NATIONAL FORESTS 1891-1991

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The Legacy of Early Foresters

When forestry emerged as a profession in the United States in the first decades of the twentieth century, many early practitioners relied on western European management techniques, which had been developed in response to the depletion of old-growth timber stands. Based on this forest history, advocates of scientific forestry in the United States warned that destructive timber practices—including the absence of sustained-yield management—would lead to a timber famine. Professional forestry in the United States undertook to ward off the inevitable famine through increased forestry productivity to meet predicted future demand. Management of the resulting increased supply was to be based on scientific conservation or wise use.

The demise of the Great Lakes timber industry in the late nineteenth century gave credence to foresters' fear of a timber famine at a time when the lumber industry was a major contributor to the national economy. Although a true scarcity never occurred, the potential became a legacy of timber management for the Forest Service. According to historian David Clary, this explains the present difficulty within the agency in adjusting to pressures for a reduced timber program.

To prevent famine and to encourage private owners to practice sound forestry, sustained-yield management was stressed by Fernow, Pinchot, and Carl Schenck. Fernow, however, felt that the private sector lacked an incentive to practice scientific forestry, and in his *Economics of Forestry* (1902) argued for government control. Government foresters Fernow and Pinchot originally advocated scientific forestry only to the private sector. Not until passage of the 1897 act that defined the purpose of the federal reserves could they begin to demonstrate the economic merits of sustained-yield forestry.

Although several authors claim credit, the 1897 Organic Act in its final form reflects Fernow's language. His 1891 report to the Secretary of Agriculture recommended that the reserves be managed "for preservation of waterflow and continuous timber supply," with scenery and wildlife secondary concerns. What finally became Forest Service policy in 1905, however, reflects Pinchot's views. For example, Fernow was trained in the domesticated forests of Germany and did not include fire and grazing in the science of forestry. Pinchot was more aware of the North American need for grazing and fire control. Although personal differences led to an estrangement between the two, they remained united on the importance of profit as the only incentive that would induce the private sector to practice sound forestry.

Contrary to the cartoon image of rapacious timber barons, sectors of the industry supported the creation of federal reserves because they could limit new competition and stabilize the market. In fact, early timber sales from national forests generated little revenue because industry pressured the Forest Service not to flood the market. Due to adequate private supplies, less than 2 percent of the nation's lumber at the beginning of World War II came from national forests. The rapid population and housing boom in the next decades did contribute to a declining private timber supply in the Pacific Northwest, and government sales grew in response.

Although certain ages and types of wood became scarce, the predicted wood famine never happened. The agency has fulfilled its historic mission to supply wood. But in an era when private industry practices sound forestry, the mission of the agency is debated. Do we want the managed forests of Europe, or the natural North American wilderness that existed only 200 years ago?

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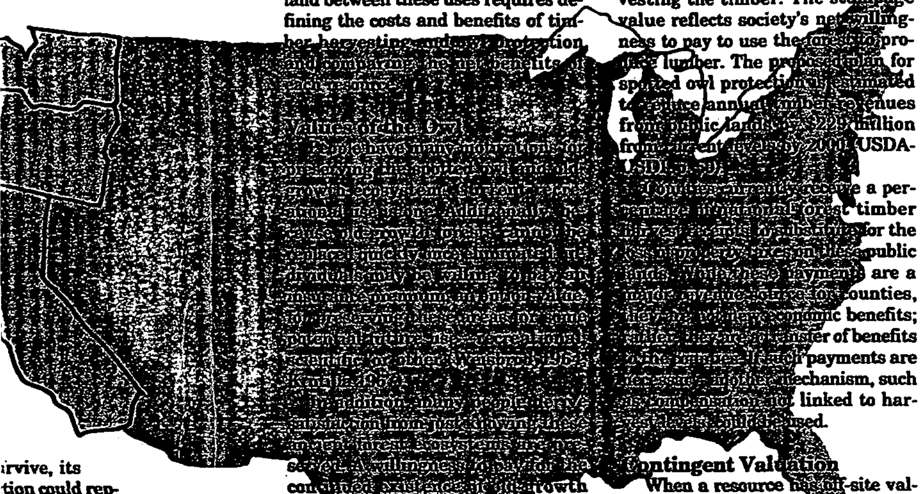
ch attention has focused on otted owl as a symbol of envi- ntal concern over old-growth. ically, the owl is an indicator d-growth temperate ecosys- the trees, associated plant unities, and wildlife species and their optimal habitat in forests. If the spotted owl can-



irvive, its tion could rep- : a lack of viability d-growth habitat itself. nation of an ecosystem, itself a e resource, clearly has greater or society than mere extinction owl.

conomic Approach

ile the economic costs of spot- l protection (lost jobs and tim- ave received a great deal of at- n, less attention has been paid economic benefits of protecting otted owl. This study provides evidence on these benefits by ating how much residents of ington State are willing to pay l protection. These calculations are then statistically adjusted to provide estimates of how much people on the West Coast and nationwide would pay. Finally, these benefits are compared to Forest Service cost estimates for spotted owl protection. Though these extrapolated results should be considered approximations, they demonstrate that the owl provides substantial benefits to many people, and that the contingent valuation approach can be used to develop estimates of the value of the spotted owl and its associated habitat.

The economic principle of maximizing social well-being seeks the combination of timber and spotted owls that gives the greatest net gain (benefits less costs) to the public. Determining the optimal allocation of land between these uses requires defining the costs and benefits of timber harvesting and [illegible] protection, and comparing the net benefits of each resource.

Values of the Owl

People have many motivations for preserving the spotted owl and old-growth ecosystems [illegible] Additionally, because old-growth forests cannot be replaced quickly once eliminated, individuals may be willing to pay an insurance premium [illegible] for preserving these areas for some potential future use [illegible] scientific or other (Weisbrod 1964, Krutilla 1967). In addition, many people derive satisfaction from just knowing these ancient forest ecosystems are preserved. A willingness to pay for the continued existence of old-growth forests and unique species generates an existence value (Krutilla 1967, Randall and Stoll 1983). Finally, many people today would be willing to pay a bequest value for the satisfaction of knowing that current preservation will enable future generations to enjoy these ecosystems.

Recreation, option, existence, bequest, and commercial values constitute the total economic value of resources (Randall and Stoll 1983, Loomis et al. 1984). Studies have shown that option, existence, and bequest values can be two to nine times greater than the recreation value of a nonmarketed natural resource (Walsh et al. 1984, Loomis 1987a).

Timber Forgone

In the short run, the costs of forgone timber production are the net value of the timber and related employment losses. The calculation of lost jobs must be done carefully: many positions in the timber industry are being lost to factory automation, overseas log shipments, and the already reduced supplies of old-growth in the Pacific Northwest, independent of wilderness or owl protection (Helfand and Emerson 1983). Only additional jobs that are lost due to spotted owl protection should be included.

Once employment shifts have been made, the economic cost to society of spotted owl protection is the forgone revenue net of costs of harvesting the timber. The stumpage value reflects society's net willingness to pay to use the forest to produce lumber. The proposed plan for spotted owl protection is estimated to reduce annual timber revenues from public lands by $229 million from current levels by 2000 (USDA-USDI [illegible]).

Counties currently receive a percentage of national forest timber [illegible] for the [illegible] public lands. While these payments are a major revenue source for counties, they are not new economic benefits; rather, they are a transfer of benefits [illegible] If such payments are necessary, [illegible] mechanism, such as compensation not linked to harvest levels, could be used.

Contingent Valuation

When a resource has off-site values (such as option and existence value), no direct market information exists to calculate its dollar amount. The primary technique used by economists, the contingent valuation method (CVM), involves developing a simulated market (Davis 1963, Loomis and Walsh 1986, Mitchell and Carson 1989). CVM elicits respondents' willingness to pay for varying quantities or qualities of a good (for both direct and off-site benefits). Using a questionnaire format, a CVM study describes the good to be valued and then asks how much an individual would pay for alternative levels of the good. CVM has been recommended by the U.S. Water Resources Council for benefit-cost analyses, and by the U.S. Department of the Interior for valuing resource damage.

Data Sources

In February 1987, surveys were mailed to Washington residents randomly selected from lists maintained by Pacific Northwest Bell. The survey described the spotted owl, its habitat, its status as a sensitive species, and the fact that its habitat can also be used for commercial purposes.

Of the 1,200 surveys sent out, about 10% were undeliverable. Of the 253 surveys returned (a 23% response rate), 249 were suitable for calculating summary statistics. In the analysis below, an additional 30 observations were eliminated because of missing data on variables used in the regression, and 3 surveys were discarded because the stated annual valuation of the spotted owl was greater than 10% of per capita income. Readers of this analysis should take into account that both the original sample and the response rate were relatively small.

A comparison of the socioeconomic characteristics of the survey respondents with those of all Washington State residents shows some response bias. The mean educational level of the survey respondents was 15.25 years, almost a four-year college degree. Only 19% of Washington residents over 25 years of age in 1980 had completed a college degree (U.S. Bureau of the Census 1988).

With the mean income level on survey returns at $35,143, and a mean surveyed family size of 2.82, per capita income of survey respondents was $12,662. Per capita income for Washington residents as a whole was $15,599 (U.S. Bureau of the Census 1989) with an average household size of 2.54 (U.S. Bureau of the Census 1988). Thus, the income in our sample group is less than the state average. We then statistically adjusted the sample's reported "willingness to pay" to overall state characteristics using the regression analysis described below.

Willingness to Pay

One survey question was "Please check off in the box below the largest amount that you would be willing to pay per year to be 100% sure that the northern spotted owl will exist in the future." Recipients were told that they would not actually be asked to pay this amount. Given check-off values ranging from $0 to $500, the average willingness to pay was $49.72 per year (*table 1*). Interestingly, when this same question was asked under the scenario that funds would come from other federal programs, respondents' willingness to pay increased.

Table 1. Estimated annual willingness to pay.

	Household willingness to pay	Number of households (x 1,000)	Aggregate willingness to pay (x 1,000,000)
Unadjusted results	$49.72		
Adjusted results			
Washington	$34.84	1,801	$ 62.7
Oregon	$36.91	1,085	$ 40.0
California	$20.88	10,722	$ 223.9
Subtotal			$ 326.6
Rest of USA	$15.21	75,871	$1,154.0
Total			$1,481.0

This approach provided a direct measure of a sample household's willingness to pay (WTP). To adjust sample WTP to general Washington household WTP, a regression equation relating household WTP to socioeconomic characteristics of the households was estimated. If factors like education and income are related to WTP, and if the sample level is different from the population level, an "adjusted WTP" can be calculated by substituting state average values for socioeconomic statistics. The resulting predicted WTP should match general state household characteristics (Schulze et al. 1983, Loomis 1987b). The adjusted willingness to pay for each Washington household to be 100% certain of spotted owl survival was calculated to be $34.84 per year. Total Washington willingness to pay was estimated to be $62.7 million per year.

One factor that makes these numbers conservative is the failure to include a check question, asked in most CVM surveys, to screen out zero WTPs that reflect a protest to the simulated market rather than the respondent's true WTP. Some people who strongly value environmental preservation balk at having to pay, believing preservation of the natural environment is their right. Since no check questions were asked, all 51 zero bids were included. This conservative approach may help to balance any overestimate resulting from the statement that individuals were not required to pay the amount that they indicated.

Nationwide Extrapolations

Due to the public goods nature of preservation, protecting spotted owls on federal lands in Washington and Oregon would provide benefits to people throughout the nation. The following extrapolations are meant to be illustrative rather than conclusive.

Studies have shown that willingness to pay decreases with distance from the affected area. To adjust WTP for distance, we used an estimate developed from Stoll and Johnson (1984) that WTP decreases about 10% for every 1,000 miles in distance.

This distance-decay factor was applied to the Washington WTP equation to predict what West Coast households would pay. Because Oregon's population is in the spotted owl habitat area, the distance-decay factor is zero and Oregon's socioeconomic characteristics are used directly in the Washington equation. We assumed that California residents on average visit Oregon or Washington national forests or parks once per year, and that Los Angeles is the population-weighted center of California. Because Los Angeles is about 1,000 miles from Portland, the predicted WTP of California households from the regression

Table 2. Annual opportunity costs of spotted owl protection (in millions of dollars).

	Employment costs, 1995	Employment costs, 2000	Short-run timber costs	Short-run total costs	Long-run total costs
Washington and Oregon	$210.2	$438.3	$452.3–$778.2	$662.5–$1,216.5	$452.3–$707.8
California	$ 23.9	$ 58.5	$ 44.8–$ 60.3	$ 68.7–$ 118.8	$ 44.8–$ 54.6
TOTAL	$234.1	$496.8	$497.0–$838.4	$731.1–$1,335.2	$497.0–$762.4

Table 3. Benefit-cost comparison of spotted owl protection, by region (in millions of dollars, using high-cost estimates from table 2).

	Benefits	Costs	Net benefits
Washington and Oregon			
Short run	$ 102.7	$1,216.5	−$1,113.8
Long run	$ 102.7	$ 452.3	−$ 349.6
California			
Short run	$ 223.9	$ 118.8	+$ 105.1
Long run	$ 223.9	$ 44.8	+$ 179.1
Total U.S.			
Short run	$1,481.0	$1,335.2	+$ 145.8
Long run	$1,481.0	$ 497.0	+$ 984.0

equation was reduced by 10%.

The same process was used to obtain an estimate of WTP for the rest of U.S. households (*table 1*). In this case, we conservatively assumed that the population-weighted center of the rest of the country is New York City, 2,900 miles from Portland, and that no non–West Coast residents visit a Washington or Oregon national park or forest. Using the U.S. average for the other variables in the WTP equation and adjusting the value down by 29% gives the distance-adjusted WTP.

Within Washington and Oregon, a 100% guarantee of the owl's survival is worth $103 million; with California included, that figure increases to $327 million. The rest of the United States is estimated to contribute the bulk of the willingness to pay for the owl, $1.15 billion, for a total U.S. value of almost $1.5 billion.

It is difficult to determine whether these values represent willingness to pay for the spotted owl alone or for old-growth in general. There are biological reasons to link the two, since the extinction of one may well mean serious damage or extinction to the other.

Cost of Owl Protection

The costs of spotted owl protection can be usefully separated into short-run and long-run costs (*table 2*). As discussed, the long-run costs include only the value of the timber given up. In the short run, additional costs may be incurred as workers are displaced from their current jobs. Over time, as workers find other positions, these costs will shrink.

With current employment as the baseline, an estimated 13,272 timber jobs will be lost by 1995 and 28,165 by 2000 (USDA-USDI). These figures probably overestimate the effects of spotted owl policy since they do not take into account the ongoing reduction in jobs in the forest industry. The average yearly pay, $17,640, was determined from U.S. Department of Labor (1990, p. 99) estimates of hourly rates in lumber and wood products manufacturing. Using this number, total job loss costs in all three West Coast states for 1995 would be $234.1 million and for 2000 would be $496.8 million.

Short-run costs are calculated by estimating the revenue per board foot for timber in 1995 (USDA-USDI, p. 42, 50–51) and multiplying that value by the reduction in the number of board feet harvested in those years. This study uses two separate assumptions: that timber prices are constant over time, and that timber prices are increasing over time. The calculations thus give a range of values for both short-run and long-run costs: a constant-price assumption (the lower figure) and a rising-price assumption (the higher figure).

Long-run costs are based on estimates of forgone timber revenue (USDA-USDI, p. 50–51). The range of values is found by calculating the implied value per board foot in 2000 and multiplying that value by the amount by which timber harvesting is reduced (USDA-USDI, p. 42). Ranges differ from short-run costs because of lower revenue values for the rising-price assumption.

Unfortunately, this study only looks at the effects on public lands. To the extent that timber prices increase, higher profits from private lands will reduce this net cost to society. Since no information is available on the effects of spotted owl protection on private timber profits, the values given here overestimate the costs of forgone harvests.

As seen in *table 3*, total costs of spotted owl protection range from about $500 million per year to about $1.3 billion per year. Mead et al. (1990) found a total cost in the first year of spotted owl protection of $932 million, including lost timber, jobs, and mill closures; over 50 years they estimated the costs at $25.7 billion, which represents an annualized value of $1.2 billion at their 4% discount rate. Though the Mead study included more costs than does this study, its results are of the same order of magnitude as those presented here.

Table 3 breaks down benefits and costs of owl protection by region using high-cost estimates. The primary spotted owl region, Washington and Oregon, demonstrates negative net benefits, even using the smallest estimate for long-run costs of owl protection. On the other hand, the estimated benefits in the rest of the U.S. are greater than the costs, using either short-run estimate. If the high estimate of short-run total costs is used, the small difference between benefits and costs—only 10%—and the uncertainty in the benefits estimation suggest that benefits may be exceeded by costs. In contrast, if the high estimate of long-run costs is used, benefits are about double costs, suggesting that benefits may outweigh costs even given the uncertainty involved.

A Possible Solution

A natural concern is the reliability of the extrapolations from the Washington results to the rest of the country. In Washington and Oregon, the net costs of owl protection range from $350 million to $1.1 billion. One way to consider the problem is to determine the per-household WTP values in the rest of the nation necessary to cover these net costs. For the 87 million households outside Washington and Oregon, each household would have to be willing to pay between $4.04 (low estimate) and $12.86 (high estimate) per year; the WTP estimate of $15.21 per household exceeds these threshold values.

This approach to the spotted owl conflict highlights a possible solution. Since spotted owl preservation appears to provide a social gain, and since the cost of preservation falls disproportionately on a few individuals, perhaps the gainers should compensate the losers. Even if the most costly estimate, $1.3 billion, is paid, gainers would still receive $146 million in benefits from owl preservation. The multiple-use mandate for national forests, however, does not give clear rights to compensation to any particular beneficiary of forest uses. Nonetheless, compensation may provide a resolution to the current debate. Probably the most efficient mechanism for such compensation is to tax the general population and use that revenue to pay affected workers.

Conclusions

While much has been written on the costs of protecting the spotted owl, the economic benefits have received much less attention. A contingent valuation survey has shown that people are willing to pay for protection of the spotted owl and the associated ancient forest ecosystem. In fact, results suggest that people nationwide are willing to pay enough for owl protection to compensate

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those who might suffer from that preservation.

The benefit numbers given here are estimated amounts, not definitive amounts. This survey suffers from a low response rate and a limited geographical basis. A more extensive survey would provide better information. With better data, more sophisticated statistical techniques could provide a more accurate benefits estimation. In developing the results given here, attempts have been made not to exaggerate owl benefits. It is hoped that this effort will encourage other researchers to develop more reliable estimates of the economic benefits of protecting the northern spotted owl. ■

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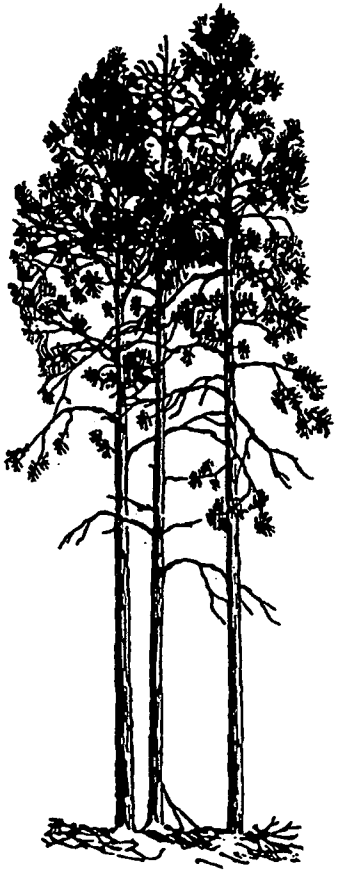
Public Regulation of Private Forestry

Proactive policy responses

By Frederick W. Cubbage



Most foresters are noted for opposing regulation in general and state forest practice acts in particular. Yet the amount of oversight is increasing. Depending on the state and locality, land management may be affected by Best Management Practice guidelines, county logging rules, state highway department restrictions, smoke management regulations, state forest practice acts, federal wetlands law, water management or soil erosion guidelines, and herbicide and pesticide restrictions. The question is no longer whether forestry operations are regulated now or will be subject to more regulation in the future. The question is who will promulgate, administer, and enforce whatever regulations are enacted.

Present Efforts

Most states in the West and two in the East already have state forest practice acts. From 1937 to 1955, 15 states passed laws controlling forest practices in some fashion. Since then, 8 states have strengthened their old laws or passed new acts. Modern legislation often contains strict timber harvesting controls, regeneration standards, and penalties.

Many states in the East have other regulations (Cubbage and Siegel 1988). For example, Maryland's seed tree law governs harvests on pine lands. The state also requires a management plan before logging can begin. The Florida Division of Forestry developed voluntary Best Management Practices (BMPs) for silvicultural operations, and the forestry BMPs must be used during silvicultural operations near streams, rivers, lakes, and wetlands. A Virginia seed tree law requires trees be left for regeneration, and the state has developed an extensive voluntary BMP education program with compliance monitoring. West Virginia also developed an extensive program of BMP enforcement in the 1980s, coupled with logger registration.

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