



Housing growth, forests, and public lands in Northern Wisconsin from 1940 to 2000

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ABSTRACT

Rural, forested areas throughout the United States are experiencing strong housing growth with potentially detrimental impacts on the environment. In this paper, we quantify housing growth in Northern Wisconsin over the last sixty years to determine if growth rates were higher near public lands, which may represent an important recreational amenity. We used data from the U.S. Census to produce decadal housing density estimates, “backcasts,” from 1940 to 2000 for northern Wisconsin to examine “rural sprawl” in northern Wisconsin and its relationship to forested areas and public lands. We integrated housing density estimates with the 1992/1993 National Land Cover Dataset to examine the relationship between rural sprawl and land cover, especially forests. Between 1940 and 2000, private land with <2 housing units/km² decreased from 47% to 21% of the total landscape. Most importantly, housing growth was concentrated along the boundaries of public lands. In 14 of the 19 counties that we studied, housing growth rates within 1 km of a public land boundary exceeded growth rates in the remainder of the county, and three of the five counties that did not exhibit this pattern, were the ones with the least amount of public land. Future growth can be expected in areas with abundant natural amenities, highlighting the critical need for additional research and effective natural resource management and regional planning to address these challenges.

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1. Introduction

Rural America has witnessed strong housing growth since the late 1960s, when the social forces driving housing growth in rural areas underwent important changes in recent decades. In the second half of the 20th century, recreational amenities became a major determinant of housing and population growth (McGranahan, 1999; Galston and Baehler, 1995). Public opinion polls dating back to the 1940s demonstrate the desire of most urban and suburban Americans to live in more rural settings (Fuguitt and Zuiches, 1975; Fuguitt and Brown, 1990; Brown et al., 1997). These preferences resulted in directional shifts of migration and population growth patterns from suburban to rural areas in the late 1960s and early 1970s, and nonmetropolitan population growth outpaced metropolitan growth again in the 1990s. The result has been substantial increases in population size, housing density, and the extent of settlement in rural areas. Residential and commercial

development is transforming the rural landscape in a process of exurbanization (Theobald, 2001), or rural sprawl (Hammer et al., 2004; Radeloff et al., 2005). Both social and biophysical impacts are evident in the wake of this transformation; housing growth has significant effects on land use (Kline et al., 2004; Kline, 2003; Wear and Bolstad, 1998; Turner et al., 1996; Douglas, 1994; Befort et al., 1988), agricultural productivity (Heimlich and Anderson, 2001), forest management (Parks et al., 2000; Nelson and Hellerstein, 1997; Wear et al., 1996, 1999; Marcin, 1993; Barlow et al., 1998; Marcin et al., 2002), wildlife habitat (Theobald et al., 1997), biodiversity (Pidgeon et al., 2007), and other ecosystem services.

Traditionally, large public land holdings such as National Forests were embedded in a rural landscape with low-density housing (Riebsame et al., 1996). Although public lands exclude housing development, one of the primary reasons they were established (Rome, 1998), public lands also offer highly valued amenities such as scenic beauty and recreational opportunities that attract housing development to their periphery. Empirical evidence suggests that housing growth is strong on areas surrounding public lands. Population projections for California indicate increasing human encroachment on wildland areas is likely (Struglia and Winter,

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2002). Adjacent open space has a clear effect on residential property values, indicating that open space is, itself, an amenity that home-owners value (Acharya and Bennett, 2001). However, this relationship has typically been studied in urban or suburban areas where the open spaces are small and generally modest in terms of their ecological significance. In response to rapid housing growth, some municipalities adopt open space policies, but research suggests that these may result in leapfrog development (Wu and Plantinga, 2003). Housing growth has occurred more rapidly in U.S. counties with federal lands than in others, but differences in growth rates could not be fully explained by the presence of federal lands, and non-Federal public lands were not considered (Frentz et al., 2004). Thus, the complex effects of public lands on growth patterns remain critical questions surrounding housing growth in rural areas, and our goal here was to examine the effects of public lands on housing growth more closely.

Although public lands include a great variety of land-cover types, the Midwestern U.S. public lands are predominantly forested. Therefore, the ecological isolation of public lands due to housing growth on nearby private lands is likely to result in the loss and fragmentation of forest ecosystems. Since their inception, public lands have been surrounded and interwoven with private lands, but land cover and land use were often similar across ownerships. As land cover in areas surrounding public lands changes due to rural sprawl, contiguity is lost and the ecological services of the public lands are affected (Hansen and Rotella, 2002). Public lands are at risk of becoming islands in a sea of human-dominated landscapes and are likely to suffer local extinctions and biodiversity loss (Blank et al., 2002). The relationship between larger tracts of forested lands and housing growth in rural settings has not been extensively investigated, and the rate at which rural sprawl is fragmenting intact, contiguous forests makes this a significant research gap (Radeloff et al., 2005).

One challenge associated with understanding the process of change and isolation of forests and public lands is the lack of spatially detailed data on long-term rural development trends. Aerial photographs can reveal fine-grained changes in the patterns of buildings (Gonzalez-Abraham et al., 2007b), but interpreting time series of aerial photographs for large areas is cost prohibitive. Land-cover data derived from satellite imagery is available for the entire U.S. (Homer et al., 2007), but it does not support long-term change analysis because no imagery is available before the mid-1970s. Moreover, even 30-m resolution Landsat data (Vogelmann et al., 2001) fail to adequately capture the low-density settlement patterns under closed canopy forests.

As a cost-effective alternative to these methods, we developed methods to backcast housing densities for previous decades using either the 1990 (Radeloff et al., 2001) or the 2000 U.S. Census (Hammer et al., 2004). Our goal in this study was to estimate, or “backcast” sub-county and sub-municipal level housing unit counts and densities over a multiple-decade period by using the “year housing unit built” question from the 2000 census (U.S. Census Bureau, 2002) and county-level housing counts from prior decennial censuses thereby analyzed housing growth from 1940 to 2000 in northern Wisconsin at fine spatial resolution. We further refined our housing backcasting method by intersecting the census geography with public land and reallocating housing units from public to private land. With this fine-scale method of backcasting housing density, we examined rural sprawl in northern Wisconsin and its relationship to forested areas and public lands.

1.1. Northern Wisconsin

Northern Wisconsin exemplifies the cyclical population oscillations characteristic of rural natural resource dependent areas, with

historic periods of decline and recent natural amenity-driven population growth and rural sprawl. These population and settlement changes affect both forest (Radeloff et al., 2001) and lake ecosystems (Schnaiberg et al., 2002), suggesting a need for a more comprehensive look at housing growth patterns in northern Wisconsin. Our study area is the 19 northernmost counties in Wisconsin (Fig. 1). A survey of Wisconsin residents suggests that socially, these 19 counties comprise a region with a distinct meaning and identity, and are typically referred to as “The North Woods” (Stedman, 1997). Ecologically, the region is part of the Laurentian Mixed Forest province (Keys et al., 1995). This region is more forested than the southern part of Wisconsin and is dominated by northern hardwood forests. A swath of coniferous forest, the Wisconsin Pine Barrens, extends northeast from Burnett County into Washburn, Douglas, and Bayfield Counties. The forested northern portion of Oneida County also contains coniferous forest. Vilas and Oneida counties tend to be mixed forest and forested wetlands. The southern counties in northern Wisconsin including Polk, Barron, Rusk, Lincoln, Langlade, and Oconto are more agricultural. Agricultural areas of limited extent are evident farther north near Lake Superior in Douglas, Bayfield, and Ashland Counties.

Understanding the current configuration of social and ecological conditions in northern Wisconsin requires an understanding of its post-European settlement history, which was largely dominated by its ecological resources. The timber industry’s exploitation of the vast white and red pine and hemlock–hardwood forests stimulated rapid population expansion in northern Wisconsin in the post-Civil War era. The demand for Wisconsin lumber was fueled by the emergence of industrial cities in the Midwest. Between 1830 and 1930, about 320 billion board feet of softwood lumber was harvested in northern Michigan, Wisconsin, and Minnesota; nearly a quarter of it harvested in just five years between 1878 and 1883 (Williams, 1989). Wisconsin’s contribution to timber production increased from 1.1 billion board feet in 1869 to 3.2 billion board feet in 1889, representing one-ninth of the total lumber production in the U.S. (Steer, 1948 as cited in Williams, 1989). Throughout the 1890s, Wisconsin was consistently among the leading timber-producing states in the U.S., holding the top position for a number of years (Bawden, 1997).

In the end, relentless timber harvesting was unsustainable. By 1900, the merchantable pine forests of Wisconsin had been exhausted and only inaccessible, low-yield, scattered tracts remained (Williams, 1989). This stagnation of the region’s major industry triggered a region-wide decline. Decennial censuses measured a population decline between 1890 and 1910 in northern Wisconsin. Concerned with the economic and demographic decline in the region, the Wisconsin State College of Agriculture (University of Wisconsin), the state legislature, lumber companies, railroads, local newspapers, and land speculators encouraged people, particularly newly arrived immigrants, to settle in the cut-over area and to “farm among the stumps” (Clark, 1956a). During World War I, agriculture promoters surpassed the zeal and organization of their predecessors by planning farming communities, screening potential residents, and providing educational programs. As a result, 20,000 new farms encompassing two million acres were established in the cut-over region by 1920, half of them after the turn of the century (Clark, 1956b). However, northern Wisconsin is not well suited for agriculture, and with the post-war slackening in the market for agricultural commodities, agriculture declined rapidly in northern Wisconsin. By 1921, property tax delinquencies encompassed one million acres in 17 counties of northern Wisconsin; six years later, tax delinquencies had increased to 2.25 million acres (Clark, 1956b).

In an attempt to reverse forest depletion and eventually revive the timber industry, reforestation efforts began in the early 1900s.

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