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Environmental Justice and the Spatial Distribution of Outdoor Recreation sites: an Application of Geographic Information Systems

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This study examines the spatial distribution of outdoor recreation sites and their proximity to census block groups (CBGs), in order to determine potential socio-economic inequities. It is framed within the context of environmental justice. Information from the Southern Appalachian Assessment database was applied to a case study of the Chattahoochee National Forest in North Georgia. Outdoor recreation sites (campgrounds, wilderness areas, good/poor fisheries habitat, and overcrowded recreation sites) were mapped using geographic information systems. All CBGs (n = 200) contained by, and within 1500 meters (approximately one mile), of the Chattahoochee National Forest were identified and characterized by four socio-economic variables (race, household income, heritage, and occupation). Logit analysis was conducted to determine the spatial relationships between outdoor recreation sites and CBG variables. Results show that household income was the only significant predictor ($p <$ .05) of proximity to outdoor recreation sites. CBGs with a higher proportion of lower income households were significantly more likely to be situated within 1500 meters of a wilderness area, campground, and/or good fisheries habitat than CBGs with higher incomes. Implications for identifying recreation as a locally desirable or undesirable land-use, applying benefits-based management, and considering sustainable community development in national forest management are addressed.

KEYWORDS: *Environmental justice, geographic information systems, outdoor recreation sites, national forests, logit analysis, sustainability, locally unwanted land uses*

Introduction

The issue of environmental equity and justice in natural resource allocation and decision-making is receiving increasing political and social attention (Albrecht, 1995; Scott, 1996). Following President Clinton's Executive Order 12898 (Federal Register, February, 1994) all federal land management agencies have been mandated to address environmental justice in nonwhite and/or low-income populations, with the goal of achieving environmental protection for all communities regardless of their racial and economic composition. Environmental justice refers to rules, regulations, and decisions that "deliberately target certain communities for least desirable land uses . . . [and] support sustainable communities where people can interact with confidence that their environment is safe, nurturing, and productive" (Bryant, 1995, p. 5-6).

Most previous environmental justice research has focused upon the proximity of locally unwanted land uses (LULUs) (Lober, 1996) such as commercial hazardous waste facilities, landfills, low-level nuclear waste sites, and Superfund sites to communities of low-income and nonwhite populations. The present study extends this work by addressing the spatial proximity of national forest[1] recreation sites to social communities (characterized as census block groups). The study area includes all census block groups (CBGs) of counties contained by, and within approximately one mile of, the Chattahoochee National Forest (NF) in North Georgia.

Environmental Justice

Empirical studies of environmental justice are relatively recent. In the late 1970s, Bullard (1983) reported that six of eight incinerators and 15 of 17 landfills in Houston, TX, were located in predominantly black communities. Over the next decade, several studies supported a relationship between race and the siting of LULUs (Bullard, 1990; Mohai & Bryant, 1992; U.S. Commission for Racial Justice of the United Church of Christ, 1987; U.S. General Accounting Office, 1983). The U.S. Commission of Racial Justice, for example, found that zip code areas with one commercial hazardous waste facility had twice the nonwhite population (24%) than those without such facilities, and that communities with more than one waste facility had an average of 38% nonwhite population. (The national average nonwhite population is 16%.)

Recent studies, however, have been less conclusive regarding the effect of race on the spatial distribution of LULUs, suggesting other factors, especially income, contribute to their siting. Kriesel, Centner and Keeler (1996) report significant differences in exposure to toxic releases (as measured using the U.S. Environmental Protection Agency's (EPA) Toxic Release Inventory) were associated with income, but not race; i.e., communities with a greater proportion of lower income residents were more likely to live within one mile of toxic release site than higher income communities. Similarly, Hamilton (1995) found race was not a significant factor explaining the capacity expansion of hazardous waste facilities when measures of income and local political activity were included.

Other studies indicate that both race and income are factors in the siting of undesirable environmental uses (e.g., Costner & Thornton, 1990; Foreman, 1996; Glickman, 1994; Lavelle & Coyle, 1992; U.S. EPA, 1992). Costner

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[1]National forests are managed by the second largest federal land management agency, the USDA Forest Service (FS). The FS manages 191 million acres of federal land as compared with the largest land management agency, the USDI Bureau of Land Management, which controls approximately 269 million acres (Zinser, 1995).

and Thornton (1990), for example, found communities in which hazardous waste incinerators were located to be made-up of 89% more nonwhites, and 15% lower income residents, than the national averages. Lavelle and Coyle (1992) indicate clean-up of waste sites takes considerably longer in poor and nonwhite communities than in more affluent neighborhoods. An EPA (1992) report concludes that exposures to air pollutants, hazardous waste facilities and other environmental costs are higher than average in nonwhite and low-income populations.

Method Concerns in Environmental Justice Research

A major reason for the conflicting findings in previous environmental justice studies concerns the methods of data collection and analysis techniques. These concerns can be grouped into at least four types: geographic scale, geographic analysis, identification of related independent factors, and statistical analysis.

Geographic scale. Past research has examined environmental justice at the county (Hird, 1993), city (Mohai & Bryant, 1992), zip code (Hamilton, 1995), and CBG (Kriesel et al., 1996) levels. The CBG is the smallest scale at which most census data has been measured and comes closest to approximating the community effects advocated by the environmental justice literature (Kriesel et al., 1996). CBGs represent an amalgamation of census blocks, containing about 250 to 550 housing units. (Census blocks do not include information on income, occupation, etc and for this reason could not be used in our study.) County, city, and zip code levels are less appropriate scales for investigating environmental justice issues because nonwhite and low-income populations are typically concentrated in small geographic areas (U.S. EPA, 1996).

Geographic analysis. Early environmental justice studies reported the frequency of LULUs in close proximity to, or within, low-income and/or nonwhite communities (e.g., Bullard, 1983; U.S. General Accounting Office, 1983). More recently, geographic information systems (GIS) technology has been used to display the spatial distribution of LULUs and their relationship to human communities (Glickman, 1994; Mohai & Bryant, 1992; Stockwell, Sorenson, Eckert, & Carreras, 1993; U.S. General Accounting Office, 1995). GIS are computerized mapping systems for analyzing, querying, displaying and organizing spatial information (i.e., points, lines, shapes) with non-geographic features (Harris, Gimblett, & Shaw, 1995; Johnson, 1990). More generally, GIS is a data input, storage, retrieval, analysis, and reporting approach for processing spatial data into information that is typically used in land management decision-making. It is used to collect spatial data from various sources; to store, retrieve and edit data; to manipulate data by estimating new parameters and performing modeling functions, etc.; and to report and produce results of data in tabular, graphic or map formats (DeMers, 1997).

In natural resource management, GIS can been used to merge coverage areas (e.g., forest types, wildlife range, wilderness areas, county demographics), spatial points (e.g., campgrounds, mines) and lines (e.g., trails, rivers) for analyzing spatial interactions. Harris et al. (1995), for example, used GIS to demonstrate the extent to which off-trail recreational use can affect sensitive wildlife species habitats. Once data are mapped, spatial analyses can be performed by examining the geographical interrelationships along a horizontal plane (Johnson, 1990), such as the frequency of campgrounds within one mile of a CBG boundary. Recent environmental justice studies have used GIS to identify the percentage of nonwhite and low-income residents within a specified distance of a LULU. Mohai and Bryant (1992), for example, found 48% of residents within one mile of a commercial hazardous site were nonwhite versus 18% living in communities more than 1.5 miles from a site. Glickman (1994) demonstrated a greater percentage of nonwhites and low-income residents lived within one mile (as compared to more than one mile) of a hazardous facility.

Identification of related independent factors. The environmental justice impetus has been rooted in the civil rights movement; i.e., people of color were considered exposed to greater environmental costs and problems than white populations (Bryant, 1995). It has been previously argued that race is the primary factor in siting LULUs and that the impact of race is largely independent of other factors such as income and occupation (Mohai & Bryant, 1992). However, given the correlation between race and other socio-economic factors (especially income and occupation), the true effect of race cannot be adequately determined without considering a broad set of indicators which includes other potential discriminatory factors and their interrelationships (Kriesel et al., 1996). In addition to race, income, and occupation (the three socio-economic factors most often considered), we also examine the effect of heritage (i.e., the length of time one has resided in the area). Heritage is thought to be an important variable because of the increasing number of people migrating to rural communities for an improved quality of life; however, it has not been included as an independent factor in recent published studies of environmental justice.

Statistical analysis. Recent environmental justice studies have employed multiple regression techniques to determine (a) the relative effect of income and race and (b) the influence of other predictor variables, on land use siting. Many earlier studies compared simple correlation coefficients for race and income separately with either the number of hazardous facilities or the amount of pollution in a specified area to demonstrate race as a more powerful predictor than income (Kriesel et al., 1996). In the past couple of years, most studies have used either Tobit or Logit regression models to examine multiple independent effects simultaneously (e.g., Hamilton, 1995; Hird, 1993; Kriesel et al., 1996). This research has shown that race has less of an influence than previously thought, while income and other social and demographic predictor variables may have a more significant role in understanding proximity to LULUs. Since race is often correlated with other less discriminating factors (e.g., occupation, income) one explanation is that the independent effects of race cannot be fully assessed without considering these other factors.

Outdoor Recreation and Environmental Justice.

While Clinton's Executive Order directed all federal land management agencies to address the potential for environmental justice, it is unclear as to whether national forest outdoor recreation sites (including campgrounds, fisheries habitat, wilderness areas, trails, etc) constitute a LULU. LULUs refer to "those lands that are generally needed by the more encompassing political or social unit, but that have specific and substantial spill-over effects in the community where the facility or development is cited" (O'Looney, 1995, p.16). Most typically, they include low-income housing, homeless shelters, hazardous waste incinerators, landfills, and recycling centers (Lober, 1996).

For some communities, certain outdoor recreation sites may be considered LULUs by virtue of the (perceived or real) negative impacts connected to their use. Tourism development in a local community, for example, may bring increased economic revenue and job opportunities, but is also associated with environmental and social costs such as increased traffic, air and noise pollution, crime, etc (Fridgen, 1984; McIntosh & Goeldner, 1990; Seaton, 1994). Visitor behavior at campgrounds, trails, and other popular recreation destinations may also produce undesirable impacts. Such problems are most likely to be exacerbated at sites that are crowded and/or where the quality of the recreation site is in poor condition. In one of the few environmental justice studies with implications for outdoor recreation, West, Fly, Marans, Larkin and Rosenblatt (1995) found ethnicity to be an important factor in toxic fish consumption. In Michigan waters, black and Native American anglers were found to consume more contaminated fish (23.9 and 21.7 grams/person/day respectively) than white anglers (17.9 grams/person/day).

While there is some empirical research to characterize certain outdoor recreation sites as LULUs, there is also evidence to suggest that recreation sites may actually be locally desirable land uses (LDLUs). Living in close proximity to recreational trails, for example, is not always perceived negatively by local residents. Previous literature suggests that, for the most part, local fears about noise, litter, vandalism, traffic, and crime associated with trail use are short-lived (Kaylen, Bhullar, Vaught & Braschler, 1993; Turco & Lee, 1996) and unwarranted (Moore, Graefe, Gietlson & Porter, 1992). Kaylen et al. (1993) showed landowners' concerns with adjacent trail development diminished shortly after the trail was established. In a similar study, Turco and Lee (1996) demonstrated that most homeowners had favorable attitudes toward living next to a trail; for those who had negative attitudes, more than half changed their minds and held positive attitudes toward the trail after construction. Moore et al. (1992) found a majority of homeowners reported no problems and preferred living near rail-trails than living near the unused railroad lines that existed prior to trail development.

There is also evidence that residing in close proximity to open space and natural resources increases property and housing values (especially in urban communities). Nelson (1986) found that urban land 1,000 feet away from a greenbelt was worth $1200 less per acre than land immediately adjacent to the greenbelt boundary. Similar findings have also been reported by Kimmel (1985), Lacy (1990), and More, Stevens and Allen (1982), among others. These and other studies indicate the potential increase in property value is dependent upon characteristics of the proximate open space. Brown and Connelly (1986) and Colwell (1986), for example, found property values increased with open space that provided some recreational access and opportunities. More generally, outdoor recreation opportunities have been shown to be an important predictor of community satisfaction and quality of life (e.g., Allen, 1990, 1991; Allen & Beattie, 1984; Decker & Crompton, 1990; Jeffres & Dobos, 1993; Sneegas, 1986). Allen (1991), for example, reports several studies in which outdoor recreation opportunities, open space, and parks are some of the major attributes (along with schools, police, health services etc) that contribute to residents' overall satisfaction with community life.

Study Objectives

Regardless of whether outdoor recreation sites are necessarily classified as desirable or undesirable, the issue of environmental equity in resource allocation remains. For example, are CBGs with higher proportions of nonwhite and/or low-income populations more or less likely to be in close proximity to certain sites (e.g., overcrowded campgrounds or high quality fisheries habitat) than CBGs with lower nonwhite and low-income residents? The following two objectives were examined in this study:

1. To identify the socio-economic characteristics (household income, race, occupation, and heritage) of CBGs contained by, and within 1500 meters of, the Chattahoochee NF in North Georgia.
2. To determine the spatial relationship between the siting of outdoor recreation opportunities (fisheries habitats, wilderness areas, campgrounds, and overcrowded recreation sites) and the socio-economic characteristics of proximate CBGs.

Method

Variables

Boundaries for the CBGs and Chattahoochee NF, as well as the geographic location of outdoor recreation sites, were gathered from the Southern Appalachian Assessment (SAA) GIS database (Hermann, 1996). Point and shape coverage data were displayed in Arcview Version 3.0 on an IBM-compatible PC using the Albers Equal Area projection in metric units. All data with the exception of fisheries habitat were derived from population estimates; fisheries data were taken from randomly sampled plots in the Chattahoochee NF. Although the SAA GIS database includes point and shape files for several hundred variables (ranging from forest coverage plots and

timber harvest rates to air quality) the parameters selected in our study represent those with the greatest implications for understanding the relationship between environmental justice and outdoor recreation.[2]

Wilderness areas were displayed as shape files (polygons) with attribute information on size (acres). Fisheries habitats were displayed as point coverage and categorized into two types, "good" and "poor," characterized in terms of their riparian benthic habitat condition (Hermann, 1996). Good benthic habitats contain the greatest potential for recreational fishing, while poor benthic sites have limited potential for recreational fishing. Overcrowded sites were displayed as point coverage and defined as areas that had exceeded their recreational carrying capacity for people in one area at one time (PAOT) as determined by the USDA Forest Service (Hermann, 1996). Overcrowded included specific points along land and water corridors and areas such as trails, rivers, lakes, etc. Campgrounds were displayed as point coverage with attribute information on number of individual campsites.

Socio-economic data were retrieved from the 1990 Census Summary Tape File (STF3) of the U.S. Bureau of the Census Look-up web-site (1990). All CBGs contained by, or within 1500 meters, of the Chattahoochee NF boundary were selected. CBGs from the following counties were included: Banks, Catoosa, Chattooga, Dawson, Fannin, Floyd, Gilmer, Gordon, Habersham, Lumpkin, Murray, Rabun, Stephens, Towns, Union, Walker, White, and Whitfield. Race was categorized as white versus nonwhite, heritage as local (i.e., having lived in the same county since 1985) versus nonlocal (i.e., lived in different county than present since 1985), and occupation as white-collar (comprised of professional, technical, managerial, clerical, and sales occupations) versus blue-collar (representing all other occupations). Household income was a continuous level variable measured as the median value per household.

Analysis

After data were spatially defined and displayed (i.e., all CBGs contained by, or within, 1500 meters of the Chattahoochee NF were identified and all relevant outdoor recreation sites were selected), the next step was to specify census block groups within 1500 meters (about 1 mile) of each outdoor recreation site. For example, all blocks groups within 1500 meters of a campground or the boundary of a wilderness area were selected. We chose 1500 meters as the proximity criterion to be consistent with recent environmental justice studies which have used GIS techniques and one mile distances to select and/or compare population characteristics across geographic regions (usually either the county, zip code or block group level) (e.g., Glickman, 1994; Hamilton, 1995; Kriesel, et al., 1996; U.S. General Accounting Office, 1995). For example, Hamilton (1995) compared zip code areas with and without commercial hazardous waste facilities in terms of their minority and

[2]One additional variable in the SAA GIS database, national recreation areas, was excluded from the study because only one area exists in the Chattahoochee NF.

income breakdown. Using a similar approach, we compared the social and demographic characteristics of CBGs within 1500 meters of an outdoor recreation site with CBGs more than 1500 meters from a recreation site.

The sample was limited to CBGs contained by, or within, one mile of the Chattahoochee NF because it was assumed that the costs or benefits of residing next to a LULU or LDLU are greatest in the immediate surrounding area. For example, the noise, traffic, and air pollution associated with an overcrowded recreation site, or the advantages of living next to a scenic wilderness area, are likely to be most concentrated within the immediate vicinity of the site itself. This approach is consistent with the NIMBY ("not in my backyard") syndrome, in which the costs of a hazardous waste site are assumed to be the greatest when the site is located close to one's own backyard (i.e., residence). Recent environmental justice research has adopted a distance of between 1 to1.5 miles as the cut-off spatial value (see above).

Once the relevant census block groups were selected, objective 2 was tested using logit regression in SPSS version 6.1 (Norusis, 1994). Logit regression is used when predicting a dichotomous dependent variable from a set of (linear and/or dichotomous) independent variables. Basically, the logit model identifies the odds of an event occurring, defined as the ratio of the probability that the event will occur to the probability that the event will not occur. There is precedence for using logit analysis in environmental justice studies (e.g., Hamilton, 1995). In our analysis, the dependent variable was set to equal 1 if a CBG was within 1500 meters of an outdoor recreation site (e.g., campground, wilderness area etc) and equal to 0 for those CBGs where no sites were located. The independent variables were percent nonwhite, percent white-collar occupation, percent local, and household income in dollars. A significance level of $p = .05$ was used for all statistical tests.

Results

Descriptive Findings

Figure 1 displays the spatial distribution of outdoor recreation sites within the Chattahoochee NF. Nine wilderness areas were identified: Cohutta (36,977 acres), South Nantahala (23,714 acres), Mark Trail (16,400 acres), Brasstown (12,975 acres), Tray Mountain (9,702 acres), Rich Mountain (9,649 acres), Raven Cliffs (9,115 acres), Elicott Rock (8,249 acres), and Blood Mountain (7,800 acres). Six campgrounds are located in the NF ranging in size from 26 sites to in excess of 100. Sixty-three recreation sites were rated as overcrowded (i.e., exceeding recreation capacity). Fifteen of the sampled fisheries habitat plots were rated in good benthic condition and four sample plots were classified as poor.

Objective 1

Two hundred census block groups were either contained by, or within 1500 meters, of the Chattahoochee NF. (Figures 2 and 3 show examples of the distribution for percentage of nonwhite population and median house-

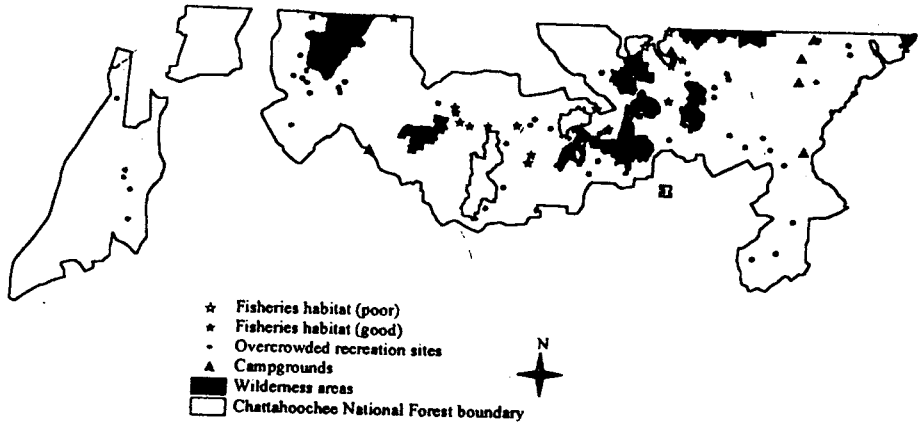

Figure 1. Distribution of overcrowded recreation sites, campgrounds, wilderness areas, and good/poor fisheries habitat in the Chattahoochee National Forest

hold income in the 200 CBGs.) The average nonwhite population was only 3.6% (ranging from a minimum of zero, to a maximum of 54.1%, with a standard error of .53%). This is considerably lower than the national nonwhite population of 16.1% (Bureau of the Census, 1990). The average median household income across the 200 CBGs was $24,763; with a range from just over $11,000 to a maximum of over $62,000 (standard error of $522). Household income in the study region was considerably lower than the national median of $33,952 (U.S. Bureau of the Census, 1994). On average, there were fewer white-collar workers (mean of 43.8%, standard error of

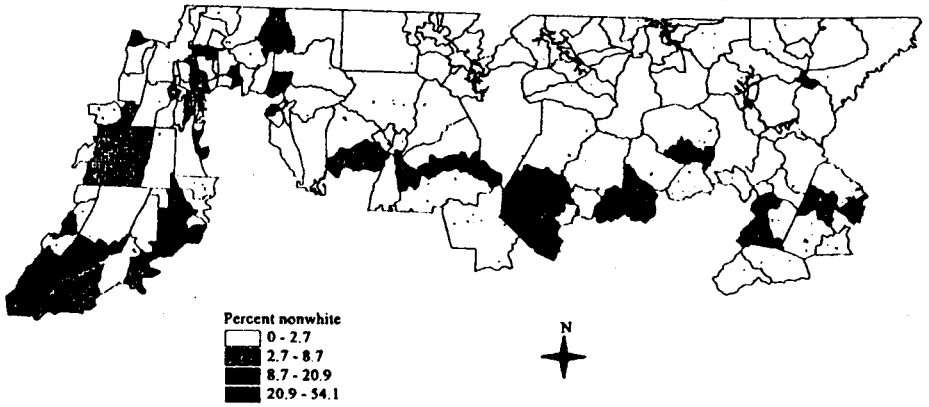

Figure 2. Percentage nonwhite population in census block-groups of counties within 1500 meters of the Chattahoochee National Forest

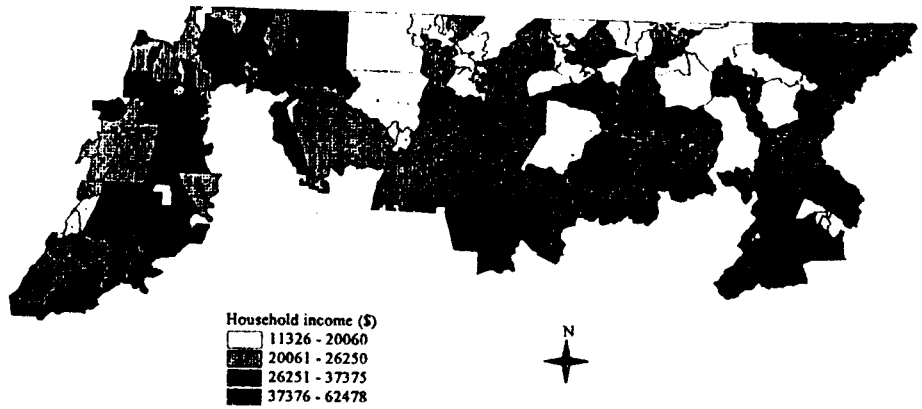

Figure 3. Median household income in census block-groups of counties within 1500 meters of the Chattahoochee National Forest

.89%) than blue-collar. Most people were of local heritage (mean of 79.6%, standard error equals .69%).

The correlation ceofficients among the four socio-economic variables for the 200 CBGs are shown in Table 1. Median household income of the CBGs was significantly and positively related to white-collar occupational status ($r = .55$). Household income was negatively correlated with nonlocal heritage ($r = -.15$) suggesting that locals earn more, on average, than nonlocals do. Nonwhites were significantly less likely to be employed in white-collar occupations than whites ($r = -.14$). No other significant correlations were observed.

Objective 2

Results of the logit regressions for each type of outdoor recreation site are shown in Table 2. The Wald statistic is interpreted in logit analysis and

TABLE 1
Correlation Coefficients of Occupation, Heritage, Race, and Median Household Income for Census Block Groups (n = 200) in the Chattahoochee National Forest

	Percentage White-collar		Percentage Nonlocal		Percentage Nonwhite	
	r	*p*	*r*	*p*	*r*	*p*
Percentage nonlocal	.080	.259				
Percentage nonwhite	−.137	.050	.061	.394		
Median household income	.547	<.001	−.150	.034	−.126	.076

TABLE 2
Logit Regression Coefficients of Chattahoochee NF Outdoor Recreation Sites with Census Block Group Variables: Race, Household Income, Occupation, and Heritage[1]

	Socioeconomic Varible														
	Race[2]			Income[3]			Occupation[4]			Heritage[5]					
Outdoor Recreation	B[6]	S.E.	Wald	B	S.E.	Wald	B	S.E.	Wald	B	S.E.	Wald	χ^2	p	R^2
Wilderness area	−.1658	.0961	2.97	−.0001*	.0001	5.64	−.0102	.0226	0.21	−.0271	.0227	1.48	16.98	.002	.15
Fisheries (good)	−.7450	.3288	1.52	−.0002*	.0001	6.19	.0096	.0280	0.01	.0197	.0280	1.23	29.48	<.001	.27
Fisheries (poor)	.7147	.4501	2.52	.0001	.0001	2.72	−.0482	.0379	1.61	−.0592	.0366	2.61	16.38	.003	.23
Campgrounds	−.0993	.0935	1.13	−.0001*	.0001	4.03	−.0002	.0301	0.01	−.0005	.0309	0.01	8.00	.092	.10
Overcrowded sites	−.0649	.0428	2.30	−.0002	.0003	0.75	−.0248	.0177	1.97	.0317	.0183	3.00	6.56	.161	.05

*$p < .05$.

[1]Sample consists of all census block groups contained by, or within 1500 meters, of the Chattahoochee National Forest (n = 200). Dependent variable in logit regression equals 1 if a block is within 1500 meters of the outdoor recreation site and 0 if the cnesus block group is greater than 1500 meters of the site.

[2]Race measured as pecennt nonwhite population.

[3]Household income measured in dollars (median).

[4]Occupation measured as percent white-collar.

[5]Heritage measured as percent nonlocals.

[6]Beta (B) is the regression coefficient for each independent (socioeconomic) variable with the dependent variable.

used as the test of significance for the removal or inclusion of a factor (Norusis, 1994). Higher Wald statistics are associated with lower p-values. The Chi-Square statistic was used as a goodness of fit measure, i.e. a test of how well the data fit the regression model. A significant Chi-Square indicates the independent variables together explain variance in the dependent measure.

Household income was the only factor significantly related to the distribution of sites. Campgrounds, wilderness areas, and good benthic fisheries habitat were significantly more likely to be located in CBGs with lower (versus higher) household incomes. None of the four socio-economic variables were significantly related to the distribution of poor benthic fisheries habitat or overcrowded recreation sites. Race, occupation, and heritage were not significant factors for any of the outdoor recreation sites examined in the present study. The four socio-economic variables combined were significant predictors of good and poor fisheries habitat (R^2 = .27 and .23, respectively) and wilderness areas (R^2 = .15).[3]

Conclusions and Implications

Is environmental justice an issue in the distribution of outdoor recreation sites within the Chattahoochee (and possibly other) National Forest(s)? Results of our study suggest a possible inequity with regard to household income, but not necessarily race, occupation, and/or heritage and only for some types of outdoor recreation sites. While this finding supports previous research which has found income to be a more important predictor of environmental justice issues than race (e.g., Kriesel et al., 1996; Hamilton, 1995), in our study CBGs with a higher proportion of lower income households were more likely to be situated within 1500 meters of more desirable outdoor recreation sites (wilderness areas, good fisheries habitats, and campgrounds) than were households with higher incomes. The four socio-economic variables were not significantly related to the location of overcrowded recreation sites and/or poor quality fisheries habitats. Together the independent variables explained about one-quarter of the total variance in both types of fisheries habitats and 15% of the variance in wilderness area locations, suggesting social indicators may play a role in the spatial distribution of some NF outdoor recreation sites.

Of the five outdoor recreation sites examined in this study, overcrowded sites and poor fisheries habitat are most likely to be seen as LULUs. Since there were no significant CBG social correlates with the distribution of these sites, environmental justice may not be a concern for undesirable national forest outdoor recreation sites (at least in the Chattahoochee NF). It should be noted however, that the four socio-economic variables together did ex-

[3]Although none of the four independent factors were significantly related to the spatial distribution of poor fisheries habitat, together the four factors explained 23% of the variance in the dependent variable, suggesting that for this particular outdoor recreation site the four independent factors had unrelated and additive effects.

plain 23% of the variance in the location of poor fisheries habitat. Although none of the four independent variables separately were significantly related to the dependent measure, the results tentatively suggest that CBGs consisting of higher income, nonwhite, blue-collar, locals (combined) are in closer proximity to these LULUs than CBGs without these combined socio-economic characteristics.

Other outdoor recreation sites examined in this study (especially wilderness areas and good fisheries habitat) may be considered LDLUs by virtue of the potential benefits they provide, such as enhanced community satisfaction (e.g., Allen, 1991), improved quality of life (e.g., Marans & Mohai, 1991), and higher property values (e.g., Nelson, 1986). Wilderness areas are environmental assets since they provide clean air, clean water, and scenic quality. Similarly, good fisheries habitat and campgrounds provide leisure opportunities for hiking, fishing, nature appreciation, etc, activities which have been found to be in increasing demand over the past two decades (National Survey on Recreation and the Environment, 1995). Since lower income CBGs may be in closer proximity to LDLUs than higher income groups, the traditional concern over environmental equity (i.e., that lower income and/or nonwhite populations are discriminated against) may be unfounded in the Chattahoochee NF, at least with regard to the spatial distribution of outdoor recreation sites.

Limitations

Before considering implications of the study findings, several limitations should be addressed. First, there was a relatively low representation of nonwhites in the CBGs examined. While previous environmental justice research has identified "minority" communities even in situations where the vast majority of residents are white (see Boerner & Lambert, 1995, for a review), our average nonwhite population across all 200 CBGs was less than 4% which is considerably below the national average of over 16%. Given such low proportions in the population, our results concerning race may be at best tentative; however, it is important to note that they do reflect the actual population diversity within and surrounding the Chattahoochee NF (i.e., it is not an issue of sampling bias with respect to the study area).

Second, although household income was a significant factor in the spatial distribution of several NF outdoor recreation sites, it is correlated with other factors (white-collar employment and recent migration to the area). This suggests that occupational status and heritage may have a role in environmental justice issues, especially when income is not assessed. Unlike previous studies, we did not observe a significant correlation between race and income, indicating that income had an effect on the distribution of outdoor recreation sites in the Chattahoochee NF, independent of racial background.

Third, the data were derived from a GIS database, but were not analyzed using GIS analysis extensions such as network or spatial analysis. Network analysis permits tests based on the actual road distances and travel times from a CBG to the access point of, for example, an outdoor recreation site, such as a wilderness area or campground. We simply identified outdoor recreation sites within 1500 meters of a CBG boundary, without regard for the road access network.

Fourth, the CBGs are spatially related; i.e., adjoining CBGs are more similar in socio-economic make-up than distant CBGs. While a true GIS-based analysis would have been able to test for the effects of such spatial correlated distributions (DeMers, 1997), we were unable to address the concern in our analysis as the 200 CBGs were treated as a flat data file (as are all data files) in SPSS.

Fifth, findings are limited to a single case study, the Chattahoochee NF. Studies conducted in other NFs, especially those in closer proximity to minority communities (such as the desert southwest or urban areas) may produce different results.

Implications

National Forest management is inextricably linked to the physical, biological, and social attributes of the forest and human populations affected. Recent developments of a human dimensions framework (e.g., Bright, Cordell, Hoover, & Tarrant, in review; Force & Machlis, 1997; Machlis, Force & Burch, 1997; Manley, et al., 1995) propose methods for better integrating social information with biophysical data in forest planning, decision-making, and eco-regional assessments. Environmental justice, the identification of groups of people who potentially bear a disproportionate share of the negative consequences of environmental practices, must clearly become an important component of any human dimensions approach.

The provision of multiple-use resources (including outdoor recreation) is becoming increasingly important in ensuring the sustainability of local communities (Yaffee, 1994). Sustainability is concerned with the optimal allocation and use of natural resources to meet the long-term needs of an increasingly diverse public. Given a focus of environmental justice research is understanding factors that "support sustainable communities" and produce "safe, nurturing, and productive" environments (Bryant, 1995), it is appropriate to examine the spatial distribution of both unwanted as well as desired land uses, and their relationship to diverse populations. For outdoor recreation sites that may be considered LULUs, we found no evidence of environmental injustice. For desirable outdoor recreation sites, we found inequity only in as much that lower income CBGs were more likely than higher income CBGs to reside within 1500 meters of a site.

As the push for a benefits-driven approach to recreation management continues (Driver, Brown & Peterson, 1991), managers and planners must become increasingly aware of who is receiving these benefits and where. Within the context of environmental justice, the issue becomes one of balancing benefits (and costs) of outdoor recreation while considering economic growth, environmental protection, and social equity. In this way efforts

can be made to ensure that decisions regarding the use and allocation of public natural resources do not unfairly benefit one group over another. When inequities do arise, either the cost of resource utilization should be borne proportionately by all those who benefit or individuals who bear the costs should be fairly compensated (Boerner & Lambert, 1995). In the case of providing outdoor recreation opportunities in national forests, perhaps the "fair compensation" is the opportunity for lower income groups to reside in close proximity to some of the most desirable land (wilderness areas, unimpaired fisheries streams, etc) in the nation.

Future studies should address at least two issues. First, we need to expand the investigation to communities in close proximity to other national forests, especially to those with more diverse racial characteristics and to include other socio-economic variables. Second, more research is needed to distinguish between outdoor recreation sites and classify them as LULUs or LDLUs.

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