Natural Amenities and Population Growth in the Greater Yellowstone Region

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Abstract

Much of the recent growth in population, jobs and income in the Greater Yellowstone Region, as well as other parts of the rural West, has been driven by ecological and social amenities, in contrast to the historical dependence on resource extractive industries and agriculture. This shift has been fueled by an increase in service occupations, retirement and investment income. Using the states of Idaho, Montana, and Wyoming, and the Greater Yellowstone Region as examples, statistical tests were conducted to test the relative influence of ecological, amenity, social and economic variables on rural population growth. The results indicate that ecological and amenity variables are necessary conditions for growth, but they are not sufficient. An educated workforce and access to larger markets via air travel are also important.

Keywords: *rural development, amenities, Greater Yellowstone.*

Introduction

The role of amenities is an increasingly important research topic for geographers, economists, demographers and sociologists seeking to explain the relatively recent phenomena of human population growth in rural counties of the Western United States. Resource extractive industries and agriculture have been the backbone of rural economies, yet their performance in the last two decades has been poor. Why then are some rural counties growing? What role do environmental factors play? How important are amenities in people's decisions to move to rural areas, and moreover, which amenities are important? And, if amenities are important, how do they stack up when compared to socioeconomic factors? In this paper we attempt to answer these questions, using the Greater Yellowstone area as a case study. If we knew whether a relationship between amenities and development exists, we would be able to shed some light on a new approach to economic development, where the land would be treated as more than a repository for raw materials to be extracted and exported to distant markets. Rather, the land — and the amenities they hold — would be considered an economic asset that attracts and holds people and business. From a research perspective an equally important finding might emerge; that geographers, economists, demographers, and sociologists should join forces with the ecological scientists in order to gain a better understanding of the role of the landscape in human development.

The Greater Yellowstone Ecosystem has long been a fruitful area for research for those seeking insight on how to balance economic growth and environmental protection. It is a complicated landscape, with multiple jurisdictions and a wide variety of competing resource uses, including mining, grazing, forestry, recreation, and it is valued for its many non-use values, such as scenery and wildlife. Federal lands make up the bulk of the ecosystem: 2.5 million acres of Yellowstone National Park and Grand Teton National Park, more than 11 million acres on seven national forests adjacent to the parks, and approximately 89,000 acres of national wildlife refuges and small parcels administered by the Bureau of Land Management. Because federal lands make up the bulk of the Greater Yellowstone Ecosystem, much of the attention of researchers, land managers and conservation-

ists has focussed on balancing the multiple uses on these lands (Glick et al. 1991; Rasker et al. 1992; Rasker 1993). Private lands, which some today consider the most vulnerable component of the ecosystem, consist of about 3 million acres.

Recent trends in economic growth in the West, particular the phenomena of amenity-driven growth, has changed much of the Western landscape (Cromartie and Wardell 1999), putting pressure on private lands, which are converted from agricultural production to residential development, thereby adversely impacting habitat for fish and wildlife (Ingram and Lewandrowski 1999). The Greater Yellowstone Ecosystem is a prime example of this type of habitat conversion.

This paper begins with a brief review of a growing body of literature which states that natural amenities are important considerations for people who migrate to the rural West. Using the Greater Yellowstone Region as an example, we explore which combination of ecological, social, and economic factors are closely associated with population growth in the last 25 years. We first determine whether a relationship exists between population growth and the ecological characteristics of the land by comparing county population growth rates in the states of Idaho, Wyoming and Montana. Once it was established which variables are significantly correlated with growth, a finer scale model was developed for the counties of Idaho, Wyoming, and Montana that lie either inside or adjacent to the Greater Yellowstone Ecosystem. At this scale — referred to as the Greater Yellowstone Region — ecological, economic, and social variables were compared and tested against one another to test which had the highest relative power for explaining population growth.

We used this two-tiered approach to test two hypotheses: First, that variation in county population growth can be established, in part, by the presence of certain environmental characteristics (used interchangeably in this paper as ecological and amenity characteristics) and second, that in the Greater Yellowstone Region, ecological and amenity characteristics are important, but so are certain social and economic factors. In other words, we wanted to test the hypothesis that amenities matter, but only in relation to certain socioeconomic conditions.

Natural Amenities and Rural Development

Previous research on the economy of the Greater Yellowstone Region was motivated by a need for a solution to the "jobs versus the environment" debate regarding the management of public lands of the ecosystem. Commonly held beliefs dictated that the backbone of the rural communities of the region were the jobs produced by the extractive industries operating on the seven national forests surrounding Yellowstone National Park (U.S. Forest Service 1985); that only resource extractive industries constitute the "base" of the economy (Polzin 1990); and that because the region has historically been dependent on resource extraction, its future must necessarily be like the past (Corporation for Enterprise Development 1989, Montana Ambassadors Association 1989). Several researchers, including Power (1991), Rasker (1991), and Rasker et al. (1992) discovered that the economy of the Greater Yellowstone is diverse and growing, with the bulk — over 95 percent — of the existing and new jobs in industries other than resource extraction. The "base" has broadened to include employment in a variety of business and producer services, such as finance, insurance, real estate, telecommunications, software development, research, and management consulting. Many of these are "footloose," in the sense that the owners of these businesses are often not tied to a particular locale and therefore able to locate to areas with a desirable lifestyle (Rasker and Glick 1994).

Much of growth in the Greater Yellowstone Region, however, is not immediately obvious (i.e. does not appear in the form of new stores on main street). For example, 51 percent of the growth in real personal income the last 25 years has been driven by non-labor income, such as retirement or earnings from past investments (US Department of Commerce 1997). Power (1991, 403) summarized the sentiment of the "jobs versus the environment" debate in Greater Yellowstone when he wrote: "the residents of the [Greater Yellowstone] area do not face some tragic choice between sacrificing the unique natural systems and landscape in which they live or facing ongoing impoverishment due to lack of economic opportunity. During the last two decades the opposite has been the case."

This research has helped uncover a new paradigm for economic development in the West: protection of the wild and scenic character of the landscape and the quality of life in local communities serves as a magnet to attract and retain local people and their businesses. These qualities are a vital part of the economic well-being of local residents, and help insulate communities from the out-migration that is all too common for the rest of rural America (Power 1991; Rasker 1994; Rasker et al. 1992; Rasker and Glick 1994; Johnson and Rasker 1995; Glick et al. 1991).

To test the hypothesis that amenities draw business Johnson and Rasker (1995) conducted a telephone survey of 500 business owners and managers in the Northern portion of the Greater Yellowstone Region: Madison, Gallatin and Park Counties. The purpose of the survey was to determine which variables influence an entrepreneur's business location decision, including "amenities" such as the community setting, natural environment, and recreational opportunities, as well as traditional factors such as the tax structure, cost of labor

and raw materials and the proximity to markets. Another objective was to add some refinement to the findings of previous survey research which indicated that "amenities" are important to immigration, without much differentiation between different forms of amenities. The results showed that amenities were relatively more important than traditional "profit maximizing" reasons, both as a draw for new businesses who relocated to the area, as well as a magnet for retaining existing businesses. The relative importance to fifteen business location variables revealed that the highest

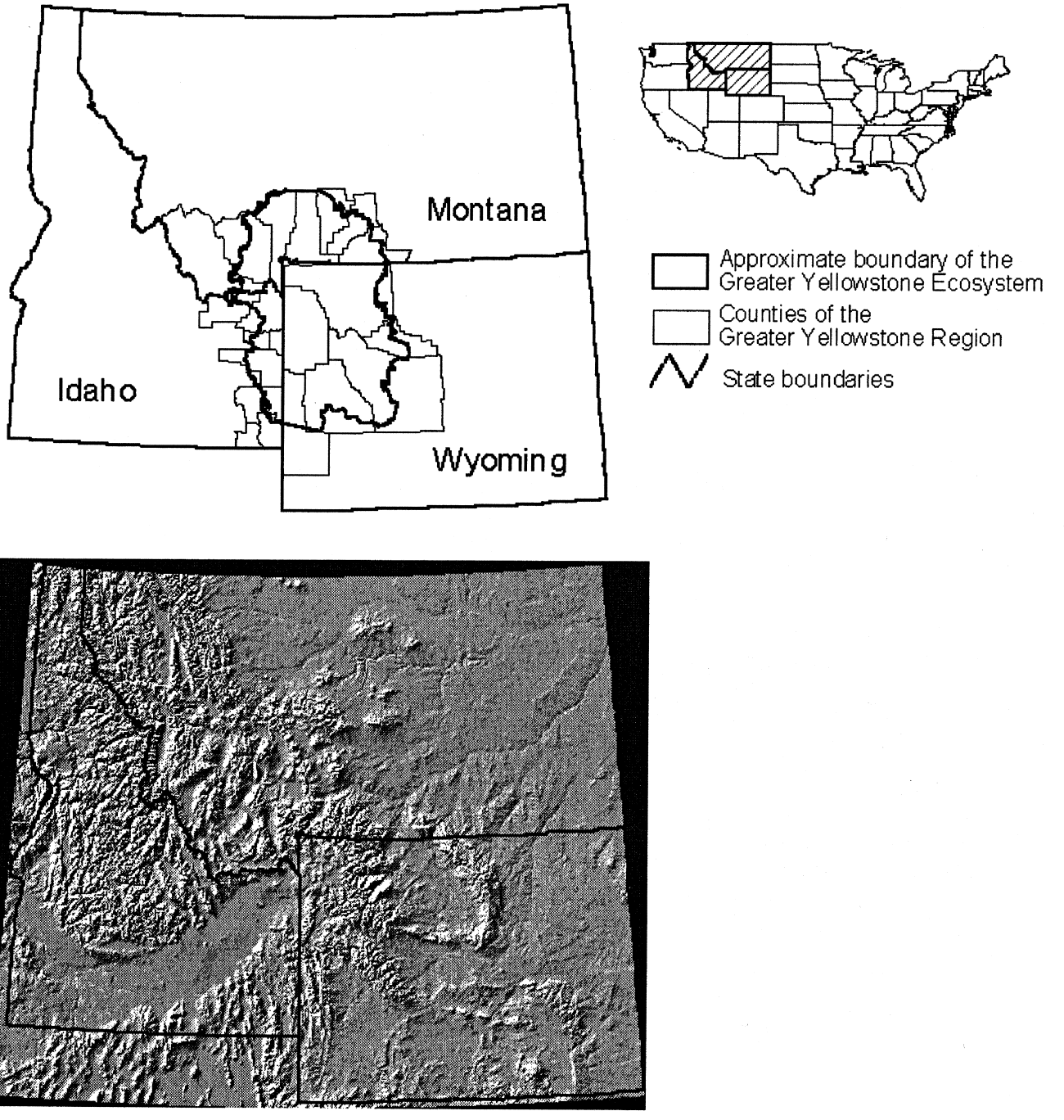

Figure 1. Idaho, Montana, Wyoming; the Greater Yellowstone Ecosystem; and the Counties of the Greater Yellowstone Region.

Table 1. Percent Change in Population from 1970 to 1997 for the Counties of the Greater Yellowstone Region.

Counties of the Greater Yellowstone Region	Percent Population Change 1970 to 1997
IDAHO	
Bear Lake	13%
Bonneville	52%
Caribou	12%
Clark	11%
Franklin	47%
Fremont	34%
Madison	72%
Teton	124%
MONTANA	
Carbon	33%
Gallatin	87%
Madison	36%
Stillwater	68%
Sweet Grass	14%
Park	42%
WYOMING	
Fremont	27%
Hot Springs	-6%
Lincoln	58%
Park	44%
Sublette	51%
Teton	185%

Source: U.S. Department of Commerce. 1997. Regional Economic Information System, Bureau of Economic Analysis. Washington, D.C.

ranking variable was "scenic beauty" (1st), followed by "quality environment" (2nd), "a good place to raise a family" (3rd), "desire to live in a rural setting" (4th), "small town atmosphere" (5th), and various other "amenities" related to recreation, plus a "low crime rate." A major finding from the study was a more precise definition of the term "amenity" to include social, cultural and recreational values.

Further analysis of the same data by Snepenger et al. (1995) revealed that 4 out of 10 business owners interviewed first experienced the region as a business or pleasure traveler and later chose to locate their business in the area. The implication is that the impact of tourism extends beyond measuring their expenditures — some come back to stay, adding to the local economy in more permanent ways.

These results — that environmental amenities are closely tied to migration and business development in rural areas — are consistent with that of other researchers. Rudzitis (1999, 9-13) recently summarized several surveys he conducted of migrants to the rural West by stating: "More people are moving to the West for reasons that have nothing to do with employment," and "Development strategies need to recognize the importance of place attachments, the value of good neighbors, social interactions, and the values people place on their social/physical environments." The link between environmental amenities and economic and population growth is now widely studied (Beyers 1994; Beyers and Nelson 1997; Nelson 1997; Cromartie and Wardwell 1999). A recent study by McGranahan (1999) boldly proclaimed its findings in the title of the article "Natural Amenities Drive Population Change."

The importance of amenities to business location was recently tested nationwide by Beyers et al. (1995). They surveyed business owners in 44 states and classified them according to three categories: "Lone Eagles," or export-oriented proprietors; "High Fliers," or export-oriented business owners who employ others; and "other firms," oriented primarily to local markets. The study was significant in that it explicitly separated export-producing services from locally oriented services. The most frequently cited reasons for locating their export-oriented business in a rural setting were "quality of life" (73 percent for Lone Eagles, 66 percent for High Fliers) and "residence nearby" (82 percent for Lone Eagles, 56 percent for High Fliers). In contrast, fewer than two percent of respondents felt traditional economic reasons ("lower local tax rates," "presence of low-cost labor," "lower and/energy/occupation costs," "government assistance") were important considerations for business location.

In light of the growing body of literature on this topic the authors felt it was appropriate to revisit the Greater Yellowstone Region to determine the relative relationship of ecological, amenity, social and economic variables to population growth in the rural counties of the region.

The Study Area

This study was conducted at two geographical scales: the states of Idaho, Montana and Wyoming, and the rural counties of these states that lie within or adjacent of the Greater Yellowstone Ecosystem (GYE) (see Figure 1 and Table 1). Counties were used as the unit of analysis because published statistics on long-term economic, social and demographic trends are readily available at the county level. The choice of counties is admittedly somewhat arbitrary. Previous studies have identified 20 counties as being part of the Greater Yellowstone Region (Power 1991, Rasker et al. 1992). These counties represent ones where a significant portion of the land lies within the ecosystem; fifty-eight percent of the counties' land base is in federal land, and in four of the counties over 70 percent of the land is federally managed (Rasker 1993). As Figure 1 illustrates, the Greater Yellowstone Ecosystem (dotted line) is a subset of the larger Greater Yellowstone Region. While the ecosystem is approximately 18 million acres in size (Glick et al. 1991), the Greater Yellowstone Region consists of 33.9 million acres

(Rasker et al. 1992). An estimated 355,000 people live in the counties of the Greater Yellowstone Region.

Methods

The overall method for this paper was to test first whether ecological, or amenity variables explain variation in population growth, and if they do, how they compare to the explanatory power of social and economic variables. Because the authors are interested in the relative influence of amenities on rural development, only counties with a small population and not adjacent to metropolitan areas were used.

Beale code definitions were used to categorize the counties of Idaho, Wyoming, and Montana into two categories: Urban and Rural. The Beale code was developed by the Economic Research Service, U.S. Department of Agriculture and they are defined in Table 2. Codes 0 through 6 and 8 are defined in this study as Urban. Codes 7 and 9 are called Rural. The purpose of this classification scheme is to differentiate between two types of counties based on whether the county has a metropolitan area, or is within commuting distance to a metropolitan area. Beale code 8 is included in the Urban category because, even though it consists of rural counties with a small population they are adjacent to metropolitan areas and therefore part of the commuter-shed. Beale codes 7 and 9 includes counties with a population of less than 20,000 as well as "completely rural" counties, with neither category including counties adjacent to a metropolitan area.

We felt this classification was necessary because we were interested only on the relative influence of amenities on rural population growth. By focussing only on counties with Beale codes 7 and 9 we were able to eliminate the influence of larger population centers of over 20,000 people, including the possibility for people to commute to adjacent counties with larger populations. The use of the term "rural" to describe these counties is admittedly somewhat arbitrary, and perhaps a better description would be "populations of 19,000 or less and remote." The term "rural" is used merely as a shorthand[3].

To test which variables are related to county population growth, two hypothesis were developed:

Hypothesis One — Certain ecological and amenity variables explain a significant portion of the variation in population growth among rural counties.

This was tested at a larger geographic scale than the Greater Yellowstone Region, using the states of Idaho, Montana, and Wyoming. A database was developed that contained as the dependent variable the percent change in population from 1970 to 1997 for the rural counties, ecological characteristics of each county. A correlation matrix was developed to determine which variables explain variation among county population growth rates. The definition of each variable, and the resulting correlations, are presented in Table 3. The variables were chosen to characterize the biophysical attributes of the counties including climate, topography, hydrology, vegetation, and land use. The variable NATR represents the percent of the county in nature preserves, such as Congressionally designated wilderness, national parks, or wildlife refuges. It is used as a proxy for outdoor recreational opportunities.

Hypothesis Two — Ecological, social and economic variables all explain significant variation in population growth of rural counties in the Greater Yellowstone Region

This was tested by using the statistically significant variables from the test for Hypothesis One, and testing these against social and economic variables for the rural counties of the Greater Yellowstone Region. The definition of the variables, and the resulting correlation when tested against population growth are represented in Table 4. Once it was determined which variables, at both geographic scales, are correlated with population growth in rural counties, a model was developed for the Greater Yellowstone Region that incorporates all of the statistically significant variables (at the 95 percent and 99 percent confidence levels). Using the statistical program SPSS, a linear regression best-fit model was applied using the backward elimination technique[4]. (An inspection of

Table 2. Beale Code Definitions.

Code	Definition
Metropolitan Counties	
0	Central counties of metropolitan areas of 1 million population or more
1	Fringe counties of metropolitan areas of 1 million population or more
2	Counties in metropolitan areas of 250,000 - 1,000,000 population
3	Counties in metropolitan areas of less than 250,000 population
Nonmetropolitan counties	
4	Urban population of 20,000 or more, adjacent to a metropolitan area
5	Urban population of 20,000 or more, not adjacent to a metropolitan area
6	Urban population of 2,500 - 19,999, adjacent to a metropolitan area
7	Urban population of 2,500 - 19,999, not adjacent to a metropolitan area
8	Completely rural (no places with a population of 2,500 or more) adjacent to a metropolitan area
9	Completely rural (no places with a population of 2,500 or more) not adjacent to a metropolitan area

Source: Economic Research Service, U.S. Department of Agriculture. (http://www.econ.ag.gov/epubs/other/typolog/index.htm)

Table 3. Correlation Coefficients and Definition of Ecological and Amenity Variables Used to Test the Correlation Between County Population Change, 1970 to 1997, for the States of Idaho, Montana, and Wyoming.

Variable	Correlation with Percent County Population Change, 1970 to 1997 Pearson Correlation (N=88)	Definition (all units correspond to counties)
FORAR	.312**	Percent area in forest cover
STR	-.004	Total length of streams
LAKER	.100	Percent of area in lakes
ELEVSTD	.256*	Standard deviation of mean elevation
PREMIN	-.017	Annual minimum precipitation (1961-1990)
PREMAX	.244*	Annual maximum precipitation (1961-1990)
PRECP	.179	Annual mean precipitation (1961-1990)
TEMP	-.189	Annual mean temperature
NATR	.302**	Percent area in nature preserves (Congressional designated wilderness, National Park, or wildlife refuge).

* Correlation is significant at the .05 level (2-tailed).

** Correlation is significant at the .01 level (2-tailed).

Sources: US Geological Service EROS Data Center — Distributed Active Archive Center; Land Cover Characteristics database (http://edcdaac.usgs.gov/glcc/tablambert_na.html);

Prairie to Mountain Explorer version 2.0 (files region/reaches.shp, region/lakes.shp and region/fedland.shp);

Natural Resources Conservation Service, Water and Climate Center, NRCS National Cartography and Geospatial Center, National Climatic Data Center, PRISM Model, Oregon Climate Service at OSU (www.ocs.orst.edu/prism/prism_products.html and www.ocs.orst.edu /data-restricted);

Natural Resources and Conservation Service, Water and Climate Center, NRCS National Cartography and Geospatial Center, National Climatic Data Center, PRISM Model, Oregon Climate Service at OSU (www.ocs.orst.edu/prism/prism_products.html)

the residuals of population increase at the 3-state level and at the GYE level revealed that both data sets were reasonably normally distributed with constant variance.)

An additional variable, called AIR, was added the model. AIR is a discrete variable representing whether or not a county is within 60 miles from an airport with daily scheduled commercial airline service. (No correlations were run for this variable since it is not possible to run a Pearsons Correlation on a discrete variable). Data for this variable were derived from the *Atlas of the New West* (Riebsame 1997). Several researchers, including Nelson (1997), Beyers and Lindahl (1996), and Pulver (1987) have stated that one of the important variables determining rural development is ready access to transportation. For example, in their survey of producer service firms Beyers and Lindahl (1996) found that over 75 percent conducted business outside the area, needing to travel to their clients, in part, via air travel.

We also attempted to determine whether the type of economy predominant in the county had any influence on predicting population growth. We did this by developing a set of dummy variables for each of the rural counties of the Greater Yellowstone Region using the classification scheme developed by the Economic Research Service (ERS). The ERS of the U.S. Department of agriculture has developed a typology to categorize counties in the United States under six mutually exclusive economic types and five over-lapping rural policy relevant types. The economic types are classified as farming, mining, manufacturing, government, and services-dependent. There is also a category for nonspecialized counties, which could have combination of the five classifications, as well as one for recreation counties, developed separately by Beale and Johnson (1998). The policy types are non mutually exclusive: retirement-destination, Federal lands, persistent poverty, commuting, and transfers-dependent. ERS typologies are based on counties that in 1993 were classified as non-metro. Each variable, including one for Beale and Johnson's (1998) "recreation" counties, was individually added and withdrawn from the best-fit model (Table 5) to test if they had any impact on the adjusted R-square value.

A Word About the Term Amenities

In this paper amenities refer both to physical or ecological variables, such as climate, topography or land cover, and they also refer to the proximity of protected natural areas, such as wilderness, national parks and wildlife refuges.

Findings and Discussion

Population growth in the rural counties of Idaho, Montana, and Wyoming is significantly correlated with variables that describe the mountainous portions of these states:

Table 4. Correlation Coefficients and Definition of Variables Used to Test the Correlation Between County Population Change, 1970 to 1997, for the Rural Counties of the Greater Yellowstone Region.

Variable	Correlation with Percent County Population Change, 1970 to 1997 Pearson Correlation (N=16)	Definition (all units correspond to counties)
Ecological variables		
FORAR	.612*	Percent in forest cover
STR	.067	Total length of streams
LAKER	.255	Percent of area in lakes
ELEVSTD	-.302	Standard deviation of elevation (i.e. topography)
PREMIN	.517*	Annual minimum precipitation (1961-1990)
PREMAX	.356	Annual maximum precipitation (1961-1990)
PRECP	.538*	Annual mean precipitation (1961-1990)
TEMP	-.419	Annual mean temperature
NATR	.585*	Percent in nature preserves (Congressional designated wilderness, National Park, or wildlife refuge).
Social variables		
COLL	.610**	Percent of population over 18 years old with a college degree, 1990
CLGUNV	.086	Number of colleges and universities in the county
CRIME	.419	Serious crimes known to police per 100,000 in 1991
Economic variables		
PROD	.668**	Counties where over 15 percent of personal income is earned in producer services in 1995[i]
BUSPER	.686**	Percent of total employment in business services, 1995
HOSBED	-.210	Community hospital beds per 100,000 in 1991
HOTPER	.430	Percent of total employment in hotels and lodging, 1995
RLTPER	-.117	Percent of total employment in real estate
HEAPER	-.075	Percent of total employment in health services

* Correlation is significant at the .05 level (2-tailed).

** Correlation is significant at the .01 level (2-tailed).

Sources: Ecological variables same sources as in Table 4. Social and economic variables from: Bureau of the Census. 1997. Decennial Census of Population and Housing (CD-ROM STF1A). U.S. Department of Commerce, Washington, DC; Bureau of the Census. 1992. *County Business Patterns.* U.S. Department of Commerce, Washington, DC.; U.S. Department of Commerce. 1997. Regional Economic Information System (REIS CD-ROM), Bureau of Economic Analysis. Washington, D.C.

[i] Producer services are defined as in Beyers (1991) to include those services that are part of goods production and they include some of the higher paying sectors, such as finance, insurance, real estate, legal and business services, membership organizations, and engineering and management services.

forest cover (FORAR), high variation in topography (ELEVSTD), maximum precipitation (PREMAX); and the degree to which the land is in some form of protected status (NATR). The correlations described in Table 3 lend credibility to the hypothesis that population growth can be attributed, at least in part, to ecological and amenity variables. Any model of population growth in the rural West should therefore include variables that account for differences in these characteristics.

The fact that the variable NATR (percent of county in nature preserves) explains 30 percent of the variation in population growth in these states is consistent with the findings of others. During the 1960s, counties containing federally designated wilderness areas had population increases three times greater than other nonmetropolitan counties (Rudzitis 1993). In the 1970s, they grew at a rate twice that of nonmetropolitan areas, and in the 1980s, their population increased 24 percent — six times more than the national average of four percent for nonmetropolitan areas and almost twice as much as counties in the rural West (Rudzitis 1993). Lorah (1996) also discovered that counties in the West containing designated wilderness or national parks and refuges added jobs at more than twice the rate of non-wilderness counties. Rasker and Hackman (1996) compared economic performance of counties with a high degree of land in protected status versus those without such protections in Western Montana, and found that "wilderness" counties outpaced others in terms of having higher growth in employment and real personal income, and lower levels of unemployment. Rudzitis and Johansen (1991) surveyed 11,000 randomly selected migrants and residents in 15 wilderness counties in the West and found that 60 percent said the presence of designated wilderness was an important reason for why they moved, and 81 percent felt wilderness areas were important to their counties. The most significant reasons for locating in a wilderness county were the environmental and ecological

Table 5. Results of a Best-Fit Regression Model to Test the Relative Explanatory Power of Ecological, Amenity, Social and Economic Variables to Population Growth, 1970 to 1997, in the Rural Counties of the Greater Yellowstone Region.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.903[a]	.815	.445	.35489
2	.903[b]	.815	.538	.32403
3	.903[c]	.815	.603	.30012
4	.903[d]	.815	.652	.28099
5	.902[e]	.814	.689	.26564
6	.902[f]	.813	.719	.25248
7	.901[g]	.812	.743	.24136
8	.888[h]	.789	.736	.24476

Dependent Variable: percent change in county population, 1970 to 1997.
[a]Predictors: (Constant), AIR, PREMIN, PREMAX, PROD, ELEVSTD, COLL, FORAR, BUSPER, PRECP, NATR
[b]Predictors: (Constant), AIR, PREMIN, PROD, ELEVSTD, COLL, FORAR, BUSPER, PRECP, NATR
[c]Predictors: (Constant), AIR, PREMIN, PROD, ELEVSTD, COLL, BUSPER, PRECP, NATR
[d]Predictors: (Constant), AIR, PREMIN, PROD, ELEVSTD, COLL, BUSPER, PRECP
[e]Predictors: (Constant), AIR, PREMIN, ELEVSTD, COLL, BUSPER, PRECP
[f]Predictors: (Constant), AIR, PREMIN, ELEVSTD, COLL, PRECP
[g]Predictors: (Constant), AIR, PREMIN, ELEVSTD, COLL
[h]Predictors: (Constant), AIR, ELEVSTD, COLL

amenities, the scenery, outdoor recreation, and the pace of life.

Population growth in the rural counties of the Greater Yellowstone Region is also correlated with forest cover (FORAR) and the percent of the county in nature preserves (NATR). Population growth is also correlated with mean and minimum precipitation, suggesting that growth is slowest in the driest counties. In contrast to the state-level findings, the variation in topography (ELEVSTD) was negatively correlated with population growth. Counties that were primarily mountainous had lower variation in topography than counties that included extensive areas of plains as well as mountains. The more mountainous counties had higher population growth rates than those with extensive areas of plains. These finding suggest that population growth in the GYE is associated with mountainous areas with extensive forests, high precipitation and high access to nature reserves.

In terms of social and economic variables, those that correlated the strongest with population growth from 1970 to 1997 in the rural portions of the Greater Yellowstone were: the percentage of the population over 18 years of age with a college degree (COLL), counties where over 15 percent of personal income in 1995 was earned in producer services (PROD), and the percent of total employment in 1995 in business services (BUSPER). Both PROD and BUSPER are measures of a component of the services sector that are relatively high wage. These include engineers, architects, software programmers, business consultants, and accountants — occupations most likely to be "footloose;" able to move to desirable locations in part due to technological innovations and delivery services (e.g., Federal Express and United Parcel Service).

Carnevale and Rose (1998), Reich (1991), Drucker (1993), Thurow (1993), Silvestri and Lukasiewicz (1989) and others have identified education as an important component in determining a high-wage service industry. This may explain why the variable COLL is highly correlated with population growth; either entrepreneurs flock to an area because it has an educated workforce, or else the measure is an indication that those who have migrated to the Greater Yellowstone area are relatively educated. The later notion is supported by research by Nelson (1999), who found that areas in the West with high levels of natural amenities have enjoyed growing populations and income levels during the 1990s, and that "Much of this growth has come from inmigration of people with income from self-employment or investments. These new migrants are usually well-educated and often work as executives or professionals or in such industries as finance, insurance and real estate or business services." The presence of relatively higher paying service industries and the education of the population are highly correlated: correlation coefficients between COLL and PROD and BUSPER are .573 and .603, respectively.

The model with the best fit (with the highest adjusted R-square value at .743 and a confidence level of over 99 percent) incorporated the following variables: whether there was access to an airport (AIR); counties that are, on average, wetter (PREMIN); counties with high variation in topography (ELEVSTD); and counties with a relatively high percentage of the population over 18 years of age with a college degree (COLL). (If the variable AIR is taken out of the model, then the adjusted R-square drops to .701, and the variable BUSPER (percent of total population employed in business services) enters the model. The results of the test for best-fit model are presented in Table 5. Analysis of variance and t-test of coefficients of the best-fit model are presented in Tables 6 and 7.

At the three-state level, the high degree of correlation between rural population growth and the presence of mountains is consistent with the findings of McGranahan (1999) who conducted a nationwide study on the relationship between amenities and rural population growth and found that "people are attracted to the West for its varied topography." A somewhat surprising finding was that at the level of the Greater Yellowstone the variable ELEVSTD (topography) showed a negative correlation coefficient (Table 4), and in the

Table 6. Analysis of Variance for Best-Fit Model (7)

	Sum of Squares	Degrees of freedom	Mean Square	F	Significance Level
Regression	2.766	4	.691	11.870	.001
Residual	.641	11	5.826E-02		
Total	3.407	15			

Dependent Variable: percent change in county population, 1970 to 1997.
Predictors: (Constant), AIR, PREMIN, ELEVSTD, COLL

best-fit model it was the only coefficient with a negative sign (Table 7). Here's why: in the Greater Yellowstone Region the counties with the highest variation in elevation are a few very large counties in Wyoming, and these extend from the mountainous portion of the Greater Yellowstone Ecosystem far to the eastern half of the state, where the topography is much flatter and the elevation low. A closer look at each of the counties in the Greater Yellowstone Region revealed that the fastest population growth occurred the most mountainous counties, a finding consistent with the three-state analysis and with those of McGranahan (1999). This finding underscores one of the difficulties in using counties as a unit of analysis; in some Western states the counties are so large that they can encompass a variety of landscapes. This point also underscores the difficulty in pinning down a precise definition for the term amenity.

A study by Cromartie and Wardell (1999) illustrates another reason why the definition of an amenity is so illusive. They examined the changing populations patterns in the nonmetro West since the 1970s and found that during the later part of the 1990s rural counties not adjacent to metropolitan counties grew at rates equal to those of counties adjacent to metro areas. They note that during the 1980s net migration to rural areas of the West were highly correlated with natural amenities, including topographic variation. In the 1990s, however, they found that the highest rates of migration occurred in counties with second highest ranking in amenities. This may be an indication that perhaps the most desirable places have already been discovered, and that at a certain point real estate and other costs of living enter into the consideration of whether people move into the most desirable locations. For the Greater Yellowstone Region, Jackson Hole (Teton County, Wyoming) offers such as an example, with many new migrants choosing to live in the more affordable neighboring community of Driggs (Teton County, Idaho) (Beyers and Nelson 1997).

Table 7. t-Test for Best-Fit Model

	Unstandardized Coefficients		Standardized Coefficients		
	B	Standard Error	Beta	t	Significance Level
(Constant)	7.137E-03	.458		.016	.988
COLL	5.555	1.575	.572	3.527	.005
ELEVSTD	-2.382E-03	.001	-.618	-3.311	.007
PREMIN	3.129E-02	.027	.194	1.158	.271
AIR	.534	.195	.452	2.743	.019

Dependent Variable: percent change in county population, 1970 to 1997.

Testing the Influence of Other Economic Variables

Adding and withdrawing each of the ERS typology variables we did not find a variable that improved the fit of the model. These results are consistent with the findings of both similar studies by McGranahan (1999) and Cromartie and Wardell (1999) who found that most of the variation in rural population growth could be explained by amenity variables. We expected to at least find that adding variables to describe "retirement-destination," and "recreation" counties would add to the fit of the model. However, as McGranahan (1999) discovered, counties classified this way do not always correlate highly with growth. Part of the explanation, according to the author, has to do with the seasonal nature of these counties. They may have amenities but that does not necessarily translate into a population growth because cold winters may discourage retirement, and the seasonal nature of recreation and tourism employment translates into fluctuations in population, a fact not taken into account by the population census figures.

Conclusions

The evidence presented in this paper support both hypothesis tested: certain ecological, and amenity variables explain a significant portion of the variation in population growth among rural counties of Idaho, Montana, and Wyoming; and in the Greater Yellowstone Region population growth in rural counties can be explained by a mix of ecological, amenity, social and economic variables. These finding have an important implication: any model for rural population growth and policies designed to aid rural development in the West should take into consideration the role that amenities play in attracting and retaining people (and their businesses). Stated differently, an informed rural economic development strategy should have as one important element the protection of the natural environment.

Which variables to choose for a study on the role of amenities is largely dependent on the location. The variables used in this study are similar to ones used in other studies and the results are consistent with previous findings: topography, climate, the presence of protected areas, and land cover are all important in varying degrees. However, in other parts of the country different proxies may be used for environmental

amenities; in the Intermountain West topography and proximity to wilderness may be more important than a warm climate, while on the West coast warm climates and access to beaches may be more accurate predictors. In either case, both statistical tests for correlations, as well as survey of migrants and business owners indicate that amenities, variously measured, play a role in rural development.

While it is tempting to conclude that rural, isolated counties with amenities will be able to grow in spite of downturns in the resource extractive sectors on which they have been traditionally dependent, the fact is that access to larger markets is an important consideration. The "footloose" owners of a service businesses, such as an engineers, architects, or software programmers, need access to their clients and larger markets via air travel. This study illustrates that population growth in the rural portions of the Greater Yellowstone is closely related to the availability of an airport with daily scheduled commercial airline service. In other words, amenities may be a necessary condition for growth for some counties, but they are not necessarily sufficient.

If reliable measures become available, further research should include measured differences in access to high-speed telecommunications infrastructure. An attempt was made in this study to differentiate counties this way, and we discovered that reliable statistics are difficult to come by, and in counties where they do exist, there is a high degree of variation within the county. Some parts of the county have access to modern telecommunications facilities, while others do not. Again, this underscores one of the problems in using counties as the level of analysis. Nevertheless, it would be interesting to understand whether the Internet has played a role in rural population growth.

Finally, the results of this study indicate a high degree of correlation between the education of the population and the percentage of people employed in the business and producer services. Combining this fact with the importance of amenities and access to larger population centers via air travel, the logical conclusion for the Greater Yellowstone Region, and perhaps for the West in general, is: rural, isolated counties with a comparative advantage will be those with natural amenities, an educated workforce, and reliable airline travel. The likely type of growth from this strategy will be in the relatively higher paying service industries. And, as indicated by Cromartie and Wardell (1999), although not tested for in this paper, these characteristics will also attract an aging population looking for a comfortable place to retire.

Because recent growth has placed pressure on private lands, which are being converted from open space and agricultural lands to residential development, research on the Greater Yellowstone has broadened in the last few years to include a desire to understand the causes and consequences of amenity driven growth. It is hoped that the results of this paper can add to a growing body of literature that attempts to explain why some rural, isolated counties in the West have been growing, and that researchers, land managers, and conservationists in the Greater Yellowstone Region can advance one step further to understanding the link between a quality environment and development. One way to do this, as demonstrated in this paper, is to combine the efforts of researchers from the social and ecological sciences.

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Endnotes

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3 For Hypothesis One, 36 counties were removed from the database because they were classified as "urban" and adjacent to metropolitan counties. The total sample size for all three states was 88 counties. For Hypothesis Two, the following counties were eliminated from the database because they were classified as "urban:" Bonneville, Idaho; Carbon, Gallatin and Stillwater, Montana. The total sample size for the Greater Yellowstone Region was 16 counties.

4 Backward elimination is a variable selection procedure in which all variables are entered into the equation and then sequentially removed. The variable with the smallest partial correlation with the dependent variable is considered first for removal. If it meets the criterion for elimination, it is removed. After the first variable is removed, the variable remaining in the equation with the smallest partial correlation is considered next. The procedure stops when there are no variables in the equation that satisfy the removal criteria.

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