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The Economics of Amenities and Migration in the Pacific Northwest: Review of Selected Literature with Implications for National Forest Management

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Abstract

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This paper reviews literature on the influence of nonmarket amenity resources on population migration. Literature reviewed includes migration and demographic studies; urban and regional economics studies of amenities in labor markets, retirement 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. A synthesis of the literature finds that the influence of amenities is consistently shown to be a positive factor contributing to population growth in urban and rural areas characterized by proximity to public forest lands. Beyond this broad finding, however, little research has been conducted at an appropriate scale to be directly useful in forest management and planning decisions. Areas for further research are identified.

Keywords: Amenities, migration, hedonic studies, rural development, land use change, regional economics.

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Introduction

Population growth in the Pacific Northwest looms as a major issue for forest planners, policymakers, and resource managers. Both urban and rural populations have grown dramatically over the past three decades, causing some rural counties to triple their populations within that timespan and causing widespread impacts on the infrastructure of Northwest cities and towns. By all accounts, key attractions of the region are the quality of the natural environment in the Pacific Northwest and the proximity to the abundant recreational opportunities available on the extensive forest land owned by state and federal governments.

Increasingly, agricultural and forest land is converted for residential development throughout the West, both in the form of intensive subdivision as well as large-lot dispersed residential parcelization. As this conversion proceeds, expanding and blurring the lines between urban, rural, and wildlands, the nature of human uses of the forest landscape is changing in fundamental ways. How to address the natural resource demands of a growing population in the Northwest region is a critical problem facing planners and federal land managers. Any attempt to gain an understanding of those demands and how they may change in the future would logically start by integrating a complex body of research cutting across numerous disciplines. The technical quality of many studies of spatial and temporal trends in migration and land use conversion published in recent years has improved with advances in statistical methods. With improved methods of analysis, however, much of the literature has addressed increasingly narrow questions, and there has been little synthesis across these diverse fields of study to identify insights and conclusions on the relationships among amenity values of the natural landscape, migration, and implications for federal land management.

This review of literature is intended to begin to draw together disparate elements of the economic and, to a lesser extent, other social science literature to identify key insights on scientific, policy, and management issues related to amenities and migration, focusing principally on the Northwest, and to reveal the potential for integrative research to aid decisionmakers facing these critical issues. The objectives of this paper are to (1) synthesize a broad range of research perspectives on amenities and migration and condense the available literature, both to make it accessible to planners and managers and to provide a broader perspective for researchers focusing on any particular area of the broader issue of amenity-driven migration; and (2) to review a range of research hypotheses and techniques that have been used in past research on this subject, to identify areas for research targeted on issues of concern to federal land managers and policymakers. Although this review incorporates a large body of literature, it is not exhaustive, and suggestions

for further research are principally incremental extensions of previous studies and applications of existing models to regional data. The overarching objective is to provide input into a more broadly integrative approach to social science research to aid forest policy and management decisions.

The geographic scope of this review is principally the Pacific Northwest; however, much of the research discussed below includes empirical applications elsewhere in the West or other regions of the United States. To the extent that research applied in other geographic contexts provides insight or illustrates an approach that would be appropriate to analyzing amenities and migration questions in the Pacific Northwest, it is included below. The results of the synthesis of literature and suggestions for further research also apply broadly to other regions, and particularly to the greater intermountain West.

Existing studies do not provide much information about the influence of natural amenities in the Pacific Northwest on labor force or retirement migration that is directly useful to managers and policymakers. Although the general area of research has been ongoing for 20 years, techniques for reliably estimating amenity values in the context of housing markets have been developed relatively recently. As such, much of the review, particularly of the economics literature, focuses on technical issues more useful to researchers than to managers. The “Integration and Synthesis” section attempts to draw these reviews together in the context of forest land management in the Pacific Northwest, identifying implications for both researchers and land managers.

Various aspects of environmental quality, including scenic, air, and water quality; access to public recreational and cultural resources; and absence of disamenities, such as crime, congestion, and noise, all fall under the heading of amenity resources.

Definitions and Origins

One difficulty in navigating the literatures reviewed in this paper is the inconsistency in the use of certain terms. The following is presented to provide some clarity on this point before proceeding further.

Amenities

Broadly speaking, an amenity is any attribute of a geographic location for which a resident or potential migrant would be willing to pay, either through higher housing costs, lower wages, or other location-specific costs, but for which there is no market through which the individual can directly purchase a given amount of that good (Judson et al. 1999). Economists generally use the term to refer to a subclass of resources and services known as public goods, which by their nature are not directly traded in markets and are generally not provided by private entrepreneurs (Randall 1987). Specifically, as used in the economics literature, amenities are those public goods that can only be enjoyed by being present in a particular loca-

tion. Thus, various aspects of environmental quality, including scenic, air, and water quality; access to public recreational and cultural resources; and absence of disamenities, such as crime, congestion, and noise, all fall under the heading of amenity resources. Clearly, desirable attributes of a place are highly subjective and differ from person to person. In empirical analysis, however, the focus is typically on attributes of sufficiently common appeal as to be identifiable in aggregate data. The focus of this literature review is on amenities and their effect on population change and implications for natural resource management, specifically land use and forest management. As such, the focus is on natural amenities rather than cultural or other amenities produced as part of the human environment.

Specific amenities identified in empirical research differ across literatures. As discussed below, labor and migration, hedonic nonmarket valuation, rural development, and land use change are some of the distinct applied fields within economic analysis, each with its own literature. All of these focus in one way or another on amenity values; however, each tends to identify a particular set of amenities related to the scale of analysis typical of the subject focus. For example, the labor and migration literature is concerned with broad population flows between regions and therefore tends to incorporate regional natural amenities, such as weather and climate, as well as cultural amenities and disamenities such as crime rates and congestion. In many of the studies in this literature, amenities are included in empirical models principally as control variables, with the main focus being on employment, population, and wage differentials. As such, they may be represented as an index combining several regional amenities (McGranahan 1999). In contrast, hedonic nonmarket valuation studies tend to focus on the value of site-specific amenity resources such as the scenic view from a particular viewpoint or proximity to a recreational site or landfill.

In an analysis of economic impacts of ecosystem management, Courant et al. (1997) pointed out that amenities can benefit both individual consumers and firms.¹ A given attribute of a location can enter into the utility function of an individual as a consumption amenity, and the production function of a firm as a production amenity (Taylor and Smith 2000). Thus, e.g., high water quality in a coastal stream can improve the well-being of a recreational fisher by increasing her catch rate, as well as improving the market for a commercial fishing guide service. Amenities can therefore affect the locational decisions of individuals, but also play an important role in the locational decisions of firms. In addition to providing direct inputs into a firm's production process, amenities further lower production costs by providing

¹ This observation was pointed out earlier by Roback (1982) in a more empirical context. See discussion in "Northwest Population and Migration Trends" section.

a form of compensation to workers, thus lowering labor costs relative to locations with poorer amenities.

Migration

Human migration is measured in a number of ways in the literature, and at different spatial and temporal scales. Most of the data come from the U.S. Bureau of the Census, at different geographic scales depending on the research question. Most commonly, the studies reviewed below use net immigration at the county level as the measure of population growth over a given period. Data at finer geographic scales are available for immigration and outmigration, e.g., census blocks, but given the regional focus of most studies and the difficulty of controlling for sources of variation at finer scales, few incorporate this degree of spatial disaggregation. The most useful secondary data available for testing hypotheses on the motivation for relocation decisions is the county-to-county migration flow data published by the Bureau of the Census, which provides the most spatially precise data on migration flows between counties of origin and destination, measured for the 5-year period preceding each decennial census. These data also provide considerable detail on the demographic characteristics of migration flows. Apart from census data, primary data from a few studies reviewed below include location decisions of individual migrants or, in some cases, representatives of firms (Carlson et al. 1998).

Northwest Population and Migration Trends

Consistent with long-term trends, population growth in the United States is expected over the next several decades to be greatest in the West and South. Research on population trends conducted by the Bureau of the Census (Campbell 1997) estimated that the population of Oregon and Washington will grow from 8.5 million to over 12 million residents over the 1995-2025 period, an increase of nearly 42 percent. Both in relative and absolute terms, the states of the Pacific Northwest (Oregon and Washington) are among the fastest growing in the Nation (figs. 1 and 2). Although other Western States are expected to grow more rapidly than Oregon and Washington, much of this growth is attributable to international migration and natural population growth (the difference between birth and deaths over a given period). It is notable that Oregon is expected to be second only to Florida in the rate of net interstate migration, with an estimated average annual increase of 7 interstate migrants per 1,000 residents. In comparison, California, with by far the largest expected population increase among U.S. states over the 30-year period, is expected to have negative net interstate migration, with growth coming from natural population increase and international immigration.

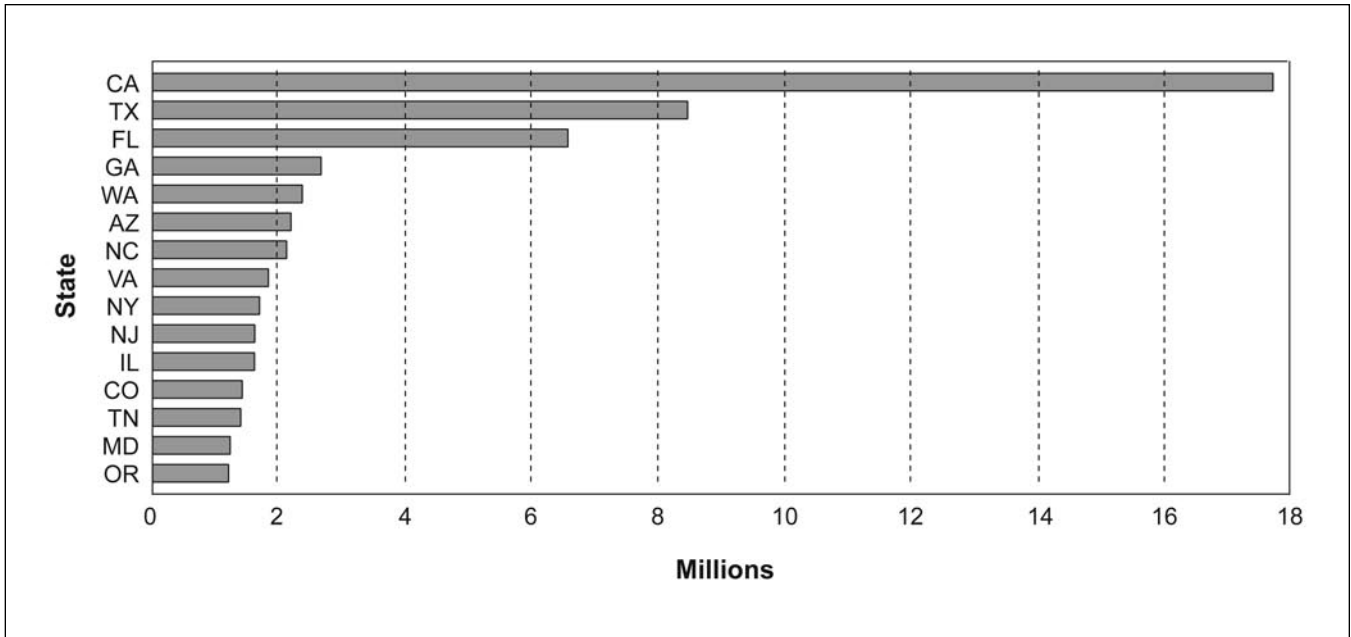


Figure 1—States with the largest projected increases in population, 1995–2025. (Source: Campbell 1996.)

Christensen et al. (2000) examined the spatial distribution of social and economic change in the area affected by the Northwest Forest Plan (72 Oregon, Washington, and northern California counties spanning the Cascade Range) during the 1990-95 period when federal timber harvests were in sharp decline. The authors examined rates of growth in the included counties and compared growth rates with respect to size class of county populations, incorporated versus unincorporated areas, and population turnover (immigration and outmigration). In Washington, the Puget Sound, Tri-City, and Northern Cascades areas grew the fastest. In Oregon, the Portland Metro area and Crook, Deschutes, and Jefferson Counties exhibited the fastest growth, with the latter including the Bend-Redmond urban growth area. Overall, the authors found that growth rates were relatively constant across incorporated areas within the region, regardless of size, with smaller cities growing somewhat more rapidly in Washington. Comparing rates of growth in the incorporated and unincorporated parts of counties in the region, the authors found that in 13 counties, including those in the Seattle and Portland metropolitan areas, unincorporated areas grew faster than incorporated areas. Although this suggests that in the counties composing the outer margins of the region’s urban centers, growth is concentrated in rural areas, the authors did not explore implications for expansion of the wildland-urban interface.

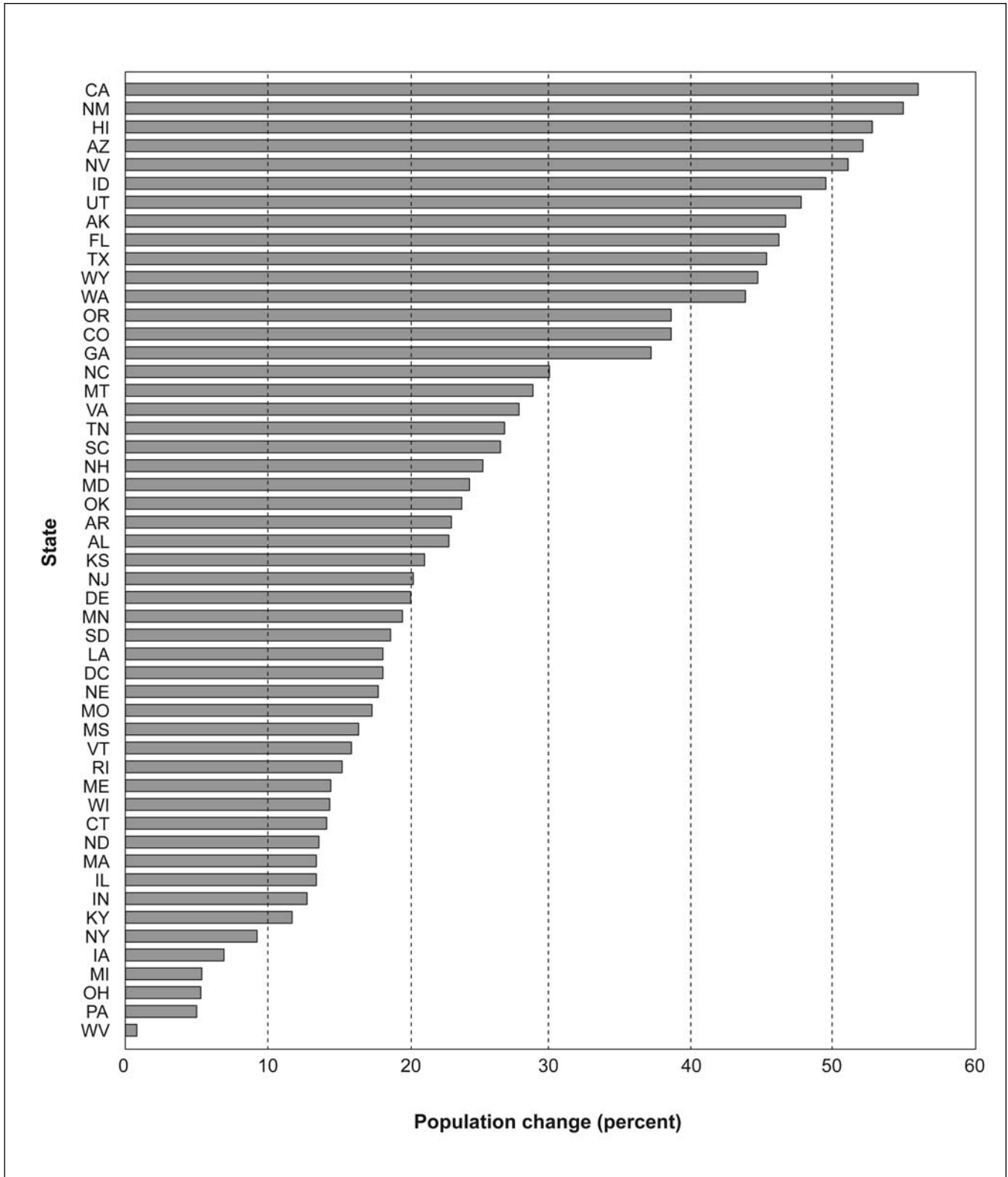


Figure 2—States ranked by projected percentage of change in population, 1995–2025. (Source: Campbell 1996.)

Christensen et al. (2000) cited USDA Economic Research Service (Bowers and Cook 1997) analysis that indicates that nationwide, counties with high federal land ownership and retirement destination counties had the highest immigration rates, but the former also had the highest outmigration rates. This suggests that employment instability may characterize fast-growing recreation- and tourism-based economies. Citing data collected by the Internal Revenue Service, the authors examined the rate of population turnover in the 72 counties within the region. Between April 1990 and April 1994, the authors found that of the 36 counties with high immigration, 27 also had high outmigration, suggesting that an active labor market likely caused high employment-driven population turnover.

A reason commonly cited for high immigration into the Pacific Northwest is the access to outdoor recreational amenities, and in particular, the proximity of large areas of public land held by the USDA Forest Service and the USDI Bureau of Land Management, as well as large areas of state park and forest land. A few studies reviewed below have employed surveys to collect data on motivations of individual migrants, but little empirical work had been performed to examine the propensity of new migrants to the Pacific Northwest to be drawn to participate in outdoor activities. The National Survey of Recreation and the Environment provides some insight (Cordell et al. 1997). Figure 3 depicts the average number of annual trips in which residents over the age of 16 within Forest Service Pacific Northwest Region (Region 6) engaged in a variety of outdoor activities, in comparison with the Nation as a whole. The survey did not discern whether the activities actually took place on public wildland; however, those listed are selected from the much larger set of activities included in the survey, most of which were less clearly associated with public wildland. Results suggest that residents of the Pacific Northwest do not have a markedly stronger propensity to engage in outdoor recreation generally, relative to the Nation. However, for a few activities most likely concentrated on public wildland—hiking, backpacking, off-highway vehicle driving, and to a lesser extent, hunting—the Pacific Northwest regional numbers are notably higher than the national average. The authors cited found that about half the residents of the Pacific and Rocky Mountain regions take part in “outdoor adventure” activities such as hiking, backpacking, mountain climbing, rock climbing, and off-highway vehicle driving, compared to about a third in other regions of the country. They attributed this principally to availability of public land and regional topography rather than preferences of immigrants to these regions, although they noted that the results are striking and called for further study.

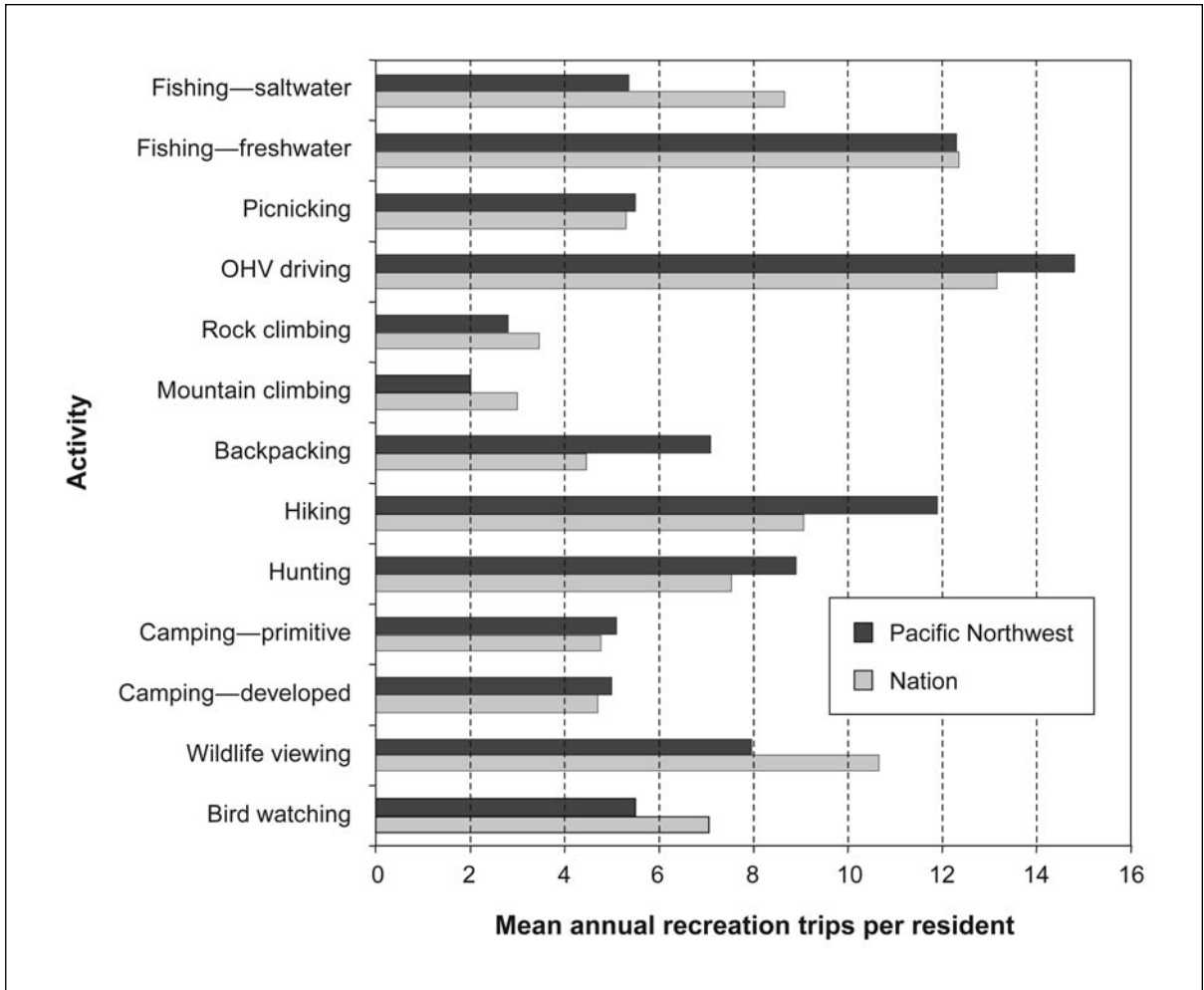


Figure 3—Average annual recreational activity trips per resident, Pacific Northwest versus national average. OHV = off-highway vehicle. Hunting figures are from the national survey of recreation and the environment, which collects data separately for big game, small game, and migratory bird hunting, of which the simple average is represented here. (Source: Cordell et al. 1997.)

Principal Lines of Research

A number of subfields in economics investigate the value of amenity resources and their relation to population migration and firms’ location decisions. Apart from economics, social science disciplines such as rural sociology, demography, and others approach these issues from different theoretical and methodological perspectives. Nearly all published studies cite Rosen (1979) and Roback (1988) as the seminal papers identifying locational amenities as critical influences in the migration decisions of both individuals and firms. The following discussion focuses largely on the economics literature and draws on other perspectives to a more limited extent. For a more thorough review of the broader social science literature pertaining to rural population growth and environmental amenities, see McCool and Kruger (2001)

and Stewart (2000). The lines drawn in this review between different literatures are rather fine and are defined solely for the purpose of structuring this review. As such, locating discussion of any given paper in the context of a particular literature is somewhat arbitrary.

Migration and Demographic Studies

The demography literature is focused principally on identifying patterns in demographic change spatially and over time. Although the sources identified as relevant to this review appeared to be largely atheoretical, a number of sources investigated the correlation of locational amenities with large-scale population movement (Campbell 1994, Cromartie and Wardwell 1999). Earlier papers in this literature tended to provide comparatively simple analyses of state-to-state migration flows, with amenities represented coarsely, e.g., inclusion of a dummy variable for coastline and a variable measuring topographical variability as explanatory variables (Cushing 1987). An important development relative to prior studies, greater detail in amenity specification has become more common, although it is probably still insufficient in later papers.

Cromartie and Wardwell (1999) examined changing population patterns, including both natural growth rates and net migration rates in the nonmetropolitan West² between 1970 and 1997. The authors found that two-thirds of total population growth over this period in nonmetropolitan counties is attributable to immigration. Migration in the nonmetropolitan West is proportionately higher than in nonmetro areas in other regions and has maintained this lead throughout nationwide fluctuations over the study period. Owing to the lower population base in the West, relative population change has been more volatile than in other regions, although patterns through time have followed the same general trends. In looking at patterns in more detail, the authors found that more recent trends in net migration are more dispersed, such that lower average nonmetro county growth rates for individual counties obscure a wider dispersion of immigration over a greater number of counties than was the case in the 1970s peak in rural immigration. The authors attribute this to a decreased dependence on proximity to urban areas and to a broadening of migrants' search for amenity-rich areas in response to increased cost of living and property values in already-developed nonmetro amenity-rich counties. The authors forecast a continued high rate of growth in nonmetro counties based on

²The authors defined the nonmetro West as comprising 325 of 414 counties within the 11 states of the Pacific coast and interior West. U.S. Bureau of the Census-defined metropolitan statistical areas are core counties containing cities of 50,000 or more people plus adjacent counties integrated with the core through commuting patterns. Nonmetro counties are those that are not designated by the bureau as metro.

three trends. First, the rural nonmetro West is largely unpopulated. Growth over the last 30 years has focused on the urban/rural interface at the margin of Western metropolitan statistical areas (MSAs) and other smaller urban areas. Several counties have transitioned from rural to urban as this margin pushes outward, and it is argued that this trend is likely to continue. Second, rural areas of the West are distinguished from those of other regions in the increasing youth and higher fertility rate of the resident population. Thus, the natural growth rate of the rural West is high, and this area continues to attract young immigrants. Third, the aging of the U.S. population is accelerating, with the first of the baby boom generation reaching retirement age in 2006. This population is attracted to rural areas as dependence on wage earning falls off and the desire for a natural amenity-rich environment increases. Although continued rapid growth is a function of many complex and interlinked sociological and economic events, the authors suggested that the capacity of rural areas to assimilate growing populations is likely to be overwhelmed if growth occurs at the high end of the range of potential growth.

Johnson and Beale (2002; see also Johnson and Beale 1998) and McGranahan (1999) presented a similar picture for the Nation as a whole, and attempted to provide more explanation for the principal drivers of migration to rural counties. Johnson and Beale (2002) identified “recreation counties,” i.e., those nonmetropolitan counties ranking higher in a weighted index of the recreation-related factors, including employment and income for recreation, tourism, and entertainment business sectors; percentage of housing units intended for seasonal use; and per capita receipts from hotels and motels. Recreational counties were of a variety of types including mountain, lake, and coastal resort areas as well as areas with casinos and national parks. All identified counties were characterized by high natural amenities with the exception of many casino-associated recreation counties. The authors noted that the greatest concentrations of recreation counties were identified in the Upper Great Lakes and the Northeast, with lesser but significant concentrations in the intermountain West and Pacific States (although they do not address the fact that Western counties are larger and fewer in number, offsetting the Eastern concentration to some degree). Also noting that rural immigration has accelerated since 1990 (Johnson and Beale 1998), the authors found that between 1990 and 2000, population growth in recreation counties was nearly twice that of nonmetro counties (20.2 percent versus 10.4 percent). Most of this growth was due to net immigration, where recreational counties grew at 2.5 times the rate of nonmetro counties generally.

Overlapping somewhat with Johnson and Beale, McGranahan (1999) developed an amenities index for all U.S. counties, aggregating normalized measures of

average January temperature and days of sun, moderation of summer temperature, summer humidity, water area, and topographic variation, and uses correlation analysis and regression models to assess the effect on migration. The index does not encompass any elements of land use or land cover, although forested area and low elevation were tested and found to be poor predictors of population change. With the exception of winter sun, the Pacific Northwest rated high in all amenity measures. Over both the short and long terms, the amenities indices were better predictors of population change than density of population, economic base, or an index of poverty. Noting that rural counties that have focused on attracting retirees or recreationists have seen much higher population change rates than other rural counties, McGranahan found that natural amenities accounted for a large portion of the growth in retirement counties, but much less so in recreation-oriented counties. It is suggested that this is likely due to the seasonality of many recreation uses. McGranahan also found natural amenities to be more strongly predictive of inter-regional population change than of intraregional population change (when using the four census regions of the United States: Northeast, Midwest, South, and West), although they are still strongly associated with the latter. However, population density and economic base were more on par with amenities in predicting inter-regional migration.

Vias (1999) used county-level aggregate data from nonmetro counties in the Rocky Mountain region to analyze trends in population and employment from 1970 to 1995. The author used a regression model³ to identify factors influencing these trends, with a focus on natural resource amenity factors (amount of Forest Service and Bureau of Land Management land and topographic variation). Two perspectives on the effect of broad-scale economic restructuring on regional growth trends are outlined in the paper (see Frey 1993, Frey and Speare 1992, and Troy 1998 for further discussion). Both interpret the effect of the shift from a manufacturing- to service-based economy. The “regional reconstruction perspective” starts from the national-level shift from rustbelt to sunbelt, suggesting that this shift was precipitated by the independence of service firms from manufacturing infrastructure, permitting location in lower cost, nonmetro areas. Fundamentally, this suggests that employment follows as firms seek low-cost locations. The “deconcentration perspective,” in contrast, suggests that firms follow people: personnel, rather than capital infrastructure, are the principal resource required by service firms, and

³ The author described a structural equations model similar to those used in the urban and regional economics literature discussed below, although he omitted a technical discussion or formal specification of the model, focusing instead on a broader discussion of social science perspectives on regional migration.

thus determine location. High-quality personnel, preferring to live in amenity-rich locations, draw firms into high-amenity nonmetro counties. The authors, although failing to provide references to specific research, suggested that recent evidence, including the trends among retiree migrants, supports the latter view. The authors' analysis of county-level data for the region is generally supportive of this argument, suggesting that, on average, firms tend to follow an amenity-seeking labor pool.

It is notable that, in their discussion, the lower wages observed in amenity-rich areas were largely overlooked by Vias et al (1999). The two views discussed above become rather coincident when one considers that amenities factor into both the utility functions of individuals as well as the production functions of firms. That is, individuals are drawn to amenity-rich locations for personal reasons, and firms are able to pay less in such locations, thus lowering the costs of production. As such, it seems rather more difficult to attribute sole causality to either the "jobs follow people" or the "people follow jobs" perspectives. This is discussed further below in the context of economic studies of labor force migration.⁴

Both Crompton et al. (1997) and Johnson and Rasker (1993) surveyed employers to identify the influence and importance of amenities on firms' siting decisions. Johnson and Rasker (1993), who surveyed firms in three rural Montana counties adjacent to Yellowstone National Park, found that amenity factors ranked much higher than business-related factors in Likert-scale importance ratings. Amenities qualitatively identified in the survey included rural nature of location, reputation for quality of life, overall community attributes, crime rate, environmental quality, scenic beauty, proximity to public land, small-town atmosphere, and general-, summer-, winter- and wildlife-based recreation opportunity. Crompton et al. (1997) surveyed development officials and representatives of private firms with responsibility for deciding that their company would locate in Colorado.⁵ The study used a fairly large sample to permit reliably testing the importance of four attributes: (1) origin of company (i.e., in-state/out-of-state migrant), (2) company size, (3) whether the

⁴Although Vias et al. (1999) investigated economic factors driving migration of individuals and firms, their analysis is distinguished from others in the economics literature because they did not use neoclassical producer or consumer theory in any formal sense, although both are somewhat implicit in their analysis.

⁵In selecting the sample, the authors noted an earlier study in Texas (Decker and Crompton 1993) that attempted to identify attributes of a location used in firms' siting decisions. The Texas study found that open space and parks played a minor role in firms' decisions to locate in towns and cities in that state relative to more traditional attributes such as cost of living and primary/secondary education. To address a key flaw of the earlier study, i.e., that the sample essentially preselected for firms that would not regard amenities as important, Crompton et al. (1997) selected Colorado as the study region. Although the focus was to identify key characteristics of firms that placed high importance on recreational and open space amenities in (re)locational decisions, this would seem to repeat the same sample selection error in reverse, as do Johnson and Rasker (1993).

company was “footloose” (i.e., directly tied to any particular input or infrastructure other than labor), and (4) whether the firm’s chief executive or owner (re)located to the company’s Colorado site. The study also compared views of private firm executives with those of economic development officials. Key findings were that development officials and private firm executives differed markedly in their views on the importance of quality-of-life attributes, particularly with regard to recreation amenities. Unlike other firms, small companies, “footloose” companies, and those in which the principal decisionmaker relocated with the firm, all regarded quality-of-life generally as more important than other business-related factors, including government incentives, and regarded recreational amenities as the most important quality-of-life attribute. Citing statistics from a variety of sources that suggest that the large majority of job growth throughout the West and elsewhere is within small firms, the authors suggested that the importance of quality-of-life attributes indicated in the survey results should be notable to those interested in regional economic development. Whereas most factors affecting firms’ revenue streams are market driven and only marginally affected by local government policy, recreation/parks/open space availability, as a direct outcome of government policy, may represent an effective incentive mechanism for promoting local job growth.

Given Campbell’s (1994) projection that retirement population will double over the period 1993–2030 to 22 percent of the U.S. population, the potential of retiree migration is especially significant in amenity-rich areas. Clark et al. (1996) focused specifically on migration of retirees and the elderly and provide a broad review of the literature of several disciplines related to this topic. The authors were critical of most studies, particularly with regard to the use of aggregate age-cohort migration data, which are often aggregated further into a single postretirement cohort. This is in contrast to the literatures in gerontology, sociology, and demography, all of which take a more heterogeneous view of elderly populations. By using a national microlevel data set that identifies migrants’ states of origin and destination, the authors more precisely reflected characteristics of elderly migrants as explanatory variables in observed migration. The analysis defined location-specific attributes as the difference between attribute level in the destination state and the origin state. The focus of the paper is on fiscal instruments that states may use to influence elderly migrants, e.g., estate and inheritance taxes, income and property tax, and welfare and educational spending. Amenity attributes included a small set of climatic and environmental quality amenities—none of which related directly to land management. Although the amenities included were highly significant, the authors noted that the use of state-level data obscures the effect of location-specific amenities, or even regional amenities. The crudeness of the analysis with respect

to natural amenities renders empirical results of little use for land and resource decisions; however, the methods used do suggest directions for future research. Given the current and potential significance of retirement migration for the Pacific Northwest, the richer analysis of personal characteristics and the destination and origin migration data used in this analysis could be combined with a richer amenity description to better forecast retirement migration into the Pacific Northwest and its subregions. The analysis could be further improved through the use of county-level or finer spatial scale.

Judson et al. (1999) reported the results of a large-sample phone survey of Oregon immigrants segmented into 15 subregional strata. The authors were primarily interested in investigating the relative influence of income and amenities in migrants' attitudes and motivations regarding locational decisions. The study included a survey of migrants to Western rural counties to investigate the influence of amenities on migration decisions, with particular attention to retirees. The analysis identified a key relationship between the age/life-cycle class of the respondent and the location within Oregon to which they moved, and correspondingly, the types of wage and nonwage benefits to which they were attracted. The authors discussed the implications for rural economic development of immigrant profiles and motivations, and suggested that luring retiree migrants can be an effective economic development strategy for high-amenity rural communities. The study found that nearly all retiree migrants cited amenities as a reason for moving and on average experienced an income loss of \$3,000 per year as a result of the move. Wage migrants were found to be younger, better educated, and less likely to cite amenities as the sole reason for moving. Late-career migrants more often than average cited amenities as the motivation for moving, and were found to experience annual income losses from \$4,000 to \$10,000. This suggests that late-career migrants may have relocated in preparation for retirement (Stewart 2003).

The studies reviewed above provide considerable empirical support for the popular notion that natural resource amenities are a significant driver of immigration in the Pacific Northwest. As noted by Cromartie and Wardwell (1999), population growth in the West over the last 30 years has been most rapid in the urban-rural interface at the margin of urban areas. An observed propensity of migrants to locate in high-amenity areas as well as affirmation of the importance of quality-of-life elements in relocation decisions of both individuals and firms emerge from the demographics literature, which includes both targeted surveys and census and other secondary data sources. Particularly notable in this literature is the focus of several studies on trends in migration among the elderly. Clark et al. (1996) and Cromartie and Wardwell (1999) in particular provided important insights

Given the impending spike in retirements as the baby boom generation reaches retirement age, a careful analysis of changing demands will help land managers understand and address these demands.

and suggested methods for analysis that would provide greater ability to forecast retirement population growth in the nonmetropolitan areas of the Northwest. Given the impending spike in retirements as the baby boom generation reaches retirement age, a careful analysis of the changing demands likely to be placed upon public lands as the age distribution of local population undergoes significant changes will help public land managers understand and address these demands.

Urban and Regional Economics and Nonmarket Valuation

Two distinct literatures within the field of economics address the role of amenities in markets for labor and housing, respectively. A major thread in the urban and regional economics literature studies the dynamics of interregional labor markets and equilibrium processes. The focus in this area of research is on the labor market itself, and amenity values tend to be a secondary concern, although some studies place considerable emphasis on the articulation of amenity measures included in analytical models. As these studies generally analyze interregional migration, broad regional amenities such as climatic variables are specified as control variables along with wage rates and housing costs in econometric models of employment and population. In contrast, within the nonmarket valuation literature, hedonic price analysis is employed with the specific focus on estimating shadow prices and demand curves for unpriced environmental amenities, often on a site-specific basis. Analysis of population migration, if it enters these studies at all, is of secondary concern. The literatures are related in the sense that both include specification of amenity measures as control variables in regression models of observable economic behavior. The following section reviews these separate literatures, along with a variety of other studies that employ similar economic models to investigate related behavior.

Amenities and labor markets—

The broad objective of these studies is the investigation of interregional labor migration and the forces, such as wage-rate and cost-of-living differentials, that contribute to population flows. As mainstream economic theory suggests, wages and other forms of economic compensation will tend to adjust in order to equilibrate the net flow of migrants from one region to another, assuming no difference in amenity levels, housing and other living costs, and other economic forces. Thus, where net labor migration rates are nonzero, labor markets are said to be in disequilibrium. Where a disequilibrium force arises, such as a change in the level of regional amenities or disamenities, or a broad change in tastes and preferences with increasing mobility, income, and educational levels, net migration to a given region may change, causing regional wage rates and housing prices, in theory, to adjust. Through this adjustment process, supply and demand in the interregional labor

market is brought to equilibrium. A substantial literature has developed to investigate this hypothesis and to explain situations where labor market disequilibrium persists over an extended period. Within this literature, an increasingly sophisticated structural equations approach has developed to model endogenous change in employment and population levels, and to a lesser extent, income levels. Although recognition of the role of regional amenities is standard in this literature, the focus is generally not on amenities themselves, which are commonly represented by a quality-of-life index representing regional amenity differences in the analytical models. The focus of the following review of this literature is on the evolution of these models (particularly with respect to the representation of amenities) and highlights those studies that have emphasized the role of natural resource amenities in migration decisions of individuals and firms.

Rosen (1979) is generally credited as the first published evidence that regional amenities are reflected in wage-rate differences between regions. This and other early studies (Graves 1976, Graves 1979, Graves 1980, Graves 1983, Graves and Knapp 1985, Graves and Linneman 1979, Greenwood et al. 1986, Linneman and Graves 1983) tended to focus exclusively on either wage or housing price differentials by using models essentially identical to those employed in the hedonic housing price models discussed in the next section. Carlino and Mills (1987), in contrast, while representing amenities only very coarsely, established the formal framework of simultaneous equations representing employment and population growth underlying most subsequent analyses. Shields and Shields (1989) provided a useful review of this earlier literature. Subsequent to Carlino and Mills, most econometric studies modeled wages and rents as independent variables, focusing more directly on measures of migration, principally changes in regional population and employment, as dependent variables. Only quite recently has wage rate been broken out again as an additional endogenous variable in the structural equations approach initiated by Carlino and Mills (see discussion of Deller et al. 2001 below).

Roback (1982), Hoehn et al. (1987), and Graves and Waldman (1991) tested the hypothesis that amenity prices are reflected in both interregional wage and housing cost differentials. Roback explicitly integrated the literature on amenity influence on intracity housing price differentials with the effect of amenities on regional wage-rate differentials in a general equilibrium framework. Roback also noted the role of amenities as potentially entering directly into firms' production functions in addition to their role as quality-of-life factors. Amenity factors included in the analysis, which the author suggested largely explain regional wage-rate differentials, include urban amenities (notably, population change between 1960 and 1970, which was found to be a disamenity), and pollution and climate variables, but not

open space or public land variables. Empirical results indicated that the effect of amenities on regional rents was unambiguously positive, whereas their effect on wage rates depended on whether the (dis)amenity could enter into firms' production functions (e.g., crime rate or annual snowfall), or in a broad context would be considered purely a consumption amenity (e.g., particulate pollution or average annual clear days). As in Rosen (1979), results were used to compute quality-of-life rankings, circa 1973, for metropolitan regions. The top three are in California; the Seattle-Everett metropolitan area, ranking 19th, is the only Northwest area to appear in the top 20. In a recent update of Roback (1982), Gabriel et al. (2003) augmented previous studies by employing a longitudinal panel data set to permit analysis of evolution in quality-of-life ratings over time as well as comparisons across states. As in Rosen, the authors included a state-level nonhousing cost-of-living index (American Chamber of Commerce 1995); however, owing to limited availability of suitable panel data, analysis was restricted to state-level aggregates. Recreational amenities were included in the analysis, with comparatively high estimated values for access to inland waterways, proportion of land in federal ownership, and access to state and national parks. In contrast to Roback's results, California and Washington came out quite low in both the 1981 and 1990 rankings, at 42 and 41 in 1990, respectively, and Oregon ranked comparatively high at 22. South Dakota was ranked first in quality of life as of 1981, switching with Wyoming for second place as of 1990.⁶

By using microlevel census data and broad measures of regional amenities, including climatic variables, environmental quality, and government services levels, Hoehn et al. (1987) provided further evidence of the multimarket nature of amenity compensation, although they did not include nonhousing costs of living. Again, the authors did not address amenities directly affected by public or private land management, including only climatic (e.g., humidity, precipitation), urban (teacher-pupil ratio, crime rate) and environmental (e.g., numbers of water pollution dischargers and landfills in county) amenities, although the latter are clearly affected by regulatory policy from local to national scales. Controlling for amenity compensation in both housing and wage rates, the authors found that households on average give up \$297 (1980 dollars) per year in wages and housing cost to gain an additional 3.5 days of sunshine, and \$468 per year to live in a county adjacent to a coastline. Mathur and Stein (1991) further developed the structural model by integrating the amenity valuation literature in the Rosen vein with migration theory. The principal aim was to incorporate regional amenities as endogenous variables, recognizing

⁶Although this particular finding would seem to call for explanation, Gabriel et al. (2003) fail to provide any further discussion.

that factors such as congestion and air quality are a function of population density. Although the authors focused principally on interregional migration and urban amenities, the principle developed in the paper is equally important in investigating the amenity-migration relationship in nonmetropolitan areas. It is interesting that, whereas the endogeneity of the “jobs-follow-people-follow-jobs” relationship has been widely recognized in the subsequent literature, the endogeneity of population-related amenities in migration models has been largely ignored with the exception of Mathur and Stein. The incremental effect of population increases on interregional or intermetropolitan area migration on regional amenities is likely to be rather small. However, population change is likely to have a much greater effect proportionately on amenities in the wildland-urban interface or rural communities where development has been focused in the Pacific Northwest and other amenity-rich areas of the West.

Greenwood and Hunt (1989) initiated a debate over whether shifts in labor demand or shifts in labor supply were the dominant cause in interregional migration, i.e., whether migration is induced by labor demand, or whether firms follow the pool of labor supply that is drawn to locations with high-amenity values and other priced and nonpriced attractions besides jobs, per se. Greenwood and Hunt attempted to refute the findings of Graves (1980), arguing that the latter’s findings on the importance of regional amenities in explaining regional migration trends are attributable to a specification error. Rather, Greenwood and Hunt argue that amenities become much less significant predictors of regional immigration when a generalized equilibrium framework is applied that includes endogenous models of employment growth and population change. Although the empirical results support this contention, the authors allowed that the degree to which the value of amenities is capitalized into wages and rents will obscure the direct effect of amenities on migration, and that employment growth can itself be attributable, in part, to the attraction of firms to high-amenity locations with lower wage rates. In response, Mueser and Graves (1995) argued that capitalization of amenity values and their effect on firm behavior are fundamental, suggesting that Greenwood and Hunt’s failure to address these effects in the statistical model of migration renders their results meaningless. Further, the authors argued, local wages and employment growth are endogenous with migration and cannot be used as proxies for employment opportunity. In addition, regional land rents, not included in Greenwood’s model, are a critical disequilibrium force driving migration. Meuser and Graves noted, however, that regional land rents and wages are extremely difficult to measure, as they are disequilibrium forces and are subject to change over time. Changes in both are obscured by confounding changes in, e.g., housing quality and employment conditions other than

nominal wage rates (also see Dumond et al. 1999 and Gabriel and Rosenthal 1999 for further discussion of this point).

By using proxy measures that are less subject to confounding effects, coupled with a more rigorous theoretical model, Meuser and Graves (1995) produced a more definitive test of the relative influence of employment versus amenity factors on migration over the period 1950–80. The authors concluded that in each of three decades, climate-related amenity factors, taken as a group, had a greater influence on regional immigration than the employment factors, as a group. Ultimately, the study concluded that regional employment effects tend to be episodic, occurring in different places over time. As such, the long-term effects of employment-related factors on migration are more muted than short-term analysis would indicate. In contrast, natural amenities are more constant over time, but trends in the tastes of migrants, increasing income and retirement rates, and technological changes all render amenities an increasingly dominant factor in regional migration.

As noted above, the general approach of this literature is relatively abstract, intended to test hypotheses regarding the influence of equilibrium and disequilibrium influences on labor migration. Relatively few of these studies have attempted to isolate empirical measures of amenity values. At the regional scale at which these studies are generally conducted, individual amenities are difficult to identify. For example, Blomquist et al. (1988) focused on evaluating amenity characteristics of all urban counties in the United States, indexing a number of amenities into a quality-of-life index calculated for each county. Implicit economic values for the indexed amenity quality of each county were estimated. Environmental amenities, including climatic variables and proximity to coastline, were combined with cultural amenities and urban disamenities (e.g., crime, pollution). With a rank of 35 out of 235 and an average annual quality-of-life premium of \$884 per resident, Lane County in Oregon was the only Northwest county identified in the top 100 U.S. counties.

Clark and Cosgrove (1991) developed a dual model of the tradeoff between both distance of relocation and wage with a set of cost-of-living and quality-of-life variables. Optimal distance to move is modeled as a function of wage gain, housing costs, personal characteristics, and the differential in a variety of amenity characteristics between the original location and the new location choice of the migrant.⁷ The wage model quantifies the tradeoff between wages and amenities in the labor market for different households. The authors stressed that it is necessary to control

⁷The authors used the 1980 U.S. Census *Public-Use Microdata Samples* (U.S. Department of Commerce, Bureau of the Census 1983), which provides detailed information on individuals and households.

for a wide variety of amenities to isolate regional wage differences that represent disequilibrium variation rather than compensation for amenity differentials. Amenities relevant to natural resource managers were two variables intended to proxy for outdoor recreational opportunity: distance to coast and quality of warm weather fishing (from the *National Survey of Fishing, Hunting and Wildlife-Associated Recreation* (U.S. Department of the Interior, Fish and Wildlife Service 1982), although several other cultural and environmental amenities were included. Interestingly, although both recreational amenities were significant and had positive coefficients in the wage model, coefficients on both variables were negative in the optimal distance model. Interpretation suggested that in the former case, desire to move nearer to a coastline was strongest among those already relatively close, i.e., those living in the interior of the country were less likely to be attracted to the coast. In the case of fishing quality, the authors suggested (somewhat cryptically) that the amenity may act as a proxy for rural destinations. Presumably, in seeking better fishing, a migrant need only move to more rural surroundings and not cross country. Although in principle the results regarding the effect of improved fishing could be used to predict how management improving recreational fisheries might affect immigration, it is likely that this variable is only a very coarse measure of recreation opportunity and may proxy for a variety of unspecified amenities. The broader conclusion of the study suggests that, as indicated in many other studies, amenities are roughly on par with wage-gain opportunities in driving migration decisions.

Deller et al. (2001) extended the two-equation Carlino-Mills model of population and employment to explicitly capture the endogeneity of wage rates, thus adding a third dimension to the “jobs follow people—people follow jobs” debate. More explicitly capturing the role of income in regional growth models by using data for 2,243 U.S. counties, the authors addressed the issue of job quality in increasingly service-oriented rural economies. Hypothesizing that amenity characteristics are central to economic growth, particularly in rural areas, the authors also focused much more specifically on amenities, criticizing earlier research for simplistic, ad hoc representation of regional amenities. Principal component analysis was used to identify scalar indices that condense 53 amenity variables into 5 general amenity and quality-of-life attributes: climate, land, water, winter recreation, and developed recreational infrastructure. The land index represents amount of federal wilderness areas, forest land, farm land, and state park land.⁸ The index differentiated Western States high in public forest, mountainous terrain, national

⁸The USDA Forest Service Wilderness Assessment Unit at the Southern Research Station provided the National Outdoor Recreation Supply Information System data set containing most of the amenity variables used in the analysis.

parks, and wilderness areas from other states. Both the water and winter recreation indices differentiated areas with high levels of developed recreation opportunity from those with undeveloped aquatic and winter natural amenities.

Deller et al. (2001) identified several notable patterns in their empirical results with respect to amenity variables. Both the water and climate indices were positively associated with population and income growth, but no significant influence on employment growth was detected, which the authors suggested is a result of the high rate of retirement migration in areas ranking high in these indices. The positive association of population and employment growth with the land amenities index is attributed by the authors to growth of tourist economies around public land resources and mountainous areas. Of particular note is the finding that no amenity index was negatively associated with income growth. With the clear implication that high-amenity rural counties have the potential to promote economic development by emphasis on those resources over more traditional resource extraction, the paper also advanced the literature by describing amenities in greater detail than previous studies. This greater conceptual detail is impeded somewhat, however, by the use of county-level data that obscure the influence of spatial effects across county lines (although it is a marked improvement over state-level data or data focusing on census metropolitan areas), suggesting a direction for future research with improved spatial data.

Retirement migration—

Relatively few papers in the economics literature have focused on the effects of amenities on retirement migration specifically. Emphasizing the point that amenities differentials are compensated for in both wages and rents, Graves and Waldman (1991) examined retirees who are no longer dependent on wages, representing a polar example of migration not driven by wages. The authors hypothesized that retirees are attracted to amenity-rich areas where the economic value of locational amenities is expressed as lower wage rates rather than higher rents. By using data and results of wage and rent response to amenities obtained from an earlier paper of similar focus (Blomquist et al. 1988), the authors tested the hypothesis that in counties characterized by wage-compensated amenities, immigration is higher among the elderly (65 and older) than among the 25 to 54 age group. The empirical results support this hypothesis and indicate that the elderly population is highly sensitive to the degree to which amenities in a given county are rent-compensated. Although the aggregate nature of the data used by Graves and Waldman (1991) renders the results only generally applicable to migration in the Northwest, the authors identified several theoretical and policy implications that may be relevant. First, regional modeling of retirement immigration must account for the relative degree of wage- versus

rent-compensation of regional amenity values. The same is true of hedonic nonmarket valuation studies that solely focus on rent differentials to value natural resource amenities. More broadly, the authors pointed out that both population groups and firms that differ from the dominant economic groups in a given area with respect to their sensitivity to land rents and wages are attracted by potential utility/profit gains resulting from their position relative to the market. An assumption used in testing this hypothesis was that retirement immigration is not a sufficiently large proportion of the population to cause upward pressure on housing costs. In certain locations in the Northwest, however, this assumption may not be valid. A potential extension of this research would identify the responsiveness of wage and rent compensation to the growth rate and proportion of county elderly populations relative to younger populations. The analysis also suggests that labor-intensive firms will be attracted to locations where amenities are largely wage-compensated rather than rent-compensated. Thus, development of regional amenities is likely to attract labor-intensive rather than land- and capital infrastructure-intensive firms.

Building on Graves and Knapp (1988) and others (Graves and Waldman 1991), von Reichert and Rudzitis (1994) defined a model to test the relative role of rent and wages on the destination choice of migrants in and out of the labor force by using new data and an alternative quantitative method. Whereas previous studies used general census data, von Reichart and Rudzitis used microlevel survey data gathered in nonmetropolitan, high-amenity counties. The analysis found no significant difference between non-labor-force and labor-force migrants in the response to housing prices, but a significant and large attraction of low-wage areas for non-labor-force migrants. The effect is particularly strong among migrants from metropolitan counties.

Firm location decisions—

The body of research reviewed in this section is oriented within the context of urban and regional economics and economic geography and attempts to explain the fundamentals of location decisions and the evolution of geographic concentrations of economic activity (see Fujita et al. 1999 for an extended treatment). This broad literature lies beyond the bounds of this review. A number of papers, however, have focused on the influence of amenity resources on locational decisions of firms (Brueckner et al. 1996, Gottlieb 1995, Granger and Blomquist 1999, Luger 1996, Zhang 1997). Kohler (1997) provided a review of this literature and performed a hedonic analysis of amenity effects on industrial location. By using a more elaborately stated model of firms' behavior than those used in earlier studies, the author investigated much the same phenomena as Vias (1999), Graves (1983), Greenwood et al. (1986), and Greenwood and Hunt (1989), and concluded that a more careful

mapping of the economic geography of firm location explains discrepancies found in these analyses. The author suggested that there is a relationship between the degree of dependence on skilled labor of a firm and the distance from high-disamenity locations where it will locate. Although the author's conclusions do not bear directly on public land management, they do suggest several theoretical points relevant to analyzing and projecting commercial and industrial development on the urban periphery. One example is that certain classes of industry and labor, i.e., mobile firms and highly skilled workers, have ample incentive to locate in high-amenity areas. More broadly, the relative sophistication of this literature provides a benchmark for rigor that other research with more direct bearing can strive for in the future.

Forest preservation and wilderness designation amenity effects—

In two recent studies, economists looked beyond the simple effects of public land open space to address the effect of public land management on migration in the context of the generalized equilibrium models reviewed above. Duffy-Deno (1998) provided a relatively sophisticated analysis of the effect of wilderness designation on county-level population and employment growth. The author used the Carlinio-Mills disequilibrium adjustment model of employment and population density on data from 250 nonurban counties in the intermountain West. The study extended the literature by analyzing the effect of the area of designated wilderness (as of 1990) on 1990 values of population and employment change. The author tested for differential effects of wilderness in resource-dependent communities broadly and more narrowly in timber-based communities, as well as differential effects of USDI Bureau of Land Management and USDA Forest Service wilderness areas. The effect of wilderness on resource- and nonresource-based employment was also analyzed. Empirical findings indicate most robustly that there is no evidence that wilderness designation has any negative effect on per capita employment rates, even in counties where 30 percent or more of the employment base is composed of timber-related jobs. Beyond this conclusion, the empirical evidence is rather more ambiguous, finding a weak positive relationship between wilderness designation and population and employment densities. The author also noted that land designated as wilderness in the past tended to be of low productivity, whereas future designations may focus on more productive land and result in greater impacts on extractive industry. Although the study attempted to control for the potential that migrants respond generally to public land amenities by including nonwilderness public land, the author suggested that future research should disaggregate the attributes of public land, e.g., by focusing on the amount of roadless areas or a more precise measure of attributes of wilderness than on management by the Forest Service or Bureau of Land Management.

Relatively little commercial activity is generated locally by wilderness areas, which tend to offer remote, multiday experiences. In contrast, the greater vehicular access to multiple-use areas may generate more day use activity, contributing to an attraction to inmigration.

Lewis et al. (2002) tested a structural model of the effect of public forest conservation land (preservation and multiple-use forest land) on employment growth and net migration in the northern forest region, comprising 92 nonmetro counties in the Northeast and Lake States. Forest products is the dominant resource-based industry in the region and accounts for up to 70 percent of total employment in some counties. In two extensions to the basic model, the authors (1) tested the differential effect of preservation land (i.e., forest preserve and national parks) and multiple-use forest land (National Forest System land not designated wilderness or other preservation status) and (2) tested for initial effects of conservation changes as public land harvest rates declined more steeply in the Northeast than in Lake states over the period 1990-97. The second extension was intended to differentiate the effect of changes in public land use designation from the long-term existence of conservation lands that were established in the early to mid 1900s. Empirical findings in testing the basic structural model indicate that the proportion of county in conservation land had no significant direct impact on employment growth (in contrast to Duffy-Deno's [1998] results), but that the reduced-form (i.e., summed direct and indirect) effect on net migration was significant, with a 9-percent increase in multiple-use conservation land corresponding to a 1-percent increase in the net migration rate.⁹ In the first extension to the basic model, preservation lands had no significant effect on either employment growth or net migration. In contrast, multiple-use conservation land had a significant positive effect on net migration. In a second extension, the authors investigated the differential effects of state and national forest multiple-use land and change in national forest harvest levels on employment growth and net migration. Again, no significant effects on employment growth are indicated, but positive direct and reduced-form effects of both state and national forest land on net migration are detected, with no significant effect attributable to harvest level.

Generally, Lewis et al. (2002) indicated that effects of public land amenity values on net migration are principally produced by multiple-use lands, which the authors explained by noting that relatively little commercial activity is generated locally by wilderness areas, which tend to offer remote, multiday experiences. In contrast, the greater vehicular access to multiple-use areas may generate more day use activity, contributing to an attraction to inmigration. Consistent with other studies on the employment impact of changing harvest levels in other regions of the United States, the authors also found that no net change in employment growth could be attributed to changing harvest levels between 1990 and 1997, although

⁹Lewis et al. (2002) findings are consistent with research demonstrating that in both Montana (Daniels et al. 1991) and Oregon (Burton and Berck 1996), neither national forest harvest nor sales levels have a significant effect on employment in the forestry sector.

they note that sectoral changes may have occurred and were unobserved in the available data. Although positive, the effects of national forest land on employment and migration tended to be fairly small, with an 8-percent increase in state or federal multiple-use land producing a 1-percent increase in net migration, and a 4-percent increase in federal forest land producing a 1-percent increase in the rate of employment growth. Thus, they suggested that although designation of conservation land may be desirable for a number of different reasons, it should not be regarded as a particularly potent tool for economic development.

Nonmarket valuation: hedonic housing price studies—

The nonmarket valuation literature is vast, covering a particularly active area of research within the resource and environmental economics subdiscipline. As noted above, the focus of this literature is development of credible estimates of consumer and producer surplus values of environmental amenities. Often, this is motivated by the need for benefits measures to integrate into environmental policy decisions via benefit-cost analyses or for damage estimates in legal proceedings. There are a variety of techniques used by economists to estimate these values. Nonmarket valuation by the hedonic price analysis method takes advantage of the availability of observable market behavior from which implicit values of amenity resources can be deduced (see Freeman 1993 for formal details).¹⁰ Most often, this is done by observing housing price and amenity-level differentials within relatively localized study areas and by using regression models to isolate the values attributable to specific amenity characteristics (Boyle and Taylor 2001, Din et al. 2001, Earnhart 2001, Graves and Knapp 1985, Johnston et al. 2001, Orford 2000, Pendleton and Mendelsohn 2000, van Ommeren et al. 2000, Wilhelmsson 2000). This relies on the assumption that housing markets analyzed are in equilibrium, i.e., supply and demand are stable, and that cross-sectional fluctuations in price can be attributed to variation in qualities of properties sold, including amenity qualities. Hedonic price analysis and other similar techniques also are used extensively to estimate the value of recreational amenities (Bowes and Krutilla 1989, Buschena et al. 2001, Englin and Mendelsohn 1991, Le Goffe 2000). As the empirical focus of this body of research is on estimation of the economic value of specific amenities, very rarely is the effect on population migration considered. As such, an extensive review of this literature is beyond the scope of this paper. However, a substantial body of

¹⁰Because these studies use observable market behavior as indirect indicators of the value of nonpriced goods, they and other similar techniques are known as **revealed preference** methods, in contrast to **stated preference** methods, which depend on survey techniques that measure response to hypothetical scenarios where no observable market behavior is available. For an extensive bibliography of stated preference studies, see Cameron (1999, 2001).

research has focused on measuring the value of natural amenities, of which a relatively few studies have focused on the value of forest and other open space amenities on residential housing markets (Bates and Santerre 2001, Geoghegan 2002, Irwin and Bockstael 2001). Given the implications for land use change in the urban periphery, this vein in the literature seems particularly relevant to this review.

Geoghegan et al. (1997) reported a study that used detailed geospatial data by means of a geographic information system (GIS) coupled with ecological indices of fragmentation and diversity of land use as regressors. The study found that in the context of urban and dense suburban housing, diversity and fragmentation are desirable and increase home sale prices. The authors interpreted this as the value of walkable access to retail and other services, schools, and undeveloped open space. In a more rural context, however, the authors found that diversity and fragmentation are undesirable and represent the intrusion of conflicting land uses into rural residential land uses, or intrusion of residential use into more traditional rural land uses. Acharya and Bennett (2001) assessed the performance of these indices relative to more traditional approaches that used proximity to crude, discrete land use classifications, finding improved model performance with the former. Use of ecological indices in modeling home sale prices is appealing, but it is unclear why these studies use indices of diversity and fragmentation rather than indexing proximity to and pattern of specific land uses. That is, both studies are critical of coarse classification schemes that collapse multidimensional information into a single variable, e.g., urban/suburban/rural, but fail to exploit the ability of GIS tools to produce improved classifications that would offer better resolution of spatial information. As a simple example, it would be useful to test whether there is a distinction between agricultural and forest land use in their influence on residential land values. Also, the authors were concerned with measuring the value of near-neighborhood land use heterogeneity, and thus did not address the effect of open space amenities at a larger spatial scale.

Lutzenhiser and Netusil (2001) presented an analysis of a variety of open space types on effects on home sale prices. Using Portland, Oregon, as the study site, and techniques similar to those in Geoghegan et al. (1997) and Acharya and Bennett (2001), the study found proximity to natural area parks (more than 50 percent of the park in natural/native vegetation) to have the greatest effect on property values. Urban parks and golf courses and other specialty parks also were included in the analysis and were shown to have weaker influence on property values overall, although they required less allocation of land to park for an equivalent increase in near-neighbor home values. Although this analysis offers improved resolution of the types of open space that may have differential amenity values, additional case

studies and a broader statistical sample are required to provide more generalizable results. An extension using similar techniques that includes the effect of National Forest System land would improve the potential application to public land management.

Irwin and Bockstael (2001) were concerned with econometric specifications that will permit identification of open space effects on property values, and used data from a four-county area of Maryland encompassing both suburban and rural residential properties. Citing an earlier literature that is largely inconclusive on the nature of amenity effects on property values, the authors pointed out that these studies were hampered by econometric problems associated with spatial data, for which statistical tools have only relatively recently become available (see Anselin and Florax 1995 for an extended treatment). The authors integrated an instrumental variables (IV) and simultaneous equations econometric framework and compared results to those of a more standard ordinary least squares (OLS) model. In addition to other explanatory variables, the authors included separate terms for privately owned developable open space, private open space protected from development by covenant, and publicly owned open space. The study found that the OLS specification produces a downward bias on the estimated coefficient for open space effects on residential property values, even to the point of reversing the sign. This strongly suggests that future analyses of similar problems should account for spatial effects.

In a study of housing price effects of permanent and developable open space in a suburban county encompassed in the data set used by Irwin and Bockstael (2001), Geoghegan (2002) presented model results indicating that a 1-percent increment of permanent open space within a 1-mile (1600-meter) buffer around a given property had an effect on sale price on par with an additional square foot (0.09 square meter) of floor space. Developable open space did not appear as a significant influence on sale price.

Tyrvaainen and Miettinen (2000) and Kim and Johnson (2002) focused specifically on the effect of forest land on urban/suburban property values. In a study of home sales in Finland, Tyrvaainen found that a 1-kilometer decrease in distance from forest land results in a 5.9-percent increase in market price, and a forest view increases price by nearly 5 percent. In perhaps the most relevant hedonic study for forest managers published to date, Kim and Johnson (2002) analyzed the effect of forest management in the viewshed of private homes on sale prices. Apart from a handful of studies analyzing the influence of designated wilderness areas on economic development, Kim and Johnson presented the only study published to date that addresses the amenity effects of forest management beyond ownership or land use classification. By using sales data from homes near a university research forest

in western Oregon, the authors analyzed the effect of both proximity to the forest boundary as well as stand characteristics (i.e., age class and hardwood/conifer mix) and the visibility of clearcut harvest areas. Results from the study of the effect of proximity of forest land on home sale prices are consistent with those found in Irwin and Bockstael (2001). The authors also found that higher property prices are associated with conifer stands and shelterwood stands with taller trees. Agricultural pasture and industrially managed forest stands, as well as visible clearcuts up to 11 years old are associated with lower prices.

Although it is uncommon to lump the urban and regional economics literature on migration with the nonmarket valuation literature that uses hedonic methods to value housing amenities, the above discussion is intended to reveal the association between the two. In one sense, the distinction is a matter of scale: the migration literature focuses on large-scale, interregional shifts in population and the influence of amenities of similar scale, whereas the hedonic property method analyzes the effect of amenities on a much finer, typically neighborhood scale. The theoretical distinction, however, is more than simply a matter of scale and has to do with the nature of market equilibrium. To estimate the value of amenities based on property transactions, the hedonic method relies on the assumption that a given housing market is in equilibrium, i.e., that both the demand and supply curves are static and the price differential between one property and another can be attributed to the value of characteristics of those properties and not on shifting demand or supply curves. Indeed, because migration results in shifting aggregate demand, hedonic studies typically control for its effect by limiting the time scale of the sample of property transactions used.¹¹ In the economics literature on migration, in contrast, the principal focus is on net population change, which is itself a disequilibrium process, and the objective of these studies is to investigate why interregional labor markets are not in equilibrium. A hypothesis that has generally been supported by research results is that changes in income, mobility, and tastes (disequilibrium factors) have resulted in net migration to amenity-rich areas. On the spatial scale at which hedonic housing price studies tend to focus, however, the migration dynamic plays out as land use change, residential conversion, and the disequilibrium process of shifting residential supply. Although theoretical and informational complexity of merging these two literatures is significant, the integration would greatly aid in the study of land use change. As noted in the next section, the approaches taken in the land use change literature are generally quite different than that proposed in this discussion.

¹¹Riddel (2000, 2001) provided unique application of techniques to control for the dynamic factors of growth in amenity qualities and residential demand, respectively.

Land Use Change

As in other areas of economic research, the emergence of tools for collecting and managing spatial information has significantly aided and expanded research of the economic forces driving changes in land use, particularly from agricultural and forest land to urban and residential uses. A number of studies are focused principally on forecasting changes in land base in forest and agriculture at county to regional scales (Ahn et al. 2000). The area-base models applied in many of these studies use physiogeographic features combined with socioeconomic (including market) variables to predict the proportion of land in distinct use classes over time, typically assuming that land use conversion occurs as present value of land in commodity production drops below its value in urban uses. These models have become increasingly spatially explicit as physiogeographic data have become available; however, the limited availability of spatially referenced socioeconomic data, particularly in time series, has limited these studies to relatively coarse spatial scales.

Ahn et al. (2000) found significant improvements in forecast accuracy of forest land base with control for cross-sectional variation in land quality and other spatial variables, particularly if time horizons are short, and suggested, as have many other authors, (see e.g., Bockstael 1996 and Kline et al. 2001), that incorporation of socioeconomic variables will provide similar improvements. The same likely holds true for significant changes in residential conversion, although residential conversion may be more subject to discontinuous changes in market conditions or regulatory influence. Kline and Alig (1999) investigated the effect of land use regulations in Oregon on conversion of forest land to developed uses. The study found that urban growth boundaries have had the effect of concentrating development within mandated urban growth boundaries (UGBs); however, the authors also find no significant difference in the rate of land conversion outside of UGBs in forest- and farm-zoned land, before and after the land use law was implemented.

A key variable in most studies predicting land use conversion to urban and residential uses is population density near land subject to conversion. As measured over time and at sufficiently fine geographic scale (e.g., census block), population density provides a spatially explicit measure of migration where data are available, thus providing a link between population migration and land use change. Other studies have used proximity to urban centers to measure urbanization pressure (Bockstael 1996, Munn and Evans 1998, Plantinga et al. 1990). Kline et al. (2001) used an index of population density and distance of the three nearest urban centers to predict the probability of conversion of parcels from farm or forest to urban land use.

In an addition to the urban and regional economics literature, Wu (2001) introduced a two-dimensional, spatially explicit model that captures the influence of amenities on urban growth. The paper is principally a formal analysis of necessary and sufficient conditions for leapfrog development, and used formal proofs rather than data to test propositions. The author suggested that spatial heterogeneity in amenity values across the urban fringe is a necessary condition for patchy, leapfrog development, i.e., urban sprawl. The key result of the paper is that unless high-amenity locations are clustered together, or the landscape is the “featureless plain” typically assumed in urban growth models, sprawl will occur as transportation costs to the urban core fall. A particularly salient finding of the paper is that measures to preserve open space, by increasing heterogeneity of amenity values across the landscape, can increase sprawl rather than constrain it, contrary to the objective of such measures. Although the paper represents a substantial improvement over earlier papers in the urban growth literature by representing landscape characteristics explicitly, a data-driven application of the model remains to be implemented.

Given the increasing use of fine-scale spatially referenced data in the nonmarket valuation literature, greater use of GIS coupled with hedonic techniques are likely to appear in the land use change literature. This point is made at length in Bockstael (1996). Augmentation of the approach used by Kline et al. (2001) and others with greater spatial representation of amenity characteristics as in Lutzenhiser and Netusil (2001) offers the potential to provide greater forecasting ability with regard to forest land fragmentation through urban and residential development. Much of the land use change research reviewed here was Forest Service sponsored and was focused on analysis of long-term trends in timber supply, wildlife habitat, and other resource conditions. As such, spatial accuracy in predicting land use change has generally not been an objective and has been pursued only insofar as it improved predictions of resource production trends. Increasing fragmentation of forest areas, however, reduces productivity of remaining commodity production, as well as having potentially profound ecological impacts. As such, incorporating greater spatial detail will increase the utility of these analyses for forest managers, as well as increasing the accuracy of production forecasts for national analyses.

Economics of Forest Preservation and Wilderness Designation

Although not a major body of research, a group of studies focusing mainly on determining the effects of forest preservation on rural economic development, e.g., wilderness and roadless area designation and county-level employment and income, has appeared in recent years. Studies using structural models to analyze the amenity effect of forest preservation are reviewed above. Survey-based research

also has appeared in the literature, authored principally by Rudzitis and several coauthors. Rudzitis and Johnson (2000) provided a recent review of the published literature. The authors found that in several recent studies of migrants to the Northwest, and particularly to rural counties characterized by proximity to wilderness and other public forest land, survey respondents consistently indicate that natural amenities are the most important reason for their migration decision, significantly outranking employment motives.

Rudzitis and Johansen (1991) surveyed residents in 11 counties across the United States that contained some federally designated wilderness, including Deschutes County in the Pacific Northwest and two northern California counties, Lassen and Trinity, near the Oregon border. The core of the survey was five questions gauging respondents' attitudes toward federal wilderness areas. Among the 11 counties, 53 percent of respondents felt that presence of designated wilderness was an important reason for them to relocate or stay in the county. Approximately half of the respondents had migrated to their county of residence within the last 10 years. Of respondents who had migrated, 60 percent said that wilderness was an important reason for them to relocate, compared to 45 percent of longer term residents giving this response. The authors did not present cross tabulations in detail, so it is not possible to identify responses by county except where they highlighted them.

Von Reichert and Rudzitis (1992) presented a survey of residents of and migrants to 15 fast-growing wilderness counties that showed that only 25 percent of the migrants increased their income, and almost 50 percent accepted income losses upon their moves to high-amenity counties. Amenities and quality of life were more important factors in the migration decision than was employment. The authors focused on migrants in the labor force and used regression analysis to identify the impact of migrants' characteristics, their satisfaction/dissatisfaction with the previous location (push), and the importance of destination features (pull) on income change on the decision to migrate. They found that migrants in higher age brackets were more inclined to accept lower incomes than younger migrants, but few migrants in high income groups had experienced income cuts. Migrants who moved for employment reasons typically realized income gains, whereas quality-of-life-oriented moves tended to be associated with income losses.

A broad literature on public land management effects on regional economic development has been published, principally in the form of agency reports and other grey literature (see, e.g., Niemi et al. 1999 and Power 2001). Two recent studies investigated questions similar to those addressed by Duffy-Deno (1998) and Lewis et al. (2002), although with a broader economic development focus and less

Survey respondents consistently indicate that natural amenities are the most important reason for their migration decision.

formal methods. Southwick and Associates (2000) investigated the association between county-level economic growth and roadless/wilderness area designation in Oregon, and Power (2000) completed a similar analysis of the effect of permanent reservation of federal roadless areas in Washington. Examining the effect in nine Oregon counties, Southwick and Associates found income and employment in extractive industries declining in relative and in some cases absolute terms, and an increasing importance of amenities. Results of the study include a positive correlation, strongest in rural Western counties, between increased allocation of land to roadless/wilderness area and income and employment growth. Power (2000) analyzed the potential impact of withdrawing remaining federal roadless forest areas from commercial harvest on local economies in the nonmetropolitan areas of Washington adjacent to national forests. Power addressed claims that withdrawal would have a significant effect on income in the wood-processing industries or that changes in this sector would lead to declines in the economic well-being of local economies. Analyzing changes in total and average income, employment, and population growth, Power noted that in nonmetro counties of the region, average earnings fell over the period 1980-90, at a time when timber harvest levels peaked. During the subsequent decade, timber harvest levels dropped precipitously, but average income levels stabilized or reversed direction while population growth and employment increased dramatically. Based on this precedent and additional evidence, the author suggested that withdrawal of roadless areas would have no significant negative economic impacts except for the case of a very few isolated timber-dependent communities. Citing nonmetropolitan population increases above national and even metropolitan Washington averages, despite substantially lower average income, the author suggested that the “second paycheck” phenomenon strongly characterizes the relationship between high amenities and lower average pay in much of the rural Northwest.¹²

¹²The notion that residents receive economic benefits from natural resource amenities has been popularized by the term “second paycheck” (Niemi and Whitelaw 1999), referring to a benefit received that is equivalent, in some sense, to additional income. The notion that the “first paycheck” is often smaller as a result does not appear to have been popularized to the same extent. Power (2001) investigated low average pay and income levels in the region’s nonmetropolitan areas relative to national averages, to test whether the gap is attributable to the decline in resource-extraction industries in the region. Rather than being due to conversion from a manufacturing to a service-based economy, the author found that pay and income gaps are attributable mainly to lower economic density, measured as average workers per acre, in the nonmetro areas of the region. Although not formally modeled, the author presented evidence that some portion of the remaining gap, amounting to an average of \$3,000 in nonmetro Washington, is attributable to the greater availability of natural amenities relative to metropolitan areas.

Integration and Synthesis: Key Amenities and Migration Economics Research Issues Relevant to Natural Resource Management

The preceding review identifies several distinct lines of research that provide different perspectives on the relationship between population growth and management of public land resources and associated amenities. The principal finding of the review of these various literatures is that natural amenities are a powerful force associated with migration flows, particularly with increasing mobility and the aging of the U.S. population. Beyond this general result, however, it is difficult to find studies that provide specific findings useful for natural resource policy and management. That is, the broadly supported result that migration to locations of high natural amenities is a long-term and increasing trend provides context for natural resources planning and policy, but provides relatively little specific guidance for policy and management decisions. Mismatches of scale and technique have hampered their usefulness in this context. Because amenity resources are inherently spatial, the coarse (e.g., county) scale of most migration studies does not provide the spatially specific information needed to guide management of amenity resources. However, the different disciplinary and subdisciplinary approaches have generated techniques that, given application in the right settings, could yield insights providing powerful guidance for public land management. A few recent studies addressed the effect of wilderness and roadless area designation on county-level employment and population growth by using rigorous analytical methods, complementing more integrative and qualitative analyses that have taken a broader look at national forest management on economic development. Although the more formal studies use data from other regions of the United States, they offer particularly relevant analyses for public land managers in the Pacific Northwest. Application of similar techniques to data from the region could be accomplished with relative expedience to provide decision support for regional policymakers and managers.

A further challenge for research is to integrate the techniques of the different subdisciplines and literatures reviewed above to answer more specific questions facing land managers. With better availability of spatially referenced data, there is a growing convergence of powerful analytic techniques at spatial scales useful to land management. Further integration, especially in the use of hedonic techniques to model land use conversion, offer the best potential to provide useful analysis and forecasting of public demand for amenities from public lands.

Migration to locations of high natural amenities is a long-term and increasing trend, but that finding provides little specific guidance for policy and management decisions.

As rapid immigration continues, demographic changes, both in the metropolitan areas of the Pacific Northwest and perhaps more significantly, in nonmetropolitan areas, lead to changing expectations of local and regional residents regarding management of public land in the region. The recreational demands of urban populations as well as homeowners seeking rural residential environments in forested areas are driven by natural amenities. Better understanding of the demand for amenities and how this plays out in the migration behavior of populations, at the national to local and even site-specific scales, can help prepare public land managers for the changing impact of human uses of forested ecosystems.

Demand for Amenity-Rich Locations

Although the evidence reviewed above is persuasive that regional migration is substantially influenced by amenities and that amenities play a particularly strong role in migration to rural locations and small, amenity-rich cities, there has been little analysis of the effect of broad forest management policies or localized management activities on migration at finer scales. In part, use of county-level data obscures cross-border effects, e.g., commuting. Western counties also are much larger than those in other regions of the United States; hence county-level analysis is less useful in the Pacific Northwest and other Western regions than elsewhere.

In the growth-follows-amenities discussion above, a principal argument is that falling timber harvest levels on national forest lands will not ultimately have a negative effect on local economies because, it is argued, they are generally more economically diversified than expected because of their attractiveness for a broad array of commercial activities owing to amenity values. The most clearly articulated theoretical response suggests that, because amenities tend to be static, they are not the dynamic cause driving net migration flows. Rather, changing tastes and the declining costs of locating in nontraditional and even remote locations as technology renders firms and workers more mobile appear to provide the disequilibrium factors driving the current migration cycle. Although natural amenities at the regional scale tend to change only very slowly if at all, as the spatial scale decreases, short-term management effects become increasingly significant in the perception of amenity qualities of a location.¹³ A clearer understanding of the sensitivity of local migration to dynamic changes in amenities associated with natural resource policy would therefore contribute to the theoretical debate, as well as provide managers with greater appreciation of the effects of forest management on the human environment.

¹³See Riddel 2001 for an application of techniques to address time trends in amenity factors in the hedonic housing price literature.

Changing tastes and the declining costs of locating in remote areas appear to be driving the current migration cycle.

Amenity Compensation

The popular notion that natural resource amenities provide an additional source of welfare to residents of amenity-rich locations, the “second paycheck,” is contrary to what would be expected by economic theory where interregional labor markets are in equilibrium. In theory, wage and housing costs would adjust to bring regional labor markets into equilibrium, given differentials in the amenity qualities in different locations. Thus, **in equilibrium**, one would expect lower wages and higher housing costs in amenity-rich areas. As such, the “second paycheck” would be compensation for lower wages and higher costs of living, i.e., a lower “first-paycheck,” and not a net gain relative to amenity-poor locations. Empirically, however, regional labor markets are not in equilibrium, and the United States has seen a long-term migration to amenity-rich areas, which suggests that wages and housing costs have not yet fully adjusted. Indeed, as Mueser and Graves (1995) pointed out, trends in increasing retirement, income, and technologically aided mobility all suggest an increasing migration to amenity-rich locations, in contrast to labor market (i.e., wage rate) fluctuations, which tend to be episodic and do not represent a prolonged influence on migration trends. The effect of amenities is also somewhat more ambiguous than suggested by the simple version of labor demand and supply equilibrium. For example, numerous studies have found that amenity values are positively expressed through lower wages and higher housing costs. However, by simultaneously modeling changes in migration, employment, and income levels, Deller et al. (2001) found no negative association between amenities and income levels, although the effect of amenities on employment was more ambiguous owing to retirement migration. Roback (1982) found that amenities were unambiguously associated with higher housing costs, but the effect on wages depended on whether the amenity was purely a consumer good or if it also acted as a production amenity by lowering firms’ nonlabor production costs (e.g., climatic conditions like lower snowfall). In a survey of early/mid-career, late-career, and retired migrants, Judson et al. (1999) found that late-career migrants, who are at the peak of their earning cycle, reported losses of \$4,000 to \$10,000 in annual earnings subsequent to migrating to high-amenity areas. Clearly, a definitive analysis of natural resource amenity values is not likely to emerge given the complexity of modeling the many factors influencing demand. Most of the analyses reviewed in this paper, however, focus on large spatial scales and interregional markets. The potential for more conclusive analysis and finer spatial scales, e.g. intraregional, has yet to be adequately tested.

Retirement Migration

As noted in McGranahan (1999) and several other studies, retirement migration looms as a potentially massive influx of population into rural counties in the West. The broader implications of the growth of so-called “mailbox economies,” in which a substantial part of income comes from pensions and other outside sources rather than locally earned wages, are beyond the scope of this review. However, the potential for changes in the economic base, demand for public services, use of public land and numerous other social and economic dynamics of rural communities throughout the region resulting from this demographic shift are profound. Studies reviewed above have indicated that counties high in public land amenities have grown in population and income relative to other rural communities, largely owing to retirement immigration. Most of the analysis of this phenomenon thus far, however, has been based on aggregate data or statistical methods with very limited predictive power, and adaptation of more spatially explicit data and analytical methods may help to better anticipate those locations that are most likely to see the greatest influx of retirement migration.

Expanding Wildland-Urban Interface and Forest Fragmentation

Two principal concerns for traditional forest management are the future supply of forest land and the management of wildfire across public and private forest land. The encroachment of urban uses on forest land represents a principal agent of change for both of these issues, particularly in the West.¹⁴ Fragmentation of commercial forest land by urban and rural residential land uses both restricts the level of commercial activity that is viable in many areas (Kline et al. 2004) and greatly increases the cost of fire suppression and the likelihood of wildfire initiation (U.S. Department of Agriculture, Forest Service 1995, 2003). Current efforts to decrease the level of fuel on public and private forest land are anticipated to take decades to complete and will ultimately command a large part of the budget for forest land management (U.S. Department of Agriculture, Forest Service, and U.S. Department of the Interior 2001). Protecting communities is a principal objective of the National Fire Plan (U.S. Department of Agriculture, Forest Service 2001), and an improved capacity to anticipate, in a spatial context, where and how communities are likely

¹⁴ Although the *National Resource Inventory* (U.S. Department of Agriculture, Natural Resources Conservation Service 2001) indicates that nationally, 23.7 million acres of cropland, pasture, and rangeland was converted to forest in 1982–97, the Forest Service Resource Planning Act assessment analysis of timberland (Alig et al. 2003) found that the Pacific Coast region was the only area where total timberland (defined as forest land where timber production is commercially viable) declined between 1977 and 1997, and that industry-owned timberland declined nationally over the same period.

to grow over time could assist in most efficiently allocating fuel reduction to those areas that currently and prospectively are most in demand for amenity-driven uses. Although land use change at the wildland-urban interface is associated with spatial factors other than amenity attractors, modeling migration and land use change at useful scales will be improved considerably with careful attention to amenity values of potential development sites.

Recent results from the hedonic property valuation literature indicate that permanent open space, i.e., public land or private land protected by covenant, have a greater influence on property values than open space that is subject to potential development in the indefinite future and that views of forest management activities diminish property values. A related question is the comparative effect of public forest land dedicated to preservation relative to nearby private land subject to extractive uses. Lewis et al. (2002) found that public forest conservation land had a more significant effect on county-level population growth than did wilderness areas. Applying the same analysis to the Pacific Northwest and addressing land use change rather than population growth could provide useful guidance in addressing the effects of forest fragmentation. Recent changes in land use designation on national forest land subject to the Northwest Forest Plan (e.g., late-successional reserves) provide the potential for a natural experiment on the effect of changing amenity supply in the context of large-scale national forest management.

National Forest Response to Amenity-Driven Migration

Most of the discussion above treats amenities as an exogenous determinant of migration. Perhaps the most salient questions for public land managers relate to the changing demands of regional populations for natural resource amenities, including recreational and scenic values and ecosystem services. Although some research indicates that declining timber harvests and wilderness designation (Duffy-Deno 1998, Lewis et. al. 2002, Power 2000, Southwick and Associates 2000) have had relatively negligible effect on county-level population or employment growth in most amenity-rich locations, there has been no research on the effect of increased emphasis on ecosystem management and concurrent changes in recreation resources on regional or county-level population growth. A broader question, and one with more pervasive implications for forest management in the Pacific Northwest, is the changing demand for amenity resources as population density and rural and urban demographics change over the coming decades. Although this literature review has largely focused on the effect of natural amenities

The question of how migration influences the demand for amenities may be the most important one for the next round of forest planning.

on migration, the question of how migration influences the demand for amenities may be the most important one for forest managers as the next round of forest planning approaches.

Conclusions

This review has focused primarily on the influence of amenities on migration. Several subfields in economics and other social sciences provide diverse analytical perspectives in investigating amenity-driven migration. Rural demography, regional labor market, and housing market studies of the effect of broadly defined amenities, and a variety of studies focusing more narrowly on the influence of natural resource amenities were reviewed. Across these various literatures, the evidence of broad association between amenity-rich locations and positive immigration is substantial. The effect of amenities on wage rates, housing costs, and employment is somewhat more ambiguous: although economic theory holds that prices in the labor and housing markets would adjust to offset the pull of amenities in population migration, net migration to amenity-rich locations remains positive, suggesting that the price adjustments that would bring equilibrium to interregional migration have not taken place. A common explanation for this is the persistent trends in increasing income, retirement, and the technologically-aided mobility of both individual migrants and firms, trends that are expected to persist in the decades ahead.

Although the existing literature provides broad support for the view that amenities are a positive influence on immigration regionally as well as locally, particularly in rural communities in the West, very little research has been conducted that provides more useful results for forest managers and policymakers. With a few exceptions, either because of mismatches of scale or analytical technique, analyses have not generally addressed specific amenity resources that are subject to change as a result of public land management or policy. Indeed, it is commonly assumed that natural resource amenities are relatively fixed, and it is the changing tastes and means of migrants that drive the dynamics of amenity migration. Although this may functionally be the case at national and regional scales, it is unlikely that the effect of management and policy changes on resource amenities has no effect on migration rates (or associated economic variables like wages, housing costs, and employment rates) at finer spatial scales. Thus far, these issues have been explored mainly in broad terms and in qualitative studies of the effects of public land management on economic development. Integration of theory and technique across social science disciplines and literatures combined with improving spatial data on

populations and demographics, as well as physiogeographic characteristics of the forest landscapes, make quantitative research possible at scales more useful for addressing questions relevant to public land management.

Two broad sets of questions face public land managers with respect to the effect of amenities on migration. Long-term trends in the U.S. economy indicate that demand for, and migration to, amenity-rich locations is likely to increase for the foreseeable future. The effect of this growing demand on public expectations for land managers is a pressing issue. Assuming the supply of natural resource amenities is fixed, analysis conducted for public land agencies should focus externally on the trends in migration of individuals and firms, in local and regional economies and communities. But at the scale relevant to public land policy, and in particular, management, amenity supply is clearly not fixed. Better understanding of the public welfare and economic development effects of policy- and management-driven changes in amenity resources would be one result of greater focus on these research questions. Perhaps the most pressing questions for public land managers are at the complex intersection of the demand and supply of amenity and other forest resources. Increasing demand and consumption of public land amenities, both through recreational use of public land and land use conversion of private land in the urban-wildland interface has largely unknown implications for forest fragmentation and the ability of both public and private forest land to provide a broad range of resources, including commodities and noncommodity values like ecosystem functions and intact habitats. Further, the influence of land management decisions, like large-scale fuel reduction, timber harvest, and changes in the preservation status of public land, on the spatial distribution of migration and land use change is largely unaddressed in the scientific literature. Data and analytical methods, however, are increasingly well-developed and offer the potential to permit valuable research to support public land decisionmaking.

Increasing recreational use of public land and land use conversion of private land have largely unknown implications for forest ecosystem functions and intact habitats.

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Metric Equivalents

When you know:	Multiply by:	To find:
Feet	.3048	Meters
Miles	1.609	Kilometers
Square feet	.0929	Square meters
Acres	.4047	Hectares

Literature Cited

- Acharya, G.; Bennett, L.L. 2001.** Valuing open space and land-use patterns in urban watersheds. *Journal of Real Estate Finance and Economics*. 22(2): 221–237.
- Ahn, S.; Plantinga, A.J.; Alig, R.J. 2000.** Predicting future forest land area: a comparison of econometric approaches. *Forest Science*. 46(3): 363–376.
- Alig, R.J.; Plantinga, A.J.; Ahn, S.; Kline, J.D. 2003.** Land use changes involving forestry in the United States, 1952 to 1997, with projections to 2050. Gen. Tech. Rep. PNW-GTR-587. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 92 p.
- American Chamber of Commerce. 1995.** ACCRA cost of living manual. Louisville, KY. 73 p.
- Anselin, L.; Florax, R.J., eds. 1995.** New directions in spatial econometrics. Heidelberg, Germany; New York; and Hong Kong: Springer-Verlag. 420 p.
- Bates, L.J.; Santerre, R.E. 2001.** The public demand for open space: the case of Connecticut communities. *Journal of Urban Economics*. 50: 97–111.
- Blomquist, G.C.; Berger, M.C.; Hoehn, J.P. 1988.** New estimates of quality of life in urban areas. *American Economic Review*. 78(1): 89–107.
- Bockstael, N.E. 1996.** Modeling economics and ecology: the importance of a spatial perspective. *American Journal of Agricultural Economics*. 78(5): 1168–1180.
- Bowers, D.; Cook, P., eds. 1997.** Rural conditions and trends. Washington, DC: U.S. Department of Agriculture, Economic Research Service. 56 p.
- Bowes, M.D.; Krutilla, J.V. 1989.** Multiple-use management: the economics of public forestlands. Washington, DC: Resources for the Future. 357 p.
- Boyle, K.J.; Taylor, L.O. 2001.** Does the measurement of property and structural characteristics affect estimated implicit prices for environmental amenities in a hedonic model? *Journal of Real Estate Finance and Economics*. 22(2): 303–318.

- Brueckner, J.K.; Thisse, J.F.; Zenou, Y. 1996.** Why is central Paris rich and downtown Detroit poor? An amenity-based theory. Louvain-la-Neuve, Belgium: Universite Catholique de Louvain. 11 p.
- Burton, D.M.; Berck, P. 1996.** Statistical causation and national forest policy in Oregon. *Forest Science*. 42(1): 86.
- Buschena, D.E.; Anderson, T.L.; Leonard, J.L. 2001.** Valuing non-marketed goods: the case of elk permit lotteries. *Journal of Environmental Economics and Management*. 41(1): 33–43.
- Cameron, T.A. 1999.** Evolution of travel cost models for the valuation of environmental goods. <http://www.sscnet.ucla.edu/ssc/labs/cameron/nrs98/tcostinv.htm>. (August 23, 2003).
- Cameron, T.A. 2001.** Evolution of hedonic property value models for the valuation of environmental goods. <http://www.sscnet.ucla.edu/ssc/labs/cameron/nrs98/index.html>. (August 23, 2003).
- Campbell, P. 1996.** Population projections for states by age, sex, race, and Hispanic origin: 1995 to 2025. Report PPL-47. Washington, DC: U.S. Department of Commerce, Bureau of the Census, Population Division. 49 p. <http://www.census.gov/population/www/projections/ppl47.html#hl-size>. (September 2004)
- Campbell, P. 1997.** Population predictions: states, 1995–2025. *Current Population Reports*. P25–1131. Washington, DC: U.S. Department of Commerce, Bureau of the Census. 6 p.
- Campbell, P.R. 1994.** Population projections for states, by age, sex, race and hispanic origin: 1993–2030. *Current Population Reports*. P25–1111. Washington, DC: U.S. Department of Commerce, Bureau of the Census.
- Carlino, G.A.; Mills, E.S. 1987.** The determinants of county growth. *Journal of Regional Science*. 27(1): 39–54.
- Carlson, J.E.; Junk, V.W.; Fox, L.K.; Rudzitis, G.; Cann, S.E. 1998.** Factors affecting retirement migration to Idaho: an adaptation of the amenity retirement migration model. *The Gerontologist*. 38(1): 7.
- Christensen, H.H.; McGinnis, W.; Raettig, T.L.; Donoghue, E. 2000.** Atlas of human adaptation to environmental change, challenge, and opportunity: northern California, western Oregon, and western Washington. Gen. Tech. Rep. PNW-GTR-478. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 80 p.

- Clark, D.E.; Cosgrove, J.C. 1991.** Amenities versus labor market opportunities: choosing the optimal distance to move. *Journal of Regional Science*. 31(3): 311–328.
- Clark, D.E.; Knapp, T.A.; White, N.E. 1996.** Personal and location-specific characteristics and elderly interstate migration. *Growth and Change*. 27(3): 327–351.
- Cordell, H.K.; Teasley, J.; Super, G. 1997.** Outdoor recreation in the United States: results from the national survey of recreation and the environment. Athens, GA: U.S. Department of Agriculture, Forest Service, Southern Research Station. 209 p.
- Courant, P.N.; Niemi, E.; Whitelaw, W.E. 1997.** An analytic typology for examining the economic effects of ecosystem management. Working Paper 407. Ann Arbor, MI: University of Michigan, School of Public Policy. 46 p.
- Cromartie, J.B.; Wardwell, J.M. 1999.** Migrants settling far and wide in the rural West. *Rural Development Perspectives*. 14(2): 2–23.
- Crompton, J.L.; Love, L.L.; More, T.A. 1997.** An empirical study of the role of recreation, parks and open space in companies' (re)location decisions. *Journal of Parks and Recreation Administration*. 15(1): 37.
- Cushing, B.J. 1987.** Location-specific amenities, topography, and population migration. *Annals of Regional Science*. 21(2): 74–85.
- Daniels, S.E.; Hyde, W.F.; Wear, D. 1991.** Distributive effects of Forest Service attempts to maintain community stability. *Forest Science*. 37(1): 261–270.
- Decker, J.M.; Crompton, J.L. 1993.** Attracting footloose companies: an investigation of the business location process. *Journal of Professional Services Marketing*. 9(1): 69–94.
- Deller, S.C.; Tsai, T.-H.S.; Marcouiller, D.W.; English, D.B.K. 2001.** The role of amenities and quality of life in rural economic growth. *American Journal of Agricultural Economics*. 82(3): 352–365.
- Din, A.; Hoesli, M.; Bender, A. 2001.** Environmental variables and real estate prices. *Urban Studies*. 38(11): 1989–2000.
- Duffy-Deno, K.T. 1998.** The effect of federal wilderness on county growth in the intermountain Western United States. *Journal of Regional Science*. 38(1): 109–136.

- Dumond, J.M.; Hirsch, B.T.; Macpherson, D.A. 1999.** Wage differentials across labor markets and workers: Does cost of living matter? *Economic Inquiry*. 37(4): 577–598.
- Earnhart, D. 2001.** Combining revealed and stated preference methods to value environmental amenities at residential locations. *Land Economics*. 77(1): 12–29.
- Englin, J.; Mendelsohn, R. 1991.** A hedonic travel cost analysis for valuation of multiple components of site quality: the recreation value of forest management. *Journal of Environmental Economics and Management*. 21(3): 275–290.
- Freeman, A.M. 1993.** The measurement of environmental and resource values: theory and methods. Washington, DC: Resources for the Future. 516 p.
- Frey, W.H. 1993.** The new urban revival in the United States. *Urban Studies*. 30(4-5): 741–774.
- Frey, W.H.; Speare, A., Jr. 1992.** The revival of metropolitan population growth in the United States: an assessment of findings from the 1990 census. *Population and Development Review*. 18(1): 129–146.
- Fujita, M.; Krugman, P.R.; Venables, A. 1999.** The spatial economy: cities, regions and international trade. Cambridge, MA: MIT Press. 367 p.
- Gabriel, S.A.; Matthey, J.P.; Wascher, W.L. 2003.** Compensating differentials and evolution in the quality-of-life among U.S. states. *Regional Science and Urban Economics*. 33(5): 619–649.
- Gabriel, S.A.; Rosenthal, S.S. 1999.** Location and the effect of demographic traits on earnings. *Regional Science and Urban Economics*. 29(4): 445–461.
- Geoghegan, J. 2002.** The value of open spaces in residential land use. *Land Use Policy*. 19(1): 91–98.
- Geoghegan, J.; Wainger, L.A.; Bockstael, N.E. 1997.** Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS. *Ecological Economics*. 23(3): 251–264.
- Gottlieb, P.D. 1995.** Residential amenities, firm location and economic development. *Urban Studies*. 32(9): 1413–1436.
- Granger, M.D.; Blomquist, G.C. 1999.** Evaluating the influence of amenities on the location of manufacturing establishments in urban areas. *Urban Studies*. 36(11): 1859–1873.
- Graves, P.E. 1976.** A reexamination of migration, economic opportunity, and the quality of life. *Journal of Regional Science*. 16(1): 107–112.

- Graves, P.E. 1979.** Income and migration revisited. *Journal of Human Resources*. 14(1): 112–121.
- Graves, P.E. 1980.** Migration and climate. *Journal of Regional Science*. 20(2): 227–237.
- Graves, P.E. 1983.** Migration with a composite amenity: the role of rents. *Journal of Regional Science*. 23(4): 541–546.
- Graves, P.E.; Knapp, T.A. 1985.** Hedonic analysis in a spatial context: theoretical problems in valuing location-specific amenities. *Economic Record*. 61(175): 737–743.
- Graves, P.E.; Knapp, T.A. 1988.** Mobility behavior of the elderly. *Journal of Urban Economics*. 24(1): 1–8.
- Graves, P.E.; Linneman, P.D. 1979.** Household migration: theoretical and empirical results. *Journal of Urban Economics*. 6(3): 383–404.
- Graves, P.E.; Waldman, D.M. 1991.** Multimarket amenity compensation and the behavior of the elderly. *American Economic Review*. 81(5): 1374–1381.
- Greenwood, M.J.; Hunt, G.L. 1989.** Jobs versus amenities in the analysis of metropolitan migration. *Journal of Urban Economics*. 25(1): 1–16.
- Greenwood, M.J.; Hunt, G.L.; McDowell, J.M. 1986.** Migration and employment change: empirical evidence on the spatial and temporal dimensions of the linkage. *Journal of Regional Science*. 26(2): 223–234.
- Hoehn, J.P.; Berger, M.C.; Blomquist, G.C. 1987.** A hedonic model of interregional wages, rents, and amenity values. *Journal of Regional Science*. 27(4): 605–620.
- Irwin, E.G.; Bockstael, N.E. 2001.** The problem of identifying land use spillovers: measuring the effects of open space on residential property values. *American Journal of Agricultural Economics*. 83(3): 698–704.
- Johnson, J.D.; Rasker, R. 1993.** Local government: local business climate and quality of life. *Montana Policy Review*. 3(2): 11–20.
- Johnson, K.M.; Beale, C.L. 1998.** The rural rebound. *Wilson Quarterly*. 12(2): 16–27.
- Johnson, K.M.; Beale, C.L. 2002.** Nonmetro recreation counties: their identification and rapid growth. *Rural America*. 17(4): 12–19.
- Johnston, R.J.; Opaluch, J.J.; Grigalunas, T.A.; Mazzotta, M.J. 2001.** Estimating amenity benefits of coastal farmland. *Growth and Change*. 32(3): 305–325.

- Judson, D.H.; Reynolds–Scanlon, S.; Popoff, C.L. 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.
- Kim, Y.–S.; Johnson, R.L. 2002.** The impact of forests and forest management on neighboring properties. *Society and Natural Resources*. 15: 887–901.
- Kline, J.D.; Alig, R.J. 1999.** Does land use planning slow the conversion of forest and farm lands? *Growth and Change*. 30(1): 3–22.
- Kline, J.D.; Azuma, D.L.; Alig, R.J. 2004.** Population growth, urban expansion, and private forestry in western Oregon. *Forest Science*. 50(1): 33–43.
- Kline, J.D.; Moses, A.; Alig, R.J. 2001.** Integrating urbanization into landscape–level ecological assessments. *Ecosystems*. 4: 3–18.
- Kohler, H.–P. 1997.** The effect of hedonic migration decisions and region-specific amenities on industrial location: Could Silicon Valley Be in South Dakota? *Journal of Regional Science*. 37(3): 379–394.
- Le Goffe, P. 2000.** Hedonic pricing of agriculture and forestry externalities. *Environmental and Resource Economics*. 15(4): 397–401.
- Lewis, D.; Hunt, G.L.; Plantinga, A.J. 2002.** Public conservation land and economic growth in the northern forest region. *Land Economics*. 78(2): 245–259.
- Linneman, P.; Graves, P.E. 1983.** Migration and job change: a multinomial logit approach. *Journal of Urban Economics*. 14(3): 263–279.
- Luger, M.I. 1996.** Quality of life differences and urban and regional outcomes: a review. *Housing Policy Debate*. 7(4): 749–771.
- Lutzenhiser, M.; Netusil, N.R. 2001.** The effect of open spaces on a home's sale price. *Contemporary Economic Policy*. 19(3): 291–298.
- Mathur, V.K.; Stein, S.H. 1991.** A dynamic interregional theory of migration and population growth. *Land Economics*. 67(3): 292–298.
- McCool, S.F.; Kruger, L.E. 2001.** Human migration and natural resources: implications for land managers and challenges for researchers. Gen. Tech. Rep. PNW–GTR–580. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 19 p.
- McGranahan, D. 1999.** Natural amenities drive rural population change. *Agricultural Economic Report*. 781. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

- Mueser, P.R.; Graves, P.E. 1995.** Examining the role of economic opportunity and amenities in explaining population redistribution. *Journal of Urban Economics*. 37(2): 176–200.
- Munn, I.A.; Evans, D.L. 1998.** The southern commercial timberland base: changes and projections. In: *Proceedings of the international conference: geospatial information in agriculture and forestry*. Ann Arbor, MI: ERIM International, Inc.: 81–88.
- Niemi, E.; Whitelaw, E. 1999.** Assessing economic tradeoffs in forest management. Gen. Tech. Rep. PNW-GTR-403. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 84 p.
- Niemi, E.; Whitelaw, E.; Johnson, A. 1999.** The sky did not fall: the Pacific Northwest's response to logging reductions. Eugene, OR: ECONorthwest. 86 p.
- Orford, S. 2000.** Modeling spatial structures in local housing market dynamics: a multilevel perspective. *Urban Studies*. 37(9): 1643–1671.
- Pendleton, L.; Mendelsohn, R. 2000.** Estimating recreation preferences using hedonic travel cost and random utility models. *Environmental and Resource Economics*. 17(1): 89–108.
- Plantinga, A.; Buongiorno, J.; Alig, R. 1990.** Determinants of changes in nonindustrial private timberland ownership in the United States. *Journal of World Forest Resource Management*. 5: 29–46.
- Power, T.M. 2000.** The economic impact of preserving Washington's roadless national forests. Missoula, MT: Economics Department, University of Montana. 72 p.
- Power, T.M. 2001.** Economic structure, economic density, and pay in the Pacific Northwest. Missoula, MT: Economics Department, University of Montana. 27 p.
- Randall, A. 1987.** Resource economics: an economic approach to natural resource and environmental policy. New York: Wiley. 434 p.
- Riddel, M. 2000.** Housing market dynamics under stochastic growth: an application to the housing market in Boulder, Colorado. *Journal of Regional Science*. 40(4): 771–788.
- Riddel, M. 2001.** A dynamic approach to estimating hedonic prices for environmental goods: an application to open space purchase. *Land Economics*. 77(4): 494–512.
- Roback, J. 1982.** Wages, rents, and the quality of life. *Journal of Political Economy*. 90(6): 1257–1278.

- Roback, J. 1988.** Wages, rents, and amenities: differences among workers and regions. *Economic Inquiry*. 26(1): 23–41.
- Rosen, S. 1979.** Wage-based indexes of urban quality of life. In: Mieszkowski, P.; Straszheim, M., eds. *Current issues in urban economics*. Baltimore: Johns Hopkins University Press: 74–104.
- Rudzitis, G.; Johansen, H.E. 1991.** How important is wilderness? Results from a United States survey. *Environmental Management*. 15(2): 227.
- Rudzitis, G.; Johnson, R. 2000.** The impact of wilderness and other wildlands on local economies and regional development trends. Proc. RMRS–P–15–Vol 2. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p.
- Shields, G.M.; Shields, M.P. 1989.** The emergence of migration theory and a suggested new direction. *Journal of Economic Surveys*. 3(4): 277–304.
- Southwick and Associates. 2000.** Historical economic performance of Oregon and western counties associated with roadless and wilderness areas. Report prepared for Oregon Natural Resources Council and World Wildlife Fund. Ferdinandina Beach, FL. 25 p.
- Stewart, S.I. 2000.** Amenity migration. In: *Proceedings: The 5th recreation and tourism trends symposium*. East Lansing, MI: Department of Park, Recreation and Tourism Resources, Michigan State University. <http://www.prr.msu.edu/trends2000/speakers.htm>. (June 2004).
- Stewart, S.I. 2003.** Personal communication. Research social scientist, USDA Forest Service, North Central Research Station, 1033 University Place, Evanston, IL 60201.
- Taylor, L.O.; Smith, V.K. 2000.** Environmental amenities as a source of market power. *Land Economics*. 76(4): 550–568.
- Troy, L.R. 1998.** Recent human migration to the interior Columbia basin and the implications for natural resource management. Missoula, MT: University of Montana, School of Forestry. 71 p.
- Tyrvaainen, L.; Miettinen, A. 2000.** Property prices and urban forest amenities. *Journal of Environmental Economics and Management*. 39(2): 205–223.
- U.S. Department of Agriculture, Forest Service. 1995.** A review of the 1994 fire season. Washington, DC: Fire and Aviation Management. 55 p.

- U.S. Department of Agriculture, Forest Service. 2001.** A collaborative approach for reducing wildland fire risks to communities and the environment: 10-year comprehensive strategy. Washington, DC. 24 p.
- U.S. Department of Agriculture, Forest Service. 2003.** Large fire cost reduction action plan. Washington, DC. 24 p.
- U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior. 2001.** Action and financial plans for the Departments of Agriculture and Interior—national fire plan implementation strategy. Washington, DC.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2001.** National resource inventory. Washington, DC. 178 p.
- U.S. Department of Commerce, Bureau of the Census. 1983.** Census of population and housing, 1980: public-use microdata samples, technical documentation. Washington, DC. 311 p.
- U.S. Department of the Interior, Fish and Wildlife Service. 1982.** National survey of fishing, hunting, and wildlife-associated recreation. Washington, DC. 156 p.
- van Ommeren, J.; van den Berg, G.J.; Gorter, C. 2000.** Estimating the marginal willingness to pay for commuting. *Journal of Regional Science*. 40(3): 541–563.
- Vias, A. 1999.** Jobs follow people in the rural Rocky Mountain West. *Rural Development Perspectives*. 14(2): 14–23.
- von Reichert, C.; Rudzitis, G. 1992.** Multinomial logistic models explaining income changes of migrants to high-amenity counties. *Review of Regional Studies*. 22(1): 25–42.
- von Reichert, C.; Rudzitis, G. 1994.** Rent and wage effects on the choice of amenity destinations of labor force and nonlabor force migrants: a note. *Journal of Regional Science*. 34(3): 445–455.
- Wilhelmsson, M. 2000.** The impact of traffic noise on the values of single-family houses. *Journal of Environmental Planning and Management*. 43(6): 799–815.
- Wu, J. 2001.** Environmental amenities and the spatial pattern of urban sprawl. *American Journal of Agricultural Economics*. 83(3): 691–697.
- Zhang, W.-B. 1997.** A two-region model with endogenous capital and knowledge—locational amenities and preferences. *International Review of Economics and Finance*. 6(1): 1–16.

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