Community Economic Competitiveness Analysis

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Outline

Executive summary

We review the empirical and theoretical literature on the impacts of natural amenities on county or state-level income and output, employment, population, and per-capita income.

The empirical studies reviewed employ both statistical modeling using empirical information and surveys to analyze the impact of natural amenities. The results of these studies clearly support the hypothesis that amenities positively impact output and employment and population growth and aggregate output in rural areas. In particular, if we limit the analysis to studies that assess the impact of protected lands, excluding studies that employ broader amenity measures such as climate or topography or man-made recreation facilities, none of the studies reviewed discovered a negative association between protected lands and income, output, employment or population. While several studies did not detect a significant impact of protected lands on income, output, employment or population, most reported significant positive impacts (Table 1).

Table 1: Findings of studies focusing particularly on local economic impacts of protected lands

Impact analyzed:	*Number of studies showing impact of conservation lands is*		
Change in	*Positive*	*Negative*	*Not significant*
Income/Output	6	0	2
Employment	9	0	2
Population	7	0	2

By contrast, the evidence on the impact of protected lands on per-capita income is mixed, with studies revealing a negative, positive or no association at all.

The role of natural amenities in regional development

Natural amenities play an important role in regional development. However, the recognition of this fact is a comparatively recent phenomenon. This recognition is the result of a large body of empirical evidence that documents that natural amenities are an important determinant of the location decisions made by people and companies. Natural amenities thus generate migration-related impacts on an area's economy in addition to the economic impacts associated with recreation visitors.

Historical perspective on the view of natural amenities of drivers of economic development

Traditionally, regional growth models were based on the theory of export-led growth first expounded by North (1955). Export-led growth theory regards the production of goods and services for outside markets as the primary driver of a region's economic growth. Historically, this encouraged the view, still widely-held today, that undeveloped areas could grow their economic base primarily through the extraction of natural resources for export to other regions. More recently, recreational tourism has been receiving growing attention as an alternative, increasingly important export product for areas high in natural amenities. However, recreation-based impacts are only part of the economic effects generated by natural amenities. High-amenity areas also experience growth in their economies as a result of high net rates of inmigration of people and firms attracted by those amenities.

Neoclassical migration models traditionally were based on the assumption that economic factors like employment and income levels were the prime determinants of people's decisions to move (Dearien et al., 2005). Though it was recognized that other, noneconomic factors might be influencing people's location choice, these were deemed too difficult to measure, and it was argued that non-money returns arising from locational preferences should be ignored (Sjaastad, 1962). Natural amenities are one of these non-money factors.

Traditional, export-based development theory has been unable to accommodate the reality of continued growth in the rural American West in the face of a widespread downturn in extractive industries since the 1980s (Rudzitis and Johnson, 2000). The historical experience shows that non-export, or residentiary (local) industries can serve as a key factor in the development of a region.[1] As a result of the inability of export-based models to explain observed reality, quality of life or amenities-based models (Graves and Linneman, 1979) of regional development have been proposed and have been receiving increased interest in the last three decades. In fact, a review of the migration and regional development literatures shows that natural amenities by now are widely being recognized as critical components in the explanatory models in these fields (Knapp and Graves, 1989). As Kwang-Koo et al. (2005) point out, from an empirical perspective, natural amenity-based economic development appears to be an important determinant in population, employment, and income growth.

[1] This argument was originally expounded by Tiebout (1956) in reply to North's (1955) theory of export-based development.

The idea that natural amenities may be important driving factors of regional growth is not a new one. Perhaps the earliest article stating the importance of amenities in regional growth was written by the geographer Ullman (1954), who identified "pleasant living conditions" - amenities - as crucial factors in explaining the rapid growth of what at the time still were considered "frontier states": Arizona, California, and Florida. Ridker and Henning (1967) and Harris et al. (1968) were other early advocates of the view that demand for environmental amenities, among other factors, was an important driver of residential location decisions. Graves and Linneman (1979) developed a location-specific amenity model that provided a theoretical framework focusing on differences in amenities between places. Early research in migration theory by Graves (1979, 1980, 1983) and Porell (1982) and Roback's (1982, 1988) capitalization theories all were attempts to model the role of amenities in economic growth.

The fundamental premise underlying the argument for inclusion of natural amenities in regional development models is that it is amenities that differentiate regions from one another (Diamond and Tolley, 1982). An amenity is defined as a location-specific, non-traded good (Graves and Linneman, 1979; Tolley, 1974). Since amenities are non-tradable, the only way households and firms can change their consumption of amenities is through relocation. Thus, if households or firms value amenities, the latter can be expected to be a factor in relocation decisions. Such relocation can be the result either of a change in preferences, income, or technology (particularly transportation and information technologies) (Rudzitis and Johnson, 2000).

Empirical evidence accumulated in the last three decades suggests that natural amenities are indeed a prime driver of location decisions. The growth of nonmetropolitan areas at rates higher than those of metropolitan areas in the 1970s and 1980s, unprecedented in U.S. history, could not be explained by the traditional migration models (Berry, 1978; Gillard, 1981; Morgan, 1978).

The theoretical basis for analyzing the impacts of environmental amenities on county growth is the assumption that households try to maximize their utility or well-being through their location decisions. Utility is a function of the consumption of private goods (itself a function of disposable income) as well as nonmarket amenities that vary across space. In the earlier economic literature, the only utility considered tended to be that associated with income, which explained the historic migration patterns from rural to urban areas in search of higher-paying jobs. However, the economic concept of utility is an all-encompassing measure of benefits that is not limited to financial factors. Thus, it is only logical that non-financial variables that influence people's well-being, such as environmental amenities, be included in the analysis of location decisions.

The reversal of the historically observed predominant rural-urban migration pattern may be attributable to a variety of causes. It may be the result of rising incomes and the associated movement along individuals' preference functions. Historically, gains in well-being obtainable from moving to higher-income urban centers appear to have outweighed the amenity losses associated with leaving rural areas. However, if the marginal utility of income is decreasing with rising incomes, there exists a point at which the relative reduction in well-being associated with reduced incomes is smaller than the gains from relocating to a high-

amenity area. This point may be reached as a result of increases in income or of a real or perceived increase in the amenity difference between urban and rural areas. Increased net migration to scenic rural areas also could be the result of structural or technological changes in the economy that create more or higher-income employment opportunities in rural areas, for example as a result of telecommuting, cheaper transport, or the increased size of rural economies. Technology indeed seems to have facilitated migration into rural high-amenity areas. Nelson (1999) found that areas rich in natural amenities have attracted high-income and highly educated people who often receive a disproportionately high share of their income from "non-traditional" sources (technology or investment sectors), whom new communication technologies have enabled to work from remote locations (Nelson, 1999). Inmigration of these people has provided economic stimuli for economic development in rural areas, creating new job opportunities (Nelson, 1999). Demographic shifts also are likely to be a contributing factor to the relative shift in migration trends from urban to scenic rural areas. Finally, such a shift in migration patterns could be the outcome of changing preferences, that is, an increase in the relative importance people attach to living in a high-amenity environment vis-à-vis higher income, at given income levels. The applicability of the last hypothesized cause is difficult to assess, as data on changes in societal preferences prior to the 1970s generally are scarce (Rudzitis and Johnson, 2000). Most likely, the observed relatively faster growth of scenic rural areas compared to urban areas in recent decades likely is the result of a combination of these causes.

Like households, firms also base their location decisions on an optimization calculus. Firms thus will follow people (customers and employees) into rural areas, especially if the reductions in labor costs associated with the frequently-observed lower wages in high-amenity areas overcompensate any higher production costs that might be associated with a location in rural areas.

Do jobs follow people or do people follow jobs?

The empirical observation of strong employment and population growth in high-amenity counties does not answer the question of whether it is jobs that follow people into these areas or whether people follow jobs to these areas.

Some studies specifically examine the direction of causality using simultaneous equations frameworks (Duffy-Deno, 1997, 1998; Lewis et al., 2002). These studies generally find that jobs follow people – people move for reasons other than jobs, specifically, natural amenities, and firms follow. Several surveys confirm these results.

In their survey of recent and long-term residents of wilderness counties in ten states that had experienced rapid population growth in the 1970s, Rudzitis and Johansen (1989, 1991) found that people tend to move to or live in such counties because of the natural amenities, not because of their jobs. Sixty percent of respondents who had recently (within the last ten years) immigrated to the areas cited wilderness as an important reason they moved. Overall, fifty-three percent of respondents stated that the presence of wilderness was an important reason they moved to or stayed in the area.

Another survey (von Reichert and Rudzitis, 1992; von Reichert, 1992) of residents of and migrants to 15 fast-growing wilderness counties found that only one quarter of the migrants increased their income, whereas close to half accepted income losses upon their moves to the high-amenity counties. Concomitantly, amenities and quality of life were more important factors in the migration decision than employment. Moreover, about 80 percent of the respondents were between 21 and 65 years of age, thus excluding retirement migration as the primary relocation driver.

Vias (1999) found similar results for the interior Rocky Mountains. Other studies have confirmed these observations, finding that up to a third of the people migrating into the rural American West move first and plan to find jobs or create their own jobs after moving (Rudzitis, 1996; von Reichert and Rudzitis, 1994; Wardwell and Lyle, 1997), and that they accept decreases in income in exchange for the high non-market amenities offered by their new locations (von Reichert and Rudzitis, 1994).

In his studies of 250 nonmetropolitan counties in the intermountain west, Duffy-Deno (1997, 1998) confirmed the importance of both the direct and indirect effects of high-amenity lands. He found that high-amenity areas attracted visitors because of recreation opportunities, resulting in direct effects on output, employment, and income, but also attracted in-migration which in turn led to increased economic activity and associated employment and incomes (the "indirect effect"). Other studies support these findings. For example, Rudzitis and Johnson (2000) confirmed the importance of indirect (i.e., inmigration based) impacts of protected lands in their study of the impacts of federal wilderness areas and other wildlands on county-level economic growth for the conterminous U.S.

Amenities attract retirees, recreationists and second-homers (McGranahan, 1999; Johnson and Stewart, 2005). They also attract people who relocate to high-amenity areas without a specific job prospect at hand (Dearien et al., 2005; Rudzitis and Johansen, 1989; von Reichert, 1992; Vias, 1999; Rudzitis, 1996; von Reichert and Rudzitis, 1994; Wardwell and Lyle, 1997). The resulting net inmigration to high-amenity lands results in an increase in both demand for goods and services and in a comparatively cheap labor supply in rural high-amenity areas, both of which attract companies and thus increase local output and employment (Riddel, 2001).

To test whether people follow jobs or vice versa, Dearien et al. (2005) administered a random stratified survey to 1,000 area residents. The results indicated that 28 percent of respondents (62 response rate) moved to the area because of amenities and did not have a job opportunity in the area when they moved. In order to get at the relative importance respondents assign to their different reasons for moving into the area, the authors also used a scaled question that asked respondents to rank factors that influenced their move. "Landscape, scenery, and environment" was ranked as important factor by the largest number of people, with 78 percent of all respondents stating that it was important in their decision to move to the area.[2] Rudzitis (1999) confirmed the importance of amenities as

[2] Other factors were "pace of lifestyle" (ranked as important by 76 percent of respondents), "crime rate" (75 percent), "outdoor recreation" (72 percent), "climate" (65 percent), "employment opportunity" (64 percent), "access to family and friends" (62 percent), "quality of schools" (56 percent), "cost of living")54 percent), and "social services" (22 percent).

"pull factors" in a study conducted for the National Science Foundation that asked people about the single-most important relocation factor. Seventy-seven percent of respondents gave amenity characteristics as the main reasons, while only 23 percent chose employment-related reasons.

Generalizing the impacts of protected lands on community economic competitiveness

Growth and development are complex processes that involve a variety of causal factors. Not surprisingly, the results of the more comprehensive modeling efforts of regional growth indicate that growth in any given period is a function, in addition to regional amenities, of historical growth patterns, and that it is conditional upon initial conditions in the period analyzed (see for example, Deller et al., 2001, 2005). As a result, any particular location is characterized by a more or less unique set of conditions and therefore it is not surprising that no two locations may experience the exact same growth impacts from their natural amenities.

In addition, the particular set of attributes that characterize the bundle of natural amenities present in a given location varies between locations. It is very difficult to accurately measure these characteristics, both in quantitative and in qualitative terms. Specifically, what do we mean by natural amenities and how do we measure them? As Deller et al. (2005) point out, answers to both questions are extremely difficult. Importantly, the literature is not uniform in its operationalization of the natural amenity variable(s) employed. A comprehensive review by Gottlieb (1994) shows that especially earlier work tended to use ad-hoc and sometimes very narrow measures of amenities (e.g., climate, wildlife refuges). A number of more recent studies use amenity variables (e.g., terrestrial, water, etc) that represent composite indexes of particular characteristics (Deller et al., 2001, 2005), while others focus on lands of particular ownership types (federal, state). Still others include man-made infrastructure in their amenity measures, such as marinas or ski areas (Deller et al., 2001, 2005).

The overall number of quantitative observations from available studies is still rather small. This, combined with the wide range of amenity measures used in the studies, makes it difficult to conduct a meta-analysis of the literature with the goal of developing a generally applicable statistical model of the economic impacts of the natural amenities in a location.

Even though such a generalized impact model is not available at this point, there is considerable empirical evidence regarding the impacts of particular types of natural amenities on income and population in a region.

These impacts commonly are distinguished into direct and indirect ones, where the former constitute the effects on the economy of spending by visitors (recreationists) while the latter stem from the increased economic activity associated with amenity-driven inmigration of households and businesses.

The following section presents a brief discussion of the most important findings regarding the role of protected lands on output, employment, income and population.

Selected literature findings on the role of natural amenities with a focus on protected lands

Our literature review included 60 studies for the U.S. that examine impacts of natural amenities on income or population cover different spatial (multi-county to national) and temporal scales and a variety of different categories of natural lands and operationalizations of amenity variables; most use the county as the spatial unit of analysis. Many more studies exist, so we decided to focus on the more recent ones. Of the studies reviewed, 16 specifically examine the impact of protected lands. We briefly summarize the most important findings of these studies in the remainder of this section. More detail on individual studies is provided in the Appendix. The remaining studies operationalize the amenity variable as water amenities (a composite variable), scenicness, climate, topography, or high relative levels of recreation-based employment. The studies that focused on protected lands included state and national parks, inventoried roadless areas, land-based amenities (a composite variable), federal wilderness areas and other wildlands, public conservation lands in general, and national wildlife refuges. Table A-1 in the Appendix provides a listing of all studies reviewed that report amenity impacts in quantitative terms. The Table indicates the Type and size of the impact analyzed in a particular study, the study area and method, the time period analyzed, the type of amenity measure used as well as the main characteristics of the amenity.

Before reviewing the findings reported in the literature, it is worth pointing out that a timing problem exists in any analysis that measures the impact of conservation lands on employment or population or growth (Lewis et al., 2002). Many conservation lands were established a long time ago. Thus, studies that use data from a comparatively recent period to analyze the community-level economic impacts of particular, "old" conservation lands may well find that these lands did not have any noticeable or significant employment impacts during the period of analysis. As Lewis et al. (2002) point out, such a finding in itself would not imply that these lands do not support local economies. Rather, the original impacts already occurred a long time ago and the economy has already adjusted to their existence and reached a new, higher equilibrium. Equally importantly, as Lewis et al. note, a finding of no noticeable impact of old conservation lands in a recent period does not support the conclusion that the establishment of *new* conservation lands does not have employment (or income or population growth) impacts.

Riddel (2001) confirms that this timing problem is in fact a real concern. Her analysis of the impacts of increases in open space around the perimeter of Boulder, Colorado indicates that a 1,000 acre increase in open space in Boulder leads to approximately 90 new jobs after two years, and a total of 100 new jobs after six years, at which point the full employment impact appears to have been realized. Thus, a study that analyzed the employment impacts of a 1,000 acre addition to open space in Boulder using data for a period beginning six years or more after the addition of that open space would find no employment impacts, when in fact approximately 100 jobs are attributable to the open space addition.

Despite of this timing issue, the literature tests for and indeed confirms positive impacts on population, local economic output, personal income, or employment for state parks (Bergstrom et al., 1990; Cordell et al., 1992; Duffy-Deno, 1997), wilderness and roadless areas (Berrens et al., 2006; Southwick Associates, 2000; Loomis and Richardson, 2000;

Rudzitis and Johansen, 1989, 1991; Rudzitis and Johnson, 2000; Rudzitis et al., 1996, Rudzitis, 1996; Duffy-Deno 1997, 1998), national parks and monuments (Southwick Associates, 2000; Rudzitis et al., 1996, Rudzitis, 1996; Duffy-Deno, 1997, 1998), national forests (Johnson and Stewart, 2007), or combinations of these and other undeveloped lands.

Counties with national forests and grasslands have been experiencing some of the highest population growth rates in the U.S. as people move near public lands (Garber-Yonts, 2004; Johnson and Stewart, 2007; USDA Forest Service 2006). This high growth is expected to continue over the next decades (Stein et al., 2007). In a study that covered all counties in the U.S., Johnson and Stewart (2007) found that between 1990 and 2000, the population residing in counties containing national forest land grew by 19 percent, compared to 13 percent for the country as a whole, mostly from net inmigration. In non-metropolitan counties, those with more than ten percent of total county area in national forest land registered faster population increases than those with less than ten percent in national forest land – 18 percent compared to eight percent over the decade (Johnson and Stewart, 2007). Nonmetropolitan counties containing national forest land grew significantly faster than other counties in each of the last three decades (1970-2000).

In another national-level study that analyzed data for the period 1960 to 1990, counties adjacent to federally designated wilderness areas were among the fastest growing counties in the nation (Rudzitis et al., 1996). The population of wilderness counties increased six times faster than the national average for other nonmetropolitan counties in the 1980's, and nearly twice as fast as other nonmetropolitan counties in the West. The difference in average growth rates was even more pronounced for counties near national parks (see also Rudzitis, 1996).

Loomis and Richardson (2001) estimate that wilderness recreation in the U.S. has an estimated annual economic value of $580-$710 million (2006 dollars; Loomis, 2000) and generates visitor spending-based community impacts that support around 27,000 jobs. They (Loomis and Richardson, 2000) estimate the recreational value and impacts associated with roadless areas to be similar to those generated by wilderness, at around $700 million (2006 dollars) per year. Visitor expenditures on recreation in roadless areas in 1999 generated an estimated $680 million (2006 dollars) in personal income (employee wages and proprietor income) and supported an estimated 23,700 jobs across the U.S. (Loomis and Richardson, 2000).

Two other national-level studies (Deller et al., 2001, 2005) found that areas with more protected lands were associated with a higher likelihood of having growth in population, income, and jobs than areas with fewer protected lands. The authors construct a composite land amenity variable that among other factors includes the number of hunting and fishing preserves, Bureau of Land Management public domain acres, acres of mountains, cropland, pasture and range land, Forest Service national forest and grassland acres, Fish and Wildlife Service refuge acres open for recreation, National Park Service acreage, National Resources Inventory forest acres, acres managed by the Bureau of Reclamation, the Tennessee Valley Authority and the U.S. Army Corps of Engineers, state park acres, The Nature Conservancy acres with public access, and National Wilderness System acres. In the earlier (2001) study, land amenities were estimated to have a positive and statistically significant impact on employment and population growth and, leading the authors to conclude that land amenities

appear to play a significant role in regional economic growth, and that rural areas endowed with high levels of natural resource amenities and overall quality of life experience higher overall levels of growth. The results of their more recent (2005) study, which uses the same expanded regional adjustment model and multidimensional amenities measures used in the 2001 study but employs a different modeling approach, confirm that higher levels of land amenities tend to be associated with faster growth rates. However, using the different modeling approach, the impacts on both employment and population growth are no longer found to be statistically significant. The interpretation of these findings is complicated by the fact that unlike most of the other studies reviewed here, Deller et al. include lands under different ownership (various federal agencies, state lands, private lands) as well as several unprotected land cover types (cropland, pasture, range land).

In addition to these studies that cover the entire lower 48 states, a number of studies focus on regions or smaller scales of analysis. For example, Bergstrom et al. (1990) examine the economic impacts of recreational visits to state parks on Georgia, North Carolina, South Carolina and Tennessee. Their analysis focuses on seven parks and indicated that in 1986 out-of-state visitation to these parks together generated an estimated total output associated of $639 million (2006 dollars), boosted total state incomes by a total of $261 million (2006 dollars), and supported a total of 10,800 jobs in the four states, leading the authors to conclude that recreational spending associated with visits to state parks generates substantial economic activity in the states studied.

In another study, Cordell et al. (1992) examine the economic growth and interdependence effects on local and state economies caused by visitation to Pomona State Park in Kansas. Cordell et al. find that out-of-area visitors to the park generated growth in total local output of $1.4 million (2006 dollars), added $0.6 million (2006 dollars) in total local income, and supported 19 jobs, not including park employees, with the growth impacts on the state as a whole about a quarter larger. By comparison, the economic interdependence impacts, which measure the total importance of the park to the local and state economies by including impacts associated with park visits by residents in addition to those by non-residents, are an order of magnitude larger. The authors conclude that state park visits have considerable positive economic impacts and together with other recreational uses of rural lands may provide means for stimulating economic growth and stability.

Focusing on 250 non-metropolitan counties in the intermountain west, Duffy-Deno (1997) uses a disequilibrium model to assess the impacts of state park density on county employment density and population growth. His results show that counties characterized by higher state park densities have significantly higher population and employment densities, with counties with a 10 percent higher state park density on average exhibiting a 1.4 percent higher long-run population density and 2.3 percent higher long-run employment density, all else constant. These impacts are the result of both the direct amenity effect, that is, recreational visits to the state parks by non-residents, and the indirect amenity effect, that is, the in-migration attracted by the amenity-enhancing effect of state parks. The author concludes that these results are consistent with the hypothesis that households are attracted to high-amenity regions and that regional amenities such as state parks can have both direct and indirect economic implications.

Lewis et al. (2002) estimate a model of simultaneous employment and net migration growth for the northern forest region with county data for the period 1990-1997. Their study area comprises 92 non-metropolitan counties in the northern Lake States region, northeastern New York, and northern New England. The conservation lands variable measures the combined county share in 1990 of national and state parks and forests, wilderness areas and wildlife refuges. The authors test for both direct and indirect effects (from increased migration) of conservation lands on employment growth. Their estimation results suggest that the share in conservation lands had no direct effect on employment growth. However, conservation land share did have a statistically significant positive effect on net migration, indicating a one percent increase in net migration for every ten percent increase in conservation lands. As the authors point out, since the share of conservation lands has a significant positive impact on net migration which they found to directly impact employment growth positively (coefficient: 1.05), conservation lands have an indirect positive impact on employment through the net inmigration they induce. This indirect effect is statistically significant and indicates that a ten percent increase in a county's share in conservation lands results in a one percent increase in the county's employment growth rate.

Southwick Associates (2000) examine the growth experience of economic sectors associated with natural amenities in Oregon. The authors select nine counties throughout Oregon chosen to achieve wide geographic representation. All of these counties show the increase in the relative importance of amenity-based sectors from 1969-97 that is also found for the state as a whole. Their statistical analysis indicates a positive relationship between county employment growth and the amount of county area in wilderness or national parks or monuments.

The authors then expand the analysis to eleven western states and estimate the impact of the presence of protected lands (comprising wilderness areas, national parks, and national monuments) and roadless areas on county income and employment growth (see also Lorah and Southwick, 2003).[3] The study finds that in the 409 western counties analyzed, the amounts of protected lands and Forest Service roadless areas, respectively, within 50 miles of a county's center are positively correlated with both income and employment growth during the period 1969-1997.[4] The authors further find that when narrowing the focus to rural counties, the importance of protected and roadless areas for economic growth is even stronger, and those counties that had the highest percentage of protected and roadless areas as a share of county area on average also experienced the highest income and employment growth rates.

A recent study by the Sonoran Institute (2006) examines the economic performance of Doña Ana county in New Mexico before and after the creation of over 200,000 acres, or 8.5 percent of the county area, as federally designated wilderness study areas (WSA) in 1980. Comparing the five-year periods immediately before and after the designation, the authors find that real per-capita income and personal income grew at substantially higher rates after

[3] The states included in the analysis are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[4] However, the percentage of county area in wilderness or National Park or Monument was only estimated to be significant in the employment regression, not in the income regression. In addition, Southwick Associates found that McGranahan's (1999) amenity measures were estimated to be significant in both income and employment regressions.

the designation. There was no change in the population growth rate, while the rate of job growth was four percent after the designation compared to five percent before.

The study also identifies a number of counties in the western U.S. that are similar to Doña Ana county in terms of eight criteria the authors regard as key characteristics.[5] The authors identify 14 "peer" counties in the western U.S. that perform similarly to Doña Ana county on these characteristics. Of these 14 counties, nine contain federally-designated wilderness, while five do not. Analysis of the economic data of the 14 counties shows that those with wilderness experienced faster annual growth of population, employment, and real personal income from 1970 to 2000 than those peers without wilderness. Peer counties with wilderness also outperformed those without wilderness in per capita income and average earnings per job in 2003. In a next step, the authors select the two out of the nine counties with wilderness that are most similar to Doña Ana and analyze their economic performance for the five-year periods immediately preceding and following major wilderness designations in 1984. The data show that employment and real per-capita income growth in both counties accelerated after designation. Personal income growth rates increased in one of the counties but slightly decreased in the other, while population growth remained stable in one and slowed slightly in the other.

Although the findings of the analysis by the Sonoran Institute are in line with those of other studies that analyze the economic impacts of protected lands, the type of analysis tends to reduce the validity of the interpretation. This is due to the fact that the approach employed is a before/after analysis, not a with/without analysis. The latter is the appropriate approach because it is better able to control for changes in factors other than wilderness designation that may influence the dependent variables of interest (employment, income, and population).

In their analysis of the economic impacts of roadless areas in New Mexico, Berrens et al. (2006) compare the performance of six economic indicators in counties with significant inventoried roadless areas (IRAs) and in the remainder of the state.[6] The indicators – total employment, wage and salary employment, income, population growth, real earnings, and earnings per worker – are evaluated over the decade that encompasses the debate and implementation of the roadless rule, 1995 to 2004 (the most recent year for which complete data are available). Berrens et al. find that counties with roadless areas performed better than the rest of the state on all of the chosen economic indicators. The differences were largest for total real income and population, which in counties with significant IRAs grew by 0.4 and 0.1 per year percent faster, respectively. Averaged across all six indicators, counties with significant tracts of roadless areas on average registered 0.1 percent faster growth per year than those without.

[5] These include growth rates of population, employment and personal income, proportion of the county's residents self-identified in the last census as either Hispanic or Latino, proportion of personal income from non-labor sources, proportion of personal income from employment in government, presence of a university, and proximity of the majority of the population that lives within an hour's drive of a commercial airport that offers daily service to various hubs and metropolitan areas.

[6] The authors define counties with significant inventoried roadless areas as counties in which such areas account for at least one percent of land area.

Dearien et al. (2005) analyze the impact of protected federal lands on population growth in the interior Northwest. They find that throughout the 1960s, 1970s, 1980s, and 1990s, average county-level population growth was consistently higher in counties with wilderness than in all nonmetropolitan counties combined, and through the 1970s-2000 has been higher in wilderness counties than in both metropolitan counties and all nonmetropolitan counties as a whole. In order to examine the impact of amenities on migration, the authors test county-level regression models of migration into the 100-county interior Northwest region for the decades of the 1970s, 1980s, and 1990s. Based on prior research by Graves (1983) and Roback (1982, 1988), Dearien et al. use median rent as a surrogate measure for amenities. They find the rent variable to be highly significant and positive in each of the three decades examined, with the strongest impact in the 1990s, thus suggesting that amenities are influencing county-level population growth in the region. They also find that population growth during the three decades is not driven by retirement migration, because the coefficient on the variable "percent of persons age 65 or older" is negative (though only significant during the 1970s). The authors then construct more detailed models for the decade of the 1990s in which they explore the impact of distance to and size of "high-amenity lands", where the high-amenity lands variable measures the total combined acreage of federal wilderness, national forests, national parks and national wildlife refuges in a county. In the distance model, the coefficient on distance to high-amenity lands is negative and significant as would be hypothesized, indicating that counties with closer proximity to high-amenity lands had higher population growth rates. In the model including the size of high-amenity lands as an explanatory variable, that variable had a positive and significant impact on population growth rates, as would be expected by the amenity-induced growth hypothesis. In all cases, the high-amenity lands variable was positive and significant at the five or ten percent level. Thus, Dearien et al.'s results indicate that lower distance to and increased share of federal protected lands both seem to increase population growth (net inmigration) rates at the county level. They found no statistically significant impact of metropolitan accessibility of high-amenity (NP, NF, wilderness areas, NWR) areas on net migration.

Conclusion

Employing both statistical modeling using empirical information and surveys, the studies discussed in the foregoing paragraphs clearly support the hypothesis that amenities positively impact output and employment and population growth and aggregate output in rural areas. Focusing specifically on studies that analyzed the impact of protected lands as opposed to that of broader amenity measures, none of the studies reviewed discovered a negative association between protected lands and income, output, employment or population. While several studies did not detect a significant impact of protected lands on income, output, employment or population, most reported significant positive impacts (Table 1).

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Employment	9	0	2
Population	7	0	2

The relation between amenities and per-capita income is more ambiguous. Several studies found that people seem to be willing to accept pay-cuts to live in high-amenity areas. For example, Judson et al. (1999) report that in the 1990s migrants who moved to non-metropolitan areas in Oregon only or in part for amenity reasons on average lost around $5,000 in annual income. The observation that migrants to high-amenity areas seem to be willing to accept declines in income is certainly consistent with what economic theory would suggest. In fact, the so-called "second paycheck" hypothesis postulates that the quality-of-life and hence welfare-enhancing non-wage benefits associated with living in a particular location form part of the total utility a household receives. Thus, households in high-amenity areas receive a relatively larger share of their total wellbeing from sources other than their income, and thus, all else equal, wages should be lower in amenity-rich areas because people trade off income for amenities.

However, the empirical evidence on this issue is mixed. For example, when simultaneously modeling changes in population, income and employment, Deller et al. (2001, 2005) in their national-level analysis found no negative association between amenities (as measured by their composite land variable) and income levels. Some studies covering more limited geographic areas find that high-amenity counties experienced faster per-capita income growth compared to moderate and low-amenity counties (Henderson and McDaniel, 1998). However, the direction of causality is difficult to determine. Is the higher level of per-capita incomes in high-amenity areas caused by wealthy people moving to those areas or are people in these areas becoming wealthier through increases in per-capita incomes from amenity-related economic growth? The empirical evidence certainly indicates that areas with high levels of natural amenities have attracted high-income and highly educated people (Judson et al., 1999; Nelson, 1999). Hunter et al. (2005) found that incomes of long-term rural households in high-growth amenity and recreation areas are higher than those of their counterparts in non-

growth/ amenity areas, but that the higher cost-of-living in high-growth amenity recreation areas effectively negates any relative income gains. This shows that consideration of cost-of-living differences is crucially important when considering impacts of population growth in high amenity rural regions.

In summary, the literature clearly demonstrates that the presence of protected lands positive affects income and output, employment and population, while the evidence on per-capita impacts is mixed.

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Appendix: Brief description of findings of the most relevant studies examining the economic impacts of protected lands

Bergstrom, J.C., H.K. Cordell, A.E. Watson, and G.A. Ashley. 1990. Economic impacts of state parks on state economies in the South. *Southern Journal of Agricultural Economics* 29:69–78.

Bergstrom et al. use an economic impact analysis framework to estimate total output, income, and employment generated from recreational visits from out-of state visitors to state parks in four southern states.[8] The authors present results of their analysis for seven parks. Total estimated output associated with out-of-state visitors' expenditures on visits to the seven parks in 1986 was $350 million (1986 dollars). The associated total income for the four states was estimated at $143 million (1986 dollars), while the total number of jobs supported in the four states by out-of-state visitors to the seven parks was estimated at around 10,800. The authors conclude that recreational spending associated with visits to state parks generates substantial economic activity in the states studied, and suggest that this finding warrants more research into the economic development potential of outdoor recreation.

Berrens, Robert, John Talberth, Jennifer Thacher, Michael Hand. 2006. Economic and community benefits of protecting New Mexico's inventoried Roadless Areas. Report prepared for Forest Guardians. Santa Fe, New Mexico: Center for Sustainable Economy. September, 2006. 69 pp.

The authors estimate the full economic benefits associated with inventoried roadless areas in New Mexico. The estimates developed include the value of selected ecosystem services (provision of clean water and sequestration of carbon), recreation benefits, passive use benefits, open space-related property value premiums, as well as employment and personal income. They also estimate that the growth rate of key economic indicators is on average 1.28% higher in counties with significant inventoried roadless areas than in counties without such areas.[9] In particular, total real income during 1995-2004 grew by 3.7 percent more (in absolute terms) in New Mexico counties with significant inventoried roadless areas than in counties without such areas, while total employment grew by 0.7 percent more and population grew by 2 percent more. Total annual personal income generated from the State's inventoried roadless areas is estimated at $14-21 million. Interestingly, the authors' analysis suggests that the economic value of water quality benefits provided by New Mexico's inventoried roadless areas is the single highest-value benefit generated by these areas.

Clark, D.E., and W.J. Hunter. 1992. The impact of economic opportunity, amenities and fiscal factors on age-specific migration rates. *Journal of Regional Science* 32(3):349-65.

Clark and Hunter investigate economic opportunity, amenities and fiscal factors as determinants of U.S. county net migration between 1970 and 1980. The authors' definition of amenities/disamenities is wide-ranging and includes crime rates, poverty, climate, state parks, major sports teams and cultural opportunities such as museums and theatres. They

[8] The states included in the analysis were Georgia, North Carolina, South Carolina, and Tennessee. The total number of parks included in the analysis was 317. However, the paper presents impact estimates only for seven parks.

[9] The authors define counties with significant inventoried roadless areas as counties in which such areas account for at least one percent of land area.

find that all three categories (economic opportunities, amenities, fiscal factors) are important determinants of migration. (The authors' definition of amenities is too broad to allow conclusions regarding the impact of natural amenities).

Cordell, H.K., J.C. Bergstrom, and A.E. Watson. 1992. Economic growth and interdependence effects of State Park visitation in local and state economies. *Journal of Leisure Research* 24:253-268.

Cordell et al. examine the local and statewide economic impacts generated by resident and non-resident visits to Pomona State park in Kansas.[10] They conduct two types of impact analysis: one examines the growth in output, income, and employment associated with non-residential visitors; the other examines the interdependency effects associated with the park. The growth analysis identifies the economic impacts the park generates from visits by nonresidents, all of which can be attributed to the park. By contrast, the interdependency analysis examines the total importance of the park to the local and state economies by including impacts associated with park visits by residents in addition to those by non-residents. This analysis highlights the total economic impact of the park; however, the interpretation of its results is different from those of the growth analysis. If the park were non-existent or were to be closed, not all interdependency impacts would be lost to the local or state economies, because some of the park-related expenditures and associated impacts would be transferred to other parks in the area or to other activities in the area. Cordell et al.'s find that the local growth impacts of the park were $0.77 million in total output, $0.33 million in total income, and 19 jobs (not including park employees; all values for 1986. The growth impacts on Kansas as a whole were slightly larger, estimated at $1 million in total output, $0.41 million in total income, and 23 jobs. The economic interdependence impacts are an order of magnitude larger: the park contributed to an estimated $5.9 million in total local output (from residents and non-residents visiting the park) and $2.5 million in total income and generated an estimated 148 local jobs. The corresponding numbers for the state as a whole were $8 million in total output, $ 3.2 million in income and 176 jobs.

Cordell et al. conclude that state park visits have considerable positive economic impacts and together with other recreational uses of rural lands may provide means for stimulating economic growth and stability.

Cromartie, John B. 1998. Net migration in the Great Plains increasingly linked to natural amenities and suburbanization. *Rural Development Perspectives* 13(1):27-34.

Cromartie examines changes in net migration rates and possible explanatory factors in counties in the Great Plain States during the 1980s and 1990s. He finds that although sparsely settled, outlying districts still experienced negative net migration rates, a distinct and widespread upturn of net migration rates occurred between the mid-1980s and mid-1990s. He suggests that together with a continued high rate of urbanization in the region and increased commuting to urban centers, natural amenities may be assuming a greater importance in explaining net migration patterns in those parts of the region characterized by attractive physical qualities including climate, topography, and presence of lakes and streams. These areas captured a larger share of net migration in the 1990s than they did in the 1980s, with high amenity locations growing faster than medium amenity locations, while locations

[10] The local area contains seven counties and includes the county in which the park is located and all adjacent counties.

with low amenity characteristics experienced negative net migration rates.[11] In the three-year period 1994-96, natural amenities are estimated to have contributed an average of 0.2 percent per year to net migration in the Great Plains region.

Dearien, Christy, Gundars Rudzitis, and John Hintz. 2005. The role of wilderness and public land amenities in explaining migration and rural development in the American Northwest. In Green, G.P., S.C. Deller, and D.W. Marcouiller (eds.). 2005. *Amenities and Rural Development*: *Theory, Methods and Public Policy*. New Horizons in Environmental Economics series. Cheltenham, U.K. and Northampton, Mass.: Elgar. Pp. 113-128.

Dearien et al. analyze the impact of Federal protected lands on population growth in the interior Northwest. They find that throughout the 1960s, 1970s, 1980s, and 1990s, average county level population growth consistently was higher in counties with wilderness than in all nonmetropolitan counties combined, and through the 1970s-2000 has been higher in wilderness counties than in both metropolitan counties and all nonmetropolitan counties as a whole.

In order to examine the impact of amenities on migration, the authors test county-level regression models of migration into the 100-county interior Northwest region for the decades of the 1970s, 1980s, and 1990s. The models include economic, demographic, social and amenity variables at the county level. Based on prior research by Graves (1983) and Roback (1982, 1988), Dearien et al. use median rent as a surrogate measure for amenities. The rent variable is found to be highly significant and has a positive sign in each of the three decades examined, with the strongest impact in the 1990s, suggesting that amenities are influencing county-level population growth in the region. The authors also find that population growth during the three decades is not driven by retirement migration, because the coefficient on the variable "percent of persons age 65 or older" is negative (though only significant during the 1970s). Dearien et al. then construct more detailed models for the decade of the 1990s in which they explore the impact of distance to and size of "high-amenity lands", where the high-amenity lands variable measures the total combined acreage of Federal wilderness, National Forests, National Parks and National Wildlife Refuges in a county. In the distance model, the coefficient on distance to high-amenity lands is negative and significant as would be hypothesized, indicating that counties with closer proximity to high-amenity lands had higher population growth rates. In the model including the size of high-amenity lands as an explanatory variable, that variable had a positive and significant impact on population growth rates, as would be expected by the amenity-induced growth hypothesis. In all cases, the high-amenity lands variable positive and significant at the five or ten percent level.

In order to test whether people follow jobs or vice versa, the authors also administered a random stratified survey to 1,000 area residents. The results indicated that 28 percent of respondents (62 response rate) moved to the area because of amenities and did not have a job opportunity in the area when they moved. In order to get at the relative importance respondents assign to their different reasons for moving into the area, the authors also used a scaled question that asked respondents to rank factors that influenced their move. "Landscape, scenery, and environment" was ranked as important factor by the

[11] The picture was similar during the 1980s, when high-amenity areas experienced the lowest average net population loss, compared to medium amenity areas and especially low-amenity areas.

largest number of people, with 78 percent of all respondents stating that it was important in their decision to move to the area.[12]

Deller, Steven C., Tsung-Hsiu (Sue) Tsai, David W. Marcouiller, and Donald B.K. English. 2001. The role of amenities and quality of life in rural economic growth. *American Journal of Agricultural Economics* 83(2):352-365.

Deller et al. estimate a structural model of regional economic growth for 2,243 rural counties in the US during the period 1985-1995. The model examines county growth in population, employment and per-capita income as a function of eleven variables representing demographic, income, education, and crime characteristics, tax rates and government expenditures, and five broad amenity measures. The amenity measures include climate, developed recreational infrastructure, land, water, and winter. The land measure is intended to describe the nature of the terrain and land resources within a county, and includes the number of guide services, number of hunting and fishing preserves, clubs, and lodges, BLM public domain acres, acres of mountains, cropland, pasture and range land, FS national forest and grassland acres, FWS refuge acres open for recreation, number of private and public campground sites, NPS acreage, NRI forest acres, acres managed by the Bureau of Reclamation, the Tennessee Valley Authority or the US Army Corps of Engineers, total rail-trail miles, state park acres, The Nature Conservancy acres with public access, and National Wilderness System acreage. The authors use principal components analysis to compress these variables into one scalar *land amenities* measure.[13] Deller et al. find that the principal component analysis-derived land amenities measure appears to separate mountainous areas with high levels of National Forest and Grassland and National Wilderness Preservation system acreage from areas that tend to be more agriculturally oriented, and that as a result counties from the western states tend to score higher on the land amenity measure than Great Plains or Corn Belt counties. For water amenities, the principal components analysis tends to emphasize value-added activities associated with water resources, such as marinas, canoe and rafting outfitters and guide services, and fishing camps. As a result, counties with a higher number of marinas, canoe and rafting outfitters and guide services and fishing outfitters tend to score higher than counties with pristine water areas. Of the five amenity attributes included in the analysis, all were positively related to at least one measure of growth, while none were negatively related to any of the measures of growth. Land amenities were estimated to have a positive and statistically significant impact on employment and population growth and no statistically significant impact on per-capita income growth, while water amenities were estimated to have positive and statistically significant impacts on population and per-capita income growth. The authors conclude that all five amenity attribute measures appear to play a significant role in regional economic growth, and that

[12] Other factors were "pace of lifestyle" (ranked as important by 76 percent of respondents), "crime rate" (75 percent), "outdoor recreation" (72 percent), "climate" (65 percent), "employment opportunity" (64 percent), "access to family and friends" (62 percent), "quality of schools" (56 percent), "cost of living")54 percent), and "social services" (22 percent).

[13] Principal component analysis uses allows the construction of a broader, scalar indicator from a number of variables, with the resulting indicator capturing much of the information contained in the original variables. The indicator is a linear combination of the original variables with the linear weights being the eigenvectors of the correlation matrix between the set of factor variables. Thus, principal component analysis inspects the sample data for directions of variability and uses this information to reduce a collection of variables into a single measure (Deller et al., 2001).

rural areas endowed with high levels of natural resource amenity endowments and overall quality of life experience higher overall levels of growth.

Deller, Steven C., David W Marcouiller, Donald B.K. English. and Victor Lledo. 2005. Regional economic growth with a focus on amenities. In Green, G.P., S.C. Deller, and D.W. Marcouiller (eds.). 2005. *Amenities and Rural Development: Theory, Methods and Public Policy*. New Horizons in Environmental Economics series. Cheltenham, U.K. and Northampton, Mass.: Elgar. Pp. 129-152.

The authors specify an expanded regional adjustment model identical to that used in Deller et al.'s 2001 paper and use the same multidimensional measures of amenities (Deller et al., 2001). As in Deller et al. (2001), the land amenities measure includes 16 independent variables and is intended to describe the nature of the terrain and land resources within a county. The principal innovation in this paper compared to Deller et al. (2001) is that the authors use a Bayesian Model Averaging approach to test different model specifications and identify the variables to be included in the analysis.[14] Deller et al.'s results indicate that higher levels of amenities tend to be associated with faster growth rates, with the exception of the climate measure. They see their findings as providing strong evidence that the fastest growth in the 1990s occurred in areas endowed with high levels of amenities, but that also had added value to those amenities by investing in recreation services. With respect to land amenities as measured through their scalar indicator composed of 16 variables (see description of Deller et al. [2001] above), their results indicate a positive but not statistically significant impact of land amenities on both employment and population growth, and a much weaker but also not significant impact of land amenities on per-capita income levels. This is different from their earlier findings (Deller et al., 2001), in which land amenities were estimated to have significant positive impacts on population and employment growth. Water amenities are estimated to have positive and statistically significant impacts on employment and population growth, and no significant impacts on per-capita income growth.

Duffy-Deno, Kevin T. 1997. The effect of State Parks on the County economies of the West. *Journal of Leisure Research* 29(2):201-224.

Duffy-Deno analyzes the local (county-level) economic impact of state parks using a sample of 250 non-metropolitan counties from the eight states in the intermountain west. He estimates a simultaneous equations model of county development that includes fiscal factors (tax levels, number of police officers per capita, and numbers of primary and secondary school teachers per pupil), local factors (highway density, income levels), and amenity factors including state park density (other amenity factors are climate, share of lands controlled by FS, NPS, BLM, and FWS, number of destination ski resorts). He finds that counties characterized by higher state park densities had significantly higher population and employment densities. Specifically, counties with a 10 percent higher state park density on average exhibited 1.4 percent higher long-run population densities and 2.3 percent higher long-run employment densities, all else constant. These impacts are the result of both economic recreational visits to the state parks by non-residents (the direct amenity effect)

[14] Bayesian Model Averaging explicitly recognizes the existence of model uncertainty and seeks to integrate out the dependence of the regression parameter on any particular model. The estimate of the regression parameter is made by averaging its expected value over the set of all possible models weighted by each model's probability of occurrence given the dataset (Deller et al., 2005).

and in-migration attracted by the amenity-enhancing effect of state parks (the indirect amenity effect).[15] The author concludes that these results are consistent with the hypothesis that households are attracted to high amenity regions and that regional amenities such as state parks can have both direct and indirect economic implications.

Duffy-Deno, Kevin T. 1998. The effect of federal wilderness on county growth in the intermountain western United States. *Journal of Regional Science* 38(1):109-136.

In this study, Duffy-Deno examines the relationship between population and employment density growth and percent of county area in Federal (BLM, FS) wilderness, in order to test the hypothesis that wilderness designation may negatively affect rural economies. The estimation results indicate that the percent of county area in Federal (BLM and FS) wilderness is not statistically associated with either population or employment density in the 250 rural intermountain counties studied.[16] Thus, there are no empirical indications that wilderness designation has negative effects on local economies. Rather, when disaggregating Federal wilderness into BLM and FS wilderness holdings, the analysis suggests that there is a positive and statistically significant relationship between the percent of county area designated as FS wilderness on the one hand, and both population density and employment density on the other hand. In particular, counties with a ten-percent greater share of FS wilderness are characterized by 1.35 percent greater population density and 0.25 percent greater employment density. The estimation results also indicate that the percent of county land area owned by the National Park Service positively and significantly affects county population density. This is consistent with the hypothesis that National Parks are a local amenity and can attract new county residents.

Fuller, Kate, Mahri Monson, Jennifer Ward, and Leah Greden Mathews. 2005. Can nature drive economic growth? *Review of Agricultural Economics* 27(4):621–629.

Fuller et al. discuss the situation of Swain County, North Carolina, a rural county that faces constrained development options as a result of a significant (71 percent of total county area) federal footprint on the county's land area. The county has been experiencing increased nature-based economic development during the past several decades. The authors examine historical and current developments with respect to projects and management actions by Federal agencies and that have the potential to impact nature-based economic development of the county. The paper does not provide a quantitative analysis of the historic importance of natural amenities on the county's employment, income, or population.

Garber-Yonts, Brian E. 2004. The economics of amenities and migration in the Pacific Northwest: Review of selected literature with implications for national forest management. Gen. Tech. Rep. PNW-GTR-617. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p.

Garber-Yonts reviews a wide range of literature on the influence of nonmarket amenity resources on population migration. His review encompasses migration and demographic studies, urban and regional economics studies of amenities in labor markets, retirement

[15] Duffy-Deno's results indicate that the direct effect dominates the indirect effect, with a ten percent increase in state park density leading to direct population and employment increases of 2.2 and 1.2 percent, respectively.

[16] The estimated coefficients on the *percent county in wilderness* variable are positive for both population and employment density, but they are not significant.

migration, and firm location decisions, nonmarket valuation studies using hedonic price analysis of amenity resource values, land use change studies, and studies of the economic development influence of forest preservation. His synthesis of the literature reveals that natural amenities consistently have been shown to positively influence population growth in urban and rural areas characterized by proximity to public forest lands.

Henderson, Jason, and Kendall McDaniel. 1998. Do scenic amenities foster economic growth in rural areas? *Regional Economic Digest* 1:11-17.

Henderson and McDaniel (1998) find that in the early 1990s (1990-1995), extensively scenic counties in the Tenth Federal Reserve district (Midwest and along the Rocky Mountain front range, including CO, KS, NE, WY and parts of NM, OK and MO) added jobs at an average annual rate of three percent, compared to moderately scenic counties' 1.7 percent, and 1.4 percent for all other rural counties. The authors define a county as extensively scenic if it has two or more scenic-related businesses, and moderately scenic if it has one scenic-related business. Scenic counties also showed markedly higher growth in real per-capita income, with extensively scenic counties growing by on average 1.2 percent per year, compared to 0.4 percent for moderately scenic counties and 0.1 percent for other rural counties. The authors also find that scenic counties adjacent to urban areas grew faster than non-adjacent scenic counties.

Hunter, Lori M., Jason D. Boardman, and Jarron M. Saint Onge. 2005. The association between natural amenities, rural population growth, and long-term residents' economic well-being. *Rural Sociology* 70(4):452-469.

Hunter et al. examine how rural demographic change in areas characterized by high levels of natural amenities and/or recreation affects the economic well-being of long-term resident households. Hunter et al. use the USDA Economic Research Service's index of amenities (McGranahan, 1999), and classify counties with amenity scores of six or higher (2+ standard deviations from the population mean) on the seven point scale as "high-amenity" counties. They use the work of Johnson and Beale (2002) to identify 329 recreation counties in the US, with 121 ranking in the top quarter of McGranahan's (1999) natural amenity scale. Of these high-amenity and/or recreation counties, Hunter et al. identify high-growth counties as those with at least a 30 percent increase in population during the period 1970-1995. The majority of high-growth amenity/recreation counties lie in the West (20); the remainder lie in the Midwest (11), the South (8), the mid-Atlantic (4), the Northeast (3), and the Southwest (2). The authors use data on individual and family characteristics from a longitudinal study, the Panel Study of Income Dynamics (PSID) conducted at the University of Michigan's Institute for Social Research Survey Research Center to examine the relation between annual family income and long-term residence in high-amenity or recreation high growth counties. Descriptive statistics reveal that in 2001, the final year of the period studied (1990-2001), average family incomes of long-term residents in high-growth high-amenity recreation (HGAR) counties were, on average, $9,000 (19.4 percent) higher than in other counties. At the same time, however, median housing value in HGAR counties was 80 percent higher than in non-HGAR counties. Using growth curve modeling (a multi-level model) to analyze the impact on a long-term rural resident family's economic well-being of being located in a HGAR county during the period 1990-2001, the authors confirm the finding of a statistically significant higher family income for HGAR counties, although the model results yield a smaller income plus ($3,500). More interestingly, the growth models allow the authors to

examine the divergence in average long-term resident family incomes between HGAR and non-HGAR counties during 1990-2001, with and without cost-of-living adjustments. Adjusted for differences in the cost of living (using median housing values as a proxy), the model results suggest that average long-term resident family incomes in rural HGAR counties did not increase faster than in non-HGAR counties.[17] Interestingly, however, the results indicate that a subset of the population in HGAR counties did experience relative gains in family income compared to their non-HGAR counterparts. These are families with lower incomes, which tend to be headed by women or less-educated individuals. The authors interpret this result as suggesting that socio-economically disadvantaged families may be those most able to gain from amenity-based population growth and the accompanying economic diversification and associated growth in relatively low-paying service jobs. Nevertheless, they suggest that it is unlikely that these low-wage employment opportunities offer a viable livelihood in the face of the rise in the cost of living that often accompanies amenity-based growth. Overall, the results of this study show that consideration of cost-of-living differences are crucially important when considering impacts of population growth in high amenity rural regions.

Ingram, Kevin, and Jan Lewandrowski. 1999. Wildlife conservation and economic development in the West. *Rural Development Perspectives* 14(2):44-51.

Ingram and Lewandrowski point out that population growth in the West since the early 1990s has been particularly high in rural areas (nonmetro counties) and that in many places, that growth has not been following the traditional pattern of concentrated growth in urban centers. The authors observe that growth extends to very remote location, often bordering national forests and parks. They argue that this growth is due in part to the increasing importance of the service sector as a main driver of new job creation, as well as an increased demand for wildlife goods and services and for living in high-amenity locations. This increased demand for wildlife-associated and scenic amenities has contributed to the growth of the tourism sector, as well as to inmigration by people building vacation or retirement homes as well as those whom new information technologies permit running their businesses from remote locations. Ingram and Lewandrowski point out that the high rate of recent population growth and associated development in western rural areas is leading to increased habitat loss and fragmentation. Protection of wildlife resources will require making other extensive sectors (agriculture, housing) more compatible with wild species and their habitat. They argue that incentive-based programs such as CRP and WRP may offer lessons of how to achieve the goal of protection of wildlife resources by addressing the unequal distribution of costs and benefits associated with species and habitat protection.

Johnson, Kenneth M., and Susan I. Stewart. 2005. Recreation, amenity migration and urban proximity. In Green, G.P., S.C. Deller, and D.W. Marcouiller (eds.). 2005. *Amenities and Rural Development: Theory, Methods and Public Policy*. New Horizons in Environmental Economics series. Cheltenham, U.K. and Northampton, Mass.: Elgar. Pp. 177-96.

[17] The coefficient on HGAR family income growth is very small and not statistically significant.

Johnson and Stewart analyze recent demographic trends in non-metropolitan (rural) recreation counties in the US.[18] They find that during 1990-2000, recreation counties experienced an overall population increase of 20 percent, far above the 10 percent seen in all non-metro counties or the 13 percent experienced in the US as a whole. Recreation counties grew much faster than counties dependent on manufacturing, government work, trade and services, or those with unspecialized economies. Most of this growth (84 percent) was fueled by net inmigration. These gains were very widespread, occurring in 88 percent of recreation counties. The authors see this as significant evidence that the presence of recreational opportunities in rural counties is strongly associated with population growth. The authors then compare population growth between recreation counties adjacent to metropolitan areas and those nonadjacent to metro areas. They find that during 1990-2000, the average growth rates of the two groups were the same (20 percent total), while rates have diverged since 2000, with adjacent counties experiencing faster growth (1.4 percent annually vs. 1.0 percent), a pattern similar to that observed in the 1980s.

Johnson, K.M., and C.L. Beale. 2002. Nonmetro recreation counties: Their identification and rapid growth. *Rural America* 17:12-19.

Johnson and Beale analyze recent demographic trends in non-metropolitan (rural) recreation counties in the US. Their results are reported above (Johnson and Stewart, 2002).

Johnson, K.M., and S. Stewart. 2007. Demographic trends in national forest, recreational, retirement and amenity areas. In: Kruger, L., R. Mazza, and K. Lawrence (eds.). Proceedings - Recreation Research and Management Workshop. Gen. Tech. Rep. PNW-GTR-698. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 187-199.

Johnson and Stewart compare the populations growth rates during 1970-2000 of counties in the U.S. with and without national forest land. They find that between 1990 and 2000, the population residing in counties containing national forest land grew by 19 percent, compared to an increase of 13 percent for the US as a whole. Most of this growth was fuelled by net inmigration. Nonmetropolitan counties containing national forest land grew significantly faster than other counties in each of the last three decades (1970-2000). In nonmetropolitan counties, those with more than ten percent of total county area in national forest land registered larger population increases (18 percent) during 1990-2000 than those with less than ten percent in national forest land (eight percent) (Johnson and Stewart, 2007).

Jones, Robert Emmet, J. Mark Fly, James Talley, and H. Ken Cordell. 2003. Green migration into rural America: The new frontier of environmentalism? *Society and Natural Resources* 16(3):221-238.

This article does not analyze growth impacts of environmental amenities. Rather, the authors compare differences in environmental attitudes between migrants and rural non-migrants. They argue that shifts in rural population and economic growth patterns may help explain rising levels of support for environmental values in many rural areas. In particular, the authors discuss a model of "green migration" that assumes that domestic in-migration, with

[18] The authors employ the Office of Management and Budget's definition of metropolitan and non-metropolitan counties, and study counties classified as recreation counties by Johnson and Beale (2002) on the basis of recreational employment and earnings, seasonal housing, and expenditures for lodging.

its impacts on the character and composition of rural communities, is one of the reasons environmental values may be gaining support in rural America. Results based on survey data obtained from two groups of rural residents of southern Appalachia support the model. A majority of the inmigrants to the region came because of its environment, and protecting environmental values remained a high priority. In-migrants were found to be slightly more knowledgeable about environmental issues, more concerned about the environment, place higher priority on environmental protection, and are more engaged in activities that promote environmental values than nonmigrants. The authors conclude that knowledge of the sociodemographic characteristics of both groups of rural residents is important to understanding how they differ on several indicators of environmentalism.

Judson, Dean H., Sue Reynolds–Scanlon, and Carole L. Popoff. 1999. Migrants to Oregon in the 1990's: Working age, near–retirees, and retirees make different destination choices. *Rural Development Perspectives* 14(2):24–31.

This article does not examine growth impacts of environmental amenities.

Knapp, Thomas A., and Philip E. Graves. 1989. On the role of amenities in models of migration and regional development. *Journal of Regional Science* 29(1):71-87.

Knapp and Graves explore the role of location-specific amenities in human migration decisions and regional development. They point out the need to include amenities as critical elements in models of regional development.

Kwang-Koo, Kim, David W. Marcouiller, and Steven C. Deller. 2005. Natural amenities and rural development: Understanding spatial and distributional attributes. *Growth and Change* 36(2):273-297.

In their regional development model, Kwang-Koo et al. examine the impact of land-based, river-based, lake-based, warm-weather-based, and cold-weather-based amenities in 242 counties in MI, MN and WI during the period 1980-1990 on population growth, retail and service employment growth, per-capita income growth, and Gini index change[19]. They use principal component analysis (PCA) to condense a set of related amenity attributes into amenity scores for these five amenity groups. Kwang-Koo et al. use a spatial error model to correct for the observed spatial correlation (clustering) of their natural amenities.

Their modeling results indicate that during the time period analyzed, most of the natural amenities in the study area did not have statistically significant relationships with the dependent variables. The only significant impact indicated by the model was a positive association between lake-based amenities and service and retail job growth.

Lewis, David J., Gary L. Hunt, and Andrew J. Plantinga. 2002. Public conservation land and employment growth in the northern forest region. *Land Economics* 78(2):245-259.

The authors estimate a model of simultaneous employment and net migration growth for the northern forest region with county data for the period 1990-1997, including the county share of land in public conservation uses in 1990 as an exogenous variable. The study area comprises 92 counties in the northern Lake States region, northeastern New York, and northern New England, and includes only non-metropolitan counties (those not containing

[19] The Gini coefficient measures the degree of income inequality in an area.

cities classified as Metropolitan Statistical Areas). The authors test for both direct and indirect effects (from increased migration) of conservation lands on employment growth. Public conservation lands are distinguished into "preservationist" lands (national and state parks, wilderness areas and wildlife refuges) and multiple-use lands (including national and state forests), and the authors test for separate employment impacts of the two land types.

The estimation results suggest that the share in conservation lands had no direct effect on employment growth (the estimated coefficient was small and negative, but insignificant). Conservation land share did have a statistically significant positive effect on net migration (coefficient: 0.1, indicating a 1% increase in net migration for every 10% increase in conservation lands). As the authors point out, since the share of conservation lands has a significant positive impact on net migration which directly they found to directly impact employment growth positively (coefficient: 1.05), conservation lands have an indirect positive impact on employment. This indirect effect is statistically significant and indicates that a 10% increase in the county share in conservation lands results in a 1% increase in the employment growth rate.

When analyzing the impacts of preservation lands and multiple-use lands separately, Lewis et al. find that the former have no significant impacts on employment growth or net migration, while multiple-use lands have a statistically significant positive impact on net migration. However, the authors point out that there a timing problem exists in any analyses that measure the impact of conservation lands on employment or population or growth. Many conservation lands were established a long time ago, and thus studies may well find that in any recent period, these lands did not have any noticeable employment impact because these impacts already occurred a long time ago (i.e., the economy has already adjusted to their existence). As the authors note, such a finding does not support the conclusion that the establishment of *new* conservation lands do not have employment (or income or population growth) impacts.

Lorah, P., and R. Southwick. 2003. Environmental protection, population change, and economic development in the rural western United States. *Population and Environment* 24(3):255-272.

This study analyzes the relationship between protected federal lands (wilderness, national parks, national monuments and roadless areas) and nearby communities in the rural western United States. The authors argue that opponents of environmental protection claim that protected lands limit the growth of nearby communities by locking up potentially valuable natural resources and restricting mining, logging and grazing, while others claim that extractive industries are no longer the backbone of rural economies - instead, the presence of protected federal lands encourages growth by attracting tourists and new residents. The authors use geographic information system to calculate the proportion of protected lands occurring within 50 miles of the center of each western county. Their calculation, in combination with detailed county-level data, indicates that environmental protection is correlated with relatively rapid population growth and with relatively rapid income and employment growth.

Marcouiller, David W. and Greg Clendenning. 2005. The supply of natural amenities: moving from empirical anecdotes to a theoretical basis. In Green, G.P., S.C. Deller, and D.W. Marcouiller (eds.). 2005. *Amenities and Rural Development: Theory, Methods and Public Policy*. New Horizons in Environmental Economics series. Cheltenham, U.K. and Northampton, Mass.: Elgar. Pp. 6-27.

In this article, the authors present a theoretical overview of several fundamental amenity characteristics and discuss how these characteristics have contributed to suboptimal public policies that often have tended to lead to amenity degradation. They argue for improved efforts to adequately take the economic importance of amenities into account in land use planning and land management decisions.

McGranahan, David A. 1999. Natural amenities drive rural population change. Agricultural Economics Report No. 781. Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. 24 pp.

McGranahan examines the historical relationship in the US between rural population change and natural amenities. He defines amenities on the basis of climatic measures (warm winters, winter sun, temperate summers, summer humidity), topographic variation, and relative size of water area. McGranahan finds that during 1970-1996, rural counties that ranked high on an amenity index comprised of measures of an agreeable climate, topographic variation, and water areas experienced 120 percent average population change, compared to one percent for counties ranking low on the amenity index. On average, a ten percent increase in varied topography was estimated to be associated with slightly less than a two percent increase in population, while a ten percent increase in water area was associated with a two percent increase in population. Analysis of broad regions of the US indicates that the importance of particular amenities varies by region (e.g., lakes make the Midwest attractive, while varied topography attracts people to the Southwest). McGranahan also finds that employment change was highly correlated with these amenities, with ten percent increases in topographic variation and water area estimated to have led to, on average, a 1.4 and 1.7 percent, respectively, increase in employment.

McGranahan points out that his analysis only considers the "basic ingredients of natural amenities" (p. 20). He recognizes that his measures do not capture the extent to which the associated amenities have been modified by human actions. Specifically, the author states that land cover and land use regulations such as public parklands or national or State forests are important contributors to the attractiveness of an area.

Monchuk, Daniel C., John A. Miranowski, Dermot J. Hayes, and Bruce A. Babcock. 2007. An analysis of regional economic growth in the U.S. Midwest. *Review of Agricultural Economics* 29(1):17–39.

The authors examine some of the forces that drive economic growth at the county level. In an effort to construct a more comprehensive regional economic growth model, they test a variety of different hypotheses by introducing a large number of variables associated with economic growth. Thei findings indicate that, in addition to state and local tax burdens, population density, amount of primary agriculture activity and demographics, amenities have important impacts on economic growth. Specifically, their estimation results indicate that counties with a higher amenity index experienced greater economic growth, with an estimated coefficient of 0.002 that is statistically significant.. The authors conclude that these results indicate that recreational amenities such as bike trails and recreational areas do explain greater county economic growth."

Nzaku, Kilungu and James O. Bukenya. 2005. Examining the relationship between quality of life amenities and economic development in the southeast USA. *Review Of Urban & Regional Development Studies* 17(2):89-103.

This study examines the relationship between quality of life amenities and rural economic development in the Southeastern USA. The authors' premise is that what is true at the national level may provide a partial or misleading picture when assessing particular areas, and that data available at the county-level often can provide richer and more precise information than what is found at the national level. The paper estimates spatial regression models using county-level data. For the most part, the results suggest that the differences in quality of life and amenities factors can explain a large portion of the trend in per capita income, employment and population change across counties in the Southeastern USA. Specifically, natural amenities are found to are positively and significantly related to changes in employment and population, and recreation amenities are positively and significantly related to changes in population.

Reeder, Richard, and Dennis Brown. 2005. Recreation, tourism, and rural well-being. Economic Research Report No.7. USDA, Economic Research Service. *www.ers.usda.gov/publications/err7/*

Riddel, Mary. 2001. A dynamic approach to estimating hedonic prices for environmental goods: An application to open space purchase. *Land Economics* 77(4):494-512.

The author argues that because research has repeatedly shown that housing markets may be endogenous – open space land purchases lead to reduced supply of developable land, pushing land prices up – and inefficient – because of information asymmetry, heterogeneous products, and high transaction costs – and hence not in equilibrium (contrary to the assumption underlying hedonic pricing models), housing price impacts of trended amenities (i.e., sustained increases in amenities) may be time variant. In other words, price effects estimated cross-sectionally may be a function of the time at which the effect is estimated, with different estimated values resulting for environmental amenities at different times. The author uses a dynamic, error-correction approach to estimate the full impact of sustained environmental quality improvements in the face of housing market inefficiency, and compares this impact to that estimated by a conventional hedonic model. The model explicitly incorporates markets impacted by environmental amenities, namely the housing, labor, and rental markets, and analyzes data for the city of Boulder, CO, from 1981-1995. The results indicate a lag between open space purchase (the goal of which it was to curtail the encroachment of Boulder onto the foothills) and the time in which it is capitalized into house prices. The total effect of the increase in open space is a shift of both supply and demand to a higher price with a slightly larger stock of housing. The 15,000 acres of open space purchased between 1981 and 1995 caused prices to rise by 3.75%. A hedonic study performed two years after adding 1,000 acres of open space in Boulder would yield a house price increase of 0.17%, while after six years, it would yield an estimate of 0.25%.

Rudzitis, G., and H.E. Johansen. 1991. How important is wilderness? Results from a United States survey. *Environmental Management* 15(2):227-233.

Rudzitis and Johansen conducted a national survey of public attitudes towards the federal management of federal wilderness areas. Their survey target population were residents in eleven "wilderness counties" in 10 states where significant population growth - ranging from 29% to 104% - had occurred between 1970 and 1980. Their sample of 2,670 respondents was almost evenly divided between recent immigrants, defined as having moved into the area

in the last 10 years, and longer-term residents. Fifty-three percent of respondents stated that the presence of wilderness was an important reason why they moved to or live in the area, and 81 percent felt that wilderness areas were important to their counties. On both issues, migrants regard wilderness as slightly more important than longer-term residents. Despite the different economic and social characteristics and the historic contexts within which the latter developed, there were no large differences in attitudes toward wilderness among the regions.

Rudzitis, G., Hintz, J., and C. Watrous. 1996. Snapshots of a Changing Northwest: Working Paper of Migration. Regional Development and the American West Project, Department of Geography, University of Idaho. See also Rudzitis, Gundars. 1996. Wilderness and the Changing American West. New York: John Wiley and Sons.

The authors assess the difference in growth rates between wilderness and all non-urban counties in the US during 1960-1990. They find that in the 1960s, population in wilderness counties as a whole grew at four times the average rate of all nonmetro counties; in the 1970s, it grew at over twice the rate, while in the 1980s, it grew at six times the rate. In all periods, the growth premium was even larger for counties located near national parks.

Rudzitis, G. and R. Johnson. 2000. The impact of wilderness and other wildlands on local economies and regional development trends. In S. F. McCool, D. N. Cole, W. T. Borrie, J. O'Loughlin, compilers. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness in the context of larger systems; 1999 May 23-27; Missoula, MT. Proceedings RMRS-P-15-VOL-2:14-26. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT. Pp. 14-26.

This study is a review and extension of the Rudzitis' earlier work (see sources listed above). The authors review the relatively few economic studies that examine the impact of wilderness on nearby communities. They find that these studies tend to indicate relatively modest wilderness-related economic impacts on the surrounding communities associated people who come to recreate in federally wilderness areas. However, the authors analyze the finings of several studies which show people are moving to areas near federally designated wilderness and other wildlands because of the environmental amenities associated with such areas. These rapid population increases are having dramatic impacts on the ongoing changing structure of local and regional economies. The authors argue that these findings need to be incorporated into development theories in order for the latter to better explain migration trends.

Rupasingha, Anil, and Stephan J. Goetz. 2004. County amenities and net migration. *Agricultural and Resource Economics Review* 33(2):245-254.

The authors use U.S. county-level net migration data and employ a general spatial model to examine the effects of various amenities on migration decisions. Their results suggest that higher county cancer risks and the presence of superfund sites in a county, or a higher ranking on the Environmental Protection Agency's hazard ranking system, reduce the relative attractiveness of a county to prospective migrants, while natural amenities on balance attract migrants, ceteris paribus. The results also reveal spatial dependence among contiguous counties in terms of net migration behavior.

Sonoran Institute. 2006. The potential economic impacts of wilderness in Doña Ana County, New Mexico. Sonoran Institute, Feb. 24, 2006. 53 pp.

The Sonoran Institute (2006) examines the economic performance of Doña Ana county in New Mexico before and after the creation of over 200,000 acres, or 8.5 percent of the county area, as federally designated wilderness study areas (WSA) in 1980. Comparing the five-year periods immediately before and after the designation, the authors find that real per-capita income and personal income grew at substantially higher rates after the designation. There was no change in the population growth rate, while the rate of job growth was four percent after the designation compared to five percent before.

The study also identifies a number of counties in the western U.S. that are similar to Doña Ana county in terms of eight criteria the authors regard as key characteristics. These include growth rates of population, employment and personal income, proportion of the county's residents self-identified in the last census as either Hispanic or Latino, proportion of personal income from non-labor sources, proportion of personal income from employment in government, presence of a university, and proximity of the majority of the population that lives within an hour's drive of a commercial airport that offers daily service to various hubs and metropolitan areas. The authors identify 14 "peer" counties in the western U.S. that perform similarly to Doña Ana county on these characteristics. Of these 14 counties, nine contain federally-designated wilderness, while five do not. Analysis of the economic data of the 14 counties shows that those with wilderness experienced faster annual growth of population, employment, and real personal income from 1970 to 2000 than those peers without wilderness. Peer counties with wilderness also outperformed those without wilderness in per capita income and average earnings per job in 2003. In a next step, the authors select the two out of the nine counties with wilderness that are most similar to Doña Ana, and analyze their economic performance for the five-year periods immediately preceding and following major wilderness designations in 1984. The two counties are Coconino county, Arizona, and Cache county, Utah. The data show that employment and real per-capita income growth in both counties accelerated after designation. Personal income growth rates increased in one of the counties but slightly decreased in the other, while population growth remained stable in one and slowed slightly in the other.

Southwick Associates. 2000. Historical economic performance of Oregon and Western counties associated with Roadless and Wilderness Areas. Report prepared for the Oregon Natural Resources Council and the World Wildlife Fund. Southwick Associates. Aug. 15, 2000. 26 pp.

Southwick Associates (2000) examine the growth experience of economic sectors associated with natural amenities in Oregon. They find that over the period 1969-1997, these sectors have been playing an increasingly larger role in the state's economy, with their share in the state's total income increasing from 20.1 percent in 1969 to 27.5 percent in 1997. The authors select nine counties throughout the Oregon (chosen with the goal of achieving wide geographic representation), all of which show the increase in the relative importance of amenity-based sectors from 1969-97 found for the state as a whole. The authors then expand the analysis to eleven western states, including Oregon, and estimate the impact that the presence of protected lands (wilderness areas, national parks, and national monuments) and roadless areas had on county income and employment growth.[20] They find that in the

[20] The states included in the analysis are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

409 western counties analyzed, the amounts of protected lands and Forest Service roadless areas, respectively, within 50 miles of a county's center were positively correlated with both income and employment growth during the period 1969-1997.[21] They further find that when narrowing the focus on rural areas, the importance of protected and roadless areas for economic growth is even stronger, and those counties that had the highest percentage of protected and roadless areas as a share of county area on average also experienced the highest income and employment growth rates.

Von Reichert, Christiane and Gundars Rudzitis. 1992. Multinomial logistic models explaining income changes of migrants to high-amenity counties. *Review of Regional Studies* 22(1):25-42.

The results of a survey of residents of and migrants to 15 fast-growing wilderness counties show that only 25 percent of the migrants increased their income, while almost 50 percent accepted income losses upon their moves to high-amenity counties. Concomitantly, amenities and quality of life were more important factors in the migration decision than was employment, for instance. The authors focused on migrants in the labor force and employed multinomial logistic regression to identify the impact of migrants' characteristics, their satisfaction/dissatisfaction with previous location (push), and the importance of destination features (pull) on income change. The authors argue that these results demonstrate a strong willingness to pay for proximity to natural areas. Moreover, roughly 80 percent of the respondents were young (21 to 35 years of age) or middle-aged (36 to 65 years of age), which excluded retirement migration as the primary factor. The authors conclude that the results of their survey support the notion that natural environments influence population growth in nearby communities.

[21] However, the percentage of county area in wilderness or National Park or Monument was only estimated to be significant in the employment regression, not in the income regression. In addition, Southwick Associates found that McGranahan's (1999) amenity measures were estimated to be significant in both income and employment regressions.

Table A-1: Overview of studies analyzing the impact of amenities on income, output, employment and population

Studies listed below are those that report quantitative results.
Studies highlighted in green focus mostly or exclusively on conservation lands
NOTE: All coefficients given are non-standardized coefficients unless indicated otherwise

Study	Impact variable (Dependent variable)	Estimated impact of protected lands		Study area	Amenity measure	Analysis type	Period covered	Characteristics of lands analyzed			
	(All measured at county level unless indicated otherwise)	*Impact size*	*Impact measure*					*Ownership*	*Protection status*	*Attractiveness/ uniqueness*	*Primary land cover*
	INCOME										
Bergstrom et al. (1990)	Total income in four states	$143 million	(1986$): Total income from out-of-state visitors to 7 SPs	7 SPs in GA, NC, SC, TN	State parks	Impact Analysis (IMPLAN)	1986	State	protected	mixed	mixed
Berrens et al. (2006)	Income growth differential	0.4 percent	1995-2004 avg. real income growth premium/year in co. with significant IRA's	NM	Inventoried roadless areas	Growth rate comparison	1995-2004	Federal	protected	high	Forest
Cordell et al. (1992)	Total income in state	$0.41/3.23 million	(1986$):Total income from nonresidents/all visitors to Pomona State Park	Kansas	Pomona State Park	Impact Analysis (IMPLAN)	1986	State	protected		mixed
Cordell et al. (1992)	Total income in 7-county area	$0.33/2.54 million	(1986$):Total income from nonresidents/all visitors to Pomona State Park	7 co. adj. to Pomona SP, KS	Pomona State Park	Impact Analysis (IMPLAN)	1986	State	protected		mixed
Deller et al. (2001)	Per-capita income growth	(not significant)	Coefficient (non-log) on *land amenities* variable	2243 rural US counties	Land amenities (incl. 16 variables)	SEq. Growth Model	1985-95	mixed	mostly prot.	high	mixed
Deller et al. (2001)	Per-capita income growth	1.154	Coefficient (non-log) on *water amenities* variable	2243 rural US counties	Water amenities (incl. 12 variables)	SEq. Growth Model	1985-96	mixed	mostly prot.	high	mixed
Deller et al. (2005)	Per-capita income growth	(not significant)	Coefficient on *land amenities* variable	2243 rural US counties	Land amenities (incl. 16 variables)	BMA, OLS/ML	1990s	Mixed	mixed	mixed	mixed
Deller et al. (2005)	Per-capita income growth	(not significant)	Coefficient (Non-log) on *water amenities* variable	2243 rural US counties	Water amenities (12 variables)	BMA, OLS/ML	1990s	Mixed	mixed	mixed	mixed
Henderson & McDaniel (1998)	Real per-capita income growth	1.6 percent	county-level growth differential compared to non-scenic counties	Federal Reserve 10th District **	Extensively scenic counties	Growth rate comparison	1990-1995				
Henderson & McDaniel (1998)	Real per-capita income growth	0.3 percent	county-level growth differential compared to non-scenic counties	Federal Reserve 10th District **	Moderately scenic counties	Growth rate comparison	1990-1995				
Hunter et al. (2005)	Family income growth	not significant	Coefficient on *high-growth amenities/recreation* variable	329 high-growth amenity/rec. co.	Climate/topography/water area (McGranahan, 1999)	MV(Growth Curve) modeling	1990-2001	Mixed	mixed	high	mixed
Kwang-Koo et al. (2005)	Per-capita income growth	not significant	Coefficient on county-level per-capita income growth	242 co. in MI, MN and WI	Lake-based amenities	MLSEM of regional growth	1980-1990	Mixed	mixed	high	
Kwang-Koo et al. (2005)	Per-capita income growth	not significant	Coefficient on county-level per-capita income growth	242 co. in MI, MN and WI	Land-based amenities	MLSEM of regional growth	1980-1990	Mixed	mixed	high	
Southwick Assiciates (2000)	Total county income growth	0.44	Coefficient on amenity variable(s)	409 co. in 11 western states	Selected climate data, water area, and topography (McGranahan, 1999)	OLS	1969-97	mixed	mixed	mixed	mixed

Unless indicated otherwise (e.g., through non-log), all coefficients represent elasticities, indicating the percent change in the dependent variable (output, income, employment, or population) resulting from a 1 percent change in the independent variable.
* Excludes Park employees; ** The Federal Reserve 10th district includes CO, KS, NE, WY and parts of NM, OK & MO
BMA - Bayesian Model Averaging; co. - counties; DAM - Disequilibrium adjustment model; ERS - Economic Research Service (USDA); Fed. - federal; IM - intermountain; IRA - inventoried roadless areas; ML - Maximum Likelihood; MLSEM - Maximum Likelihood Spati Error Model; MV - multivariate; NF - National Forest(s); NP - National Park(s); NWR - National Wildlife Refuge(s); OLS - Ordinary Least Squares; prot. - protected; rec. - recreation; SEq. - structural equationa; SP - State park; WA - Wilderness areas; Wil wildlife refuges

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Studies listed below are those that report quantitative results.
Studies highlighted in green focus mostly or exclusively on conservation lands
NOTE: All coefficients given are non-standardized coefficients unless indicated otherwise

Study	Impact variable (Dependent variable) *(All measured at county level unless indicated otherwise)*	Estimated impact of protected lands		Study area	Amenity measure	Analysis type	Period covered	Characteristics of lands analyzed			
		Impact size	*Impact measure*					*Ownership*	*Protection status*	*Attractiveness/ uniqueness*	*Primary land cover*
	OUTPUT										
Bergstrom et al. (1990)	Total output in four states	$350 million	(1986$): Total output from out-of-state visitors to 7 state parks	7 SPs in GA, NC, SC, TN	State parks	Impact Analysis	1986	State	protected		mixed
Cordell et al. (1992)	Total output in state	$0.99/7.98 million	(1986$):Total output from nonresidents/all visitors to Pomona State Park	Kansas	Pomona State Park	Impact Analysis (IMPLAN)	1986	State	protected		mixed
Cordell et al. (1992)	Total output in 7-county area	$0.77/5.87 million	(1986$):Total output from nonresidents/all visitors to Pomona State Park	7 co. adj. to Pomona SP, KS	Pomona State Park	Impact Analysis (IMPLAN)	1986	State	protected		mixed
Loomis & Richardson (2000)	Total value added	916 million	(1999$) Annual value added from recreation in U.S. roadless areas	US	roadless areas	Impact Analysis (IMPLAN)	1999	Federal (FS)	protected	high	forest
Loomis & Richardson (2000)	Total personal income	576 million	(1999$) Annual personal income from recreation in U.S. roadless areas	US	roadless areas	Impact Analysis (IMPLAN)	1999	Federal (FS)	protected	high	forest
	EMPLOYMENT										
Bergstrom et al. (1990)	Total employment in four states	10,759	Total jobs supported by out-of-state visitors to 7 parks	7 SPs in GA, NC, SC, TN	State parks	Impact Analysis	1986	State	protected	mixed	mixed
Berrens et al. (2006)	Employment growth differential	0.1 percent	1995-2004 avg. employment growth premium/year in co. with significant IRA's	NM	Inventoried roadless areas	Growth rate comparison	1995-2004	Federal	protected		Forest
Cordell et al. (1992)	Total employment in state	22/176	(1986):Total jobs from nonresidents/all visitors to Pomona State Park*	Kansas	Pomona State Park	Impact Analysis (IMPLAN)	1986	State	protected		mixed
	Total employment in 7-county area	19/148	(1986):Total jobs from nonresidents/all visitors to Pomona State Park*	7 co. adj. to Pomona SP, KS	Pomona State Park	Impact Analysis (IMPLAN)	1986	State	protected		mixed
Deller et al. (2001)	Employment growth	1.491	Coefficient (non-log) on *land amenities* variable	2243 rural US counties	Land amenities (incl. 16 variables)	SEq. Growth Model	1985-95	mixed	mostly prot.	high	mixed
Deller et al. (2001)	Employment growth	(not significant)	Coefficient (non-log) on *water amenities* variable	2244 rural US counties	Water amenities (12 variables)	SEq. Growth Model	1985-96	mixed	mostly prot.	high	mixed
Deller et al. (2005)	County employment growth	(not significant)	Coefficient on *land amenities* variable	2243 rural US counties	Land amenities (incl. 16 variables)	BMA, OLS/ML	1990s	Mixed	mixed	mixed	mixed
Deller et al. (2005)	County employment growth	1.052	Coefficient (Non-log) on *water amenities* variable	2243 rural US counties	Water amenities (12 variables)	BMA, OLS/ML	1990s	Mixed	mixed	mixed	mixed
Duffy-Deno (1997)	Employment density	0.23	Coefficient on *density of state park lands in county* variable	250 non-metro co. in IM west	State parks	DAM					

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* Excludes Park employees; ** The Federal Reserve 10th district includes CO, KS, NE, WY and parts of NM, OK & MO
BMA - Bayesian Model Averaging; co. - counties; DAM - Disequilibrium adjustment model; ERS - Economic Research Service (USDA); Fed. - federal; IM - intermountain; IRA - inventoried roadless areas; ML - Maximum Likelihood; MLSEM - Maximum Likelihood Spati Error Model; MV - multivariate; NF - National Forest(s); NP - National Park(s); NWR - National Wildlife Refuge(s); OLS - Ordinary Least Squares; prot. - protected; rec. - recreation; SEq. - structural equationa; SP - State park; WA - Wilderness areas; Wil wildlife refuges

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Studies listed below are those that report quantitative results.
Studies highlighted in green focus mostly or exclusively on conservation lands
NOTE: All coefficients given are non-standardized coefficients unless indicated otherwise

Study	Impact variable (Dependent variable) (All measured at county level unless indicated otherwise)	Estimated impact of protected lands		Study area	Amenity measure	Analysis type	Period covered	Characteristics of lands analyzed			
		Impact size	*Impact measure*					*Ownership*	*Protection status*	*Attractiveness/ uniqueness*	*Primary land cover*
	EMPLOYMENT										
Duffy-Deno (1998)	Employment density	not significant	Coefficient on *percent county in Federal wilderness* (FS&BLM) variable	250 non-urban co. in IM west	Federal (BLM+FS) WAs	DAM	1980-1990	Fed. (FS, BLM)	protected	High	mixed
Duffy-Deno (1998)	Employment density	0.025	Coefficient on *percent county in FS wilderness* variable	251 non-urban co. in IM west	FS wilderness areas	DAM	1980-1990	FS	protected	High	Forest
Henderson & McDaniel (1998)	County employment growth	1.1 percent	county-level employment growth differential compared to non-scenic co.	Federal Reserve 10th District**	Extensively scenic counties	Growth rate comparison	1990-1995	mixed	mixed		
Henderson & McDaniel (1998)	County employment growth	0.3 percent	county-level employment growth differential compared to non-scenic co.	Federal Reserve 10th District**	Moderately scenic counties	Growth rate comparison	1990-1995	mixed	mixed		
Kwang-Koo et al. (2005)	Service and retail job growth	0.7 percent	Coefficient on county-level lake-based amenities variable	242 counties in MI, MN and WI	Lake-based amenities	MLSEM of regional growth	1980-1990	Mixed	mixed	high	
Kwang-Koo et al. (2005)	Service and retail job growth	not significant	Coefficient on county-level land-based amenities variable	242 counties in MI, MN and WI	Land-based amenities	MLSEM of regional growth	1980-1990	Mixed	mixed	high	
Lewis et al. (2002)	Employment growth	0.1	Coefficient on indirect effect of cons. lands variable (through net migration)	92 co. in northern forest region	Public conservation lands		1990-1997	Fed./SPs, WAs/WRs	high	high	forest
Loomis & Richardson (2000)	Local employment	23,700	Total employment in communities close to roadless areas	US	Roadless areas	Implan	1999	FS	high	high	forest
McGranahan (1999)	Total employment growth	0.17	**Standardized** Coefficient on *water* amenity variable	rural US counties	- water	OLS	1969-96	mixed	mixed	mixed	mixed
McGranahan (1999)	Total employment growth	0.14	**Standardized** Coefficient on *topographic variation* amenity variable	rural US counties	- topography	OLS	1969-96	mixed	mixed	mixed	mixed
Southwick Associates (2000)	County employment growth	3.823	coefficient on % of county area in wilderness	409 co. in 11 western states	% county in wilderness and NP	OLS	1969-98	Federal	Wild./NP/NM	high	forest
Southwick Associates (2000)	County employment growth	0.115	Coefficient on amenities variable	co. in 11 western states	Selected climate data, water area, and topography (McGranahan, 1999)	OLS	1969-97	Mixed	mixed	mixed	mixed

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BMA - Bayesian Model Averaging; co. - counties; DAM - Disequilibrium adjustment model; ERS - Economic Research Service (USDA); Fed. - federal; IM - intermountain; IRA - inventoried roadless areas; ML - Maximum Likelihood; MLSEM - Maximum Likelihood Spati Error Model; MV - multivariate; NF - National Forest(s); NP - National Park(s); NWR - National Wildlife Refuge(s); OLS - Ordinary Least Squares; prot. - protected; rec. - recreation; SEq. - structural equationa; SP - State park; WA - Wilderness areas; Wil wildlife refuges

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NOTE: All coefficients given are non-standardized coefficients unless indicated otherwise

Study	Impact variable (Dependent variable) *(All measured at county level unless indicated otherwise)*	Estimated impact of protected lands		Study area	Amenity measure	Analysis type	Period covered	Characteristics of lands analyzed			
		Impact size	*Impact measure*					*Ownership*	*Protection status*	*Attractiveness/ uniqueness*	*Primary land cover*
	POPULATION										
Cromartie (1998)	Population growth	0.2 percent	Increase in annual net migration rates associated with amenities	all 478 Great Plains counties	climate/topography/ water bodies (ERS)	Regression analysis	1994-96	mixed	mixed	mixed	mixed
Dearien et al. (2005)	Population growth	-2.126	Coefficient on distance to Federal protected/wild lands variable	100-county interior Northwest	Fed. Wilderness, NF, NP, NWR	Regression analysis	1990-2000	Federal	protected	high	Forest
Dearien et al. (2005)	Population growth	13.661	Coefficient on size (percent) of Federal protected/wild lands variable	100-county interior Northwest	Fed. Wilderness, NF, NP, NWR	Regression analysis	1990-2001	Federal	protected	high	Forest
Deller et al. (2001)	Population growth	0.854	Coefficient (non-log) on *land amenities* variable	2243 rural US counties	land amenities (incl. 16 variables)	SEq. Growth Model	1985-95	mixed	mostly prot.	high	mixed
Deller et al. (2001)	Population growth	0.432	Coefficient (non-log) on *water amenities* variable	2244 rural US counties	Water amenities (12 variables)	SEq. Growth Model	1985-96	mixed	mostly prot.	high	mixed
Deller et al. (2005)	Population growth	(not significant)	Coefficient on *land amenities* variable	2243 rural US counties	Land amenities (incl. 16 variables)	BMA, OLS/ML	1990s	Mixed	mixed	mixed	mixed
Deller et al. (2005)	Population growth	0.386	Coefficient (Non-log) on *water amenities* variable	2243 rural US counties	Water amenities (12 variables)	BMA, OLS/ML	1990s	Mixed	mixed	mixed	mixed
Duffy-Deno (1997)	Population growth	0.12	Coefficient on density of state park lands in county	250 non-metro co. in IM west	State parks	DAM					
Duffy-Deno (1998)	Population density	not significant	Coefficient on *percent county in Federal wilderness* variable	250 non-urban co. in IM west	Federal (BLM+FS) WAs	DAM	1980-1990	Fed. (FS, BLM)	protected	High	mixed
Duffy-Deno (1998)	Population density	0.135	Coefficient on *percent county in FS wilderness* variable	250 non-urban co. in IM west	FS wilderness areas	DAM	1980-1990	FS	protected	High	Forest
Duffy-Deno (1998)	Population density	0.595	Coefficient (log) on *percent county in NPS lands* variable	250 non-urban co. in IM west	NPS lands	DAM	1980-1990	NPS	protected	High	mixed
Johnson & Stewart (2005)	Net population growth	0.8 percent	Growth rate premium/yr of rural rec. co. over rural non-rec. co.	2303 nonmetro	high relative level of recreation-linked	Growth data	1990-2000	-	-		
Johnson & Stewart (2007)	Net population growth	1.0 percent	Growth rate premium/yr of non-metro NF co. over other rural co.	2303 nonmetro	containing NF lands	growth data	1990-2000	FS	protected	mixed	forest
Johnson & Stewart (2007)	Net population growth	0.6 percent	Growth rate premium/yr of all NF co. over other co.	All 3141 US counties	containing NF lands	growth data	1990-2000	FS	protected	mixed	forest
Kwang-Koo et al. (2005)	Population growth	not significant	Coefficient on county-level lake-based amenities variable	242 counties in MI, MN and WI	Lake-based amenities	MLSEM of regional	1980-1990	Mixed	mixed	high	

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		Impact size	*Impact measure*					*Ownership*	*Protection status*	*Attractiveness/ uniqueness*	*Primary land cover*
	POPULATION										
Kwang-Koo et al. (2005)	Population growth	not significant	Coefficient on county-level land-based amenities variable	242 counties in MI, MN and WI	Land-based amenities	MLSEM of regional	1980-1990	Mixed	mixed	high	
Lewis et al. (2002)	Net migration	0.098	Coefficient on Conservation lands variable	92 co. in northern forest region	Public cons. lands		1990-1997	Fed. and state parks, WAs, WR	high	high	forest
McGranahan (1999)	Total population growth	0.20	**Standardized** Coefficient on *water* amenity variable	rural US counties	- water	OLS	1970-96	mixed	mixed	mixed	mixed
McGranahan (1999)	Total population growth	0.16	**Standardized** Coefficient on *topographic variation* amenity variable	rural US counties	- topography	OLS	1970-96	mixed	mixed	mixed	mixed
Rudzitis/Rudzitis et al. (1996)	Population growth	0.9	Avg. annual growth rate premium (absolute %) of counties with fed. WAs over other nonmetro counties	All nonmetro counties in US	Federally designated WAs		1960-70	Federal	high	high	mixed/forest
Rudzitis/Rudzitis et al. (1996)	Population growth	1.7					1970-80	Federal	high	high	mixed/forest
Rudzitis/Rudzitis et al. (1996)	Population growth	2.0					1980-90	Federal	high	high	mixed/forest
Rudzitis/Rudzitis et al. (1996)	Population growth	2.0	Avg. annual growth rate premium (absolute %) of counties near NPs over other nonmetro counties	All nonmetro counties in US	National parks		1960-70	Federal	high	high	mixed/forest
Rudzitis/Rudzitis et al. (1996)	Population growth	2.0					1970-80	Federal	high	high	mixed/forest
Rudzitis/Rudzitis et al. (1996)	Population growth	2.2					1980-90	Federal	high	high	mixed/forest

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