes a substantial share of the estimated total value. An overview of these studies is provided below. A summary of their findings regarding total value is provided in Table II on pages 24-25.

Barrick and Beazley (1990) employ the contingent valuation method to estimate option value for a Wyoming wilderness area. Their survey asked respondents to apportion their willingness to pay among four motives: interest in personal visitation, interest in others visiting, interest in the availability of the wilderness for future generations and interest in knowing that the wilderness exists. The study population consisted of users of the area and also households from selected metropolitan and rural areas nationwide. Estimates of willingness to pay which are

attributable to the above motives are obtained. For the group identified as users of the wilderness area, the annual average household option value estimate was $46.17. For the groups identified as urban and rural residents the corresponding estimates were $9.70 and $8.43. These are interpreted as estimates of passive-use value.

Bennett and Carter (1993) employ the contingent valuation method to estimate the total value of preserving forestlands in southeastern Australia. They also apply the travel-cost method in order to estimate recreation benefits. The study population comprised residents of New South Wales, Victoria and the Australian Capital Territory. They report a median annual willingness to pay of $43.50. (They did not report a mean value due to some statistical problems with their study, thus the comparability of their results to other studies described here is limited.) The study reports an annual per-person willingness to pay for recreation activity of $8.90 from their travel-cost study. Using their conversion factor of approximately two persons per household, this yields an annual household recreation benefit of approximately $17.80. While we cannot compute a passive-use estimate from the available information, it is nonetheless consistent with other studies in that the total valuation estimate exceeds the use-value estimate by more than a factor of two.

Gilbert, Glass and More (1991) employ the contingent valuation method to estimate use and passive-use values for the Lye Brook Wilderness Area in Vermont and then for all Eastern wilderness. Their survey instrument asked respondents to allocate their willingness to pay among future use, option, preservation, bequest and altruism components. The study populations resided in a 25 mile radius around the Lye Brook Wilderness (for Lye Brook values) and within a 25 to 75 mile radius of the Lye Brook Wilderness (for all Eastern wilderness values). The estimated economic benefit falling into their passive-use categories (existence, bequest, option and altruistic value) was an annual average per household willingness to pay of $8.43 for the Lye Brook Wilderness and $12.04 for all Eastern wilderness. In both cases the passive-use component was over 84% of the total value of the resource.

**Table II**

**Studies Pertaining to Other Public Forestlands**
(Mean Annual Willingness-to-Pay per Household)

| *Study** | *Resource* | *Population Sampled* | *Est. WTP* |
|---|---|---|---|
| Barrick and Beazley (1990) | 73 1,000 acres Washakie Wilderness | users and selected U.S. urban and rural areas | |
| | | users | $126.30 |
| | | urban residents | $18.49 |
| | | rural residents | $16.23 |
| Bennett and Carter (1993) | S.E. Australia forests | N.S.W., Victoria, Aus. Cap. Terr. | $43.50 (median) |
| Gilbert, Glass, More (1991) | Eastern wilderness | 75 mi radius of Lye Brook Wild. | $14.30. |
| | Lye Brook only | 25 mi radius of Lye Brook Wild. | $9.70 |
| Haefele, Kramer, Holmes (1991) | S. Appalachian Mtns. | 500 mi. radius of Asheville, N.C. | |
| Payment-card format | Along roads and trails | | $18.08 |
| | All remaining forest | | $20.86 |
| Referendum format | Along roads and trails | | $59.22 |
| | All remaining forest | | $99.57 |
| Lockwood, Loomis, DeLacy (1993) | E. Gippsland forests | Victoria and E. Gippsland | $51.48 |
| Walsh, Bjonback, Aiken, Rosenthal (1990) | 13.5 million acres of Colorado forest | Colorado residents | $47.00 |

*(Table II continued on next page)*

**Table II continued**

| *Study* | *Resource* | *Population Sampled* | *Est. WTP* |
|---|---|---|---|
| Walsh, Loomis, Gillman (1984) | Colorado Wilderness | Colorado residents | |
| | 1.2 million acres | | $25.77 |
| | 2.6 million acres | | $37.50 |
| | 5.0 million acres | | $55.00 |
| | 10.0 million acres | | $83.76 |
| Pope and Jones (1990) | Utah wilderness | Utah residents | |
| | 2.7 million acres | | $52.72 |
| | 5.4 million acres | | $64.30 |
| | 8.1 million acres | | $75.15 |
| | 16.2 million acres | | $92.21 |

Haefele, Kramer and Holmes (1991) employ the contingent valuation method to estimate use and passive-use values from protecting the quality of spruce-fir forests in the southern Appalachian Mountains. The study population consisted of residents within a 500 mile radius of Asheville, North Carolina. Respondents were asked to partition their bids into use, bequest, and existence components. They were also asked to value two different levels of protection: (1) protection only along roads and trails and (2) all forest areas. They employed a payment card CV format for part of the sample and a discrete-choice CV format for the other part. They compute passive-use value to be 9 1.8% of total value with the payment-card format and 87.2% under the discrete-choice format. While this proportion is relatively consistent across the two CVM formats, the absolute magnitudes of value were quite different. For the discrete-choice survey the average annual household total willingness to pay was $59.22 for protection along roads and trails and $99.57 for protection of all Southern Appalachian forests. The corresponding values for the payment-card approach were $18.08 and $20.86. While such differences lead one to suspect bias, it is interesting to note that even if the lower-bound estimates are used, the annual passive-use

value per household is over $19 for the protection of all forests in this region. Such findings add to the evidence that passive-use values are significant.

Lockwood, Loomis and DeLacy (1.993) employ the contingent valuation method to estimate the willingness to pay to preserve Australian National Estate eucalyptus forests in the East Gippsland region. The study population consisted of residents of Victoria and another sample was taken within the area of East Gippsland. Respondents were asked to apportion their willingness to pay among current use, option, existence and bequest motives. They report a total valuation result of $5 1.48 per household per year. Of this, $46.02 (89.6%) was attributable to passive-use value.

Lockwood, Loomis and DeLacy (1994) estimate the nonmarket willingness to pay for the logging of forests in southeastern Australia. The question being investigated is whether people place a value on timber production over and above its commodity value. Such willingness to pay may be motivated by social concerns over unemployment or by a "nonmarket intrinsic production value". They estimate that the nonmarket value placed on timber production is about 4% of the value placed on preservation of the same forests. They caution that this result may not be transferable to situations where there is a substantial traditional component to the harvesting activity.

Pope and Jones (1990) employ the contingent valuation method to estimate the total willingness to pay for wilderness preservation in Utah. The study population consisted of Utah households. Respondents were presented with four preservation scenarios: the preservation of 2.7 million acres, 5.4 million acres, 8.1 million acres and 16.2 million acres. The average annual household willingness to pay for each of these options was $52.72, $64.30, $75.15 and $92.21. This study was not designed to estimate use and passive-use values separately. However, questions regarding recreational habits of respondents yield some information which the authors interpret as suggesting that the difference in willingness to pay between wilderness recreationists and non-recreationists is "relatively small". This would suggest a high passive-use content to these estimates.

Walsh, Bjonback, Aiken and Rosenthal (1990) describe a contingent valuation study which was employed in an effort to estimate willingness to pay to protect forest quality. The study region was the state of Colorado and the issue concerned the effect of insect infestation on the character of Colorado forests. The structure of their survey instrument allows them to apportion total willingness to pay into categories for recreation, option, existence and bequest. Recreation use value is calculated to be $13.00 per household per year and the passive-use components come to $34.00 per household per year.

Walsh, Loomis and Gillman (1984) report results from a contingent valuation study on the willingness to pay for additional wilderness protection in Colorado. The survey population consisted of Colorado residents. Respondents were asked to determine their willingness to pay for four "quantities" of wilderness protection: 1.2 million acres, 2.6 million acres, 5 million acres and 10 million acres. In addition, respondents in this mail survey were asked to allocate their willingness to pay among four categories of value: recreation use, option, existence and bequest. The annual household passive use value ranged from $13.92 for the 1.2 million acre preservation scenario to $3 1.83 for 10 million acres. The percentage of total value accounted for by passive use ranged from 54% for 1.2 million acre to 38% for 10 million acres.

Loomis (1994) argues that passive-use values must be taken into account in order to develop sound forest-management policies. Estimates of the relative and absolute and relative magnitudes of passive-use values are tabulated from a survey of contingent valuation studies. He finds that passive-use values are large relative to recreation benefits. He also argues that the passive-use value alone can often outweigh the commodity value of forests.

Finally, it is interesting to note that in a survey of the literature on wildlife and fishery resources, Duffield (1991) summarizes several studies which employed different methods to estimate existence values and finds remarkable consistency among them. In four of five cases examined, the estimated share due to existence value was at least 62%. While Duffield's paper does not pertain explicitly to forestlands, the results are nonetheless instructive.

The studies summarized above suggest that passive-use values are large in both absolute and relative terms. Even if one took a conservative view of these estimates out of concern over a possible upward bias in contingent valuation estimates, one still would be faced with the recognition that passive-use values should not be ignored in forest-management decisions.

## IV. Implications of Existing Studies for Eastside Forests

### A. The Potential Value of Eastside Forest Preservation

While it is not possible to provide an estimate of the passive use values provided by eastside forests, the studies discussed above suggest that healthy forest ecosystems do provide significant passive use value for the average household. Even if the per-household values for eastside forests are a small fraction of the values found for public forestlands elsewhere, the *aggregate* value could be very large. This is because of the "public-good" nature of passive use values. For such goods, the appropriate aggregation involves summing the values across households and through time (where future benefits are discounted at an appropriate rate). Table III below shows the effect of this type of aggregation for an initial annualized value of just one dollar per household.

The various entries differ with respect to two factors: the number of years over which the benefits from preservation are obtained, and the rate of growth in aggregate benefits. This latter factor we should expect to be positive if the goods yielded by preservation are "normal" goods (i.e., goods for which the demand varies positively with income). Aggregate real income has been growing in the U.S. since the beginning of the industrial revolution, both because of population growth and because of growth in income per capita. The growth in aggregate real income has averaged just over 3 percent per year. If the level of a given set of benefits (as measured by willingness-to-pay) remains constant as a share of income, and if income continues to grow according to past trends, then the annual value of those benefits would increase by about 3 percent per year (before discounting). This scenario is shown in the bottom row of the table

(after discounting at a 4 percent real rate). Alternative rates of growth in benefits of 0% and 1.5% are also shown so as to illustrate the effects of modifying this assumption.

**Table III**

**Present Value of Benefits in U.S.**
**with Initial Annual Benefits of $1.00 per Household**

**(millions of dollars)**

| | TOTAL NUMBER OF YEARS | | | |
|---|---|---|---|---|
| | 25 | 50 | 100 | 200 |
| *g*(%) | | | | |
| 0.0 | 1,559.7 | 2,144.8 | 2,446.6 | 2,495.0 |
| 1.5 | 1,820.0 | 2,810.6 | 3,643.1 | 3,962.8 |
| 3.0 | 2,142.5 | 3,825.2 | 6,184.8 | 8,538.3 |

Real Discount Rate: 4%

Based on initial U.S. population of 96,000,000 households

g: real rate at which benefits grow;
given the historical growth in real income, a 3% rate would imply that benefits remain roughly constant as a share of total income.

As the above table demonstrates, a very modest initial annual value per household can result in an enormous aggregate value when summing across households and through time (even when discounting future benefits at a 4 percent real rate). Once again, aggregation in this form is appropriate given the fact that the passive-use goods yielded by preservation are public goods, both within and across generations. For *each* dollar of initial benefits on a per-household, annual basis, the discounted present value of benefits for the U.S. as a whole would be approximately *$8.5 billion* if the benefits grow at the trend rate of real income and persist for 200 years. Modifying these assumptions downward still yields very large aggregate benefits per-dollar of household benefits. Thus even if the passive-use values of eastside forests are a fraction of those

found for public forestlands elsewhere, the aggregate value is likely to be large. This point can be illustrated with a simple example based on the results for westside forests discussed above.

Table IV presents an illustrative example of the potential magnitude of the value of eastside forest preservation using various fractions of estimated values from westside forests. The mid-range and lower-bound estimates from the Hagen, et al., study are used, adjusted downward to 1/4 and (in the case of the lower-bound) 1/10 of the westside estimates.

**Table IV**

**Present Value of Benefits in U.S.**
**at Various Ratios of Westside Old-Growth Forest Values**

**After 50 years**

**(millions of dollars)**

| | g = 1.5% | g = 3% |
|---|---|---|
| 1/4 of mid-range estimate* (= $21.58) | 60,652.7 | 82,547.8 |
| 1/4 of lower-bound estimate* (= $11.98) | 33,671 .0 | 45,825.9 |
| 1/10 of lower-bound estimate*(= $4.79) | 13,462.8 | 18,322.7 |

*Based on results of Hagen, et al. (1992a) and
initial U.S. population of 96,000,000 households

Real Discount Rate: 4%

g: real rate at which benefits grow;
given the historical growth in real income, a 3% rate would imply that benefits remain roughly constant as a share of total income.

As Table IV shows, even at a value of 1/10th of the lower-bound westside estimate and with a rather limited time horizon of 50 years, the aggregate value would be approximately 13.5 to 18.3 billion dollars (for growth rates of 1.5 and 3 percent, respectively). While the ratios and time horizon in the table are arbitrarily chosen, the results do serve to illustrate the potential

magnitude of the passive-use values associated with protection of eastside forest ecosystems.

To obtain actual estimates of the passive-use values associated with eastside forests under alternative management regimes would require that a valuation study be done that is specific to eastside forests. This in turn would require that the biological, physical and institutional constraints affecting the alternatives for eastside forest management be more fully specified. Practical application of the contingent valuation method requires that a limited set of discrete alternatives be identified. This set of alternatives can then be the subject of a specific valuation study. At this time, however, the evidence allows us to' conclude only that, in the aggregate, the passive-use values are likely to be sufficiently large to warrant their consideration in the decision-making process.

**B. Distributional Issues**

An issue that is somewhat separate from the level of passive-use benefits is the *distribution* of those benefits both within and across generations. The theory and the evidence relating to passive-use values of public forestlands allow us to reach some general conclusions regarding the distribution of passive-use values along three dimensions: the intra-generational distribution of benefits by income level, the intra-generational distribution of benefits by region, and the distribution of benefits across generations.

The study by Hagen, et al. (1992a) suggests that the passive-use benefits of protecting forests are an increasing function of income, as a statistically significant positive correlation was found between willingness to pay for forest preservation and the income of the household. This is in accord with the notion that the goods provided by preservation are normal goods, for which the income elasticity of demand is positive. Consistent with this is the frequently-made observation that members of conservation organizations have above-average income levels. If the willingness to pay for preservation is indeed an increasing function of income, then we would. expect the benefits provided by preservation to accrue disproportionately to higher-income households.

The regional distribution of benefits would likely depend on whether the passive-use values are correlated with use. In the case of fish runs (a resource for which there is substantial use value), the findings of Olsen, Richards and Scott (1991) summarized above suggest that users have higher total value from preservation than do nonusers. This could just reflect the addition of use value to passive-use value, although it might also be suggestive of higher passive-use value among users vis-a-vis nonusers (the former having a greater "appreciation" of the resource). If this were true, then the distribution of this value would accrue disproportionately in the Northwest. The national spotted owl study of Hagen, et al. (which focused on a resource for which there is relatively little use) found no significant difference in value between the Northwest and the rest of the country. This would suggest that for such resources, the geographic distribution of the passive-use benefits would be rather uniform. The preservation of Columbia River Basin public forestlands affects the provision of various goods, including some for which there is substantial local recreational use (such as salmon) and other resources whose value might be predominantly in the form of passive-use value (such as remote, little-visited stands of old pines). On balance, therefore, we might expect the passive-use benefits from the preservation of healthy eastside forest ecosystems to accrue somewhat disproportionately to Northwest households, although to a much lesser extent than in the case of recreational use value.

Finally, with respect to the distribution of benefits across generations, we would expect future generations to have a higher (non-discounted) demand for preservation. This is largely because of the positive income elasticity discussed above, together with the expectation that total real income will continue to grow. Discounting these benefits at a rate that exceeds the growth in demand results in a lower level of *discounted* benefits (on an annual basis) accruing to future generations. It might be argued, however, that this assumption regarding the relative growth and discount rates is not accurate. It is possible that the growth in demand over time may reflect a gradual shift in preferences as attitudes toward preservation continue to evolve. If so, or if the income elasticity proves to be higher than assumed here, it is possible that the willingness to pay for the goods yielded by preservation may grow faster than real income. In the case of forest

management decisions involving irreversibility or long recovery periods, the effects of these decisions may thus have very serious implications for future generations--implications that we cannot yet fully understand. This would argue for a measure of caution regarding such decisions.

## V. Summary and Conclusions

There is a substantial and growing body of literature that suggests that healthy forest ecosystems provide substantial passive-use value to the American public. This component of value may in many cases represent the dominant source of value derived from preservation. In the past, however, it is recreational use which has received nearly all of the attention in analyses of the benefits of forest preservation. By ignoring passive-use values such as existence value and option value, such studies may seriously understate the benefits associated with the preservation of wilderness areas, wildlife, old forests, and other goods associated with preservation. If forest management decisions are to be based on sound economic principles, then such values must be taken into account.

The specific implications of the above for the management of public forestlands in the Interior Columbia River Basin are not easily discerned given the existing information. Studies have been conducted which examine the benefits derived from management alternatives for westside forests. There is an absence of studies that speak directly to the management issues concerning eastside forests, however, where the issues are in many respects different. Any eastside forest management plan can be expected to contain many dimensions, including the role of prescribed fire versus wildfire, the role of forest thinning and other forms of harvesting (including salvage logging), the possible use of restoration projects, and many other factors. It can be argued that the biological, physical, political, and institutional constraints affecting the management alternatives are not well defined at this point. As these constraints become better defined, and as clearly specified management alternatives begin to take form, economic analysis can play a role in the evaluation of the alternatives. This will require, however, additional study of both use and passive-use values as they relate to eastside forests. In the absence of the

information provided by such studies, the only conclusions that we are able to reach are very general in nature. The passive-use values associated with forest preservation are potentially very large, and could by themselves dominate the values associated with extractive use. As such, they should not be ignored in the formation of policy.

**Annotated Bibliography of Selected Items**
(a comprehensive bibliography follows in the next section)

Barrick, K.A. and Beazley, R.I., "Magnitude and Distribution of Option Value for the Washakie Wilderness, Northwest Wyoming, USA." *Environmental Management* 14(3):367-380, 1990.

Bar-rick and Beazley employ the contingent valuation method to estimate option value for a Wyoming wilderness area. In order to estimate passive-use values they asked respondents to apportion their willingness to pay among four motives: interest in personal visitation, interest in others visiting, interest in the availability of the wilderness for future generations and interest in knowing that the wilderness exists. The study population consisted of users of the area and also households from selected metropolitan and rural areas nationwide. For the group identified as users of the wilderness area, the annual average household option value estimate was $46.17. For the groups identified as urban and rural residents the corresponding estimates were $9.70 and $8.43. These are interpreted as estimates of passive use value. They interpret their results as indicating that respondents hold significant existence value and bequest motives for this wilderness.

Bennett, J. W. and M. Carter, "Prospects for Contingent Valuation: Lessons from the South-East Forests," *Australian Journal of Agricultural Economics;* 37(2), August 1993, pages 79-93.

Bennett and Carter employ the contingent valuation method to estimate the total value of preserving certain forestlands in southeastern Australia. They also apply the travel-cost method in order to estimate recreation benefits. From the contingent-valuation study they report a median value of $43.50 for total willingness to pay. Comparing the results of the two studies lead Bennett and Carter to the conclusion that the ratio of recreation benefits to total benefits is on the order of 1:3. The study population comprised residents of New South Wales, Victoria and the Australian capital territory.

Brown, Gardner, D. Layton, and J. Lazo, "Valuing Habitat and Endangered Species," Institute for Economic Research Discussion Paper, University of Washington, Series #94-1, January 1994.

Brown, Layton and Lazo employ the contingent valuation method to estimate the marginal willingness to pay to decrease the likelihood that the northern spotted owl becomes extinct. The results are also interpreted as willingness to pay for preservation of additional acreage of ancient forests. Preservation demand driven by a desire to save species is interpreted as having a significant passive-use component, although this passive-use component is not directly estimated.

Duffield, John, "Total Valuation of Wildlife and Fishery Resources: Applications in the Northern Rockies", in Payne, C., J. Bowker and P. Reed, eds,, *The Economic Value of Wilderness: Proceedings of the Conference,* Jackson, WY, May, 199 1. U.S. Forest Service, General Technical Report SE-78. pp. 97-l 14.

Duffield summarizes the economic-theoretic basis for the value of natural assets. In this discussion he points to the importance of both use and existence values as contributors to total economic value. He also discusses the important role that the contingent valuation method plays in their estimation. In this paper he explores the ways in which researchers might be able to estimate the share of total value attributable to existence motives. He summarizes several studies which employed different methods to estimate existence values and finds remarkable consistency among them. In addition it is found that in only one of five cases did the share due to existence motives fall below 50%. In the remaining four cases the share due to existence value was at least 62%, reaching a high of 83%.

Gilbert, A., Glass, R., and More, T., "Valuation of Eastern Wilderness: Extramarket Measures of Public Support.", in Payne, C., J. Bowker and P. Reed,. eds., *The Economic Value of Wilderness: Proceedings of the Conference,* Jackson, WY, May, 1991, U.S. Forest Service, General Technical Report SE-78, pp.57-70a.

Gilbert, Glass and More employ the contingent valuation method to estimate use and passive-use values for the Lye Brook Wilderness Area in Vermont and then for all Eastern wilderness. Their survey instrument asked respondents to allocate their willingness to pay among future use, option, preservation, bequest and altruism categories. The study populations resided in a 25 mile radius around the Lye Brook Wilderness (for Lye Brook values) and within a 25 to 75 mile radius of the Lye Brook Wilderness (for all Eastern wilderness values). The find an average annual willingness to pay of $8.43 for the Lye Brook Wilderness and $12.04 for all Eastern wilderness.

Haefele, Michelle, Randall A. Kramer, and Thomas Holmes, "Estimating the Total Value of Forest Quality in High-Elevation Spruce-Fir Forests.", in Payne, C., J. Bowker and P. Reed, eds., *The Economic Value of Wilderness: Proceedings of the Conference,* Jackson, WY, May, 1991, U.S. Forest Service, General Technical Report SE-78, pp.91-96.

Haefele, Kramer and Holmes employ the contingent valuation method to estimate use and passive-use values of spruce-fir forests in the southern Appalachia Mountains. The study population consisted of residents within a 500 mile radius of Asheville, North Carolina. Respondents were asked to partition their bids into use, bequest, and existence components. They employed a payment card format for part of the sample and a discrete-choice format for the other part. They compute use value to be 8.2% of total value with the payment-card format and 12.8% under the discrete-choice format. In absolute terms, however, the total willingness to pay estimates were significantly lower in the payment cart format that in the discrete-choice case. If one adopts a conservative, lower-bound approach to interpreting their results by employing the low estimates, it is still found that

annual passive-use value per household is approximately $19.

Hagen, D. A., J. W. Vincent, and P. G. Welle, "Benefits of Preserving Old-Growth Forests and the Spotted Owl," *Contemporary Policy Issues,* 10, pp. 13-26, April 1992.

Hagen, Vincent and Welle employ contingent valuation to estimate the total value of setting aside the old-growth acreage recommended in the "Thomas Report" (Thomas, et al., 1990). The description presented to the survey respondents indicated that the policy would preserve the old-growth forest ecosystem in addition to the spotted owl. The study population was the entire U.S. Employing different sets of assumptions in interpreting the data, they compute estimates of annual household willingness to pay which range from $47.93 to $144.28. Although passive-use values were not estimated separately, it can be expected that the preponderance of the total value is in the form of passive-use value.

James, David, "Application of Environmental Economics to Sustainable Management of the Forests of South-East Australia," *Annals of Regional Science,* March 1994, 28(1), pp. 77-89.

James estimates the value of preserving different proportions of National Estate forests in southeast Australia. He uses the contingent valuation method to estimate the total value of various proportions (100%, 50% and 10%) of the National Estate forests which might be placed in conservation areas. The study population consists of residents of New South Wales, Victoria and the Australian Capital Territory. The travel-cost method is employed in an effort to estimate the use value associated with these preservation regimes. The results are interpreted as revealing that there are substantial use and nonuse values associated with preservation of these old-growth forests. (The results found in this study appear to be based on the same survey as that reported in Bennett and Carter (1993), and thus do not add any new information.)

Lockwood, M., Loomis, J., DeLacy, T., "A Contingent Valuation Survey and Benefit Cost Analysis of Forest Preservation in East Gippsland, Australia," *Journal of Environmental Management, 3 8,* 1993.

Lockwood, Loomis and DeLacy employ the contingent valuation method to estimate the willingness to pay to preserve certain Australian National Estate eucalyptus forests. The study population consisted of residents of Victoria and another sample was taken within the area of East Gippsland. Respondents were asked to apportion their willingness to pay among current use, option, existence and bequest motives. They report a total valuation result of $51.48 per household per year. Of this, $46.02 (89.6%) was attributable to passive-use value.

Lockwood, M., Loomis, J., DeLacy, T., "The Relative Unimportance of a Nonmarket Willingness-to-Pay for Timber Harvesting," *Ecological Economics,* 9(2), 1994.

Lockwood, Loomis and DeLacy estimate the nonmarket willingness to pay for the logging

of forests in southeastern Australia. The question being investigated is whether people place a value on timber production over and above its commodity value. Such willingness to pay may be motivated by social concerns over unemployment or by a "nonmarket intrinsic production value". They estimate that the nonmarket value placed on timber production is about 4% of the value placed on preservation of the same forests. They caution that this result may not be transferable to situations where there is a substantial traditional component to the harvesting activity.

Loomis, J.B, "Measuring Recreation Use and General Public Preservation Values for Forest Resources: Evidence From Contingent Valuation Surveys," Paper presented at the Forestry and the Environment Conference, Alberta, Canada, Oct. 14, 1994.

Loomis argues that passive-use values must be taken into account in order to develop sound forest-management policies. Estimates of the relative and absolute and relative magnitudes of passive-use values are tabulated from a survey of contingent valuation studies. It is found that passive-use values are large relative to recreation benefits. It is also argued that the passive-use value alone can often outweigh the commodity benefits of forests.

Loomis, J.B. and A. Gonzales-Caban, "Estimating the Value of Reducing Fire Hazards to Old Growth Forests in the Pacific Northwest: A Contingent Valuation Approach", *Wildland Fire,* forthcoming.

Loomis and Gonzales-Caban employ a contingent valuation mail survey to estimate the value to Oregon residents for reducing the risk of destruction by fire of critical spotted-owl habitat in old-growth forests. They find a $77 per household willingness to pay for a reduction of 3,500 acres of critical spotted-owl habitat burned. Although their study was limited to Oregon, it is likely that the reduced fire risk would be valued nationwide, just as setting aside old-growth acreage is. As with other forest preservation policies, it is likely that passive-use motives would account for an important proportion of this total-value estimate.

Loomis, J.B., M. Lockwood, and T. DeLacy, "Some Empirical Evidence on Embedding Effects in Contingent Valuation of Forest Protection," *Journal of Environmental Economics and Management*, *25,* 1993, 45-55.

This study involves a further analysis of the results reported in Lockwood, et al. (1993). In this paper the authors test for the presence of respondent "embedding" in contingent valuation studies. While results on total valuation of forest resources are reported, those interested in what the data from this study reveal regarding passive-use values are advised to consult Lockwood, et al. (1993).

Olsen, D., J. Richards, and R.D. Scott, "Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs", *Rivers,* 2(1), January 199 1.

Olsen, Richards and Scott report results from a contingent valuation study of the willingness to pay of Pacific Northwest residents to double the size of salmon and steelhead runs by the year 2000. The study population consisted of Pacific Northwest households (Pacific Northwest is not defined in their paper). They asked respondents to categorize themselves as "user", "nonuser with some probability of future use" and "nonuser, with no probability of future use". For these groups they calculate total value estimates of (on an annual, per-household basis) of $74.16, $58.56 and $26.52. The method employed in this study would not be expected to yield true estimates of the use and passive-use categories. While the estimates from the non-user categories could be interpreted as passive-use-value estimates, the increment to value in the user category cannot be regarded as use value, as users may derive higher passive-use value as well.

Pope, C.A., III and Jones, J.W., "Value of wilderness designation in Utah," *Journal of Environmental Management, 30:* 157-174, 1990.

Pope and Jones employ the contingent valuation method to estimate the willingness to pay for wilderness preservation in Utah. The study population consisted of Utah households. Average annual household willingness to pay ranged from $52.72 for preservation of 2.7 million acres to $92.21 for preservation of 16.2 million acres. This study was not designed to estimate use and passive-use values separately. However, questions regarding recreational habits of respondents yield some information which the authors interpret as meaning that the difference in willingness to pay between wilderness recreationists and non-recreationists is "relatively small".

Rubin, J., Helfand, G., Loomis, J., "A Benefit-Cost-Analysis of the Northern Spotted Owl - Results from a Contingent Valuation Survey," *Journal of Forestry,* 1991, 89(12), pp 25-30.

Rubin, Helfand and Loomis report results from a contingent valuation study of residents of the state of Washington. This study was conducted in order to estimate the value of ensuring the preservation of the northern spotted owl, and focused on the preservation of the owl itself (rather than focusing on its role as an indicator of health of the old-growth forest). They find a within-sample mean annual value of $49.72 per household, which is adjusted downward to $34.84 based on the demographics of the respondents vis-a-vis the state as a whole. While they also provide values for the rest of the nation, these are based on the authors' speculation, as they have no observations outside of Washington state.

Walsh, R., R. Bjonback, R. Aiken and D. Rosenthal, "Estimating the Public Benefits of Protecting Forest Quality," *Journal of Environmental Management, 30, 255-268,* 1990.

This paper describes a contingent valuation study which was employed in an effort to

estimate willingness to pay to protect forest quality. The study region was the state of Colorado and the issue concerned the effect of insect infestation on the character of Colorado forests. The structure of their survey instrument allows them to apportion total willingness to pay into components for recreation use, option, existence and bequest motives. Recreation use value is calculated to be 27.4% of total willingness to pay, and comes to approximately $13.00 per household per year. The passive-use components are estimated to be $34.00 per household per year.

Walsh, R., J. Loomis and R. Gillman, "Valuing Option, Existence, and Bequest Demands for Wilderness," *Land Economics,* 60( 1): 14-29, 1984.

Walsh, Loomis and Gillman report results from a contingent valuation study on the willingness to pay for additional wilderness protection in Colorado. Respondents were asked to determine their willingness to pay for four "quantities" of wilderness protection, ranging from 1.2 million acres to 10 million acres. In addition, respondents in this mail survey were asked to allocate their willingness to pay among four categories: recreation use, option, existence and bequest. The annual household passive use value ranged from $13.92 for the 1.2 million acre preservation scenario to $3 1.83 for 10 million acres (see Table II for more detail). The percentage of total value accounted for by passive use ranged from 54% for 1.2 million acre to 3 8% for 10 million acres.

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## Appendix:
## Search Method

The primary focus of the literature search was to obtain references pertaining to the measurement of passive-use values for public forestlands. The search consisted of three fundamental components: 1) database searching, 2) bibliographic cross-referencing, and 3) direct contact with experts in the field.

The first tier of our search was an exploration of databases and bibliographies. Databases on CD-ROM included *Econlit*, the *Social Science Citation Index, AGRICOLA*, and *AGRISEARCH.* We also employed on-line information technology, including the *Social Sciences of Forestry* index, *GOPHER,* and the University of Minnesota system. Given that passive-use studies predominantly employ the contingent valuation method, we also employed the comprehensive set of references assembled by Carson, et al. (1994), *A Bibliography of Contingent Valuation Studies and Papers.* This list contains 1,672 references and allowed us to identify pertinent studies not uncovered by other search methods. This stage of the search produced a large set of references from which we could focus and extend the search.

Database searches typically fall short of being comprehensive because a number of government documents, working papers, unpublished studies and conference papers are frequently not cataloged on these indexes. In order to locate such material, it was necessary to cross-reference the bibliographies of the papers we had already obtained. This process yielded an additional collection of sources.

The third aspect of our search was to directly contact those people who had significant involvement in this area of research. The following were among the people we contacted (none of whom are in any way responsible for any errors or omissions contained in this report):

Richard Bishop
Professor of Agricultural Economics, University of Wisconsin-Madison

Chris Neher
Bioeconomics, Missoula, Montana

John B. Loomis
Associate Professor of Agricultural and Resource Economics,' Colorado State University

V. Kerry Smith
Professor of Environmental Economics, Duke University

These researchers were able to direct us to some less visible studies that had been or were currently being conducted. In addition, Forest Service experiment stations were contacted in order to obtain papers or conference "Proceedings" volumes pertaining to the issue.