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# Public Demand for Preserving Local Open Space

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*Increased development results in the loss of forest, farm, range, and other open space lands that contribute to the quality of life of U.S. residents. I describe an economic rationale for growing public support for preserving local open space, based the growing scarcity of open space lands. I test the rationale empirically by correlating the prevalence of open space referenda in U.S. counties to socioeconomic variables, including population density, change in density, per capita income, education, and other factors. Data come from the Trust for Public Land LandVote database and the U.S. Bureau of the Census. The results suggest how key socioeconomic trends—most notably, population growth, rising incomes, development, and increasing open space scarcity—motivate interest and support for preserving open space, when open space lands remain unprotected. The analysis provides a context for discussing policy and management strategies for addressing urban sprawl and open space loss.*

**Keywords** ecosystem services, forest and farmland preservation, wildland–urban interface

Recent socioeconomic trends have renewed concern in the United States about development and loss of open space—forest, farm, range, and other rural lands—that add to the quality of life of U.S. residents. Growth and urban sprawl often edge out more traditional issues, such as crime, as top concerns of Americans (Pew Center for Civic Journalism 2000). Population growth inevitably increases demands for housing and infrastructure, resulting in greater development in growing regions. Rising economic status combined with a quest for environmental amenities prompts migration of people to rural areas (Cordell et al. 2004). Nationally, developed lands increased by 34% from 1992 to 1997 and may double by 2025 (Alig et al. 2004). Declines in open space coupled with population growth mean that remaining open space lands are shared among greater numbers of people. From 1982 to 1997, undeveloped land per capita declined by 15% from 8.1 acres to 6.9 acres per person, with greater reductions in the most rapidly growing regions (Natural Resources Conservation Service 2001; U.S. Bureau of the Census 2000a). Such trends help to motivate current interest in open space preservation among the public, government,

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and nonprofit agencies and organizations (e.g., Ewing et al. 2005; USDA Forest Service 2006).

The economic roles of open space lands as inputs into forestry, farming, and ranching are of longstanding concern. Preserving farmland often is advocated to protect agriculture, jobs, and the economic stability of rural communities (Sorensen et al. 1997). Forestry researchers and policymakers often note the seemingly adverse effects of increasing population densities on production forestry (Stein et al. 2005) and the difficulties of managing wildfire in forest–urban settings (USDA Forest Service 2000). Land use conferences and workshops often focus on protecting "working lands" (KAG 1999; DeCoster 2000; Sampson and DeCoster 2000). Also of growing national interest is the role of open space in protecting ecosystem services: air and water quality, flood control, climate stabilization, pollination, and nutrient cycling, for example (USDA Forest Service 2006). While all of these issues are important, they may somewhat transcend the personal values many people may associate with local open space lands: values that arise from daily access to recreation, and the aesthetic and environmental characteristics of the communities in which they live and work.

Conceivably, impetus for preserving local open space arises from fairly local factors—the role of open space in people's daily lives. Much preservation work occurs locally (Bengston et al. 2004). State farmland preservation programs typically are administered through county boards. Land trusts often focus on specific communities or watersheds. Preservation funds often are raised by county and municipal voter initiatives and ballot measures. Apart from state or national economic and ecological goals, as important at local levels may be daily concerns like: What is the scenery like on my daily commute? Where can I walk the dog? Is there a place to take the kids to play and experience nature? Is where I live a pleasant place to be? Such concerns are tangibly rooted in individuals' personal experiences with local open space lands. Local socioeconomic conditions and rapid development—the politics of place—also matter in people's responses to open space and urban sprawl (Solecki et al. 2004). Open space policies and programs arise from the political process when enough voters become sufficiently concerned about the loss of open space lands (Wolfram 1981). The impetus then for local political activity on behalf of open space and support for any preservation policies and programs that emerge may derive rather significantly from how much people value remaining local open spaces lands and whether they are willing and able to afford their preservation. These values likely change with changing socioeconomic conditions, and especially as local open space lands grow scarce.

Voting data from public referenda often are used to describe demand for public goods such as open space (Deacon and Shapiro 1975; Kline and Wichelns 1994; Kahn and Matsusaka 1997; Press 2003; Salka 2003; Solecki et al. 2004). I consider how such referenda even emerge by describing an economic rationale for public impetus to preserve local open space. I examine open space referenda in the United States to identify socioeconomic factors that are correlated with the prevalence of county referenda nationally. Data are from the Trust for Public Land LandVote database (Trust for Public Land 2005) and the U.S. Bureau of the Census. The results suggest how key socioeconomic trends—most notably, population growth, rising incomes, development, and increasing open space scarcity—tend to motivate support for preserving local open space. The analysis provides a context for discussing public demand for preserving open space and its implications for policy and management strategies to address urban sprawl and open space loss.

## Open Space Scarcity and Increasing Demand

Among the most direct measures of public demand for preserving open space are bond and tax referenda used to finance public open space programs. Such referenda can occur as voter initiatives or government-sponsored ballot measures. U.S. voters have seen hundreds of open space referenda in recent years—1070 since 1999. Of those, 827 were approved: 25 by states, 148 by counties, 631 by municipalities, and 23 by other jurisdictions (Trust for Public Land 2005). Their financing methods vary—364 of approved referenda raised property taxes, 324 issued bonds, 62 raised sales taxes, 28 raised income taxes, and 49 raised preservation funds by other means. Since 1999, open space referenda have passed somewhere in 39 states, with fund obligations exceeding $1 billion in California, Colorado, Florida, and New Jersey, and per capita obligations highest in those states as well as Arizona and Rhode Island (Table 1). New Jersey—the most densely populated state, with 1134 people per square mile, compared to 92 persons per square mile for the United States excluding Alaska (U.S. Bureau of the Census 2000b)—led all states, with 273 referenda approved (Trust for Public Land 2005). Still, in many places, open space referenda either have not passed or have not been placed on ballots. The necessary conditions creating the impetus for political action to preserve open space have not emerged.

Voters typically are assumed to cast ballots in their perceived self-interest (Deacon and Shapiro 1975; Kahn and Matsusaka 1997). People value open space for the recreation, aesthetic, ecological, and resource protection benefits it provides (Kline and Wichelns 1998; Rosenberger 1998; Duke and Aull-Hyde 2002). Local open space can exist as protected lands, such as national or state forests and parks and privately protected reserves, or may be unprotected and at risk to development. The marginal values that people hold for local open space—the values held for an additional acre—depend on how much development has encroached on undeveloped lands and how much open space remains. In rural areas—places with relatively low populations, that have experienced little development, and that still possess significant open space lands—marginal values may be low. Losing some open space to development may matter little, because other open space lands remain. Recreation lands may be uncongested; the landscape may be quite scenic. These qualities may even attract new development (Kaplan and Austin 2004; Vogt and Marans 2003), and development may be welcomed (e.g., Janofsky 2003). In more populated places lacking in protected open space, where greater development has resulted in visible declines in open space, marginal values may be higher—people see that open space is growing scarce. Recreation lands are more congested; the landscape is losing its aesthetic character. Losing additional open space in more populated places means more significant reductions in valued open space benefits just as those benefits are appreciated by growing numbers of people.

The increasing values people may hold for local open space can be rooted in many factors, including their value orientations, attitudes, and norms (Berry 1976; Vaske and Donnelly 1999). Some individuals may be concerned about ecological protection, others about protecting environmental amenities and quality of life, and still others about conserving natural resources such as timber and clean water (DeHaven-Smith 1988). Community identity also can play a role, when communities worry about the magnitude, location, rapidity, and appropriateness of environmental changes caused by development. Communities become protective of traditional landscapes and places with symbolic or community connections—stability of identity

**Table 1.** Value of open space voter-approved municipal, county, and state bond and tax measures, 1999–2004, by state

| State | Open space funds ($) | Per capita ($) | Per acre all land ($) | State | Open space funds ($) | Per capita ($) | Per acre all land ($) |
|---|---|---|---|---|---|---|---|
| AK | 0 | — | — | MT | 22,500,000 | 24.94 | 0.24 |
| AL | 0 | — | — | NC | 401,330,000 | 49.86 | 11.91 |
| AR | 2,000,000 | 0.75 | 0.06 | ND | 0 | — | — |
| AZ | 594,394,000 | 115.85 | 8.15 | NE | 0 | — | — |
| CA | 6,507,288,000 | 192.12 | 64.10 | NH | 46,927,000 | 37.97 | 7.90 |
| CO | 1,538,979,687 | 357.80 | 23.10 | NJ | 2,043,462,604 | 242.85 | 391.80 |
| CT | 72,840,000 | 21.39 | 22.80 | NM | 42,540,000 | 23.39 | 0.55 |
| DE | 4,250,000 | 5.42 | 2.77 | NV | 127,800,000 | 63.96 | 1.81 |
| FL | 1,548,768,920 | 96.90 | 41.26 | NY | 994,116,344 | 52.39 | 31.70 |
| GA | 628,900,000 | 76.82 | 16.66 | OH | 776,479,000 | 68.39 | 29.36 |
| HI | 25,000,000 | 20.63 | 6.01 | OK | 3,133,320 | 0.91 | 0.07 |
| IA | 4,970,000 | 1.70 | 0.14 | OR | 12,450,000 | 3.64 | 0.20 |
| ID | 10,000,000 | 7.73 | 0.19 | PA | 386,469,020 | 31.47 | 13.33 |
| IL | 503,874,549 | 40.57 | 13.97 | RI | 139,577,760 | 133.14 | 171.62 |
| IN | 0 | — | — | SC | 286,071,200 | 71.30 | 14.35 |
| KA | 11,500,000 | 4.28 | 0.22 | SD | 0 | — | — |
| KY | 0 | — | — | TN | 0 | — | — |
| LA | 0 | — | — | TX | 427,878,279 | 20.52 | 2.50 |
| MA | 227,268,963 | 35.80 | 42.57 | UT | 22,400,000 | 10.03 | 0.41 |
| MD | 22,054,000 | 4.16 | 2.80 | VA | 212,643,700 | 30.04 | 7.85 |
| ME | 57,500,000 | 45.10 | 2.74 | VT | 4,547,500 | 7.47 | 0.74 |
| MI | 249,690,797 | 25.12 | 6.69 | WA | 38,200,000 | 6.48 | 0.87 |
| MN | 51,635,000 | 10.50 | 0.96 | WI | 30,880,000 | 5.76 | 0.86 |
| MO | 24,480,000 | 4.38 | 0.55 | WV | 0 | — | — |
| MS | 0 | — | — | WY | 8,450,000 | 17.11 | 0.13 |
| | | | | US | 18,100,252,143 | 64.51[a] | 9.33[a] |

*Note.* Value of open space funds in nominal dollars and estimated by Trust for Public Land (2005). Population data from U.S. Bureau of the Census (2000b). Land area from Natural Resources Conservation Service (2001).

[a] Excludes Alaska.

in the face of change (Sell and Zube 1986). Whatever the reasons, as local open spaces grow scarce and marginal open space values rise, public demands and political support for preserving open space lands will tend to increase. These conditions are most likely to occur where population growth is increasing demands for land in developed uses, resulting in significant open space loss, and where people are willing and able to afford the costs of preservation.

This process is consistent with economics and sociology research. Voting on all types of environmental referenda indicates greater support for protection among urban voters (Kahn and Matsusaka 1997; Salka 2003; Solecki et al. 2004). Perhaps rural voters are less supportive of protection, because they are less exposed to environmental degradation (Tremblay and Dunlap 1978). Urban voters may more

often witness degradation firsthand. Of open space referenda specifically, voter support for preserving farmland tends to be highest in places where population densities are increasing most rapidly, but lower in less developed places comprising more farmland (Kline and Wichelns 1994). In related research regarding land trusts—nonprofit organizations that preserve open space—Albers and Ando (2003) suggest that the prevalence of land trusts may be positively correlated with population density, but may decline as places become so developed that few unprotected open space lands are left to preserve. To the extent that residents actually know it, how much local land is already protected could influence perceptions of how much additional protection may be needed. People in places with large proportions of federal, state, or county land or significant holdings by nonprofit organizations could perceive less need to preserve additional open space even as development increases.

Other factors also can play a role. Socioeconomic conditions, such as education and income, can influence community environmental activeness (Parisi et al. 2004). These and political ideology have been linked to environmental voting generally (Press 2003, 835–836). Democrats tend to be more in favor of government intervention to correct market failures than Republicans (Salka 2003, 258–259), consistent with public preservation programs. Income also can influence voters' willingness and ability to pay for preserving open space. Passage of open space referenda typically results in increased taxes or government bond issues, with wealthy voters conceivably more able to pay. There can be limits to this wealth effect if increasingly wealthy voters substitute local open space lands with access to private lands and travel elsewhere.

For many environmental referenda, such as those calling for increased regulation, lower support often is found in rural areas that depend on natural resource industries (Salka 2003). Rural voters seem to respond to a perceived "price" of protection at the polls (Kahn and Matsusaka 1997). With open space this potential link is unclear. Although many open space programs do remove some forest, farm, and ranch lands from commodity production, to enhance wildlife or recreation, for example, many programs focus on protecting forestry, farming, and ranching. Employment in these occupations can have a positive influence on preservation support if an objective is to safeguard forest, farm, and ranch lands, or a negative influence if preservation is perceived as restricting forestry, farming, and ranching. Employment in other industries, including mining, construction, and real estate, also could negatively influence preservation support. The influence of employment on open space voting likely depends on the specific objectives of referenda and their expected economic effects in different locations.

## The Prevalence of Open Space Referenda in U.S. Counties

I evaluated the influence of open space scarcity and other socioeconomic factors on public impetus for preserving open space by examining the prevalence of county open space referenda in the United States, excluding Alaska and Hawaii, from 1999 through 2004. Data describing county open space referenda come from the Trust for Public Land LandVote database (Trust for Public Land 2005). I used these particular years, because they are the most recent years for which consistent data were available. Of 3066 counties examined, 124 voted on at least one open space referendum from 1999 to 2004 and some counties voted on more than one, for a total of 148 nationwide (Trust for Public Land 2005). If increasing open space scarcity

motivates local preservation effort, we would expect political impetus for preservation as indicated by county open space referenda to be more prevalent among more densely populated counties where development has resulted in significant open space loss. In fact, county referenda were more prevalent in more densely populated counties—population densities in counties that voted on open space referenda averaged 753 people per square mile, versus 195 people per square mile in counties that did not vote on referenda. In metropolitan counties (Economic Research Service 2004) 10% voted on open space referenda, versus 1% for nonmetropolitan counties.

I constructed a dummy variable $y_i$ such that $y_i = 1$ for counties that voted on open space referenda and $y_i = 0$ for counties that did not vote on referenda. The dummy variable enables the estimation of a logistic model describing the probability that counties voted on referenda as

$$P(y_i = 1) = \frac{\exp(\alpha' x_i)}{1 + \exp(\alpha' x_i)} \tag{1}$$

where $x_i$ are explanatory variables and $\alpha'$ are estimated coefficients. The explanatory variables describe socioeconomic and other factors hypothesized to influence the prevalence of county open space referenda, including population density, change in density, metropolitan designation, income, and education. Population density is used as an inverse proxy for the amount of open space lands remaining, and, along with change in density and metropolitan designation, describes the rural–urban and development characteristics of counties. I expected open space referenda to be more likely in metropolitan counties, with greater population densities, and where population densities have increased rapidly. Data describing voter registration, as a proxy for political ideology, could not be easily obtained for all counties, and were omitted. County data describing the extent of all federal, state, county, and privately protected land were unavailable, so I used the proportion of land under federal ownership as a proxy. Also, although support for environmental protection often is found to be higher among women (Mohai 1992), county-level data describing gender ratios typically possess insufficient variation to test this hypothesis. The potential influence of employment in particular occupations also was not tested in the model, because the specific objectives of county referenda varied.

The actual model estimated was

$$\begin{aligned}\text{Logit}(Yes) = {} & \alpha_0 + \alpha_1(\text{POPULATION DENSITY}) + \alpha_2(\text{POPULATION DENSITY}^2) \\ & + \alpha_3(\Delta\text{DENSITY}) + \alpha_4(\text{METRO}) + \alpha_5(\text{PER CAPITA INCOME}) \\ & + \alpha_6(\text{PER CAPITA INCOME}^2) + \alpha_7(\text{EDUCATION}) \\ & + \alpha_8(\text{FEDERAL LAND}) + \alpha_{(8+j)}(\text{region}_j) + \varepsilon\end{aligned} \tag{2}$$

where the explanatory variables are described in Table 2 and $\varepsilon$ is error. $\text{Region}_j$ describes eight region dummy variables used by Alig et al. (2004), with one region omitted ($j = 1$ to 7) to enable model estimation. Multicollinearity, often present in socioeconomic data, was not a significant problem. I included quadratic forms of both POPULATION DENSITY and PER CAPITA INCOME to test whether public motivation for preserving open space declines as counties become so crowded that little local open space remains to preserve and as increasingly wealthy residents find substitutes for local open space elsewhere. A log-likelihood ratio test suggests that POPULATION DENSITY$^2$ and PER CAPITA INCOME$^2$ do help to explain

**Table 2.** Descriptions of explanatory variables tested in the empirical models

| Variable | Description |
|---|---|
| POPULATION DENSITY | County population (1,000 s) per square mile in 2000 (U.S. Bureau of the Census 2000b). |
| ΔDENSITY | Percent change in population per square mile from 1990 to 2000 (U.S. Bureau of the Census 2000b). |
| METRO | Variable equals 1 if county is identified as metropolitan by the U.S. Office of Management and Budget (Economic Research Service 2004). |
| PER CAPITA INCOME | Per capita income ($1,000s) in county (U.S. Bureau of the Census 2000b). |
| EDUCATION | Proportion of individuals in county aged 25 years or older with 4-year college degree (U.S. Bureau of the Census 2000b). |
| FEDERAL LAND | Percent of land in county under federal ownership (Natural Resources Conservation Service, 2001). |
| SOUTHWEST | Variable equals 1 if county is located in the states of AZ, CO, NM, NV, UT; 0 otherwise. |
| SOUTH | Variable equals 1 if county is located in the states of AL, FL, GA, KY, MS, NC, SC, TN, VA, WV; 0 otherwise. |
| CALIFORNIA | Variable equals 1 if county is located in California; 0 otherwise. |
| NORTHWEST | Variable equals 1 if county is located in the states of ID, OR, WA; 0 otherwise. |
| GREAT PLAINS | Variable equals 1 if county is located in the states of MT, ND, NE, SD, WY; 0 otherwise. |
| NORTHERN MIDWEST | Variable equals 1 if county is located in the states of IA, IL, IN, MI, MN, MO, OH, WI; 0 otherwise. |
| NORTHEAST | Variable equals 1 if county is located in the states of CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, or VT; 0 otherwise. |
| SOUTHERN MIDWEST | Variable equals 1 if county is located in the states of AR, KS, LA, OK, TX; 0 otherwise. |

the prevalence of open space referenda in counties ($\chi^2 = 21.9$, df $= 2$, $p < .01$). The estimated logistic model is statistically significant ($\chi^2 = 329$, df $= 15$, $p < .0001$). Estimated coefficients for all socioeconomic explanatory variables are statistically significant at the 5% level or better (Table 3).

The estimated coefficients for POPULATION DENSITY and POPULATION DENSITY$^2$ together suggest that population density had a positive but diminishing influence on the prevalence of county open space referenda. The estimated coefficient for △DENSITY—the percent change in population density from 1990 to 2000—suggests that counties that experienced greater recent population density increases were more likely to place open space referenda on their ballots. The estimated coefficient for METRO suggests that metropolitan counties were more likely

**Table 3.** Estimated coefficients of the logistic model describing the prevalence of open space referenda in U.S. counties, 1999 to 2004

| Variable | Estimated coefficient | $t$ Statistic | Marginal effect |
|---|---|---|---|
| Constant | −13.939[d] | −7.37 | −0.1222 |
| POPULATION DENSITY | 0.550[d] | 2.88 | 0.0048 |
| POPULATION DENSITY$^2$ | −0.036[b] | −2.35 | −0.0003 |
| ΔDENSITY | 1.465[b] | 2.30 | 0.0128 |
| METRO | 0.948[c] | 2.95 | 0.0083 |
| PER CAPITA INCOME | 0.575[c] | 3.55 | 0.0050 |
| PER CAPITA INCOME$^2$ | −0.009[c] | −2.98 | −0.0001 |
| EDUCATION | 5.241[c] | 2.94 | 0.0459 |
| FEDERAL LAND | −1.120 | −1.41 | −0.0098 |
| SOUTHWEST | 2.816[c] | 4.57 | 0.0247 |
| SOUTH | 1.117[b] | 2.29 | 0.0098 |
| CALIFORNIA | 1.075 | 1.51 | 0.0094 |
| NORTHWEST | 0.917 | 1.25 | 0.0080 |
| GREAT PLAINS | 0.773 | 1.02 | 0.0068 |
| NORTHERN MIDWEST | 0.691 | 1.33 | 0.0061 |
| NORTHEAST | 0.144 | 0.25 | 0.0013 |
| SOUTHERN MIDWEST[a] | — | — | — |
| Summary statistics: | $N = 3066$, log likelihood = −329.34, $\chi^2 = 379.74$, df = 15, $p < 0.0001$ | | |

*Note.* Explanatory variables are defined in Table 2. Excludes Alaska and Hawaii.
[a] Base case region.
[b] Probability of $t$ statistic exceeding the critical $t$ value is greater than 95%.
[c] Probability of $t$ statistic exceeding the critical $t$ value is greater than 99%.

to have open space referenda than non-metropolitan counties. Other explanatory variables based on rural–urban continuum codes (Economic Research Service 2004) were tested but showed little variation in referenda likelihood across finer non-metropolitan rural categories. The estimated coefficients for PER CAPITA INCOME and PER CAPITA INCOME$^2$ together suggest that, like population density, income had a positive but diminishing influence on the prevalence of county open space referenda. The estimated coefficient for EDUCATION suggests that open space referenda prevalence was greater among counties with voters of higher educational attainment.

The negative estimated coefficient for FEDERAL LAND suggests that referenda prevalence was lower among counties with greater proportions of land under federal ownership, consistent with lower interest in preservation in counties comprising greater protected lands. Although the statistical significance of FEDERAL LAND is rather weak based on its $t$ statistic ($t = -1.41$, $p > .15$), it was retained because a log-likelihood ratio test indicates that it does help somewhat to explain the prevalence of open space referenda in counties ($\chi^2 = 6.1$, df = 1, $p < .05$). The estimated coefficients for the regional dummy variables suggest that county open space referenda (1999 to 2004) were more likely in the southwest and south after controlling for other socioeconomic factors (Table 3).

## Discussion

The results suggest that the impetus for preserving local open space is positively correlated with increasing population density, income, and education. The results are consistent with previous studies suggesting greater voter support for farmland and open space referenda among more educated and affluent people in more densely populated and metropolitan locations (Kline and Wichelns 1994; Solecki et al. 2004), as well as studies showing the influence of socioeconomic factors on environmental voting generally (Kahn and Matsusaka 1997; Press 2003; Salka 2003). The empirical results support the hypothesis that marginal values for open space increase with growing open space scarcity, motivating public support for preservation.

The effect can be illustrated by using the estimated coefficients of the logistic model describing county referenda prevalence (Table 3) to compute predicted values describing the likelihood that metropolitan counties voted on referenda as a function of population density, holding other variables at metropolitan county-mean values. The resulting likelihood curve, starting at the minimum population density found among metropolitan counties (1.4 people per square mile in Owyhee County, Idaho), shows how public demand for preserving open space might change as places become more populated (Figure 1). In places comprising significant amounts of open space and where population densities are low, open space referenda are less likely. People see little need to preserve open space, because plenty still remains. As places become more populated and open spaces lands are lost to development, people become more concerned; they take greater interest in protecting open space. Open space voter initiatives and government-sponsored ballot measures are more likely to appear on local ballots. Eventually, places become so populated that little open space remains that is not already protected. People may even become resigned to the inevitability of further development and open space loss. The impetus for preserving local open space declines. Public interests may shift to those concerns more common to urban areas—city services, crime, and public transportation, for example.

The "S" shape of the curve is a result of including a quadratic version of the population density variable in the estimated model; this particular specification

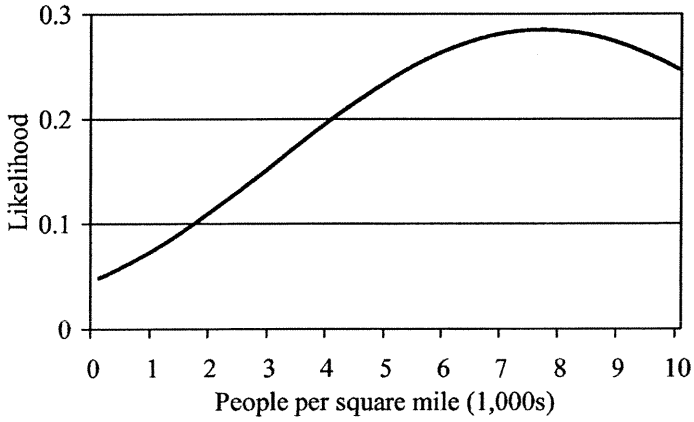


**Figure 1.** Predicted likelihood that U.S. metropolitan counties voted on open space referenda, 1999–2004, by population density.

yielded the best fit. The "S" shape of the curve, however, generally is consistent with Solecki et al. (2004), suggesting greater support for a 1998 open space initiative in New Jersey in places experiencing rapid development and open space loss, as well as a "falloff" in voter support in core urban areas (p. 636). In their study of land trust prevalence, Albers and Ando (2003) initially found that numbers of land trusts were negatively correlated with population density, seemingly contrary to their expectation that increasing open space scarcity would lead to greater numbers of land trusts. Albers and Ando (2003), however, found the expected positive correlation by dropping New Jersey—the most densely populated state—from their sample. Thus, their result also suggests that greater open space scarcity, as indicated by higher population densities, may result in greater support for local open space preservation, but that support eventually may slacken in the most urban places. Whether the falloff actually arises from a lack of open space left to protect, resignation of the public to the inevitability of more development, or shifting public interests can not be confirmed with the data examined. An alternative explanation is that falloff is an artifact of a potentially nonlinear relationship between population density and new development. Conceivably, high-density counties might absorb greater numbers of people with comparatively less land developed than low-density counties. A population increase in high-density counties then could cause less concern in open space loss terms than the same increase in low-density counties.

Most U.S. metropolitan counties still fall on the lower left-hand side of the curve with population densities below 1000 people per square mile. Of 3066 counties examined, nonmetropolitan counties, none of which have a population density over 344 persons per square mile, outnumber metropolitan counties 2013 to 1053. Despite widespread concern about open space loss, much of the United States remains sparsely populated. Still, several counties do fall along the center and upper right-hand side of the curve with population densities over 1000 people per square mile. These more densely populated counties are home to 36% of the U.S. population. Near the inflection point, where the curve's slope is steepest, are places like Wayne County, Michigan (3292 people per square mile), including Detroit; Orange County, California (3605 people per square mile), south of Los Angeles; and Denver, Colorado (3616 people per square mile). Approaching the peak are still more urban counties—Cook County, Illinois (5685 people per square mile), including Chicago; Essex County, New Jersey (6285 people per square mile), including Newark; and Arlington County, Virginia (6607 people per square mile), west of Washington, DC. Off the chart, with population densities over 10,000 people per square mile, are major cities—four of the five counties comprising New York City (Bronx, Kings, New York, Queens), San Francisco County, Suffolk County including Boston, Philadelphia County—counties with virtually no open space left beyond already protected public parks and reserves. Open space referenda also appear all along the curve: in 2003 in Bergen County, New Jersey (3778 people per square mile); in 2002 in Arlington County, Virginia (7287 people per square mile); and in 2003 in Hudson County, New Jersey (12,957 people per square mile), for example.

A final results highlight concerns the potential influence of income on preservation demand—that for the prevalence of open space referenda, income appears to have a positive but diminishing effect. As with population density, this effect can best be illustrated by using the estimated coefficients from the logistic model describing county referenda prevalence (Table 3) to compute predicted values for

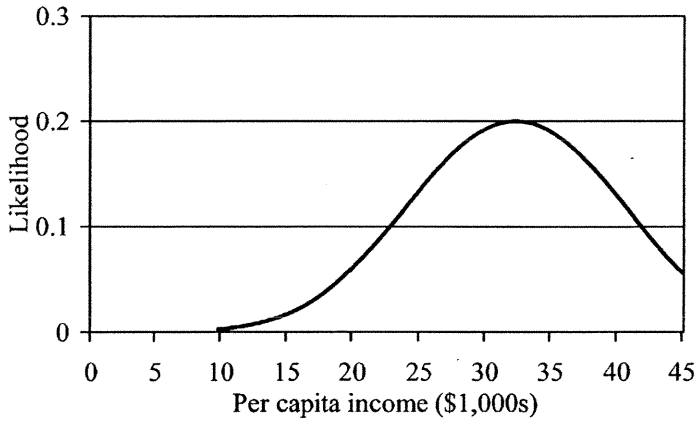


**Figure 2.** Predicted likelihood that U.S. metropolitan counties voted on open space referenda, 1999–2004, by per capita income.

metropolitan counties as a function of per capita income, holding other variables at metropolitan county-mean values. The resulting predicted likelihood curve, drawn over the range of average per capita incomes found in metropolitan counties ($9,900 to $45,000), suggests how public demand for preserving open space might change as county residents become more affluent (Figure 2). Like environmental goods generally, open space typically is thought to be a normal good—more is demanded as incomes rise. The predicted values of open space referenda likelihood support that idea to a point. At the average per capita income for metropolitan counties ($20,000), the slope of the likelihood curve is positive and still increasing. Near $32,400, however, the curve peaks and then declines with higher incomes.

As with population density, the "S" shape of the curve is a result of including a quadratic income term in the estimated model, because this particular specification yielded the best fit. The curve's "S" shape, however, is consistent with Kahn and Matsusaka (1997), who suggest that at higher incomes, certain environmental goods may become inferior—fewer are demanded as incomes rise. In the case of preserving local open space, the most affluent people either may afford their own local "open space" in the form of estates, private clubs, and gated communities, or more often travel to other locations to enjoy open space lands. The results suggesting that public support for preserving local open space may increase with population density and income but decline in the most densely populated and affluent places imply that there can be windows of opportunity when public support for local preservation is more likely. These windows of opportunity coincide with socioeconomic factors that influence people's marginal values for local open space lands. What effect local socioeconomic factors may have on peoples' support for preserving (nonlocal) open space elsewhere remains unknown.

## Conclusions and Policy Implications

The results from an empirical model describing the prevalence of county open space referenda in the United States are consistent with increasing public demands for preservation arising with population growth, rising incomes, development, and

growing open space scarcity. Greater open space scarcity, coupled with greater crowding of remaining open space lands, likely increases the marginal values that people hold for remaining open space, causing people to become more concerned about further open space loss. This conclusion does not deny other theories of increasing public support for preserving open space, but rather suggests one explanation for the apparent influence that changing socioeconomic factors have on the impetus for that support. Socioeconomic factors likely work in concert with other factors—people's value orientations, attitudes, norms, and community identity, for example—to influence demands for preserving local open space. Describing these other factors, however, generally calls for primary data gathered from focus groups, surveys, and other methods. Alternatively, many socioeconomic factors can be monitored using U.S. Bureau of the Census data and other data and, when examined in light of existing open space protection levels in different regions, could help land use planners and policymakers anticipate where open space concerns might soon arise.

Open space advocacy by government and nonprofit agencies and organizations often highlights the need to protect productive "working" forest, farm, and ranch lands, as well as general environmental benefits, such as air and water quality, and other ecosystem services. Although these broad concerns may resonate with some voters, it is likely that other voters support local preservation only to the extent that they value open space in their daily lives, for recreational access, aesthetics, and the environmental characteristics of the communities in which they live and work. These perceptions likely vary, depending in part on the extent and rate at which open space lands have been lost in given locations, and the types of open space lands affected. Public impetus for local preservation may be less likely to arise until open space lands grow sufficiently scarce and residents become willing and able to afford their protection. Although most open space advocates acknowledge the positive contributions of open space to people's quality of life—environmental amenities, water resource protection, recreation, and other benefits—local factors may not be fully recognized for the potentially critical role they play in motivating public support for local preservation policies and programs. If environmental policy advocates might best build electoral and policy support by advocating environmental protection as an investment in the future (Davis and Wurth 2003, 737), open space advocates might best emphasize local open space as an investment in residents' future quality of life.

Farmland preservation programs still tend to focus on agricultural production criteria to guide what lands should be preserved. However, research over the past decade suggests that multiple factors, especially environmental amenities, motivate public support for preserving farmland and should influence selecting preserved lands (Kline and Wichelns 1996; Rosenberger 1998; Duke and Aull-Hyde 2002). Focusing on working lands, rather than amenities, may be inconsistent with factors motivating public demands. Now they may also be inconsistent with lower marginal values rural people may hold for farmland as open space. Protecting working lands—forest, farm, and ranch lands—in particular, can imply different approaches than for other open space, because of the need to address economic issues affecting farming, ranching, and forestry (Daniels 2000). Although preserving open space can prevent development of forest, farm, and ranch lands, there may be little direct effect on forestry, farming, and ranching profitability, which is one key to maintaining those particular land uses. Planners and policymakers should take a hard look at

the factors motivating local preservation concerns before initiating specific planning and policy responses.

Advocating open space preservation to maintain ecosystem services as well as forestry and agriculture-based livelihoods in rural communities (e.g., USDA Forest Service 2006) also may be inconsistent with lower marginal open space values among rural residents. Some rural communities may want development and the increased economic activity they believe it will bring. These desires may hamper ecologically motivated local open space efforts. If preserving open space is necessary to safeguard habitat for particular species (Ewing et al. 2005), planners and policymakers should not expect political impetus for local preservation to spontaneously emerge until local landscapes become sufficiently developed. Moreover, although maintaining ecosystem services may be a noble goal, it may have limited meaning or relevance to any local, often modestly funded, open space preservation efforts that do emerge, which at best may afford only limited amounts of protected land. Habitats and watersheds may be lost or harmed by development long before local preservation becomes a priority among local residents. Where key resources must be protected, planners and policymakers may need to build local support for preservation by public education and outreach or seek funding and support from outside sources.

Although public demands for preserving open space may increase with growing open space scarcity, it also is likely that the types of open space people desire change over time as places develop. Perhaps initially people desire to protect scenic amenities and the rural character of their communities. But as open space lands grow increasingly scarce, they may be satisfied with simply protecting some place nearby to go for daily recreation. Data used in this study do not permit testing these hypotheses. Also, the conservation benefits of land can vary by the amounts and types of land protected (Wu and Boggess 1999; Albers and Ando 2003). Perhaps eventually landscapes become too crowded by development to contribute in any meaningful way to maintaining habitats and ecological services. In such places, quality-of-life objectives, such as protecting local water quality and access to open space lands for recreation, may become paramount. Research suggests that the amenities and housing opportunities that often attract in-migration and development to rural areas—open space provided by working forest, farm, and ranch lands, and the opportunity to purchase large lots in natural environments—often can be provided more efficiently by public open space, including parks (Kaplan and Austin 2004; Roe et al. 2004). In regulating development, planners and policymakers must also anticipate how best to provide desired open space in the future to satisfy growing numbers of new residents.

Sustaining open space has long been seen as a critical economic issue and is now also seen as integral for sustaining our psychological health and ethical relationship to the nonhuman world (Gobster 2004). Although short-term interest may vary, the open space issue will persist. Much of the United States remains uncrowded and undeveloped when compared to most other affluent countries. Many locations have potential for significant future population growth and development as U.S. residents continually seek to improve their quality of life in response to changing socioeconomic factors. Evaluating public demands for preserving open space in light of their relationship to changing socioeconomic conditions will continue to be a necessary step in fostering desirable forms of development and preservation, now and in the future.

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