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Predicting success incorporating conservation subdivisions into land use planning

Stephen Allen[a,*], Christopher Moorman[b], M. Nils Peterson[b], George Hess[c], Susan Moore[c]

[a] North Carolina State University, Fisheries, Wildlife, and Conservation Biology Program, Campus Box 8008, Raleigh, NC 27695-8008, United States
[b] North Carolina State University, Fisheries, Wildlife, and Conservation Biology Program, Campus Box 7646, Raleigh, NC 27695-7646, United States
[c] North Carolina State University, Department of Forestry and Environmental Resources, Campus Box 8008, Raleigh, NC 27695-8008, United States

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ABSTRACT

Conservation subdivisions have emerged as a development option for communities wishing to conserve important ecological features and maintain rural character without decreasing housing density. Yet, these alternatives to conventional subdivisions rarely are used. We used logistic regression models to identify variables that predict county level success at adopting an ordinance and having a conservation subdivision built. Important predictors for adopting ordinances were median income, percent urban population, and a negative interaction between the two variables; important predictors for successfully completing a conservation subdivision were the adoption of an ordinance allowing conservation subdivisions and percent of residents with at least a four year college degree. Urban counties and the rural counties with higher median income were most successful adopting ordinances. Urban counties with higher education levels and an ordinance in place were most likely to have a conservation subdivision built within them. In poor rural counties, implementation may be more difficult because of limited resources to develop ordinances; these counties could collaborate with land trusts, other planning departments, or a regional council of governments to help lessen the financial burden associated with rewriting ordinances and implementing new land use practices.

Introduction

The expansion of metropolitan areas into the urban fringe presents a challenge for elected officials, city and county planners, and developers trying to manage growth in a way that maintains rural character and appeals to residents without limiting property rights of landowners (Beatley and Manning, 1997). Conventional residential development is characterized by low-density development that is automobile dependent, lacks central planning, and has segregated land uses (Kaplan et al., 2008; Brown, 2001). The changing land use patterns associated with substantial population growth and suburban development can negatively affect wildlife habitat and threaten ecosystems (Milder, 2007). Although several alternative neighborhood design strategies are available, developers may be hesitant to embrace novel approaches (SEMCOG, 2003; Bowman and Thompson, 2009).

Conservation subdivisions have emerged as a development option for communities that wish to conserve important ecological features, conserve open space, or maintain rural character and scenic views without compromising property rights (Arendt, 1999; Nelessen, 1994). Conservation subdivisions use a design strategy that attempts to conserve undivided tracts of land with important ecological features as communal open space (Arendt, 1996; Milder, 2007; Pejchar et al., 2007). In a conservation subdivision, ideally 50–70% of the buildable land is set aside as permanent open space by grouping or clustering homes on the portions of the land to be developed.

When compared to conventional homes in a similar housing market, conservation subdivisions offer environmental and economic benefits such as lower construction costs for developers and faster appreciation in market value (Arendt, 1996; Mohamed, 2006; Bowman and Thompson, 2009; Milder, 2007). Conservation subdivisions can decrease landscape fragmentation and help protect ecosystem services, including wildlife habitat, water quality, and aesthetic viewsheds (Elmendorf and Luloff, 1999; Lenth et al., 2006). If conservation developments are designed in conjunction with regional conservation efforts, open space in these developments can provide connectivity to other protected areas and benefit wildlife species that require larger tracts of intact habitat and connectivity between habitat patches (Hostetler and Drake, 2009;

* Corresponding author at: North Carolina State University, Campus Box 8008, Raleigh, NC 27690, United States. Tel.: +1 336 209 5093; fax: +1 336 209 5093.
E-mail addresses: stevecallen1@gmail.com (S. Allen), chris_moorman@ncsu.edu (C. Moorman), nils_peterson@ncsu.edu (M.N. Peterson), george_hess@ncsu.edu (G. Hess), susan_moore@ncsu.edu (S. Moore).

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Odell et al., 2003). However, there are perceived risks for elected officials and developers that may impede integration of conservation subdivisions into land-use planning (Allen et al., 2012).

Despite their potential environmental and economic benefits, conservation subdivisions are an underused option (Vogt and Marans, 2004; Bowman and Thompson, 2009; Carter, 2009). Although natural amenities are important to some homebuyers, cost is a concern and interest in traditional amenities such as large lots and large homes remains prevalent (Vogt and Marans, 2004). In a 2002 national survey, community characteristics such as highway access, park areas, trails, and sidewalks were desired by 20% of homebuyers, whereas larger houses, larger lots, and less developed areas were desired by 40% of the recent homebuyers (National Association of Home Builders, 2002).

Some communities are more successful at implementing environmentally friendly land use practices such as conservation subdivisions than others, but the specific reasons behind that success are largely unknown. Our objectives were to determine: (1) what factors predict success at adopting conservation subdivision ordinances; and (2) what factors predict success at building a conservation subdivision. We used a survey of all 100 county planning departments in North Carolina to assess predictors of success adopting ordinances and success completing conservation subdivisions.

In North Carolina, the population growth rate averaged 16.6% statewide from 2000 to 2009 (U.S. Census Bureau, 2009). In 1997, farmland comprised 30% (38,222 km^2) of the total land area. By 2007, this number decreased to 27% (34,295 km^2), a loss of 3926 km^2 in 10 years (U.S. Department of Agriculture, 2007). North Carolina's population grew by 16.6% to 9,222,414 between 2000 and 2009, and it was the eighth fastest growing state in the United States (U.S. Census Bureau, 2009). The state had a population density of 64 people per square kilometer and a median household income of $46,574, which is $5455 lower than the national median (U.S. Census Bureau, 2007). For each new resident that moved to North Carolina, 0.8 ha of land were developed during this period (North Carolina Wildlife Resources Commission, 2009), and 3 million new residents are expected between 2007 and 2030 (North Carolina Wildlife Resources Commission, 2009). By 2030, North Carolina is expected to be the seventh most populous state in the United States, surpassing New Jersey, Michigan, Ohio, and Georgia (U.S. Census Bureau, 2007).

Methods

Survey

We surveyed the 100 county planning departments in North Carolina using e-mail and telephone interviews. We focused on county governments because low density development in the United States typically occurs outside existing cities and their annexation zones (Soule, 2006). Planning staff from each county was asked if conservation subdivisions currently were allowed in their zoning ordinance or subdivision regulations, whether there were incentives in place to promote them, and whether a conservation subdivision had been successfully completed in their community. The response rate for planning departments was 100%. We recorded median income, percent urban population, and college education level for each county (U.S. Census Bureau, 2009).

Analysis

We modeled success adopting conservation subdivision ordinances and success building a conservation subdivision using binary logistic regression. The binary dependent variables were if the county had a conservation subdivision ordinance (No = 0; Yes = 1) and if the county had completed a conservation subdivision (No = 0; Yes = 1). Independent variables included in the models were median income, percent urban population, and college education level (percent with four-year degree or higher). We hypothesized education and income would predict conservation subdivision ordinance adoption and development because previous literature suggested education and income are positively related to more environmentally friendly behavior (Dietz et al., 1998; Straughan and Roberts, 1999). We included the interaction between median income and percent urban population in the model for adopting a conservation subdivision ordinance but removed it from the final model for building a subdivision because it was not significant. We included this interaction to determine what effect income had on success adopting an ordinance as percent urban population increases. In the model predicting success building a conservation subdivision, we included a class variable representing whether or not the county had a conservation subdivision ordinance in place. In both models, we divided median income by 1000 to facilitate comparisons of model coefficients. Analysis was conducted using SPSS System 17.0 for Windows Vista (SPSS Inc., Chicago, IL 60606).

Table 1
Binary logistic regression models predicting success adopting conservation subdivision ordinances and success constructing a conservation subdivision.

Parameter	Estimate	Standard error	*P*	Nagelkerke R^2
Ordinance				
Median income	0.325	0.089	0.000	0.376
Urban population	0.163	0.062	0.008	
College education	−0.009	0.053	0.869	
Median income * urban population	−0.004	0.001	0.015	
Construction				
College education	0.120	0.058	0.039	0.474
Urban population	0.014	0.013	0.297	
Median income	−0.057	0.068	0.402	
Ordinance	−2.902	0.828	0.000	

Results

Fifty-one counties out of 100 in North Carolina had ordinance language allowing conservation subdivisions in their development regulations (Fig. 1). Of the 51 counties with conservation subdivisions in their development regulations, 24 had successfully completed a conservation subdivision; two counties had completed a conservation subdivision without a specific ordinance in place. Counties with conservation subdivision ordinances experienced higher immigration (mean = 0.56%, SE = 0.17%) during the 1990s than counties which did not develop ordinances (mean = −0.17, SE = 0.16; U.S. Census Bureau, 2009).

A negative interaction between median income and percent urban population predicted successful adoption of a conservation subdivision ordinance (Table 1). When percent urban population was >50%, the probability of successfully adopting an ordinance was high regardless of income (Fig. 2). However, counties with <50% urban population had a higher likelihood of successfully adopting a conservation subdivision ordinance as median income increased; rural counties with lower median income were the least successful at adopting a conservation subdivision ordinance.

Probability of successful construction of a conservation subdivision increased with the adoption of an ordinance and as college education level increased (Table 1). Education levels in counties in which a conservation subdivision was built were higher (28% with a four-year degree or higher [range 9–52%]) than in