In-Migration to Remote Rural Regions:

The Relative Impacts of Natural Amenities and Land Developability

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Abstract: Remote rural regions rich in natural amenities exist within distinctive developmental contexts and confront significant constraints to land availability for development in addition to economic growth and sociodemographic change. In this study, we compare the associations of natural amenities and land developability with in-migration in the counterurbanization process. Empirically, we focus on a remote rural subregion of the U.S. Lake States at the minor civil division level. Results suggest that public lands and lands available for development are strongly associated with in-migration to remote rural areas; their associations are stronger in remote rural areas than in other areas. Forests and wetlands are not appreciably associated with in-migration within this remote rural region. Forests and wetlands seem to become attractive to migrants only when they can be accessed through managed recreational areas. Policy implications of this study focus on the reconceptualization of the roles played by natural amenities and land developability in recent transformations taking place within remote amenity-rich rural regions.

Keywords counterurbanization; migration; public lands; natural amenities; land developability; remote rural

1. Introduction

Counterurbanization pressures in remote amenity-rich regions present a host of land use, environment, and development planning issues (Abrams et al., 2012; Argent et al., 2007). This specific form of rural residential development and demographic change, which defines counterurbanization, reflects the diffusion of more affluent "urban refugees" to remote high-quality environments, catering to consumers in the development of both primary and recreational housing (as second, third, and fourth homes) (Halfacree, 2012; Mitchell, 2004). Indeed, many argue that counterurbanization represents the driving factor behind enclaves of the rural rich—their spatial presence, leisure activities, and resulting community impacts (Rudzitis et al., 2011).

Remoteness, often characterized as being distant from urban areas and as having low population density, exhibits itself as geographic inconvenience in accessing urban resources and often creates demographic differentials in migratory motivators among age, income, and education cohorts. A good example of this can be found throughout the mid-continent of North America, with out-migrating high school graduates seeking education or occupation in urban areas and retiree in-migrants simultaneously seeking natural amenities (Carr and Kefalas, 2009; Ward, 2011). Natural amenities refer to the hedonic and aesthetic aspects associated with natural and landscape characteristics such as trees, open space, water (lakes, rivers, and coastline), and topography (mountains, canyons, and hills) (Argent et al., 2007; Marcouiller et al., 2002). Remote rural regions endowed with significant natural resource assets and recreational resources, or natural amenities, have experienced a turn-around net in-migration; posited, by some, to be driven by amenity-led residential development (Gude et al., 2006; Green et al., 2005; Isserman et al., 2009; McGranahan, 2008; McGranahan et al., 2011; Ward and Brown, 2009). A combination of increased affluence, development of transportation infrastructure, active regional

competitiveness, globalization, and environmental awareness/sensitivity has driven development into a post-industrial phase that places quality of life and amenities as central determinants of migration and rural welfare (Abrams et al., 2012; Buttel, 1995; McGranahan and Wojan, 2007; Thompson et al., 2006).

While natural amenities can be central to characterizing development within remote rural regions, their presence and attractive power also present specific and unique environmental issues that require sensitivity in land-use and development planning. Adapting existing patterns of development, accommodating growth, and minimizing the detrimental effects of rapid counterurbanization present challenges to rural community development, land use, and environmental planners. The extent to which amenity-driven residential development in these regions is constrained by land available for conversion and development is particularly important because amenity-rich regions often have higher levels of federal-, state-, and county-owned lands that are protected from developmental conversion. The land available for residential, commercial, and industrial development is referred to as "land developability" in this manuscript and is measured by the proportion of land that is available for future conversion. Further, lakes, shorelines, riparian areas, wetlands, and sensitive steep slopes, which exist as underlying natural amenities, can be ill-suited, restricted, and/or highly regulated when converted and/or developed to alternative uses. The potential tradeoff relationship between natural amenities and developability with respect to in-migration has yet to be explored in the literature.

In this manuscript, we examine the potential tradeoff relationship between natural amenities and land developability in an effort to better understand how they compete with each other in impacting in-migration to remote rural regions. Using a case study of a remote rural subregion of the U.S. Lake States, we take a spatial regression approach to investigate the associations of

natural amenities and land developability with in-migration within the context of regional socioeconomic, physical infrastructure, and natural amenity characteristics. Specifically, we ask two research questions. First, what are the relative associations of natural amenities and land developability with in-migration to remote rural areas? And, second, are the associations different from those in less remote areas? Equipped with answers to these questions, we can begin to understand the relative roles that natural amenities and land developability play in affecting migration and the potential spatial variation of these roles in the counterurbanization process. This spatial variation could help explain inconsistent and sometimes contradictory findings within the existing empirical literature on migratory effects of natural amenities (c.f. Chi and Marcouiller, 2011; Graves, 1983; Gude et al., 2006; Treyz et al., 1993; Waltert and Schläpfer, 2010). Also, practical planning and policy implications can be drawn from our work that allow a more complete exploration of strategies that promote sustainable development in remote rural regions.

This study makes two contributions to the literature on amenities and development. First, this study compares natural amenities to land developability in their associations with in-migration. Natural amenities are often found to exist in regions containing undevelopable land in public ownership. Further, the private land that is developable has more constraints on development (due to physical and environmental characteristics). Therefore, higher levels of natural amenities could be associated with lower levels of land developability. With respect to migration, the former can be thought to encourage migration and the latter to discourage migration. This study addresses how the two competing factors work together to affect in-migration. Second, this is also one of the few studies that exclusively focus on remote rural regions. Existing studies of amenities and development have been conducted in a variety of regional contexts at differing

regional scales. For reviews of this literature, we refer interested readers to work by Abrams et al. (2012), Fleming et al. (2009), and Gosnell and Abrams (2009). Studying natural amenities in remote rural regions could provide insights into the relationship between amenities and development, as remote rural regions exist within differing contexts that include socioeconomic conditions, growth mechanisms, and transportation infrastructure, as well as the extent of remoteness itself (Argent et al. 2005; Wu and Gopinath, 2008).

We have organized this manuscript into five subsequent sections. In the next section we review and discuss the associations of natural amenities and land developability with development and migration in remote rural regions within the context of socioeconomic and physical infrastructure. Following this we describe the research data and the methods used in this empirical case study conducted at the minor civil division level (a subcounty level) for a remote and amenity-rich rural region of Northern Wisconsin, USA. We then report our empirical findings that focus on the migratory effects of natural amenities and land developability. Finally, we conclude this manuscript with a summary and a discussion of policy implications that can be drawn from our empirical results focused on the unique developmental dilemmas faced by remote rural regions rich in natural amenities.

2. Migrating to Remote Rural Regions

As noted in the introduction, remote rural regions exhibit geographic inconvenience in accessing urban resources and continue to experience a drain of younger age groups to metropolitan areas. Unlike rural regions adjacent to metropolitan areas that benefit from agglomeration and suburbanization effects, remote rural areas have traditionally relied on extractive resources for economic development. They typically have less developmental stimuli than urban areas and

93 often cannot rely on state or federal supports but must use their own resources for development
94 (Isserman, 2001). Remoteness, as a concept, is complex and presents unique developmental
95 contexts and constraints on economic growth and sociodemographic change such as out-
96 migrating high school graduates seeking education or occupation in urban areas (Argent 2005;
97 2007; Carr and Kefalas, 2009). These regions are often far distant from metro cities; thus,
98 residents face different constraints on their livelihoods. Key livelihood distinctions involve levels
99 of urbanity that affect employment opportunities, healthcare facilities, shopping centers,
100 entertainment centers, cultural and educational facilities, and others. These regions also may
101 have public infrastructures that afford residents different levels of access to transportation
102 (highway networks and commercial airports), real estate services, and legal/political elements.
103 Despite these challenges, some remote rural areas are experiencing population and
104 employment growth (Isserman et al. 2009). In some areas, this growth is argued to be driven by
105 presence of natural amenities. A large body of literature has addressed the role of natural
106 amenities in promoting regional growth and development. Natural amenities have been seen as a
107 latent primary factor of production in the local provision of goods and services (Graves, 1983;
108 Marcouiller 1998) and a regional benefit considered in household migration decisions (Roback,
109 1982). The importance of natural amenities for growth and development has also been addressed
110 in an increasing number of empirical studies with mixed and inconsistent results (c.f. Deller et al.,
111 2001; Kim et al., 2005; Krannich et al., 2006; McGranahan, 2008; Winkler et al., 2007).
112 Land developability, which measures the availability of land for development, also affects in-
113 migration to remote rural areas. Net in-migration into remote rural regions has resulted in the
114 conversion of forestry and agricultural lands into dispersed residential and commercial
115 developments (Smith and Spadoni, 2005). However, the availability of lands for conversion and

development limits future development in these regions. The land developability of a region is determined by geophysical characteristics, extent of built-up lands, cultural and aesthetic resources, and legal constraints (Chi, 2010a). Geophysical characteristics can either limit or encourage land development (Morris, 1994). Publicly owned and/or tax-exempted lands are legally protected lands and usually are not available for residential or commercial land development. Publicly owned lands include federal-, state-, and county-owned lands established as public forests and parks, trails, wildlife refuges, and fishing areas. Further, lakes and rivers in the Midwest United States are publicly owned and managed. It should be noted that while publicly owned lands can be leased or used for residential or commercial purposes, the magnitude of this use is small and thus this study considers all publicly owned lands as undevelopable. This study also does not consider built-up lands as developable for new residential development; built-up lands include existing residential, commercial, and industrial developments as well as lands used for transportation infrastructure. It should be noted that although rural residential areas are often seen as viable for new amenity-driven residential development through subdivisions and changes to zoning regulations, the new development occurs in the region proximate to existing residential areas, but not on the existing housing locations; therefore, existing residential lands in these areas are not developable either.

Other factors that affect in-migration to remote rural regions include in-migration trends in the past, proximity to metro cities, transportation accessibility, human capital, and economic conditions (Wu and Gopinath, 2008). First, a high in-migration rate in the past is an indicator that the host area is attractive, and thus the area can expect more in-migrants. The “sense of place” literature argues that migrants often move to places where their preference and socioeconomic characteristics are similar to previous migrants (Amsden, Stedman, and Kruger,

2011). The past in-migrants provide information and support to potential new in-migrants (Haug, 2008). Second, proximity to metropolitan regions facilitates development. Large cities provide job opportunities, shopping centers, entertainment centers, healthcare facilities, and cultural and educational resources (Glaeser, 1997; Isserman et al., 2009), which are important amenities that many migrants are not willing to live without reasonable proximity to. Third, the presence of commercial airports allows in-migrants to access opportunities in distant metropolitan cities (Irwin and Kasarda, 1991; Rasker et al., 2009). Easy access to highways is also important in connecting remote rural areas to other areas and large cities (Chi, 2010b). Fourth, human capital, often measured by local education levels, is an important factor in attracting in-migrants (Deller et al., 2001). Fifth, economic variables such as unemployment rate, median household income, and median house value are also important factors in affecting migration because economic theory suggests that potential migrants seek destinations where their economic benefits can be maximized (Treyz et al., 1993; Tunali, 2000).

A review of the literature provides insights into the associations of natural amenities and land developability with in-migration in remote rural regions within the context of regional socioeconomic and physical infrastructure characteristics. Based on our literature review, we devised three hypotheses for this study. First, in remote rural regions, natural amenities are positively associated with in-migration when the former can be easily accessed, such as through managed public lands. Second, land developability is also positively associated with in-migration in remote rural regions. Third, the associations of natural amenities and land developability with in-migration are stronger in remote rural regions than in other types of regions.

3. Study Area and Data

3.1. The Study Area

In the research reported here, we examine the associations of natural amenities and land developability with in-migration to a remote rural region of Northern Wisconsin known for its endowment of forest and water resources (Figure 1). We conduct our analysis by using data collected for the minor civil divisions (MCDs) within eight counties (Ashland, Florence, Forest, Iron, Oneida, Price, and Vilas). Each MCD (a city, a village, or a town) is a functioning governmental unit with elected officials who provide services and raise revenues. All eight counties are non-adjacent to metropolitan areas, and the 2003 Urban-Rural Continuum (URC) codes (USDA ERS, 2004) classify them as either 7 (urban population of 2,500 to 19,999, not adjacent to a metro area) or 9 (completely rural or less than 2,500 urban population, not adjacent to a metro area). The eight counties used in this case study make up the largest contiguous remote rural region in Wisconsin.

This region has relatively low population density—28 persons per square kilometer in 2000, compared to an average population density of 89 persons per square kilometer for all nonmetropolitan MCDs in Wisconsin as defined by the USDA URC codes and 142 persons per square kilometer for all MCDs in Wisconsin; this suggests that the selected study area is sparsely populated and, for Wisconsin, is at the very “rural” end of the urban to rural continuum. The MCDs in the eight remote rural counties have an average direct distance of 111 kilometers to their nearest metropolitan region, compared to an average distance of 65 kilometers for all nonmetropolitan MCDs in Wisconsin and 52 kilometers for the all MCDs in Wisconsin; this suggests that the selected study area is remote, particularly within the context of Wisconsin. It should be noted that remoteness can be measured using several references besides the USDA

URC codes. The URC codes use population size and adjacency to a metro area as the two criteria in classifying counties. A more precise measure should consider alternative metrics of population density that account for small settlement concentration, accessibility, and availability of services (Argent et al., 2005, 2007). Certainly, further refinements of this definition can more precisely represent remoteness.

[FIGURE 1 ABOUT HERE]

3.2. Data

The analytical dataset consists of 129 MCDs, which serve as the units of analysis for this study. The MCD geography represents a non-nested, exhaustive, and mutually exclusive political landscape. Wisconsin is a strong MCD state composed of many small villages, towns, and cities, as well as a few large cities and surrounding neighboring suburbs. MCDs are designated by the U.S. Census Bureau on the basis of legal entities rather than on population sizes and are recognized in 28 U.S. states. The advantage of using MCDs is their relevance to planning and public policy making. In most parts of the state, census tracts have an average size similar to MCDs and provide an alternative unit of analysis. However, census tracts are geographic units delineated by the Census Bureau only for purposes of the decennial census and exist without political or social meaning. Thus, this study uses MCDs rather than census tracts as the units of analysis.

We compiled the data from a variety of primary and secondary sources. We obtained migration data from the 1990 and 2000 decennial censuses; the data of natural amenity characteristics and land developability from the U.S. Geological Survey, the Wisconsin Department of Natural Resources, and the 2001 National Land Cover Database produced by the Multi-Resolution Land Characteristics Consortium; and transportation accessibility, human

capital, and economic data from the U.S. Census Bureau and the Wisconsin Department of Transportation. A detailed summary of the data and data sources is contained in Table 1.

[TABLE 1 ABOUT HERE]

The in-migration rate from 1995–2000 serves as the response variable (Figure 2). The MCDs within the eight Northern Wisconsin counties (henceforth termed Remote Rural Wisconsin) experienced rapid in-migration in the five years under study—on average they gained more than 30% population through in-migration. For comparison purposes, we provide descriptive statistics not only for Remote Rural Wisconsin but also for the rest of Wisconsin (henceforth Rest of Wisconsin) and for Wisconsin as a whole (henceforth Wisconsin as a Whole). Overall, though, the average in-migration rate from 1995–2000 was similar across Remote Rural Wisconsin, the Rest of Wisconsin, and Wisconsin as a Whole as shown in Table 2 (note that the average 1985–1990 in-migration rate of Remote Rural Wisconsin was slightly higher than the Rest of Wisconsin and Wisconsin as a Whole).

[FIGURE 2 ABOUT HERE]

[TABLE 2 ABOUT HERE]

Measures of natural amenities and land developability serve as explanatory variables. Definitions of natural amenities vary widely, as different researchers focus on different sets of variables to study the influences of natural amenities and perceptions of natural amenities vary geographically (Argent et al., 2007). Because of this, no standard method for measuring natural amenities exists (Kim et al., 2005; Waltert and Schläpfer, 2010). In this study we use five variables to represent natural amenities on the basis of landscape characteristics and previous studies conducted in the Northern Wisconsin region (e.g., Chi and Marcouiller, 2011; Kim et al., 2005). They include forests, water area, shoreline distance, wetlands, and public lands. The

231 forests variable represents the proportion of forest coverage within the MCD. Likewise, the
232 water area variable represents the proportion of water area. The shoreline distance variable
233 represents the length of lakeshore, riverbank, and coastline adjusted by the square root of the
234 MCD area using shape analysis (Baker and Cai, 1992) to reflect the richness of hydrographic
235 lengths. The wetlands variable represents the proportion of wetland coverage. The public lands
236 variable represents the proportion of public land coverage, which includes publicly owned
237 (national- and state-owned) forests, parks, trails, wildlife refuges, and fishing areas. Public lands
238 may overlap with forests, water areas and views, and wetlands, but the former are more
239 accessible than the latter three. Thus, we expect that public lands are more associated with
240 migration than are other factors. Given its geographic focus within the Lake States, this study
241 does not consider other natural amenity variables that researchers have used in existing studies,
242 such as climate (e.g., Rappaport, 2007) and mountains (see Robbins et al., 2009 for a review of
243 the literature).

244 In Remote Rural Wisconsin, forests cover 60% of all lands, which is twice the percentage of
245 that in the Rest of Wisconsin; the difference is statistically significant (Table 2). The average
246 proportion of land area covered by water is similar in both regions. The average shoreline
247 distance is higher in Remote Rural Wisconsin than in the Rest of Wisconsin; again, the
248 difference is statistically significant. The average proportion of wetland area in Remote Rural
249 Wisconsin is twice that in the Rest of Wisconsin. The average proportion of public land area is
250 more than five times that in the Rest of Wisconsin. The comparison between Remote Rural
251 Wisconsin and the Rest of Wisconsin suggests that the selected study area has a significantly
252 larger endowment of natural amenities and thus serves as an appropriate exemplar of a remote,
253 rural, and amenity-rich region.

Land developability represents the proportion of developable area within each MCD, namely, the exclusion of undevelopable areas including water, wetlands, slope (>20%), public lands, and built-up lands (Chi, 2010a). We aggregated development elements into a single index to provide a relatively accurate estimate of actual land developability across geographic units. Specifically, we adopted a land developability index developed through spatial overlay methods similar to that employed and fully described by Chi (2010a). Spatial overlay is a set of methods that can be utilized to integrate several geographic data layers that share all or part of the same area into one data layer that identifies the spatial relationships. First we overlay the data layers of the five variables to create one layer representing all undevelopable lands in Wisconsin. Next we intersect this single layer with a geographic MCD layer to create a layer that contains the information for undevelopable lands at the MCD level. We then calculate the proportion of undevelopable land for each MCD. Finally, we generate the developability index by subtracting the proportion of undevelopable land from 1; for example, if the proportion of undevelopable land in a MCD is 0.4, its developability index is 0.6. Land developability generated by the spatial overlay method can represent land availability for development more accurately than other methods (Chi, 2010a). On average, only 57% of the land base within the Remote Rural Wisconsin region is developable (Table 2). This compares to a 74% developable land base in the Rest of Wisconsin. It should be noted that the eight-county region experiences low land developability largely due to the supply of public lands (namely the Chequamegon-Nicolet National Forest and an assortment of state and county lands) that are protected from development.

As stated previously, in addition to natural amenities and land developability, this study controls for several other factors, including in-migration in the previous decade, distance to

277 metro cities, distance to the nearest commercial airport, highway density, proportions of people
278 (age ≥ 25 years) with high school and Bachelor's degrees, unemployment rate, median
279 household income, and median house value. All these control variables, except distance to an
280 airport, exhibit statistical difference between Remote Rural Wisconsin and the Rest of Wisconsin
281 (Table 2). These factors are often not well controlled for in existing studies of natural amenity
282 effects. Inefficiency and bias can result from models constructed with missing yet relevant model
283 variables (Dalenberg and Partridge, 1997).
284
285 **4. Methods**
286 Migration is a demographic characteristic often found to be spatially clustered. This observed
287 pattern of spatial interrelation has been well explained by regional economic theories (Perroux,
288 1955), theories of population geography (Bailey, 2005), and the findings of residential
289 preference studies (Brown et al., 1997). Migratory factors such as natural amenities in a place
290 (city, village, or town) may entice migrants who move into both the place itself and its
291 neighboring places because of access to the benefits of the attractive place as provided by the
292 transportation infrastructure. Overall, these factors and effects tend to exhibit spatial process
293 elements, which need to be controlled for in empirical models of migration (Chi and Zhu, 2008).
294 In this study, we compared the relative association of natural amenities and land
295 developability with in-migration between Remote Rural Wisconsin and the Rest of Wisconsin
296 first using ordinary least squares (OLS) regression models. To diagnose and account for potential
297 spatial dependence in the OLS model, it was necessary to establish a neighborhood structure via
298 a spatial weight matrix for each location by specifying a lattice on those locations that are its
299 neighbors (Anselin, 1988). We note that there exists little theory to guide the selection of an

appropriate spatial weight matrix. In this study we created and compared forty spatial weight matrices and selected the one that achieved the highest coefficient of spatial autocorrelation along with a high level of statistical significance. We selected the first-order queen's weight matrix for Remote Rural Wisconsin, the 4-nearest neighbor weight matrix for the Rest of Wisconsin, and the 5-nearest neighbor weight matrix for Wisconsin as a Whole. The results of the OLS regression models as well as the forty spatial weight matrices are available upon request but are not presented in order to focus this manuscript on the research questions rather than methodological strengths.

We determined the appropriate spatial regression model for incorporating spatial dependence using Lagrange Multiplier (LM) tests and robust LM tests for lag and error dependence (Anselin, 1988; Anselin et al., 1996). The LM tests and robust LM tests for lag and error dependence suggest that in order to control for the spatial dependence in the model residuals, a spatial error model is appropriate for Remote Rural Wisconsin, a spatial lag model is appropriate for the Rest of Wisconsin, and a spatial lag model is appropriate for Wisconsin as a Whole. Measures of fit and diagnostics for spatial dependence in the OLS model residuals are summarized in Table 3.

[TABLE 3 ABOUT HERE]

We specified the spatial error model as $Y = X\beta + u$, $u = \rho Wu + \varepsilon$ and the spatial lag model as $Y = X\beta + \rho WY + \varepsilon$, where Y denotes a vector of response variables, X denotes the matrix of explanatory variables, W denotes the spatial weight matrix, and ε denotes the vector of error terms that are independent but not necessarily identically distributed (Anselin and Bera, 1998). The spatial error model specifies spatial autocorrelation by an error term (u) and the associated spatially lagged error term (Wu). The three spatial regression models (one spatial error model and two spatial lag models) appeared to exhibit better fits to data than their corresponding OLS

regression models (Table 4). This statement is based on the fact that Akaike's Information Criterion (AIC) and Schwartz's Bayesian Information Criterion (BIC) values were smaller but the log likelihood values were larger in the spatial regression models than in their corresponding OLS models. Thus, we deemed the spatial regression models superior for interpreting the migratory effects of various variables. The following Results section reports the results from the spatial regression models that examine the association of natural amenities, land developability, and control variables with in-migration from 1995–2000.

[TABLE 4 ABOUT HERE]

5. Results

In this study, we found that in Remote Rural Wisconsin, water and public lands were positively associated with in-migration at the $p \leq 0.05$ level (Table 4). In the Rest of Wisconsin, public lands were the only natural amenity variable that had statistical association with in-migration. Other natural amenity variables were not associated with in-migration in Remote Rural Wisconsin or the Rest of Wisconsin. Public lands were statistically significantly and positively associated with in-migration to Remote Rural Wisconsin, the Rest of Wisconsin, and Wisconsin as a Whole. Each additional 10% of public land area was associated with a 1.51% increase in in-migration rate in Remote Rural Wisconsin (0.66% in the Rest of Wisconsin and 0.55% in Wisconsin as a Whole). Although public lands often overlap with areas in forests and wetlands, the latter two were not statistically associated with in-migration. One possible reason may be that forests and wetlands do not, in and of themselves, have much recreational value. They become attractive only when people can access them through managed recreational areas, such as parks, trails, wildlife refuges, and fishing areas. This finding can be partially supported by McGranahan

(2008), who found that a moderate amount of forest coverage promotes population growth at the county level but too much forest does not.

Our results also indicate that water was positively associated with in-migration, but only in Remote Rural Wisconsin. Each additional 10% of water area was associated with a 2.44% increase in in-migration rate. Water area is significant in the spatial error model at the $p \leq 0.05$ level and shoreline is significant at the $p \leq 0.10$ level. Overall, the results suggest that water, measured in either area or length, was positively associated with in-migration. This finding is consistent with results reported by Duffy-Deno (1997).

Land developability as measured by the proportion of land available for development was statistically significantly and positively associated with in-migration to Remote Rural Wisconsin, the Rest of Wisconsin, and Wisconsin as a Whole. Each additional 10% of lands available for development was associated with a 2.09% increase in in-migration rate in Remote Rural Wisconsin; this compared to only 0.51% in the Rest of Wisconsin and 0.54% in Wisconsin as a Whole. Higher levels of land developability allow more space for new development. This study specified water, wetlands, tax-exempt lands, built-up lands, and steep slope (> 20%) as undevelopable. These types of lands limit the potential for further development. Land developability seemed to be more associated with in-migration in Remote Rural Wisconsin than in the Rest of Wisconsin, possibly due to the fact that land developability is relatively lower in the former than in the latter.

Distance to metro was negatively associated with in-migration to Remote Rural Wisconsin; the farther a MCD is from its nearest metropolitan region, the lower the MCD's in-migration rate. Each additional ten kilometers closer to the nearest metropolitan region was associated with a 1% increase in in-migration rate. This result is consistent with the residential preference literature

(e.g., Brown et al., 1997), which finds that migrants to nonmetropolitan regions prefer locations close to metropolitan regions so that they can not only enjoy natural amenities in rural areas but also access urban amenities such as employment opportunities, shopping centers, healthcare facilities, cultural and educational centers, and others.

Historical trend effects also played an important role in promoting in-migration: MCDs that had previously experienced rapid in-migration continued in-migration trends. Migrants move to places where they want to be part of the community; previous in-migrants may have already helped transform the communities into attractive destinations. Each additional 10% of in-migration in the previous decade was associated with a 4.81% increase in the in-migration rate from 1995–2000 in Remote Rural Wisconsin. It should be noted that this historical trend effect showed a stronger association with in-migration than land developability, public lands, and water areas did; the MCDs that experienced high in-migration from 1985–1990 continued the trend from 1995–2000. Distance to metropolitan regions and historical trend were the two most statistically significant variables in the spatial error model.

Human capital as measured by the proportion of population with a Bachelor's degree was also positively associated with in-migration. Each additional 10% of population with Bachelor's degrees was associated with a 4.02% increase in in-migration rate. It may simply be that in-migrants prefer locations with well-educated people (Deller et al., 2001). In addition, income and house value were negatively but negligibly associated with in-migration; each additional $10,000 of average household income was associated with a 4% decrease in the in-migration rate, and each additional $10,000 of average house value was associated with a 1% decrease in in-migration rate. It may simply be that in-migrants prefer locations with relatively lower house prices, everything else remaining equal.

Natural amenities, land developability, distance to metropolitan regions, previous in-migration trends, and other variables may work together in transforming communities in remote rural regions to be more livable and desirable, which further attracts migrants to these remote rural areas. This echoes the concept of "sense of place" or "small-town living", which argues that migrants often move to places where their preferences and socioeconomic characteristics are similar to previous migrants (Amsden et al., 2011).

6. Summary and Implications

The structure and function of remote rural regions have experienced fundamental changes in recent decades; declines in traditional commodity-based land uses and increases in natural-amenity-based recreation and tourism uses mark this transition, which has taken place within unique developmental contexts and significant constraints to economic growth and sociodemographic change. Natural resources, their amenity characteristics, and land developability lie at the core of these transitions. The research reported here compares the associations of natural amenities and land developability with in-migration to a remote rural region analyzed using a synthetic spatial framework in which we model transportation accessibility, human capital, economic conditions, and spatial process effects to collectively explain in-migration. We used a spatial modeling approach to compare the associations of natural amenities and land developability with in-migration at the minor civil division level in a case study of a remote rural region of Northern Wisconsin. We carefully diagnosed spatial dependence and incorporated it into the model, which helped improve model fitting balanced with model parsimony.

Our empirical findings suggest that public lands and water are statistically significant in associating with in-migration to remote rural regions. Other natural amenity variables such as forests and wetlands are not associated with in-migration within the transportation, human capital, and economic context. We posit that public lands provide a key access component to conserved lands that connects underlying natural-resource-based amenities as useful to the leisure pursuits of in-migrants. Land developability also appears to be positively associated with in-migration into the case study region.

The findings of this study have important implications for land-use policies, chambers of commerce, and civic organizations seeking to address key elements associated with remote rural areas. Decision makers and planners have increasingly relied on the natural resources of these areas for promoting development. However, the effects of natural amenities on promoting development and attracting migrants depend upon other factors, such as the availability of land for development, proximity to metro cities, transportation networks, livability, and others. People are not enticed to migrate to remote regions that have constrained access or lack livability elements, despite the attractiveness of the regional natural amenity assets. Decision makers and planners in such areas need comprehensive assessments of their resources and infrastructure for attracting migrants and promoting development.

That said, the practice of rural planning needs contextual sensitivity with respect to land-use policies, natural resource management, social services, and economic development. In regions that experience amenity-driven in-migration, distributional aspects associated with revenue generation and public service provision can pit long-time residents against new urban refugees. This set of “been here” versus “come here” conflicts are often entwined in property tax debates, access to local lakes, and local emphasis of service provision within rural towns that serve as

primary locales for rural public schools and places of commerce (Argent et al., 2007). Counterurbanized rural areas around lakes tend to be both more remote and relatively less served with locally provided public services. Yet, it is these amenity rich locations that represent the highest residential property values and resulting local tax bases.

Our findings suggest that theoretical drivers of rural migration need to differentiate among rural amenity types. An important hypothesis that requires further empirical testing relates to the relative extent to which different types of amenities are associated with in-migration. In particular, public lands and water appear to be significant amenity types that can be linked to in-migration within this case study region. There are several avenues for further research along these thematic lines. Our findings support the work of others who argue that public lands play a substantial role in affecting in-migration. Public lands exist as an amenity themselves. The extent to which amenity-migrants rely on public lands as a migration decision determinant requires further examination. Also, it would be logical to think that public lands vary widely in their usefulness to both local residents and in-migrants. In the work reported here, public lands consisted of national and state forests and parks, trails, wildlife refuges, and fishery areas. How are different types of public lands perceived by local residents, new in-migrants (both permanent and seasonal), and potential in-migrants? How are public lands perceived by various demographic cohorts across their life cycles? What roles do the various types of public lands play in forming both appropriate access to conserved open space and a sense of place that attracts in-migrants? Answers to these questions can help provide insights into the economic linkages between public lands (and their agents) and amenity-driven development. This type of new-age development includes rural tourism, counterurbanizing residential and commercial development, and community quality of life that determine important measures of local well-being such as

housing market vitality, rural poverty, income distribution, and social attributes. These further impact the social fabric of remote rural communities, including demographic restructuring, infrastructure demand and development, and difference of interests between local residents and new in-migrants along the research line of productivism versus consumptionism.

Another important future research need regards the role of land use and natural resource policy instruments in affecting the quality and quantity of regional natural amenities. This takes on both theoretical and empirical elements that relate to the supply (or production) and spatial distribution of natural amenities. With respect to our case study work reported here, we are particularly interested in future research that helps us understand tradeoffs between the regional supply of natural amenities and land developability. Policy instruments that focus on protection and enhancement of natural amenity endowments can serve to limit land development and in-migration, especially in regions with existing constraints on land available for development. Natural resource policies, both public and private, can have effects beyond the physical and environmental aspects of regional natural resource endowments. Important human dimensions of resource policy include population dynamics as well as the economic and social development of remote rural regions. Future research could examine how migration has changed in remote rural regions that have experienced natural resource policy changes.

Our empirical spatial analysis utilized a case study approach that examined 129 MCDs in eight Northern Wisconsin counties reflective of a unique set of natural amenity types and rural development contexts; therefore, the findings and policy implications are only partially generalizable to other remote rural regions across the U.S. and Canada. While there are other U.S. Lake State regions whose local characteristics (e.g., natural amenity assets, demographic characteristics, socioeconomic conditions, transportation infrastructures, and planning practices)

482 are similar to those of Northern Wisconsin (most notably including regions in Minnesota,
483 Michigan, and New York), future research needs to extend geographically into a larger set of
484 remote rural regions. This would have the benefit of generating a broader, more robust set of
485 results aimed at helping us understand the impacts of natural amenities and land developability
486 on population redistribution as well as economic growth and development.

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List of Tables

Table 1. Variable descriptions and data sources

Variables	Variable descriptions	Data sources
In-migration 1995–2000	The in-migration rate, 1995–2000	Census 2000 SF3
In-migration 1985–1990	The in-migration rate in home county, 1985–1990	Census 1990 STF3
Forests	The proportion of forest area	ArcIMS servers: http://maps.dnr.state.wi.us and http://maps.botany.wisc.edu. Available in 30-meter pixels.
Water	The proportion of water area	The U.S. Geological Survey (USGS) 1:100,000 Hydro Digital Line Graphs. Available in 30-meter pixels.
Shoreline	The length of riverbank, lakeshore, and coastline adjusted by MCD areas	The USGS 1:100,000 Hydro Digital Line Graphs
Wetlands	The proportion of wetland area (including emergent/wet meadow, lowland shrub, and forested wetland)	Wisconsin Wetlands Inventory. Available in 30-meter pixels.
Public lands	The proportion of public land area (including federal and state forests and parks, trails, wildlife refuges, and fishery areas)	ArcIMS servers: http://maps.dnr.state.wi.us and http://maps.botany.wisc.edu. Available in 30-meter pixels.
Land developability	The proportion of lands available for development	The USGS 1:100,000 Hydro Digital Line Graphs and the Digital Elevation Model, Wisconsin Wetlands Inventory, ArcIMS servers http://maps.dnr.state.wi.us and http://maps.botany.wisc.edu, and 1992-93 Landsat Thematic Mapper Imagery. Available in 30-meter pixels.
Distance to metro	Distance to nearest metro city (km)	Census Urban Areas 1990
Distance to airport	Distance to nearest airport (km)	Wisconsin Department of Transportation and the National Atlas of the U.S.
Highway density	Total lengths of major roads divided by the MCD's area (km/km^2)	National Atlas of the U.S.
High school education	Proportion population (age ≥ 25) with high school degree in 1990	Census 1990 STF3
Bachelor's degree	Proportion population (age ≥ 25) with Bachelor's degree in 1990	Census 1990 STF3
Unemployment	Unemployment rate in 1990	Census 1990 STF3
Income	Median household income in 1990	Census 1990 STF3
House value	Median house value in 1990	Census 1990 STF3

Table 2. Descriptive statistics of variables

Variables	Wisconsin as a Whole	Remote Rural Wisconsin	Rest of Wisconsin	Difference
	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)	(Remote Rural Wisconsin – Rest of Wisconsin)
In-migration 1995–2000	0.315	0.308	0.315	–0.007
	(0.079)	(0.087)	(0.078)	
In-migration 1985–1990	0.145	0.175	0.142	0.033***
	(0.071)	(0.089)	(0.069)	
Forests	0.297	0.604	0.274	0.330***
	(0.228)	(0.139)	(0.216)	
Water	0.058	0.062	0.057	0.005
	(0.242)	(0.078)	(0.250)	
Shoreline	17.048	21.650	16.700	4.950***
	(9.999)	(10.213)	(9.899)	
Wetlands	0.124	0.250	0.115	0.136***
	(0.127)	(0.146)	(0.120)	
Public lands	0.051	0.220	0.038	0.182***
	(0.138)	(0.295)	(0.108)	
Land developability	0.725	0.574	0.736	–0.163***
	(0.192)	(0.214)	(0.185)	
Distance to metro	52.019	111.234	47.547	63.688***
	(29.160)	(22.056)	(24.353)	
Distance to airport	54.421	53.026	54.527	–1.501
	(22.962)	(28.223)	(22.521)	
Highway density	2.608	2.239	2.636	–0.397***
	(1.811)	(0.928)	(1.858)	
High school education	0.747	0.720	0.749	–0.029***
	(0.082)	(0.089)	(0.082)	
Bachelor’s degree	0.114	0.101	0.115	–0.014**

	(0.077)	(0.053)	(0.079)	
Unemployment	0.058	0.086	0.055	0.031***
	(0.039)	(0.054)	(0.036)	
Income	27,464.76	20,149.39	28,017.26	–7,867.87***
	(8,615.90)	(4,126.81)	(8,614.93)	
House value	52,492.78	42,693.80	53,232.86	–10,539.06***
	(22,671.29)	(13,970.80)	(23,030.20)	
N	1,837	129	1,708	

Note: *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$; standard errors (std. dev.) in brackets.

Table 3. Measures of fit and diagnostics for spatial dependence in the residuals of ordinary least squares (OLS) regression models

	Wisconsin as a Whole	Remote Rural Wisconsin	Rest of Wisconsin
Diagnostics for spatial dependence			
Spatial weight matrix	5-nearest neighbor	Queen contiguity, Order 1	4-nearest neighbor
Lagrange Multiplier (error)	17.121***	2.282	12.637***
Robust Lagrange Multiplier (error)	2.647	4.131*	2.031
Lagrange Multiplier (lag)	26.493***	0.119	19.338***
Robust Lagrange Multiplier (lag)	12.019***	1.969	8.731**
Measures of fit			
Log likelihood	2243.33	163.93	2100.52
AIC	–4454.66	–295.859	–4169.05
BIC	–4366.41	–250.102	–4081.96
N	1,837	129	1,708

Notes: *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$; standard errors in brackets.
AIC = Akaike's Information Criterion. BIC = Schwartz's Bayesian Information Criterion.
We selected an appropriate spatial weight matrix for each model among forty weight matrices. The selected matrix achieved both the highest coefficient of spatial autocorrelation and a high level of statistical significance.

Table 4. Coefficients of spatial regression models

	Wisconsin as a Whole	Remote Rural Wisconsin	Rest of Wisconsin
Forests	0.011	–0.061	0.010
	(0.010)	(0.054)	(0.011)
Water	0.011	0.244*	0.010
	(0.007)	(0.119)	(0.007)
Shoreline	5.63E–5	0.001	–4.67E–5
	(1.94E–4)	(0.001)	(2.03E–4)
Wetlands	–0.009	0.042	–0.014
	(0.016)	(0.058)	(0.017)
Public lands	0.055***	0.151*	0.066***
	(0.015)	(0.062)	(0.019)
Land developability	0.054***	0.209*	0.051***
	(0.012)	(0.093)	(0.012)
Control variables			
In-migration 1985–1990	0.378***	0.481***	0.378***
	(0.026)	(0.076)	(0.027)
Distance to metro	–3.78E–4***	–0.001***	–1.71E–4)
	(9.03E–5)	(2.43E–4)	(1.23E–4)
Distance to airport	–1.03E–4	–1.4E–4	–2.61E–4*
	(8.74E–5)	(1.87E–4)	(1.11E–4)
Highway density	–0.002*	–0.013	–0.002
	(0.001)	(0.008)	(0.001)
High school education	0.073*	–0.010	0.100**
	(0.029)	(0.089)	(0.031)
Bachelor’s degree	–0.054	0.402**	–0.094*
	(0.036)	(0.143)	(0.037)
Unemployment	0.032	–0.168	0.046
	(0.052)	(0.135)	(0.057)
Income	–1.80E–6***	–4.28E–6*	–1.88E–6***
	(4.46E–7)	(1.87E–6)	(4.59E–7)
House value	7.95E–7***	–1.17E–6	9.43E–7***
	(1.57E–7)	(6.51E–7)	(1.63E–7)
Spatial lag dependence	0.169***	——	0.139***
	(0.033)		(0.032)
Spatial error dependence	——	–0.074*	——
		(0.029)	
Constant	0.150***	0.373***	0.140***
	(0.025)	(0.098)	(0.025)

Measures of fit			
Log likelihood	2255.81	166.339	2109.80
AIC	–4477.61	–300.679	–4185.60
BIC	–4383.84	–254.922	–4093.07
N	1,837	129	1,708

Notes: *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$; standard errors in brackets.
AIC = Akaike's Information Criterion. BIC = Schwartz's Bayesian Information Criterion.

List of Figures

Figure 1. Northern Wisconsin Counties and MCDs used in the case study

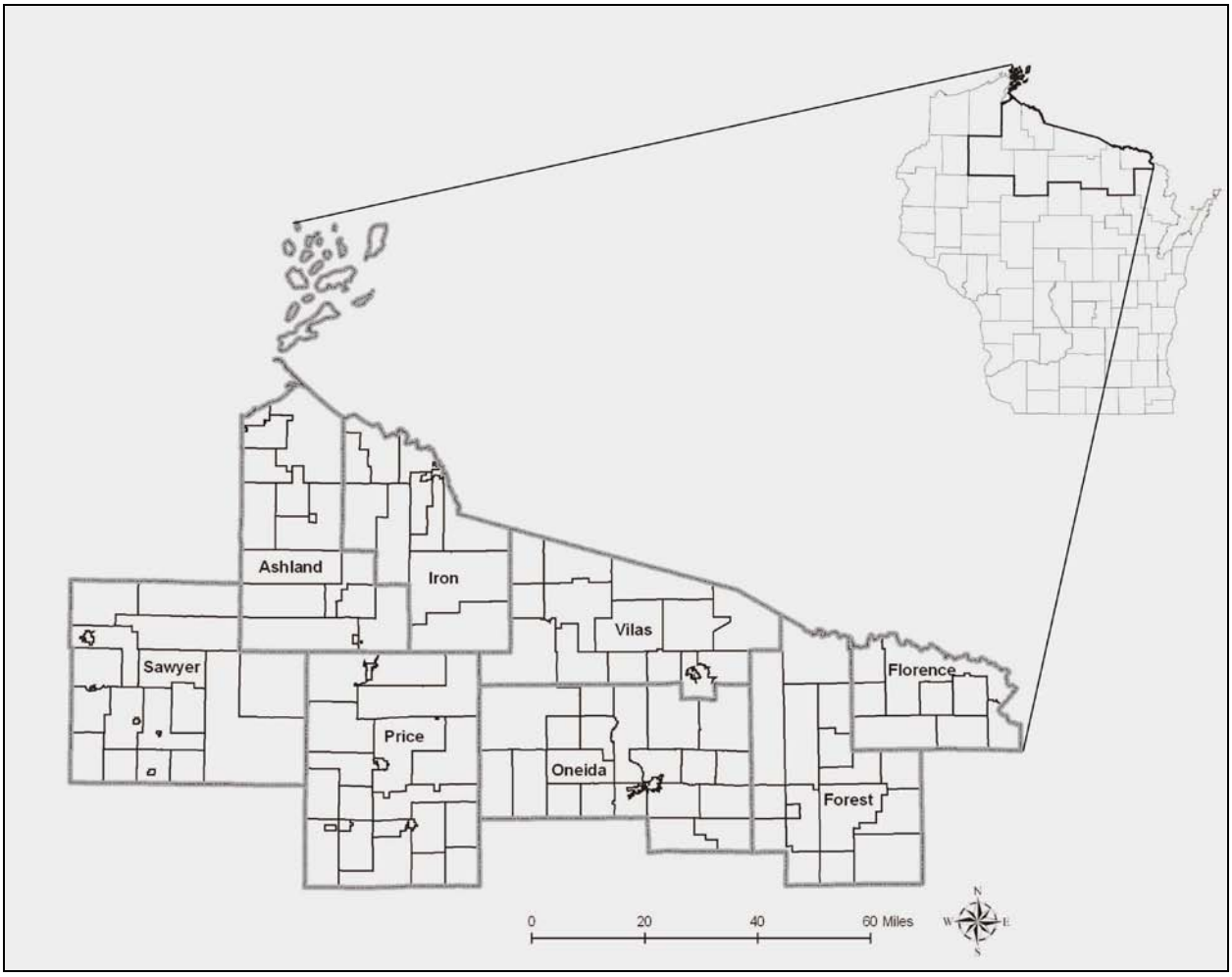

Figure 2. In-migration rate from 1995–2000 in Northern Wisconsin region used as a case study