ABSTRACT

ALLEN, STEPHEN C. Identifying Barriers to Conservation Subdivisions in North Carolina. (Under the direction of Drs. Susan E. Moore and Christopher E. Moorman).

Rapid urbanization, population movement into suburban and rural areas, and the ensuing land use changes reduce open space and associated biodiversity. Conservation subdivisions have emerged as an option to conserve open space, protect water quality and wildlife habitat, and maintain scenic views without compromising property rights. We used a mixed method study combining a survey of 576 people who attended conservation subdivision workshops with a qualitative case study of four communities that successfully developed conservation subdivisions. Survey respondents indicated the top barrier to completion of conservation subdivisions was the lack of incentives for developers. Other barriers, in order of ranking, were the perception that conservation subdivisions are more expensive to build, lack of interest from elected officials, smaller lot sizes, restrictive zoning, and concerns over the long-term management of open space. The case study communities overcame resistance from developers and landowners through educational efforts including informal meetings, charettes, and workshops focusing on the environmental and economic benefits of conservation subdivisions. The communities had support from elected officials, and planning staff devoted necessary resources to rewrite ordinances, review sketch plans, and perform site visits. To overcome barriers to conservation subdivisions, communities could provide incentives including density bonuses and expedited approval processes. Encouraging participation in workshops and design charettes for proposed developments also

may alleviate concerns of landowners who may perceive a loss of property rights from new regulations and aid in the acceptance of conservation subdivisions.

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. 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 college education level. 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 of conservation subdivisions 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.

Identifying Barriers to Conservation Subdivisions in North Carolina

by
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DEDICATION

To my wife, Melissa, for her love and support as we traveled together on this graduate school journey, and my late parents, Annette Williamson and Larry Allen, for always encouraging me to follow my dreams.

BIOGRAPHY

Stephen Allen was born on April 3, 1972 in Columbia, South Carolina to Annette and Larry Allen. He has one older sister Kim Atkinson, an older step-sister Juli Bradley, and a younger step-brother Luke Williamson. Stephen spent most of his life in Columbia, but lived for a few years in Manning, South Carolina where he spent time exploring the outdoors with his cousins Eric, Jody, and Jeremy Morris. It was during these few years that his appreciation for nature was first formed. Camping, fishing, exploring the woods, and catching snakes with his cousins made a lasting impression about the value of nature and the need to protect it. Stephen graduated from the University of South Carolina in 1994 with a BA in Journalism and Mass Communications. He spent the next 13 years working as a newspaper designer in Kinston, Greensboro, Cape Cod, and Raleigh before deciding to return to school and pursue a degree in Fisheries, Wildlife, and Conservation Biology. Stephen began his research project in January 2008 to identify barriers to conservation subdivisions in North Carolina. Along with the research project, Stephen has used his journalism background to design the quarterly program newsletter as well as assist with the design of other graduate student projects.

Stephen is married to Melissa Turner and their son, Isaac, was born on January, 8 2011. Upon graduation Stephen hopes to receive a job working for a state wildlife agency or a non-profit organization to promote conservation initiatives and ecologically sensitive development practices as a way to balance the need for growth with a more environmentally friendly approach to development.

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Overcoming Socio-economic Barriers to Conservation Subdivisions: A Case-study of Four Successful Communities

Introduction

Human population growth and the ensuing land use changes pose significant challenges to natural resource conservation. In the United States, 18 states experienced population growth rates greater than 10 percent from April 2000 to July 2009 (U.S. Census Bureau, 2009). In 2006, privately owned forests were being converted to commercial and residential use at the rate of 1,620 ha per day (Stein et al. 2006). Conversion of forest and farmland to residential development alters habitat for plant and animal species, and in rural and suburban areas could be the greatest threat to biodiversity (Milder 2007).

New Urbanism, low-impact development practices, and conservation subdivisions have emerged as alternatives to conventional residential subdivision design where the entire parcel of land being developed is divided into individual lots with little or no open space conserved. New Urbanism attempts to establish a more social, close-knit community that encourages residents to interact in the "public sphere" through smaller lots, reduced setbacks, and more functional front porches that face the streets and common areas (Talen 1999). Low-impact development practices are intended to preserve the pre-development hydrology of sites through the integration of planning and design techniques that minimize land

disturbance, conserve open space, and protect natural systems and hydrological processes (Dietz 1998).

Conservation subdivisions use a design strategy that attempts to conserve undivided, otherwise buildable tracts of land as communal open space for residents (Arendt 1996). In a conservation subdivision, ideally 50 to 70 percent 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. Conservation areas are identified through site visits with developers and planners and an environmental inventory to identify the most ecologically valuable land to conserve. This process uses the natural features of the site to guide how it is developed (Milder, 2007). Conservation subdivisions usually are permitted to have the same number of housing units, or slightly more, as a conventional subdivision would have on the same parcel. The difference is that the housing units in a conservation subdivision are clustered closely together, leaving large areas of common open space.

Conservation subdivisions offer potential environmental and economic benefits when compared to conventional subdivisions in a similar housing market (Mohamed 2006, Milder 2007). Clustering developments on a portion of the land reduces infrastructure costs an average of 34% when compared to conventional subdivisions which require additional grading, more stormwater infrastructure, and a longer road network (Thomas 1991, Mohamed 2006, Bowman 2009, Pejchar 2007). With minimal site disturbance and the conservation of large habitat reserves, developers and planners can decrease landscape fragmentation, protect stream buffers, and provide valuable habitat for wildlife (Lenth et al. 2006). If planned in conjunction with regional conservation efforts, open space in

conservation subdivisions can provide connectivity to other protected areas and benefit to wildlife species requiring larger tracts of intact habitat and connectivity between habitat patches (Odell 2003).

Conservation subdivisions are relatively rare despite their promised environmental and economic benefits, which suggests a need to assess social and logistical barriers impeding their use (Bowman 2009). Preliminary research indicates conservation subdivisions face resistance from realtors reluctant to market environmentally friendly development practices and from developers who perceive risks associated with trying a new development strategy in untested markets (Bowman 2009). Carter (2009) suggested that the most obvious barrier is lack of ordinance language allowing conservation subdivisions as a "use-by-right" in zoning and development regulations. Without this language in place, a developer may have to go through a lengthy rezoning or variance request that costs both time and money. Another challenge associated with conservation subdivisions is long term open space management (Austin and Kaplan 2003). To address this concern, some ordinances require a conservation easement or a transfer of development rights to guarantee the open space is conserved in perpetuity (Arendt 1996). Stewardship funds and homeowner association (HOA) fees can be used to cover the costs associated with the maintenance of open space, but resident involvement and lack of knowledge about open space management can lead to disagreements among residents (Austin and Kaplan 2003).

Previous research has focused on barriers to implementation of conservation subdivisions from the perspective of developers and planning officials, but gaining perspective from other stakeholder groups could explain why conservation subdivisions are

an underused option despite their potential benefits. Accordingly, we examined the barriers to implementing conservation subdivisions in North Carolina from the perspective of various stakeholder groups, and how communities that successfully implemented conservation subdivisions overcame those barriers.

Methods

Our mixed-method approach combined quantitative data from an online survey of participants from nine workshops on conservation-based development with qualitative data from the four case-study communities. The mixed-method approach was chosen to gain a more comprehensive perspective of the research questions (Greene et al. 1989, Tashakkori and Teddlie 1989), including a more in-depth look at how successful communities overcame barriers to implementation. Our survey population included city and county planners, developers, land conservancy staff, foresters, elected officials, landowners, and interested citizens. We chose this population to survey because we wanted to determine perceived barriers to implementation from a variety of stakeholders, expanding the research beyond the focus on planners and developers reflected in most of the literature on conservation subdivisions.

Study Area

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 has a population density of 64 people per square kilometer and a median household income of $46,574, which is $5,455 lower than the national median (U.S. Census Bureau, 2007). Three of the fastest growing regions in North Carolina – the Triangle (Raleigh-Durham-Chapel Hill), the Triad (Greensboro, High Point, Winston-Salem), and the Charlotte

metropolitan area – all ranked among the nation's top 20 sprawl centers at the turn of the century (Otto 2002). In fact, North Carolina was the only U.S. state with three sprawl centers in the top 20 (Otto 2002). In 1997, farmland comprised 30% (38,222 km^2) of the total land area in North Carolina; by 2007, this number decreased to 27% (34,295 km^2), a loss of 3,926 km^2 in 10 years (U.S. Department of Agriculture 2010). For each new resident that moves to North Carolina, 0.8 ha of land are developed on average (NC DENR 2007), and 3 million new residents are expected by 2030 (North Carolina Wildlife Resources Commission 2009).

More than 40 plant and animal species listed as federally endangered or threatened and over 200 state-listed species occur in North Carolina; eight of the top 21 most endangered ecosystems in the U.S. occur in the state (N.C. Wildlife Action Plan 2005). Habitat loss and fragmentation from urban development pose the greatest threats to these ecosystems (North Carolina Wildlife Action Plan 2005).

North Carolina has no statewide conservation subdivision ordinance. Instead, subdivision regulations are controlled by counties or municipalities and vary with respect to the amount of open space required and the approval process. Some allow conservation subdivisions "by right" while others may require a rezoning process or a special use permit. Of the 100 counties in North Carolina, 51 have ordinances allowing conservation subdivisions (Allen 2011).

Survey methods

We created an online questionnaire to survey participants from nine workshops on conservation-based development offered by North Carolina State University's Forestry and

Environmental Outreach Program between 2004 and 2006. Contact information was obtained from workshop registration records.

The questionnaire was reviewed by a county planner, a land conservation specialist, and a developer before it was administered. We followed Dillman's (2007) Tailored Design Method for Internet Surveys and used the online program Survey Monkey (Surveymonkey.com, Portland, Ore.). A pre-survey email and survey email was sent to 576 participants, and three reminder emails were sent one, three, and four weeks after the survey email. A fourth and final reminder was sent to the remaining non-respondents two months after the original request for participation in the survey.

We used Likert scale questions (a 4-point scale with 1 being "not a barrier" and 4 being "a complete barrier" to implementation) to determine how respondents rated potential barriers to successful implementation. Workshop attendees were asked about their interest in sharing information learned at the workshops, about the receptiveness of stakeholder groups to the information, and about their perceptions of costs of homes in conservation subdivisions.

To assess for non-response bias, we randomly selected 30 people from the 316 non-respondents. Of these 30 non-respondents, 25 were successfully contacted by telephone and asked to complete an abridged version of the survey.

Case studies

We used a modified multiple case-study approach to achieve a more in-depth understanding of the conservation subdivision process in four North Carolina communities (Yin 1994). We sought to identify the barriers these communities faced in implementing conservation

subdivisions and what steps they took to overcome them. Based on the survey of conservation subdivision workshop attendees, Randolph County, Orange County, the Town of Davidson, and the City of Hickory were identified as representative communities that have successfully adopted ordinances and successfully completed a conservation subdivision. We chose two case study communities that had a higher socio-economic ranking than the state average (Orange County and the Town of Davidson), and two communities that had lower socio-economic rankings (Randolph County and the City of Hickory) (Table 1). Between June 2009 and August 2009, we conducted in-person, individual, semi-scripted interviews with a member of the planning staff, a planning board member, and a developer from each case study community to obtain varying perspectives. Interviews were recorded and transcribed for qualitative analysis.

We asked planning staff and board members about the process their community underwent to incorporate conservation subdivisions into their zoning or development regulations. Questions addressed who or what prompted the zoning regulation change, how much time and money was spent during the process, where resistance was encountered, and how the resistance was overcome. Other questions focused on how conservation subdivisions were defined, the approval process, whether incentives were offered, and the selection and long-term management of open space in the development. All questions were open-ended. Each developer was contacted and asked about their motivation for building a conservation subdivision, barriers they faced during the process, and how they overcame those barriers. Other questions focused on the long-term management of open space, the design process, marketing, and incentives to encourage the use of conservation subdivisions in local development regulations.

Analysis

We analyzed data from the online survey using SPSS System 17.0 for Windows Vista (SPSS Inc., Chicago Illinois, 60606). We used the overall means of the Likert-scale responses from workshop attendees to rank the barriers to conservation subdivisions. One-way analysis of variance with a Duncan post-hoc test were used to determine if ranking of barriers varied by occupation and to determine if occupation was a predictor of success sharing conservation subdivision concepts following the workshops. To test for non-response bias, we compared the ranking of barriers for respondents and non-respondents using Chi-square tests.

Data from the recordings of case study interviews were transcribed (by SCA) and analyzed to identify common themes and keys to successful implementation of conservation subdivisions. Responses were grouped to form the narrative of perceptions of barriers to conservation subdivisions and how the successful communities overcame these barriers. As themes emerged, we grouped them into the categories 1) motivation to adopt conservation subdivisions 2) barriers to implementation 3) steps taken to overcome barriers. All respondents consented to be identified in quoted text, with the exception of the City of Hickory planning staff who asked to be referred to as “Hickory city planning staff.”

Results

The survey response rate was 45%. Respondents were: landscape architects (32%); planning staff, planning board members, or board of commissioner members (31%); developers and real estate agents (15%); conservation and land protection group representatives (12%); with foresters, land managers, and other occupations making up the

remaining 10 percent. Non-respondents and survey respondents did not differ in how they ranked barriers to implementing conservation subdivisions.

Barriers to implementation

Respondents rated the lack of incentives for developers as the top barrier to implementing conservation subdivisions (Table 2), and the barrier was rated similarly among occupations (Table 3). The perception that homes in conservation subdivisions are more expensive to build was rated the second highest barrier. When asked about the cost of homes in conservation subdivisions compared to similar homes in conventional subdivisions, 67% of respondents said homes in conservation subdivisions cost more, 29% said they cost the same, and only 3% said that homes in conservation subdivisions cost less.

The third highest rated barrier was lack of interest from elected officials to change zoning regulations with no difference in the ranking detected among occupations (Table 3). The fourth highest rated barrier was smaller lot sizes associated with conservation subdivisions. Restrictive zoning was rated the fifth most important barrier, with conservation groups, developers, landscape architects, and interested citizens rating it higher than planning staff and elected officials. The long-term management of open space, the reluctance of planners to review sketch plans, and lack of model ordinance language were less important barriers. Difficulty sharing information among developers, elected officials, and realtors was also a barrier (Figure 1).

Case study communities and barriers

Informants from all case study communities described conservation subdivisions as a response to perceived threats to their community's rural character posed by rapid

development. Conservation subdivisions were implemented to conserve open space while not infringing on landowner property rights. Open space conservation had been a key issue in Orange County for some time, according to Barry Jacobs of the Orange County Board of Commissioners. "We've been looking at them [conservation subdivisions] for 20 years. We had something called the Rural Character Study in the late 80s and early 90s that looked to provide incentives for maintaining rural character by having subdivisions that clustered and created permanent open space."

In the mid-1990s, the Town of Davidson was experiencing unprecedented growth from commuters and immigrants from the Charlotte-Mecklenburg region. Board of Commissioners member Margo Williams said town officials realized they couldn't stop the growth and formed a land planning committee to shape it in a way that would maintain the town's values and rural character. During this planning period, the town enacted a moratorium on new subdivisions. Davidson planning director Kris Krider said the town's actions were a result of seeing other municipalities in the region struggle with staggering growth rates and suburbanization. Krider said "I think that what promoted it was the tremendous growth that was going on in Huntersville and Cornelius. We were at a 74 percent growth rate (from 1990-2000) because we put a stop to it. We said timeout, we're not ready to grow, not in a suburban mode. So, we were very protective of remaining a rural area, and being the farthest away from Charlotte and still being in Mecklenburg County helped us."

In the late 1980s, Randolph County also was experiencing a period of rapid growth. Randolph County Planning Director Hal Johnson said the increase in major residential

development in the county was diminishing the county's rural character. In response, the county changed the subdivision approval process in 1988 to require that all major subdivisions go through a rezoning process, bringing subdivision approvals into the public arena. Prior to the change, subdivision approval only required a proposed development to undergo a technical review from planning staff, meet the requirements of the ordinance, and receive approval from the planning board or the planning staff. The change gave residents a forum to voice their opinions on how they want their community to look. Adjacent property owners concerned about the rural character of the community were less opposed to proposed developments once they saw the types of conservation subdivisions being proposed. The public review helped make conservation subdivisions less controversial and often the preferred type of development because it was more appealing to adjacent landowners. Phil Kemp of the Randolph County Board of Commissioners noted the value of a less controversial review process saying, "it gets approved a little easier because there is less controversy when you have the neighborhood meetings and they see it's going to be a conservation-type subdivision. We have those (informal meetings) as part of the (rezoning) process. It's an informal time where citizens can come to the county office and meet with the developer and meet with the planning staff before it goes to the public hearing and the planning board and county commissioners. And that's been one of the best things that we've ever done."

The City of Hickory added conservation subdivisions to their development regulations in 2000 after focus groups of residents identified the need for more open space. Planning staff for the City of Hickory said the city took more of a market approach to conservation

subdivisions, adopting the ordinance and letting the demand for open space subdivisions lead to the successful implementation.

Providing incentives for developers

Each of the case study communities incentivized conservation subdivisions using density bonuses, flexibility in lot size requirements, or an expedited review process to encourage the use of conservation subdivisions. Density bonuses are an incentive-based planning tool that allows developers to build more homes in exchange for retaining the required amount of open space in a development (Center for Land Use Education 2005). A density bonus can be given for public access to open space or trails, conserving environmentally sensitive areas, or for linking trails to an existing network of greenways.

Randolph County traded density bonuses for several attributes of conservation subdivisions. Developers could add one additional lot for each additional 5 percent of open space conserved, preserving a designated Natural Heritage site, maintaining forest and natural buffers along parcel lines, developing an approved forestation plan for the open space, and developing and maintaining connector trails to a designated county greenway.

Granting a density bonus for public access is a way some communities increase the amount of publicly available open space without having the financial responsibility of maintaining a public park or greenway. In Davidson, there is a density bonus if open space is a part of a greenway system or has trails available for public use. If 60 percent of open space is publicly accessible, the developer may increase the density by 0.4 units per 0.4 ha.

The conservation subdivision option in Hickory allows for a 50 percent reduction in lot size and a 25 percent reduction in setback requirements as a density bonus. In Orange

County, developer Tom Heffner noted lack of density bonuses and less flexibility in lot size requirements in the rural buffer as a problem. "You're driven to do large-lot subdivisions anyway and you have to do a 1/3 open space by the ordinance. I think in the truest form, about what his [Randall Arendt's] philosophy is and I think his philosophy would say to do even smaller lots than what Orange County does and set aside larger amounts of open space. And I think even if you had a very small incentive, maybe even 5 percent, certainly 10 percent would be a gracious plenty to encourage you to do one."

Perception conservation subdivisions are more expensive to build

The successful communities in our case studies reached out to developers through workshops and informal meetings to overcome misperceptions about the costs associated with building homes in conservation subdivisions. Randolph County and the Town of Davidson held workshops featuring Randall Arendt and promoting the benefits of conservation subdivisions. The informal meetings in Randolph County and the charettes in Davidson created an ongoing dialog with developers, planning staff, and property owners. Developers in all four communities stated that construction costs for the conservation subdivisions they built were comparable to conventional subdivisions. Two developers saved money on stormwater management by minimizing the use of curb and gutter and incorporating natural filtration and roadside swales, but some of the savings may have been offset by time spent negotiating with planning staff for special use permits because the ordinance calls for the use of curb and gutter. Davidson developer John Robbins said the conservation subdivisions he built had comparable costs compared to conventional subdivisions. Developer Tom Heffner said "I don't think they're any more expensive. You know, if you use Randall [Arendt]'s

pure theory, his theory would be that by clustering the lots in smaller areas you would build fewer streets … it's certainly theoretically possible that a conservation subdivision would be less expensive to build because you'd have less infrastructure."

Blue Sky Acres is an open space development built by Hickory's Habitat for Humanity of Catawba Valley. The extension of water and sewer lines in the area allowed Habitat to cluster homes on smaller lots and conserve over 20 percent of the property as communal open space. "For us it would definitely be cheaper. Because without the conservation subdivision we would have had fewer lots so your infrastructure costs per lot would have been higher, you know maybe 20-30 percent higher," Mitzi Gellman said.

Gaining support from planning department and elected officials

Planning staff and the boards of commissioners in each community supported development of conservation subdivisions and pushed for change in the land use policy. In Randolph and Orange counties, focus groups and growth studies were used to determine how residents wanted to see their communities grow. In Orange County, Randolph County, and the Town of Davidson, the planning department staff developed ordinance language allowing conservation subdivisions. The City of Hickory hired a consulting firm to develop their land use plan.

In the Town of Davidson, the proposed changes were met with resistance from developers and property owners who feared conservation subdivision regulations would hurt their property values. Margo Williams, a member of the Town of Davidson Board of Commissioners, said the town worked to address these fears with multiple meetings and workshops featuring Randall Arendt and other land use experts. The workshops focused on

the benefits of open space conservation in subdivisions. Williams said "it was the committee's goal to work with the property owners to see if we could discuss things in greater detail to allay some of the concerns of the property owners and out of those discussions arose our lease of development rights in case a transfer of development rights was a little too radical. After the ordinance was passed, it was the gradual realization on the part of property owners that what we had done had not damaged them."

Davidson planning director Kris Krider said the process created a negative image of the town in the eyes of some landowners and developers, and it took several meetings and workshops to overcome some of these concerns and rebuild the community's trust. He said "I think it was a series of seeking out people like Randall Arendt at a time when the town was trying to adopt a new land plan. It was a really heartbreaking battle to work through this. Ultimately, the town board adopted the ordinance and it was known as the land grab…It was a hard issue for many people to swallow and it all resulted around takings – 'You're taking my property rights' – so we sought out people like Randall [Arendt]…"

Smaller lot sizes

The successful case study communities used reduced setback requirements and flexibility in lot sizes to overcome the challenges associated with smaller lots in conservation subdivisions. Smaller lot size may be more of an issue in rural areas, because smaller lots can make setbacks for outbuildings and septic systems difficult to achieve. Placing septic fields in the open space, the use of communal septic fields, and on-site treatment plants can allow rural subdivisions to achieve smaller lots. Planning staff from all four case studies said that communal septic fields are an option, but are rarely used and are not encouraged because of

long-term management concerns. If these communal septic fields or on-site treatment plants are not properly maintained, the city or county may have to become involved in taking over management of the system.

The flexibility in lots sizes allowed Habitat for Humanity of Catawba Valley to develop more lots while conserving valuable woodlands that provide open space and recreation opportunities to residents. The lots in Blue Sky Acres average about 0.07 ha. Mitzi Gellman, Executive Director for Habitat for Humanity of Catawba Valley, said the community quickly became the most popular Habitat community in Hickory. Gellman said the neighborhood is unique because it gives residents an alternative to typical lower-income urban settings and offers children in the development a natural playground not available in the more urban Habitat communities. "It's nice that they have a place to do this. Typically our kids are coming out of really low-income neighborhoods or trailer parks, they're coming out of public housing, and so the idea that there are woods across the street that they can play in that feel relatively safe is a new thing as well."

The Town of Davidson requires a variety of lot sizes. No more than 50 percent of the lots in a development can be the same size, which leads to a variety of home sizes, more affordable homes, and more diverse homebuyers. Lots in the Woodlands at Davidson vary from 0.1 ha to nearly 0.4 ha for the estate lots, with the majority being 0.2 ha. In Orange County's rural buffer, there is a 0.8 ha minimum lot size, which means with the 33 percent open space requirement each lot requires 1.2 ha of land. Where water and sewer are available, the minimum lot size can be reduced to 0.13 ha.

Restrictive zoning

The case study communities used a combination of flexibility in lot sizes, varying open space requirements, approval processes that favor conservation subdivisions, and density bonuses to overcome developers concerns about restrictive zoning. Without ordinance language in place, a developer would have to navigate an often lengthy and costly rezoning or special use permit, which usually deters applicants from pursuing conservation developments.

Open space standards, conservation easement requirements, and long-term management requirements differed in each community. The City of Hickory's ordinance allows less than 30 percent open space in some zoning districts, but the range of open space required reaches 50 percent in others. Orange County requires 33 percent open space for each new subdivision and requires identifying primary and secondary conservation areas during the initial planning phases. When flexible developments were first added, the Orange County planning staff and Board of Commissioners would make a recommendation to the developer, but the final decision on which type of development to build was left up to the developer. Overwhelmingly, developers chose to build conventional subdivisions. To encourage open space subdivisions, Orange County revised their process to require submission of a flexible development plan (but not a conventional plan) and place the final decision with the Board of Commissioners. The flexible development plan requires at least 33 percent open space to be permanently protected through deed restrictions or a conservation easement. Since the approval process was changed, Orange County has seen a number of flexible developments built, but has also seen an increase in the number of minor

subdivisions. Under North Carolina law, minor subdivisions (under 4.05 ha) are exempt from zoning regulations.

The Town of Davidson's ordinance includes several options for developers and property owners and requires the conservation of at least 42 percent of a proposed development as permanently protected open space. An environmental inventory is required for all development proposals and is meant to be the guiding factor for identifying the conservation areas. The developer pays for the environmental inventory, which identifies significant natural areas, sensitive wildlife habitat, wetlands, and existing vegetation on the site.

Flexibility in lot sizes is a key component to the Randolph County ordinance that allows developers to achieve the same or higher number of units as a conventional subdivision. The ordinance requires that 50 percent of the proposed conservation development be set aside as open space. The county is divided into three growth categories: rural, secondary, and primary. The lot size requirements vary by growth area, but the conservation subdivision option gives developers flexibility in lot sizes. In the rural growth area, the minimum lot size is 1.2 ha, but the conservation subdivision option allows a minimum of 0.61 ha. In the secondary and primary growth areas, the minimum lot size is 0.37 ha for a conventional subdivision or ~0.18 ha for a conservation subdivision, allowing developers to achieve the same number of units they would with a conventional development.

The City of Hickory used varying open space requirements to conserve more open space where more land is available in rural areas, while still conserving some open space in

more urban areas. The most rural residential district has a 50 percent open space requirement for conservation subdivisions; the requirement is 20% in all other residential zoning districts. The ordinance calls for the preservation of sensitive areas on the property, including wetlands, mature woodlands, and other significant natural features.

Long-term management of open space

To overcome challenges associated with the long-term management of open space, the case study communities used mandatory conservation easements, transfer of development rights, or homeowners' associations with fees dedicated to open space management. Randolph County limits the future development of open space by deed restrictions rather than requiring a conservation easement. Deed restrictions generally do not involve third party oversight for the management of the open space by an organization such as a land trust. Ownership of the open space can be retained by the developer, or by a homeowners' association. If ownership is retained by the developer, they are responsible for paying taxes on the land in perpetuity, which can deter developers from maintaining ownership. Developer Stan Byrd has built three conservation subdivisions in Randolph County and retained ownership of the open space in two and transferred ownership to a homeowners' association in the third. Byrd said he would build another conservation subdivision in Randolph County, but he would not build one that did not have a homeowners' association to assume ownership and maintenance of the open space.

A conservation easement is required on the open space in Orange County and the Town of Davidson, but it does not have to be held by a local land trust. The Davidson Land

Conservancy is active in promoting conservation subdivisions in Davidson but the easement also may be held by the developer, the homeowners' association, or the Town of Davidson. Triangle Land Conservancy owns the 105 ha of open space in the Creek Wood and North Field developments in Orange County and has linked the open space to an adjacent property they owned to create a larger nature preserve.

A common concern from a planning department standpoint is the lack of knowledge on the part of homeowners' associations regarding the long-term management of open space. "The big challenge for the town I think is those public lands or publicly accessible lands that you've got HOAs that don't know how to manage them. They know how to take care of pools and manicure lawns because they hire a landscape company, but they don't know anything about protecting woods. So I think that's where land trusts like the Davidson Lands Conservancy can fill an important role," Davidson Planning Director Kris Krider said.

From the City of Hickory's standpoint, the long-term management of the open space is one of the primary concerns regarding conservation subdivisions. "As subdivisions age, homeowners' associations dissolve. They have a tendency to just basically go away over time, unless you have a real established neighborhood. It is a concern because properties change hands several times over a period of years and homeowners' associations begin to lose their clout if there's not a strong board. I can see that being a big issue especially if it's more than just a forested area that's in open space."

Discussion

Those most critical to implementing conservation subdivisions – developers (Daniels, 1999; Mohamed 2006; Bosworth 2007), elected officials, and realtors (Carter 2009) – may be

more resistant to conservation subdivisions than other groups because they stand to lose the most if claims about customer preferences and construction cost savings prove false. Although homebuyers value open space in their neighborhood and are willing to pay more when it is protected in neighborhood design, developers believe low-impact design techniques and conservation subdivision designs increase the final costs of homes, and many believe homebuyers are not interested in or willing to pay for homes in conservation subdivisions (Bowman 2009).

The case study communities used financial incentives to encourage developers to build conservation subdivisions. Indeed, such incentives have driven adoption of most recent green innovations including hybrid cars (Diamond 2009), geothermal heating and cooling (Kagel and Gawell, 2005), and solar and wind power (Lancaster and Berndt 1984). Preserving rural character (Ryan 2002) and access to open space (Irwin 2002) are important factors in resident perceptions of subdivision design, yet conservation subdivisions that provide these features are still the exception. Density bonuses and an expedited permit process have been promoted to overcome concerns from developers about perceived additional costs associated with conservation developments (Bowman and Thompson 2009). As with the case study communities in our study, other communities used reduced minimum lot sizes as an incentive to increase open space, and community residents supported the use of these types of financial incentives to promote more environmentally friendly homes (Ellis 2006). However, a combination of incentives, such as reduced setback requirements, density bonuses, and state and federal tax credits, may be the best option to promote conservation subdivisions in some communities (Carter 2009).

Although developers and residents concerned about property rights often resist conservation planning efforts (Peterson and Liu 2008), community workshops were able to address these concerns in three of our case study communities. Highlighting the economic and environmental benefits of conservation subdivisions and dispelling myths about higher construction costs helped address concerns in Randolph County while bitter conflict erupted in the Town of Davidson over the issue of "takings" and the perceived loss of property value associated with smaller lots in conservation subdivisions. Community workshops, informal meetings, charettes, and presentations by experts helped overcome the communication barriers in case study communities. Before the workshops and meetings, communication between adjacent landowners and developers of conservation subdivisions was limited to the more formal settings of public hearings or board of commissioners meetings. The workshops and charettes created an informal setting where adjacent landowners and concerned citizens could see the proposed development plan, raise their concerns directly to the developer, and work with the developer to find a solution that addressed their concerns. The goal of the public meetings and workshops was to create a constructive, open conversation between stakeholders groups with the goal of coming to an agreement by consensus (Cox 2006). Encouraging public participation early on in the process was one key to success. Public participation often comes too late in the process, after decisions have been made, leaving local officials to defend decisions instead of educating the public and seeking input (Cox 2006). Conversely, involving relevant stakeholder groups early in the process, reaching decisions by consensus, and adopting a problem-solving approach can facilitate environmental advocacy efforts (Cox 2006).

Resistance to conservation subdivisions among local politicians may be explained by concerns about potential public backlash against perceived property rights violations or economic damage related to slowing the pace of construction by lengthening approval and permitting processes. The first concern can be addressed with the same type of community workshops used in case study communities to educate developers. Concerns about economic damage can be addressed in part using workshops and seeking out examples of successful neighboring communities. The City of Hickory was able to encourage conservation subdivisions by changing regulations to remove barriers without adding additional regulations, or increasing permitting or approval time, potentially a politically costly option (Carter 2009, Bowman 2009). This market approach removed barriers to conservation subdivisions without raising concerns about slowing economic growth through excessive regulation.

However, local communities also must address political pressures from beyond their geographic boundaries as immigrants from urban areas migrate to rural areas (Smith and Krannich 2000). When residents are concerned about loss of rural character associated with future development, politicians can gamble with new regulations favoring conservation development (Ryan 2002, Carter 2009). Once external development pressures reach high levels, new regulations must be proposed in a high stakes environment where politicians face potentially unacceptable risk (Peterson and Liu 2008). Our case study findings suggest successful communities reacted to impending development before development pressures overwhelmed local infrastructure and political capital. Building moratoriums are a way communities can halt residential growth while a land use plan is developed. Moratoriums

were used in the Town of Davidson to stop development while the town gauged public sentiment about the direction of the community growth and adopted a land use plan. Davidson was growing at a rate of 74 percent over 10 years and land prices were at a premium when the town passed the building moratorium. This may explain why new regulations were met with such opposition from developers and landowners who felt the new regulations would lower their property values or increase housing density. Moratoriums are more common in areas of rapid growth as a way to halt the approval of building permits due to a lack of public facilities like sewers, roads, or schools (Janczyk and Constance 1980). Low-density, unplanned development raises the cost of providing public services while higher-density, compact, planned development can reduce the amount of infrastructure required and reduce the public service costs (Carruthers and Ulfarsson 2003).

Success at implementing conservation subdivisions also may require more time from the planning department to meet with developers, review sketch plans, perform site visits, and work with developers and residents to come up with a plan that conserves quality open space (Arendt 1999). A concurrent study showed that poor rural counties in North Carolina were least likely to have a conservation subdivision ordinance, while urban counties and rural counties with higher median income were most successful at adopting conservation subdivision ordinances (Allen 2011). Rural counties without the resources necessary to adopt conservation subdivision ordinances could seek out regional partners with land trusts or a council of governments to help defray the costs of rewriting ordinances and sponsoring workshops to promote conservation subdivisions (Carter 2009). Having an active land trust involved in promoting conservation subdivisions also might alleviate concerns over the long-

term management of open space, and could help conserve more ecologically significant open space if the land trust was involved early in the process.

Conservation subdivisions may offer environmental and economic benefits when compared to conventional subdivisions, but there are several potential barriers that must be addressed by communities trying to incorporate conservation subdivisions into development regulations. Increased education about the potential benefits of conservation subdivisions, providing incentives to developers, requiring funding and long-term management plans for the conserved open space, and reworking the approval process to favor conservation subdivisions can overcome barriers to their successful implementation. Without such incentives conservation subdivisions likely will continue to be underused.

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FIGURES AND TABLES

Table 1: 2000 U.S. Census data for North Carolina and four case study communities in North Carolina

Category	North Carolina	Orange County	Town of Davidson	City of Hickory	Randolph County
2000 population	8,046,406	115,536	7,139	37,222	130,472
2009 population estimate	9,380,884	129,083	9,645	41,469	142,151
Persons per square km	63.8	111.57	--	540.73	64.02
Percent growth 1990-2000	21.4	23.1	76.4	31.5	22.5
Median income	$39,184	$59,874	$78,370	$37,236	$44,369
College education level	22.5%	51.5%	57.2%	28%	11.1%
Percent urban population	57.8	68	--	--	39.7
Median home value	$108,300	$179,000	$270,000	$125,000	$94,700

Table 2: Ratings of barriers to implementing conservation subdivisions in North Carolina from a survey of conservation subdivision workshop attendees (2009). Survey respondents were asked to rank barriers on a scale of 1-4 with 1 being "not a barrier" and 4 being a "complete barrier" to implementation.

Possible barrier to conservation subdivisions	N	Overall Mean	Std. Deviation
No incentives for developers	246	3.51	1.21
Perception CSDs are more expensive to build	243	3.43	1.18
Lack of interest from elected officials	246	3.16	1.40
Smaller lot sizes	244	3.07	1.23
Restrictive zoning	219	3.05	1.28
Management of open space	246	2.95	1.23
Lack of consumer demand	221	2.85	1.30
Lack of interest by realtors	220	2.79	1.35
Lack of model ordinance language	220	2.78	1.39
Lack of resources to rewrite ordinances	220	2.76	1.37
Lack of maps of potential conservation lands	220	2.51	1.29
Reluctance of developers to submit sketch plans	220	2.47	1.22
Reluctance of planners to review sketch plans	220	2.20	1.18

Table 3: Ratings by occupation of possible barriers to implementing conservation subdivisions in North Carolina from a survey of conservation subdivision workshop attendees (2009). Survey respondents were asked to rank barriers on a scale of 1-4 with 1 being "not a barrier" and 4 being a "complete barrier" to implementation.

Occupation or interest	N	No incentives for developers	Perception CSDs cost more to build	Lack of interest from elected officials	Small lot sizes	Restrictive zoning	Long term management of open space
Planning staff or board of commissioner	61	3.21	3.21	2.75	3.23	2.21 A	3.18
Developer/real estate	26	3.65	3.00	3.38	2.88	3.48 B	2.58
Conservation/land protection group	24	3.13	3.13	3.25	2.96	3.61 B	2.67
Land planner/ designer/architect	60	3.73	3.64	3.45	3.03	3.42 B	2.88
Interested citizen/private landowner	20	3.45	3.45	3.50	3.05	3.37 B	3.15

Means within a column followed by different letters differ at the 0.05 probability level according to Duncan's post-hoc test.

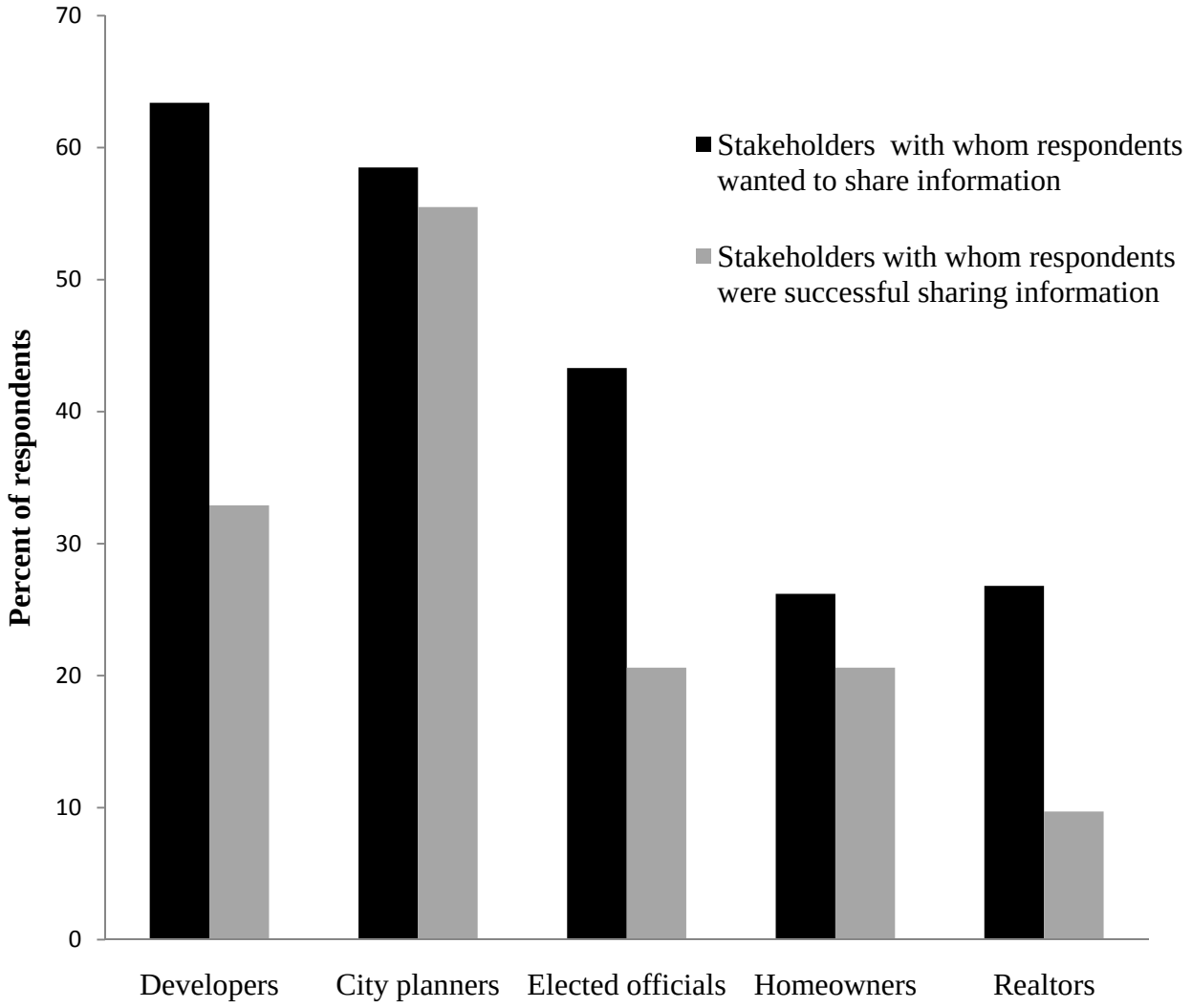

Figure 1: Stakeholder groups with whom survey respondents were most interested in sharing information on CSDs and the stakeholder groups with whom they were most successful sharing information. (North Carolina, 2009).

Predicting Success Incorporating Conservation Subdivisions Into Land Use Planning

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 2003, 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 open space and 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, buildable tracts of land as communal open space for residents (Arendt 1996). In a conservation subdivision, ideally 50% to 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). However, there are perceived risks for elected officials and developers that may impede integration of conservation subdivisions into land-use planning (Allen 2011).

Despite their potential environmental and economic benefits, conservation subdivisions are an underused option (Vogt 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 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 100 county planning departments in North Carolina to assess predictors of success adopting ordinances and success completing conservation subdivisions.

Methods

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 3,926 km^2 in 10 years (U.S. Department of Agriculture 2010). 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 has a population density of 64 people per square kilometer and a median household income of $46,574, which is $5,455 lower than the national median (U.S. Census Bureau, 2007). For each new resident that moves to North Carolina, 0.8 ha of land are developed on average (NC DENR 2007), and 3 million new residents are expected by 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 2000).

Survey

We surveyed the 100 county planning departments in North Carolina using e-mail and telephone interviews. Planning staff from each county were 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 2000).

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 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 1,000 to facilitate comparisons of model coefficients. Analysis was conducted using SPSS System 17.0 for Windows Vista (SPSS Inc., Chicago Illinois, 60606).

Results

Fifty-one counties out of 100 in North Carolina had ordinance language allowing conservation or cluster subdivisions in their development regulations (Figure 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.

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 (Figure 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 (21.9% with a four-year degree or higher [range 9.0%-51.5%]) than in counties in which no conservation subdivisions were built (14.1% with a four-year degree or higher [range 8.2%-37.1%]).

Discussion

The higher probability of adopting a conservation subdivision ordinance and completing a development in urban centers likely reflects a response to rapid urban sprawl around North Carolina's metropolitan regions. The North Carolina counties that successfully adopted conservation subdivision ordinances were close to the state's major metropolitan areas – the Triangle (Raleigh-Durham-Chapel Hill), the Triad (Greensboro, High Point, Winston-Salem), and Charlotte – all of which rank among the nation's top 20 sprawl centers (Otto 2002). Further, urban counties typically have a larger planning staff and more resources than rural counties. Such resources likely facilitate conservation planning efforts,

including adoption of conservation subdivision ordinances and incentives to developers to promote conservation subdivisions (Carter 2009).

Successful adoption of conservation subdivision ordinances in rural counties with higher median incomes may be explained by new residents seeking to protect the natural amenities that attracted them to the counties. Rural counties that successfully adopted ordinances were located along major interstate corridors that border the state's largest metropolitan areas. These counties were experiencing rapid population growth as relatively wealthy residents from the urban center moved to more rural areas. Natural amenities such as open space and developments featuring mature trees, farmland, or forests draw residents to rural areas (Sofranko and Williams 1980, Crump 2003, Vogt 2004). However, rapid increase in residential development jeopardizes the rural character that attracted the new residents. The "gangplank" hypothesis proposes that new residents are drawn to rural communities because of natural amenities, scenic views, and small-town character, and become concerned about future development threatening these values (Smith and Krannich 2000, Groothius 2010). These newcomers typically are more supportive of land use restrictions than long-term residents (Cockerham and Blevins 1977, Inman and McLeod 2002, Groothius 2010). Thus, it is possible newcomers are driving adoption of conservation subdivision ordinances in rural counties with higher median incomes as a way to maintain the rural amenities that attracted them.

Our results suggest the most important step for successful construction of a conservation subdivision is the adoption of ordinances that explicitly allow conservation developments. In North Carolina, restrictive zoning that does not allow conservation

subdivisions or lot size flexibility was rated the fifth most important barrier to successful completion of a subdivision (Allen 2011). Developers and landscape architects, who would be taking a perceived financial risk to build a conservation subdivision, rated this more of a barrier than planning staff and elected officials. Without an explicit conservation subdivision ordinance in place, developers may be deterred by what could be a time-consuming, costly special permitting process to build a conservation subdivision without an ordinance (Carter 2009, Bowman and Thompson 2009). Only two North Carolina counties built a conservation subdivision without an ordinance allowing them. These counties were located in the mountains of western North Carolina, where the resort home market and higher-end developments, along with the desire to preserve open space and scenic views, may make conservation subdivisions a viable option even without an ordinance.

Our results highlight a link between education and demand for development practices perceived as environmentally friendly (Straughan 1999). In North Carolina, 22.5% of residents have at least a four-year college degree, but communities that had built conservation subdivisions had much higher proportions of college educated residents, (e.g., Durham County [40.1%], Orange County [51.5%], and Wake County [43.9%]). Additionally, communities with conservation subdivisions often had a college or university that may have attracted more environmentally conscious residents. For example, North Carolina State University, the University of North Carolina – Chapel Hill, and Duke University are located in Wake, Orange, and Durham counties, respectively, which all have successfully built conservation subdivisions.

Almost half of the 51 counties with a conservation subdivision ordinance had not completed a development, so barriers in addition to lack of ordinances may impede implementation. Changes in land-use regulations can create conflict over property rights among landowners, developers, and elected officials (Peterson and Liu 2008; Allen 2011). In most cases, a combination of support from planners, legislators, developers, and consumers would be needed to address this barrier (Vogt 2004, Peterson and Liu 2008). In North Carolina, the lack of incentives for developers, concerns about higher construction costs, and concerns about smaller lot sizes may present additional barriers to construction of conservation subdivisions (Allen 2011).

In the absence of model statewide ordinances, low-income rural counties trying to implement conservation subdivisions must seek partners to help promote conservation subdivisions. Local, regional, or statewide land trusts interested in holding easements in conservation subdivisions may be willing to aid in the promotion or adoption of conservation subdivision ordinances. In some states, land trusts play an active role in the promotion of conservation subdivisions by providing examples of model ordinance language and actively pursuing easements in conservation subdivisions (Natural Lands Trust 2011). Although some land trusts in North Carolina have easements in conservation subdivisions, they may not actively pursue them due to long-term management concerns (Allen 2011).

To defer costs from rural counties that lack resources, regional councils of governments also may assist in the development of ordinances, regional conservation planning, or organization of workshops promoting conservation subdivisions. Without these

partnerships, low-income rural counties will be less likely to adopt a county ordinance or have a conservation subdivision successfully built.

Although our study suggests that enacting an ordinance allowing conservation subdivisions by right is the most important factor leading to successful construction of a conservation subdivision, counties may need to do more than just adopt such an ordinance. Educating developers about the higher prices homebuyers are willing to pay for homes with access to urban open space may encourage construction of more conservation subdivisions (Bolitzer and Netusil 2000, Geoghegan 2002). Incentives for developers, expedited permit reviews, and reworking subdivision approval processes to favor conservation subdivisions over conventional subdivisions can make them more appealing to developers.

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FIGURES AND TABLES

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

	Parameter	Estimate	Standard error	*P*	NagelkerkeR^2
Ordinance	Median income	.325	.089	.000	.376
	Urban population	.163	.062	.008	
	College education	-.009	.053	.869	
	Median income * Urban population	-.004	.001	.015	
Construction	College education	.120	.058	.039	.474
	Urban population	.014	.013	.297	
	Median income	-.057	.068	.402	
	Ordinance	-2.902	0.828	0.000	

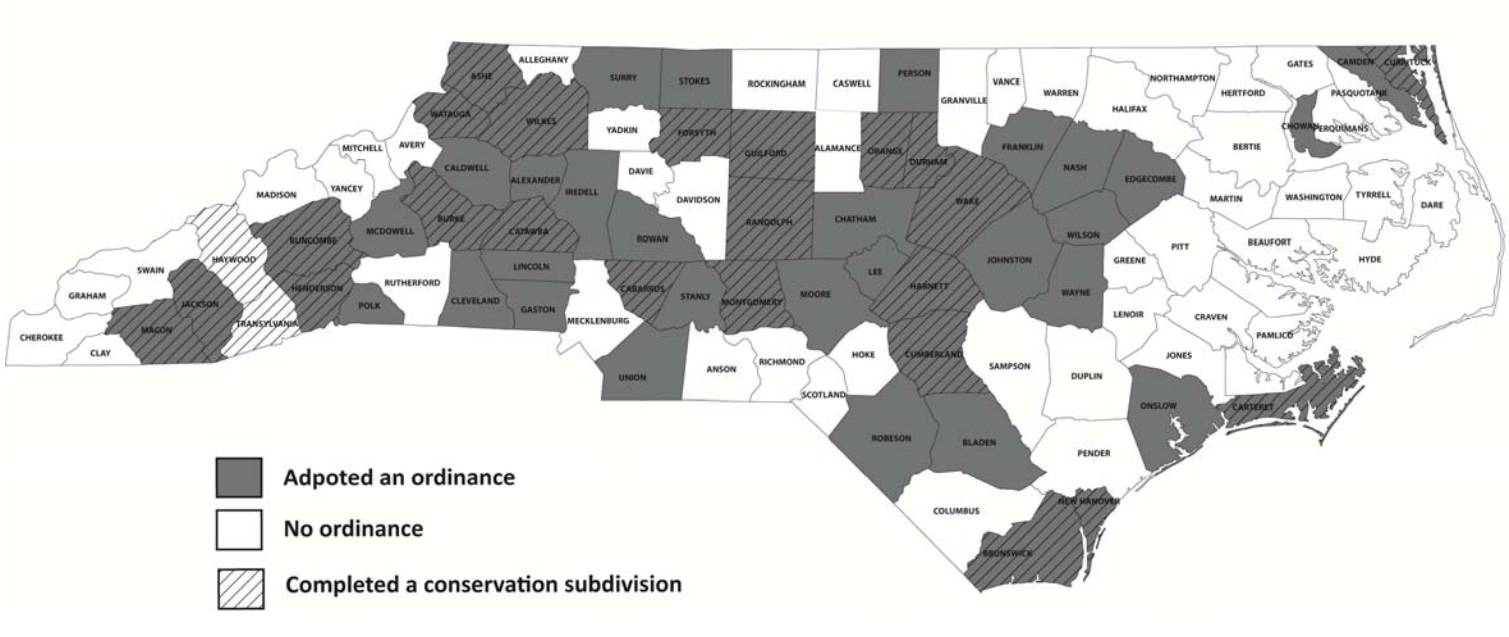

Figure 1: North Carolina counties that had successfully adopted conservation subdivision ordinances and successfully completed a conservation subdivision (2010)

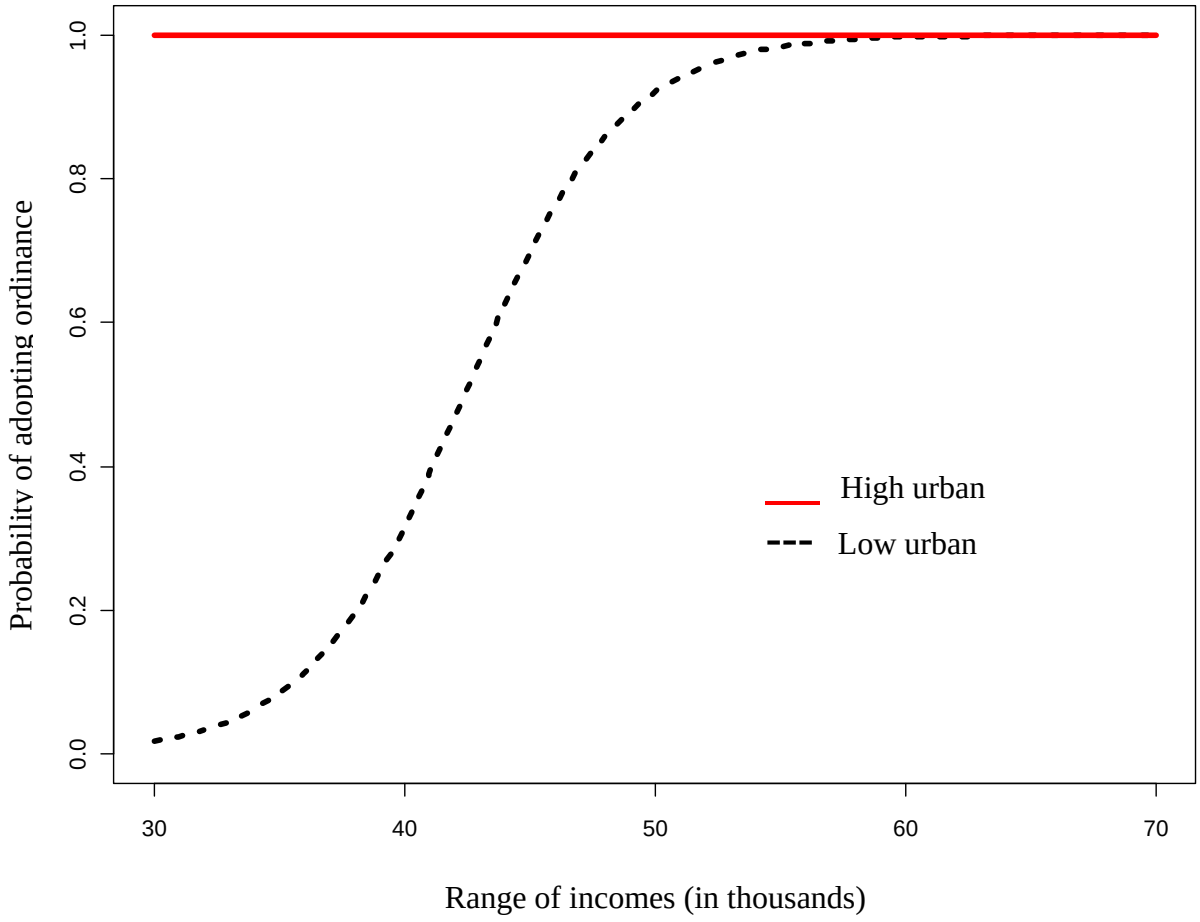

Figure 2: Probability of adopting conservation subdivision ordinance across a range of income in counties with high (>50%) and low (<50%) percent urban populations. Urban population percentages were based on the 10th and 90th percentiles from 2000 Census data.

APPENDIX

APPENDIX

Online survey: Identifying Barriers to Conservation Subdivisions

1. Which workshops on conservation development sponsored by N.C. State University's Forestry and Environmental Outreach Program did you attend? Choose all that apply.

- o Charlotte- March 3-4, 2004
- o Raleigh – April 13,14, 2004
- o New Bern, Dec. 1, 2004
- o Leland, Brunswick County – Dec. 2, 2004
- o Salisbury- April 21, 2005
- o Asheville-April 22, 2005
- o Winston-Salem- June, 2006
- o Charlotte- Nov. 15, 2006
- o Hickory – Nov. 14, 2006

2. Why did you attend the workshop on conservation based developments? Check all that apply.

- o Personal interest
- o Part of your job
- o Continuing education credits
- o Other

3. What is your occupation or interest? Please choose only one.

- o City or town planner
- o County planner
- o Forester/land manager
- o Land planner/designer
- o Planning board member
- o Interested citizen
- o Developer
- o Conservation group
- o Land trust/ land protection group
- o Real estate
- o Private landowner
- o Other ___ please specify

4. Does your city or county have a planner who specializes in conservation planning?

- o Yes
- o No

- Don’t know

5. What percentage of the planning department’s time do you estimate is allocated to conservation planning efforts?

- 0%
- 1-25%
- 26-50%
- More than 50%
- Don’t know

6. Are conservation subdivisions currently allowed in your jurisdiction's zoning or development ordinances?

- Yes
- No
- Proposed, but not passed
- Don’t know

7. What township, city and/or county you primarily work in?

8. What is your perception of how home prices in conservation subdivisions compare to prices of similar sized homes in traditional lot-by-lot subdivisions?

- Homes in conservation subdivisions cost the same
- Homes in conservation subdivisions cost less
- Homes in conservation subdivisions cost more
- Don’t know

9. At the workshop, what was the most important information you learned about conservation subdivisions? (Open ended question).

10. Following the workshop, did you intend to share this information with others? If no, please skip to question 14.

- Yes
- No

11. With what groups or organizations did you attempt to share information from the workshop? Choose all that apply.

- Have not shared
- Developers
- Homeowners
- Planners

- o Elected officials
- o Realtors

12. Which groups or organizations did you find most receptive to information on conservation subdivisions? Choose all that apply.

- o Have not shared
- o Developers
- o Homeowners
- o Planners
- o Elected officials
- o Realtors
- o Other (please specify)

13. Please rate how workshop information was received by decision makers in your community.

	Did not share	Skeptical response	Lukewarm reception	Enthusiastic reception
A. Changing zoning or development ordinance to allow conservation subdivisions.				
B. Incorporating sketch plans into the planning process.				
C. Incorporating site visits into the planning process.				
D. Using case studies of successful implementation of conservation subdivisions.				
E. Using conservation easements in the long-term management of open space.				
F. Using mandatory conservation subdivisions to preserve water quality or maintain rural character.				
G. Providing developer incentives for conservation subdivisions				

14. Following the workshop, what was the most important information about conservation subdivisions you wanted to implement? (Open-ended question).

15. Please check the box in each row that best describes your community's actions related to implementing conservation subdivisions.

Coded for binary regression	Community won't try to implement Community tried unsuccessfully to implement	Community in process of implementing Community implemented successfully Community will try to implement in the future

A. Change local zoning or development ordinance to allow more flexibility for conservation subdivisions.
B. Incorporate sketch plans into the planning process.
C. Incorporate site visits into the planning process.
D. Providing incentives for developers to build conservation subdivisions.
E. Create mandatory conservation subdivisions in certain areas to maintain water quality or to preserve rural character.
F. Complete a conservation subdivision.
Other (please specify) or Additional Comments

16. If your community provides developer incentives for conservation subdivisions please list those here. (Open-ended response)

17. What do you view as the most significant barrier to implementing conservation subdivisions in your community? (Open-ended response)

18. Please rate the following potential barriers to implementing conservation subdivisions in your community.

Likert-scale question	Not a barrier	Minor barrier	Not certain	Moderate Barrier	Complete barrier	Other

A. Lack of demand from consumers for conservation subdivisions.
B. Long-term management of open space in conservation subdivisions.
C. Perception that conservation subdivisions are more expensive to build.
D. Smaller lot sizes associated with conservation subdivisions.
E. Reluctance of developers to submit sketch plans during the planning process.
F. Lack of interest on the part of planners to review sketch plans in the planning process.
G. Lack of model ordinance language to help develop a conservation subdivision ordinance.
H. Restrictive zoning.
I. Lack of interest by realtors to sell conservation subdivisions.
J. Lack of incentives to build conservation subdivisions.
K. Lack of interest from elected officials to changeordinances.
L. Lack of resources to rewrite ordinances to allow conservation subdivisions.
M. Lack of maps of potential conservation lands.
Other (please specify) or Additional Comments

19. Please check the box that best describes the availability and usefulness of each resource in implementing conservation subdivisions.

Likert-scale question	Not available, but would be useful	Available, but not used	Available, but not useful	Available, moderately useful	Available, extremely useful	Don't know

A. Case studies of communities that have successfully implemented conservation subdivisions.
B. Model ordinance language adaptable to your needs
C. Build out maps for the city or region.
D. Map of potential conservation lands to reference during planning stages of developments.
E. Incentives for developers to encourage conservation subdivisions.

20. Do you think conservation subdivisions are an appropriate tool to limit sprawl?
    - Yes
    - No
    - Don't know
21. What concerns do you have about conservation subdivisions? (open ended response)

22. Is there anything else you'd like to share with us? (open ended response)

North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina

Office of Research and Graduate Studies

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From: Debra Paxton, IRB Administrator
North Carolina State University
Institutional Review Board

Date: May 14, 2009

Project Title: Identifying barriers to conservation subdivisions in North Carolina

IRB#: 945-09-5

Dear Mr. Allen:

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 46.101.b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review.

NOTE:

1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days.

Please provide a copy of this letter to your faculty sponsor. Thank you.

Sincerely,

Deb Paxton
NCSU IRB