Environmental Equity and the Conservation of Unique Ecosystems: An Analysis of the Distribution of Benefits for Protecting Southern Appalachian Spruce–Fir Forests

JOSEPH E. ALDY

Council of Economic Advisers
Washington, DC, USA

RANDALL A. KRAMER

Duke University Nicholas School of the Environment
Durham, North Carolina, USA

THOMAS P. HOLMES

U.S. Department of Agriculture Forest Service
Research Triangle Park, North Carolina, USA

Some critics in the environmental equity literature argue that low-income populations disproportionately have environmental risks while the wealthy and better educated gain disproportionately from protecting unique ecosystems. We test this hypothesis in an analysis of the decline of southern Appalachian spruce–fir forests. We calculate willingness-to-pay measures for forest protection through a contingent valuation survey. Survey respondents consider spruce–fir forest protection to be a normal good (income elasticity: 0.421). Education does not influence willingness to pay. In an assessment of willingness to pay scaled by income, we found that income has a negative effect, implying that as income increases, willingness to pay as a percentage of income decreases. Education weakly influences willingness to pay in this assessment. Given the substantial existence and bequest values associated with these forests, these results substantiate our rejection of the hypothesis that conserving this unique ecosystem only benefits the wealthy and better educated.

Keywords contingent valuation, ecosystems, environmental equity, spruce–fir forests

Over the past three decades, the federal government has taken an active role in the management of the nation's environmental quality and maintained and strengthened its role as steward of nearly one-third of the nation's lands. Through major legislation on air and water quality, solid and hazardous wastes, toxic chemicals, and pesticides, as well as wilderness areas, national parks, endangered species, and national forest planning, the United States has achieved significant improvements in environmental quality and natural resource management. While these improvements benefited the American public, they came with substantial costs (Freeman 1982; Carlin et al. 1992). Continued improvements in environmental quality and

Received 17 June 1997; accepted 2 February 1998.

The views expressed in this article do not necessarily represent those of the Council of Economic Advisers or the U.S. Department of Agriculture. The authors thank the anonymous referees for their constructive comments. As usual, all errors and omissions are the sole responsibility of the authors.

Address correspondence to Joseph E. Aldy, Council of Economic Advisers, Executive Office of the President, Room 319, Old Executive Office Building, Washington, DC 20502, USA. Email: aldy_j@a1.eop.gov

Society & Natural Resources, 12: 93–106, 1999

0894-1920/99 $12.00 + .00

natural resource management appear more challenging in light of increasing costs and present budget constraints (U.S. House of Representatives 1995).

During this period when the nation made significant investments to restore its environmental and natural resource quality, some demographic groups did not fully reap the rewards of these endeavors. While the federal government, through the Clean Air Act, virtually eliminated airborne lead pollution, minority and low-income children remain much more susceptible to lead poisoning in urban environments than white and wealthy children. The federal government has been accused of insufficient cleanups at Superfund sites in predominantly poor and minority areas. Minority and low-income populations appear to bear a disproportionate burden of health risks from the siting of hazardous waste and municipal solid waste facilities (Bullard 1994, 239–240).

In the context of the present budget austerity, many have called the federal government to prioritize its activities (U.S. House of Representatives, 1995). At the same time, the federal government has begun to consider environmental equity issues in its decision making (Gore 1993; Federal Actions 1994). Some have called on the federal government to integrate equity concerns in its priority-setting process (Bullard 1994, 1995).

As the federal government attempts to set its priorities better through the constraints of an environmental equity framework, some new questions should be posed. First, if the disproportionate burden of environmental risks creates injustice, then shouldn't the disproportionate accrual of benefits also create injustice? If, through some environmental and natural resource programs, only the wealthy gain benefits, in effect making the wealthy wealthier, then wouldn't this be considered inequitable? Second, if environmental protection requires policymakers to address it through an equity framework, then shouldn't management of natural resources also require analysis through such a framework? From a larger perspective, if the government mandates that consumers of private goods receive equitable treatment (e.g., fair housing practices), and if the government provides public goods (such as education and environmental protection) under an equity framework, then shouldn't another public good, such as the provision of national parks and wilderness areas, also be analyzed through this framework?

In this article, we evaluate the environmental equity issues associated with the conservation of a unique natural resource, the southern Appalachian spruce–fir forests. In the next section, we review the environmental equity literature and discuss the importance of assessing the benefits of environmental and natural resource management. Then we describe the southern Appalachian spruce–fir forests and the damage they presently suffer. Then, we provide a description of a survey to assess the household values for these forests, present results of the statistical analysis, and discuss future research needs.

Environmental Equity Literature

Environmental equity and environmental justice have come to the political and academic forefront primarily over the past decade. Activists began raising issues of environmental equity in the 1970s; however, the 1982 siting of a polychlorinated biphenyl (PCB) landfill in Warren County, NC, served as the dawning of the environmental equity movement on the national scene. Since this event, the environmental equity literature has focused on local issues usually concerning exposures to environmental risks by minority and/or low-income populations.

In most cases, the literature addresses health concerns resulting from siting of municipal solid waste landfills and hazardous waste disposal facilities, Superfund sites, and urban lead poisoning. The United Church of Christ Commission for Racial Justice (1987), Anderton et al. (1994), Bullard (1990), and Goldman and Fitton (1994), among others, studied the relationship between location of hazardous waste sites and racial and socioeconomic characteristics. Hamilton (1993, 1995) assessed the decisions of hazardous waste facilities to expand in the context of affected minority populations. Sexton and Anderson (1993) edited a special journal issue on environmental health risks and minority and low-income populations. Several studies in Westra and Wenz (1995) addressed local environmental health risks posed to minority populations. Rosen (1994) provided evidence of environmental injustice and the response through an emerging grassroots movement. Capek (1993) noted how environmental justice evolved out of grassroots campaigns, and is still characterized by these local movements. The U.S. House of Representatives (1992) addressed the issue of lead exposure to minority and low-income children.

The environmental equity literature has concentrated on the local environmental health risks borne by low-income and minority populations. As a social justice issue, the field of environmental equity appears unusually constrained. Very few papers have considered the distribution of benefits of government programs; however, some authors have suggested that the government should do so (Graham 1994, 19). In addition, few papers consider the environmental equity issues associated with conserving unique ecosystems, such as national parks and wilderness areas, especially over large spatial scales, although some have noted that the demographics of recreational natural resource users do not match the demographics of the nation's population (Goldsmith 1994, 20; Hendon 1991, 107).

While the environmental equity literature ignores the distribution of benefits, other social issues, such as education, have attracted significant attention to the benefits distribution. Senator Paul Simon (1994) commented that "One of the goals of public education is to reduce the inequities into which we are born" (p. 1). However, Simon lamented that financing of education has become inequitable, further exacerbating social inequalities. In the 1970s, at least 22 states implemented school finance system reforms in order to equalize funding opportunities for local school districts (Carroll 1979, 1). In more recent years, local school districts have sued their state governments over the inequitable nature of school funding.[1] Just as in the environmental arena, the debate over educational resources has often focused on the conflict between equity and efficiency.[2] In the case of Kentucky, and illustrated by other states' reforms, governments have aimed to provided equitable educational resources.

There appears to be a natural parallel between equity in education and equity in environmental and resource management. Education and environmental and resource management may both be considered public goods.[3] As such, governments provide for both of these through public schools and universities and environmental protection, parks, wilderness areas, and recreation areas. Since both types of goods are provided by governments through decisions made by policymakers, the magnitude and distribution of the benefits and costs of providing these goods are important inputs in those decisions.

In addition to ignoring the importance of benefits of environmental and resource management, the environmental equity literature has not focused on the use of natural resources, especially national parks and other unique ecosystems.

Some writers perceive that the national parks and other outdoor recreation sites primarily benefit the wealthier, better educated, and predominantly white components of the nation's population. Stewart (1977) presented his perception of the distribution of benefits and costs:

> It is the wealthy and educated that will primarily benefit from the maintenance of pristine environments. It is the poor who will bear much of the burden- the rural poor denied the fruits of development, the urban poor choking on pollution that cannot be exported to more thinly populated areas. (p. 476)

Hendon (1991) found that wilderness use is often "attributable to income, opportunity, barriers such as discrimination, as well as the preferences and life styles of these individuals" (p. 107). Riddiough (1990) questioned whether the nation should "clean up the national parks so that a few well-to-do people can use them, while other, poorer people have to try to cope with toxic waste in their back yards."[4] Representative Don Young of Alaska derided the creation of national parks in Alaska as simply a decision to benefit "jet-setting hippie backpackers" (GOP Floats Idea 1995). In the following section, we test Stewart's hypothesis that only the wealthy and educated benefit from management of unique natural resources in an analysis of the decline of the southern Appalachian spruce–fir forests.

The Southern Appalachian Spruce–Fir Forests

The southern Appalachian spruce–fir forests occur in North Carolina, Tennessee, and Virginia at elevations above 4500 ft. Only 7% of the lands supporting spruce–fir forests are privately owned (Dull et al. 1988). The spruce–fir forests cover more than 34,000 hectares in the southern Appalachians, with 80% existing within the Great Smoky Mountains National Park (GSMNP) boundaries. The Smokies' spruce–fir forests are the only temperate rainforests in the United States east of the Mississippi River and support 132 vascular plants, 8 of which are endemic to the southern Appalachian spruce–fir forests (Shank 1954, 335; King and Stupka 1950, 41). The spruce–fir forests serve as the southern edge of many northern plant species, and the northern edge of many southern plants. These forests also serve as a significant source of recreation in the southern Appalachians, especially in the GSMNP, Mount Rogers National Recreation Area, several national forests, and parts of the Appalachian Trail.

The Decline of the Southern Appalachian Spruce–Fir Forests

The U.S. Forest Service studied the southern Appalachian spruce–fir forests in the late 1980s (refer to Dull et al. 1988). By aerial photography, the Forest Service estimated the magnitude of forest decline. The Forest Service employed a three-tiered classification system, where light mortality referred to 30% standing dead dominant trees, heavy mortality referred to 30% to 70% standing dead dominant trees, and severe mortality to more than 70% standing dead dominant trees. Table 1 illustrates the degree of mortality at the various areas supporting spruce–fir populations.

TABLE 1 Fraser Fir Mortality in the Southern Appalachians.

Area	Light (ha)	%	Heavy (ha)	%	Severe (ha)	%
GSMNP	14,433	73	2,692	6	10,365	21
Black Mountains	2,229	76	120	4	573	20
Balsam Mountains	834	37	223	10	1,210	53
Roan Mountain	170	25	236	34	282	41
Mount Rogers	640	100	0	0	0	0
Grandfather Mountain	267	71	50	13	59	16
Total	18,573	54	3,321	10	12,489	36

Note. From Dull et al. (1988, 23).

Several recent changes in the southern Appalachian environment have caused the decline of the spruce–fir forests. The introduction of the balsam woolly adelgid, acid deposition, and ozone pollution have stressed the Fraser fir and the red spruce. The adelgid infests Fraser fir trees, causing them to eventually die by preventing the transport of water and nutrients within a host tree (Eager 1984, 42–44). The GSMNP experienced acid precipitation events with pH levels as low as 3.4 in the early 1980s (Carpenter 1982, 77). Acid deposition increases with elevation, as does the codominance of red spruce and Fraser fir (Lovett 1984, 226–227). A recent review article concluded that "regional scale air pollution has played a significant role in the decline of red spruce in the eastern United States" (Johnson et al. 1992, 406). Increased ambient ozone concentrations may cause further decline in red spruce populations (Ross 1985, 81, 83). At Clingman's Dome in GSMNP, 80% of the red spruce exhibit slow growth, canopy dieback, and needle thinning (Peine 1986, 135, 177; Charlier 1992). All three factors may generate a negative synergistic effect on the viability of spruce–fir stands (Charlier 1992).

Use of Spruce–Fir Forests

Since 93% of the southern Appalachian spruce–fir forests exist on public lands, characteristics of the users of these lands may provide some insight into the distribution of benefits derived from the forests. While most of the agencies managing areas supporting spruce–fir stands have not collected demographic information on users, the National Park Service has surveyed the users of the Great Smoky Mountains National Park (Peine and Renfro 1988). The demographic characteristics of all users of the park may serve as a sufficient proxy for the characteristics of the users of the spruce–fir forests within the park, and likely resemble the user characteristics of the other public lands supporting spruce–fir stands. The GSMNP is the most highly visited park in the nation, with visitors coming from all states, but especially those states in the east.

In their study, Peine and Renfro intercepted cars at three major park entrances and randomly interviewed an adult in each vehicle. As Table 2 indicates, users of the park are almost exclusively white. The users are wealthier and better educated than the national averages. These findings are consistent with the perceptions of the users of unique ecosystems discussed earlier. From Peine and Renfro's research, it appears that the benefits of the *use* of a unique ecosystem may be accrued by a specific

TABLE 2 Demographic Characteristics of Great Smoky Mountains National Park Visitors.

Characteristic type	1985 $n = 1595$	1980 Census	1975 $n = 5243$	1970 Census
Mean age	37[a]	30	35[b]	28
Percent male	48[a]	49	50[b]	49
Percent white	98	83	97	88
Percent married	86	66	87	72
Income > $20,000 in current dollars (percent)	82	52	41	25
Income > $20,000 in constant dollars (percent)[c]	31	24	26	19
Attended college (percent)	46	16	51	11

Note. From Peine and Renfro (1988, 15).

[a] All vehicle occupants were included in the analysis. Therefore, for these figures, $n = 5107$, which includes all the members of groups associated with the survey respondents.

[b] For these figures, $n = 14{,}568$, which includes all the members of groups associated with the survey respondents.

[c] Constant dollars are based on the implicit price deflator for the gross national product using 1972 as the base year, where $100 = $100.

population. However, the value of a unique ecosystem includes more than simply the benefits derived from use. Unique ecosystems provide substantial nonuse or passive use benefits to consumers (Krutilla 1967). In order to determine the full environmental equity impact of conserving the southern Appalachian spruce–fir forests, the use and nonuse values held by individuals must be assessed. In the next section, we discuss a contingent valuation study employed to estimate the values for conserving these forests and their environmental equity implications.

Data

The contingent valuation method involves the use of a survey to elicit individuals' willingness to pay for goods. As opposed to revealed preference methodologies, where economists analyze individuals' willingness to pay based on actual consumption decisions, this stated preference methodology assesses individuals' willingness-to-pay values that are contingent on the information provided in the survey. After the survey respondent receives information about the good in question, the respondent answers an experimental willingness-to-pay question. This question can take several forms, including open-ended, payment card, and referendum. In our analysis, we assess individuals' willingness-to-pay values from a contingent valuation study employing the payment card format.[5]

The payment card method was initially developed to avoid the starting-point bias problem associated with iterative bidding games. The payment card presents more structure to the respondent than either an open-ended or dichotomous choice question and may be easier to answer. Although payment cards have been thought to induce range bias (Mitchell and Carson 1989), a recent study found the payment card format to be free of range and centering biases when the correct range of the willingness to pay distribution is included on the payment card (Rowe et al. 1996).

Consequently, the range of values displayed on the payment card should be based on a pretest survey question.[6]

In the spring of 1991, a survey on forest quality was mailed to 1200 households. The format of the survey and its implementation closely followed the Dillman (1978) method. Focus groups and a pretest were used to develop and refine the survey instrument. The sampling frame was households living within a 500-mile radius of Asheville, NC. A sheet of color photographs depicting three stages of forest decline and a map identifying the study area were provided to the sample households. Summary information about forest damage and forest protection programs was also provided.

This survey requested information on household knowledge of spruce–fir decline, visits to these forests, trip expenditures for visits, environmental attitudes, outdoor and environmental activities, demographics, and willingness to pay in additional annual taxes for a protection program for all spruce–fir forests and for those forests along road and trail corridors (approximately one-third of the total).[7] Following the willingness-to-pay questions, respondents were asked to apportion percentages of their willingness to pay bids to use value, bequest value, and existence value.[8] The overall response rate was 52% of delivered surveys (53% of the payment card set).

Results of Regression Models

We developed two statistical models using the LIMDEP software (Greene 1992). In the first model we used a censored ordinary least-squares regression where the dependent variable was the logged willingness to pay for a protection program for those forests along road and trail corridors (see Cameron and Huppert 1989 for a discussion of the need to use a censored model for payment card data). The other model we used was an ordinary least squares regression where the dependent variable was the willingness to pay for a protection program for those forests along road and trail corridors scaled by the logarithm of the respondents' income. Table 3 lists the independent variables used in these models.

Model I

The results of the first model indicate that income is a significant factor determining a respondent's willingness to pay for protecting southern Appalachian spruce–fir forests (see Table 4). The coefficient for the income variable is positive and significant at the 5% level, implying that the richer the household, the more it is willing to pay for the conservation of these forests. The coefficient estimate for income is 0.421, indicating that respondents consider forest protection to be a normal good.[9] This finding conforms to Kristrom and Riera's (1996) results.[10] They "note that the income elasticity is less than one in two prominent 'state-of-the-art' CVM studies, the Imber et al. (1991) (Australian data) and the Carson et al. (1992) study (U.S. data). The 'income elasticities' are in the range of 0.2–0.3" (p. 50). While our income elasticity is slightly larger than the range presented by Kristrom and Riera, it is still statistically different from 1.

The education variable was not statistically significant. Therefore, the perception that the better educated value unique ecosystems more than the less educated is not supported by this analysis. The age variable is also significant at the 5% level, although the coefficient is negative. This indicates that the older the household, the

TABLE 3 Explanatory Variables.

Variable name	Description	Mean (SD)
log(income)	Survey respondents could select from 10 different income categories ($0–$9,999; $10,000–$14,999; $15,000–$29,999; $30,000–$44,999; $45,000–$59,999; $60,000–$74,999; $75,000–$89,999; $90,000–$104,999; $105,000–$119,999; $120,000+). This variable assigns the natural log of the midpoint of the income range to each respondent.	10.38, $31,793 (0.81)
age	Respondent's age.	45.6 (15.3)
gender	1 If male, 0 otherwise.	0.33 (0.47)
education	Survey respondents could select from 21 different education levels where 1–8 referred to grade school, 9–12 referred to high school, 13–16 referred to college, and 17–21+ referred to graduate school.	14.0 (3.3)
active	Survey respondents answered the following question: Which of the following recreation activities do you participate in: 1) sightseeing or driving for pleasure; 2) nature study or bird watching; 3) hiking or backpacking; 4) camping; 5) picnicking; 6) fishing or hunting; 7) bicycling; 8) skiing; 9) white water activities; 10) off-road vehicle use. If the respondent answered yes to three or more of these, then the variable was assigned 1, 0 otherwise.	0.56 (0.50)
envir	Survey respondents answered the following four questions regarding their environmental attitudes and behavior: Do you 1) recycle aluminum, glass, paper or other materials; 2) purchase products made from recycled paper; 3) carpool or take public transportation; 4) give money to environmental organizations or are you a member of any environmental organizations. If the respondent answered yes to two or more of these questions, then the variable was assigned 1, 0 otherwise.	0.59 (0.49)
house	Respondent's household size.	2.82 (1.46)
heard	1 If respondent had read or heard about southern Appalachian forest damage, 0 otherwise.	0.49 (0.50)
raredum	1 If respondent considered protecting rare and endangered species somewhat or very important, 0 otherwise.	0.74 (0.44)
distance	Respondent's distance from Asheville, NC.	312.9 (119.3)

less it is willing to pay for the conservation of forests. This result implies that older generations have weaker preferences for the protection of unique ecosystems. The household size variable is statistically significant at the 10% level, and is also negative, implying that the larger the household, the less it is willing to pay. This is consistent with economic theory, which would hold that smaller households have more disposable income than larger households, *ceteris paribus*.

The environmental attitudes variable is significant at the 10% level and its coefficient is positive. This is consistent with the hypothesis that individuals undertaking environmentally friendly behavior hold higher values for natural and unique areas. The dummy variable for the importance of protecting rare and endangered species is significant at the 5% level and its coefficient is positive. Households believing that protecting rare species is important may believe that protecting rare ecosystems is also important. The preferences undergirding the interest in protecting species likely supports the household's value for protecting ecosystems.

TABLE 4 Willingness to Pay for Protection of Spruce–Fir Corridors.

Variable	Coefficient	*t*-Ratio	Prob | *t* | *x
constant	−3.183	−1.527	0.127
log(income)	0.421	2.033	0.0420[b]
age	−0.0262	−2.457	0.0140[b]
gender	0.0425	0.142	0.887
education	−0.00664	−0.130	0.896
active	0.377	1.264	0.206
envir	0.538	1.935	0.0530[a]
house	−0.190	−1.922	0.0546[a]
heard	0.420	1.539	0.124
raredum	0.752	2.247	0.0247[b]
distance	0.00347	2.884	0.00393[b]

Note. $n = 172$, $R^2 = 0.19$, adjusted $R^2 = 0.14$.
[a] Significant to 10%.
[b] Significant to 5%.

The variable for the distance between the responding household and Asheville, NC (assumed geographic centroid of spruce–fir forests), is significant at the 5% level, and its coefficient is positive, implying that the farther away a household lives from these forests, the more it values them. Households living in close proximity to the spruce–fir forests may consider the vast extent of lower altitude forests in western North Carolina and western Virginia as substitutes and report a lower willingness to pay for protecting the spruce–fir stands than households living farther away.

Model II

The results of the scaled willingness-to-pay model indicate that income is statistically significant at the 1% level and the coefficient is negative (see Table 5). In the context of the first model, this result provides an interesting illustration of the role of wealth in the preferences for conservation of unique ecosystems. While the first model indicates that willingness to pay increases with income, this model finds that willingness to pay as a function of a household's ability to pay decreases as its ability to pay increases. A low-income household would be willing to pay more as a percentage of its income than would a high-income household. This result is contrary to the presumptions that unique ecosystems are luxury goods and that only the wealthy benefit from them. Indeed, the respondents to this survey provide values illustrating that they consider southern Appalachian spruce–fir forests as normal goods. When considering benefits relative to income, conserving this unique ecosystem may benefit low-income households more than high-income households.

This result is consistent with our finding in model I and the recent research by Kristrom and Riera. In a study of another unique ecosystem, Reaves et al. (1995) also found a negative coefficient for the income variable in a similar willingness-to-pay scaled by income model for protection of red-cockaded woodpecker habitat. This result is also consistent with findings in the charitable contributions literature. Hodgkinson and Weitzman (1990) reported that low-income households donated a higher percentage of their incomes to charities than did households with higher

TABLE 5 Willingness to Pay for Protection of Spruce–Fir Corridors Scaled to Income.

Variable	Coefficient	*t*-Ratio	Prob | *t* | *x
constant	0.00810	5.007	0.000[b]
log(income)	− 0.000802	− 4.976	0.000[b]
age	− 0.0000180	− 2.152	0.0329[b]
gender	0.000125	0.527	0.599
education	0.0000773	1.957	0.0521[a]
active	0.000244	1.030	0.304
envir	0.000493	2.264	0.0249[b]
house	− 0.0000813	− 1.031	0.304
heard	0.0000818	0.382	0.703
raredum	− 0.000129	− 0.508	0.612
distance	0.00000124	1.363	0.175

Note. $n = 172$; $R^2 = 0.20$, adjusted $R^2 = 0.15$.
[a] Significant to 10%.
[b] Significant to 5%.

incomes (p. 48). Clotfelter (1985) reviewed 16 econometric studies on charitable donations, and noted that only 3 out of the 16 studies found income elasticities larger than 1.

As in the first model, the age variable is significant at the 5% level and its coefficient is still negative. The education variable becomes significant at the 10% level in this model with a positive coefficient. There may be a weak education effect. In the first model, the income effect precludes any recognition of the role of education in willingness to pay bids. However, once we scale the willingness to pay bids to reflect respondents' ability to pay, education does play a role. Better educated households do appear to value the spruce–fir forests more as a percentage of their income than less educated households. The environmental attitudes variable is significant in this model as well, and has the expected positive coefficient.

Conclusion

If wealthy households predominantly use the spruce–fir forests, why do less wealthy households value them more as a percentage of their income? When asked to apportion their willingness-to-pay bids to various types of value, the average percentage for nonuse values (bequest and existence) was approximately 90%. Only about 10% of the willingness-to-pay bids reflect the households' value for using these forests.[11] While McConnell (1992) indicated that it may not be reasonable to believe that respondents have the cognitive ability to disaggregate their willingness to pay bids into use and nonuse categories, these results do provide at least qualitative evidence of the relative importance of the categories of value.

We fail to find support for the hypothesis that conserving the southern Appalachian spruce–fir forests only benefits the wealthy and the educated. Conservation of this unique ecosystem should pass any equity test for the allocation of resources for environmental and resource goods. This analysis provides an illustration that, given the significance of nonuse values for unique resources, extrapolating household values for a resource based on use trends can result in misleading outcomes.[12]

Additional research is needed to replicate and expand these results to other unique ecosystems. Due to data limitations, this study did not address the distributional effects on minority populations. Further contingent valuation research on other unique ecosystems should incorporate a minority variable to assess if benefits accrue differentially based on ethnic background.

Notes

1. Tinder (1994) provides a discussion of a recent lawsuit in Illinois. In 1989, the Kentucky Supreme Court struck down the state's educational system as unconstitutional. In its decision, the Supreme Court noted that "The system of common schools must be adequately funded to achieve its goals. The system of common schools must be substantially uniform throughout the state. Each child, every child, in this Commonwealth must be provided with an equal opportunity to have an adequate education" (Rose v. Council for Better Education, KY 790 SW 2d 186). Miller et al. (1991) reviewed the effects of this ruling in the 1990 Kentucky Education Reform Act.

2. For example, refer to Secada (1989) for a review of President Reagan's attempt to replace equity with "standards of excellence" reflecting "a concern for more efficient production" (p. 1).

3. One could consider that both goods are not perfectly public because of congestion (see Randall 1987, 176–177).

4. Marie Lynn Miranda argues that this is in fact a false dichotomy. The nation should not make trade-offs between national parks and toxic waste management. Instead, decision makers should prioritize the entire federal budget instead of allocating within the small environment/natural resource pie.

5. For a review of the merits and drawbacks of the contingent valuation method, refer to Arrow et al. (1993), Mitchell and Carson (1989), Hausman (1993), and the fall 1994 *Journal of Economic Perspectives* (vol. 8).

6. The range of values displayed on the payment card used in our survey was based on an open-ended pretest survey question.

7. One-half of the households asked to participate received a survey instrument that employed a payment card elicitation format. The other half received surveys that employed a dichotomous choice (referendum) format. For more discussion of the advantages and disadvantages of each format type, see Mitchell and Carson (1989), chapter 4. In this article, we use the data from the payment card format due to ease of estimation and interpretation.

8. A copy of the survey instrument and a copy of the data set are available from the authors upon request.

9. The parameter estimate of the logarithm of income is the income elasticity of willingness to pay. This implies that a 10% increase in income would result in about a 4% increase in willingness to pay.

10. To facilitate comparisons with Kristrom and Riera's results, we have employed their definition of income elasticity of willingness to pay. They note that "if the income elasticity of willingness to pay for an environmental improvement is greater than one, the share of willingness to pay allocated to the environment increases with income. This is, in some sense, analogous to the private good case and the Engel curve analysis" (p. 47). Based on this definition, "a luxury public good will have an increasing willingness to pay share of income and the opposite is true for a necessary [normal] good" (p. 48).

11. This result is consistent with the findings of Schulze et al. (1983) in their evaluation of existence values for the preservation of visibility in national parks in the southwestern United States (p. 172); Gilbert et al. (1991) in their assessment of preservation values for eastern wilderness areas in the United States (p. 61); and Loomis et al. (1993) in their review of existence and bequest values for forests in Australia (p. 53). All three studies found that nonuse values dominated respondents' willingness to pay.

12. However, economic equity in recreational use constitutes an important research topic, especially in regard to the new User Fee Demonstration Program being implemented on selected federal lands. Public Recreation Visitor Survey (PARVS) and CUSTOMER data collected by the U.S. Forest Service contain information on visitor profiles, origins and destinations, expenditures, and measures of preference satisfaction that could be analyzed to evaluate equity impacts.

References

Anderton, D. L., A. B. Anderson, J. M. Oakes, and M. R. Fraser. 1994. Environmental equity: The demographics of dumping. *Demography* 31(2):229–248.

Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner, and H. Schuman. 1993. Report of the National Oceanic and Atmospheric Administration (NOAA) Panel on Contingent Valuation. *Fed. Reg.* 58(10):4602–4614.

Bullard, R. D. 1990. *Dumping in Dixie: Race, class, and environmental quality*. Boulder, CO: Westview Press.

Bullard, R. D. 1994. Unequal environmental protection: Incorporating environmental justice in decision making. In *Worst things first? The debate over risk-based national environmental priorities*, eds. A. M. Finkel and D. Golding, 237–266. Washington, DC: Resources for the Future.

Bullard, R. D. 1995. Environmental justice for all: It's the right thing to do. Speech, Duke University, Durham, NC. November 1.

Cameron, T. A., and D. D. Huppert. 1989. OLS versus ML estimation of non-market resource values with payment card interval data. *J. Environ. Econ. Manage.* 17:230–246.

Capek, S. M. 1993. The "environmental justice" frame: A conceptual discussion and an application. *Social Problems* 40(1):5–24.

Carlin, A., P. F. Scodari, and D. H. Garner. 1992. Environmental investments: The cost of cleaning up. *Environment* 34(2):12–20, 38–44.

Carpenter, D. E. 1982. Impacts and influences of the Great Smoky Mountains National Park: An annotated bibliography with a discussion and review of selected findings, recommendations and conclusions. Atlanta, GA: U.S. Department of the Interior, National Park Service, Research/Resources Management Report SER-64.

Carroll, S. J. 1979. The search for equity in school finance: Summary and conclusions. Santa Monica, CA: The Rand Corporation. Report R-2420-NIE.

Carson, R. T., R. C. Mitchell, W. M. Hanemann, R. J. Kopp, S. Presser, and P. A. Ruud. 1992. A contingent valuation study of lost passive use values resulting from the Exxon Valdez oil spill. Anchorage, AK: Attorney General of the State of Alaska. November.

Charlier, T. 1992. Boiler flap heats issue of smokies pollution. Memphis Commercial Appeal. February 23. *Newsbank* 1992 ENV 13:F4–F6.

Clotfelter, C. T. 1985. *Federal tax policy and charitable giving*. Chicago: University of Chicago Press.

Dillman D. 1978. *Mail and telephone surveys: The total design method*. New York: Wiley.

Dull, C. W., J. D. Ward, H. D. Brown, G. W. Ryan, W. H. Clerke, and R. J. Uhler. 1988. Evaluation of Spruce and Fir mortality in the southern Appalachian Mountains. Atlanta, GA: U.S. Department of Agriculture, U.S. Forest Service, Southern Region. Protection Report R8-PR 13. October.

Eager, C. 1984. Review of the biology and ecology of the balsam wooly adelgid in southern Appalachian spruce–fir forests. In *Southern Appalachian spruce–fir ecosystem: Its biology and threats*, ed. P. S. White, 36–50. Atlanta, GA: U.S. Department of the Interior, National Park Service. Research/Resources Management Report SER-71.

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. 1994. Executive Order 12898. *Fed. Reg.* 59(32):7629–7633.

Freeman, A. M. 1982. *Air and water pollution control: A benefit–cost assessment*. New York: John Wiley and Sons.

Gilbert, A., R. Glass, and T. More. 1991. Valuation of eastern wilderness: Extramarket measures of public support. In *The economic value of wilderness*. Asheville, NC: Southeast Forest Experiment Station. General Technical Report SE-78.

Goldman B., and L. Fitton. 1994. *Toxic wastes and race revisited: An update of the 1987 Report on Racial and Socioeconomic Characteristics of Communities with Hazardous Wastes*. Washington, DC: Center for Policy Alternatives.

Goldsmith, J. 1994. Designing for diversity. *National Parks* 68(5/6):20–21.

GOP floats idea of closing parks like the one at arch. 1995. *St. Louis Post-Dispatch*. January 29:10D. NEXIS.

Gore, A. 1993. Establish a blueprint for environmental justice throughout EPA's operations. In *From red tape to results: Creating a government that works better and costs less*. 39–41. Environmental Protection Agency. Accompanying Report of the National Performance Review. Washington, DC: Government Printing Office. September.

Graham, J. D. 1994. Prepared statement. Use of Risk Analysis and Cost–Benefit Analysis in Setting Environmental Priorities. Hearing before the Committee on Energy and Natural Resources, United States Senate, November 9, 1993, 16–20. Washington, DC: Government Printing Office.

Greene, W. H. 1992. *LIMDEP user's manual*. Bellport, NY: Econometric Software, Inc.

Hamilton, J. T. 1993. Politics and social costs: Estimating the impact of collective action on hazardous waste facilities. *RAND J. Econ.* 24(1):101–125.

Hamilton, J. T. 1995. Testing for environmental racism: Prejudice, profits, political power? *J. Policy Anal. Manage*. 14(1):107–132.

Hausman, J. A., ed. 1993. *Contingent valuation: A critical assessment*. Amsterdam: Elsevier Science.

Hendon, W. C. 1991. The wilderness as a source of recreation and renewal: Who uses it? What are their characteristics? Their other interests? Their preferences? *Am. J. Econ. Sociol*. 50(1):105–112.

Hodgkinson, V. A., and M. S. Weitzman. 1990. Giving and volunteering in the United States: Findings from a national survey. Washington, DC: Independent Sector.

Imber, D., G. Stevenson, and L. Wilks. 1991. A contingent valuation survey of the Kakadu Conservation Zone. Canberra, Australia: Australian Government Printing Office of the Resource Assessment Commission.

Johnson, E. H., S. B. McLaughlin, M. B. Adams, E. R. Cook, D. H. DeHayes, C. Eager, I. J. Fernandez, D. W. Johnson, R. J. Kohut, V. A. Mohnen, N. S. Nicholas, D. R. Peart, G. A. Schier, and P. S. White. 1992. Synthesis and conclusions from epidemiological and mechanistic studies of red spruce decline. In *Ecology and decline of red spruce in the eastern United States*, eds. C. Eager and M. B. Adams, 385–411. New York: Springer-Verlag.

King, P. B., and A. Stupka. 1950. The Great Smoky Mountains- Their geology and natural history. *Sci. Monthly* 71:31–43.

Kristrom, B., and P. Riera. 1996. Is the income elasticity of environmental improvements less than one? *Environ. Resource Econ.* 7:45–55.

Krutilla, J. V. 1967. Conservation reconsidered. *Am. Econ. Rev.* 57:777–786.

Loomis, J., M. Lockwood, and T. DeLacy. 1993. Some empirical evidence on embedding effects in contingent valuation of forest protection. *J. Environ. Econ. Manage*. 24:45–55.

Lovett, G. M. 1984. Pollutant deposition in mountainous terrain. In *Southern Appalachian spruce–fir ecosystem: Its biology and threats*, ed. P. S. White, 225–234. Atlanta, GA: U.S. Department of the Interior, National Park Service. Research/Resources Management Report SER-71.

McConnell, K. E. 1992. Does Altruism Undermine Existence Value? Department of Agricultural Economics, University of Maryland, April. Unpublished manuscript.

Miller, M. H., K. Noland, and J. Schaaf. 1991. *The Kentucky Education Reform Act of 1990:*

A citizen's handbook. Frankfort, KY: Legislative Research Commission. September.
Mitchell, R. C., and R. T. Carson, 1989. *Using surveys to value public goods. The contingent valuation method*. Washington, DC: Resources for the Future.
Peine, J. D. 1986. Testimony. Hearing: Impacts of Air Pollution on National Park Units Before the Subcommittee on National Parks and Recreation, U.S. House of Representatives. May 20–21, 1985. Washington, DC: Government Printing Office.
Peine, J. D., and J. R. Renfro. 1988. Visitor use patterns at Great Smoky Mountains National Park. Atlanta, GA: U.S. Department of the Interior, National Park Service. Research/Resources Management Report SER-90.
Randall, A. 1987. *Resource economics: An economic approach to natural resource and environmental policy*. New York: John Wiley and Sons.
Reaves, D. W., M. L. Miranda, R. A. Kramer, and T. P. Holmes. 1995. Reauthorizing the Endangered Species Act: Lessons from the red-cockaded woodpecker. Durham, NC: Duke University. Unpublished manuscript.
Riddiough, C. 1990. Building ecosocialism in the nineties. *EcoSocialist Rev.* 4(2). Internet address: http://ccme-mac4.bsd.uchicago.edu/ESR/RID.html
Rosen, R. 1994. Who gets polluted? *Dissent* 41(2):223–230.
Ross, M. N. 1985. The sky has no limits: Air pollution and biosphere reserves. *Proc. Conf. Management of Biosphere Reserves*, November 27–29, 1984, Great Smoky Mountains National Park, ed. J. D. Peine, 81–94. Gatlinburg, TN: U.S. Department of the Interior, National Park Service.
Rowe, R. D., W. D. Schulze, and W. W. Breffle. 1996. A test for payment card biases. *J. Environ. Econ. Manage*. 31:178–185.
Schulze, W. D., D. S. Brookshire, E. G. Walther, K. K. MacFarland, M. A. Thayer, R. L. Whitworth, S. Ben-David, W. Malm, and J. Molenar. 1983. The economic benefits of preserving visibility in the national parklands of the southwest. *Natural Resources J.* 23:149–173.
Secada, W. G., ed. 1989. *Equity in education*. New York: Falmer Press.
Sexton, K., and Y. B. Anderson, eds. 1993. Special issue: Equity in environmental health: Research issues and needs. *Toxicol. Ind. Health* 9(5):679–977.
Shank, R. E. 1954. Climates of the Great Smoky Mountains. *Ecology* 35:354–361.
Simon, P. 1994. Testimony, School Finance Equity. Hearing before the Subcommittee on Education, Arts, and Humanities of the Committee on Labor and Human Resources, U.S. Senate, October 4, 1993. Washington, DC: Government Printing Office.
Stewart, R. B. 1977. Paradoxes of liberty, integrity and fraternity: The collective nature of environmental quality and judicial review of administrative action. *Environ. Law* 7:463–484.
Tinder, R. 1994. Testimony, School Finance Equity. Hearing before the Subcommittee on Education, Arts, and Humanities of the Committee on Labor and Human Resources, U.S. Senate, October 4, 1993. Washington, DC: Government Printing Office.
United Church of Christ Commission for Racial Justice. 1987. Toxic wastes and races in the United States: A national report on racial and socioeconomic characteristics of communities with hazardous wastes. New York: United Church of Christ.
U.S. House of Representatives. 1992. Impacts of lead poisoning on low-income and minority communities. Hearing before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives. June 19, 1992. Washington, DC: Government Printing Office.
U.S. House of Representatives. 1995. Downsizing Government and Setting Priorities of Federal Programs. Hearings before Subcommittees of the Committee on Appropriations, House of Representatives. January 11, 12, 18, 24, 25, 26, 31, February 2, 1995. Washington, DC: Government Printing Office.
Westra L., and P. S. Wenz. 1995. *Faces of environmental racism: Confronting issues of global justice*. Lanham, MD: Rowman and Littlefield Publishers.