Who’s your neighbor? Adding resolution to rural land use change

*Exploring affects of fine-scale land ownership patterns in Down East, Carteret County, North Carolina on communities’ perceptions of land use change and development*

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ABSTRACT
Researchers at Duke University are working on a North Carolina Sea Grant project (R/BS-18): Changing Coastal Communities, Perspectives from Down East. The intent of this research is to better understand communities’ perceptions of land use change and development in eastern Carteret County, North Carolina. Building off this study, this paper seeks to expand our understanding by adding geospatial resolution to these data. My work is broken into two primary parts: (1) First, I develop a regional typology to describe the spatial composition of development across the landscape. (2) These data are then coupled with the study’s social survey data to examine the extent to which fine-scale patterns are tied to peoples’ attitudes. Results of this simple exercise highlight the heterogeneity that exists within rural landscapes and suggests that fine-scale ownership patterns affect peoples’ responses to land use change and development.

GOALS
(1) To describe fine-scale geospatial patterns of land ownership in Down East, Carteret County;
(2) To develop a framework that blends spatially explicate data with social data;
(3) To integrate the results of stage (1) with the study’s survey data using the framework developed in stage (2) as a way to discuss the interplay between attitudes towards change and space in the region;
(4) To add depth to our understanding of amenity migration;
(5) To provide meaningful commentary on the challenges, assumptions, and opportunities of GIS in social science research.
ACKNOWLEDGEMENTS

I would like to offer my gratitude to all those who have been instrumental in shaping this research and, more importantly, the last two years of my life:

To my family. Their support – even from afar – makes everything possible. To the people who call Down East home. I find their openness as refreshing as it is frustrating. To the Woodrow Wilson Foundation. I am forever grateful for their generosity. To my colleagues, and now friends. They deserver more than mere acknowledgement. I am especially indebted to those who have challenged my narrow views, added balance to my day, and loved (or at least tolerated) my enthusiasm – as overly optimistic as it may be. To the members of the Campbell lab. They have been the intellectual spark that has made this more than a credential. And finally, to Lisa Campbell. I am honored to call her my advisor. Without her support and guidance I wouldn’t have chased an idea.
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“It used to be that everyone was connected to each other, and now it is diluted.”

~ Survey participant, 2009

One traditional home, two new homes.
INTRODUCTION

“A lot of people have sold their land on Harkers Island and moved to the mainland because land is cheaper here. For instance, my husband and I bought grannies house in Marshallberg. We could not afford to buy my grandmother’s house on Harkers Island because it was on the water. The economics are totally different. A lot of people say, ‘Well, it’s just not Harkers Island anymore.’ They don’t feel like they’ve left Harkers Island, Harkers Island has left them.”

~ Survey Participant, 2009

Land ownership represents more than a simple distribution of people. “It is an indicator,” writes Shumway (2001), “and often an instigator of a wider range of economic, social, cultural, political, and environmental transformations” (p. 492).

I use this observation as the starting point for my research. The study of rural land ownership, viewed through Shumway’s lens, represents an opportunity to deepen our understanding of the complexity and dynamics of rural communities. I am interested, broadly, in rural land ownership patterns and in the relationship(s) between spatial arrangements of ownership/exurban development and people’s attitudes towards change. More specifically, I am interested in the extent to which people’s attitudes are linked to spatial configurations (e.g. patches, clusters, adjacency, etc) of locally and non-locally owned land. At the root of this interest is a string of simple questions: Is the scale and/or resolution at which we examine rural change important? Are peoples’ attitudes affected by development at the parcel, township, or regional scale? Does the geographic arrangement of parcels themselves (i.e. where they are located within and across the landscape) matter? Can we treat ownership (local versus in-migrant) as a binary factor
(present or absent) associated with rural transformation, or, by adding a spatial dimension to our analysis, can we build a more revealing picture that more accurately describes local discourses?

Using these questions as the motivation for my research, this project examines the spatial relationship between local and in-migrant land ownership in eastern North Carolina and the spatial adjacencies between the two. The intent of this work is to better understand the relationship between land ownership patterns and people’s attitudes towards land use change and development? To explore this question I take a mixed-methods approach, combining geospatial data with social survey data. Here, I develop a set of geospatial tools (using ESRI’s Arc GIS) that transform standard county-level tax data into ‘ownership’ maps that define clusters of locally owned land and the proportion of land owned by in-migrants adjacent to each locally owned parcel. I then use these layers to build a typology that describes the landscape in terms of ‘exurban’ development. The methods and results of this process are described in this paper and have been merged with social survey data collected over the course of the past two years. Together these results provide the basis for an engaging discussion about the affects of land ownership patterns on perceptions of land use and development and on the complexity of heterogeneous landscapes. These data, and the process of integrating them, also provide a platform to reflect on the challenges and opportunities of applying geospatial tools (and its associated data) to social science research.

This paper is situated within the study of rural land use change and is most relevant to the growing body of literature that focuses on amenity migration. Though admittedly conceptual, this paper hopes to have practical relevance to community
organizers and planners. My work aims to inform/reform thinking about rural development strategies at the local level by way of highlighting the importance of fine-scale spatial planning and the bearing it may have on community dynamics. Adding spatial resolution to our understanding of rural change is particularly useful in terms of how we talk about ‘conflict’ and ‘community.’ By defining the heterogeneity of the rural landscape (and its development patterns), we can more accurately articulate how and why conflicts arise, exist, and persist. This comes at an especially important point in time when the pace of development has been muted by the economic downturn, the conflict between local and newcomers has been temporarily tempered, and there is an opportunity for rural communities to envision and develop forward-looking strategies for the future.

I have divided this paper into five sections. The first section provides a short literary review of amenity migration and, to some extent, the broader ‘rural change’ literature. This overview provides context and serves as justification for this work. The remainder of this paper is structured traditionally, and includes a methods section along with results, discussion, and a conclusion.
CONTEXT: RURAL CHANGE

1. Amenity migration: change, conflict, simplification

The demographic face of rural communities across the United States has undergone a substantive transformation in the past three decades as a result of complex social, economic, and political conditions at play (Dillman 1979; Brown 2005). The influx of new settlers (and the panoply of ecological, social, cultural, economic, and political complexities associated with it) has attracted the attention of a wide variety of academic interests, spanning a range of disciplines and sub-disciplines. Within the so-called rural change literature, academics have recently produced a semi-structured body of writing that explores the social implications of this evolution.

Much of the research to date deals with demographic change through the lens of two key concepts: amenity migration and exurban development (or exurbia) and ‘exurbanites.’ Amenity migration, as defined Gosnell and Abrams (2009) is “the movement of people based on the draw of natural and/or cultural amenities” (p. NA) (2009). Exurbanites, plainly stated, are the migrants themselves. These are the individuals who “purchas[e] primary or second residences in rural areas valued for their aesthetic, recreational, and other consumption-oriented use values” (p. 131) (2008). Though both terms have been critiqued for their ambiguity (Nelson 2009; Taylor 2009), Taylor 2009 insists that the terms remain “a powerful conceptual approach to capture and discuss the complex processes producing this phenomenon [e.g. demographic change]” (p. NA).

It is within this general body of literature – that is,amenity migration and exurban development – that this paper takes root. A common theme that weaves through the
amenity migration/exurbia literature is the notion of conflict associated with the arrival and assimilation of in-migrants. Jones et al. 2003, for instance, describe implications of “green migration” (i.e. the arrival of ‘environmentally conscious’ newcomers). They assert that the greening of rural attitudes does not reflect a wholesale shift in rural communities’ perceptions of environmental issues, but instead, reflects a shift in the actual character and demographic composition of rural communities themselves (i.e. the influx of exurbanites). Exurban in-migrants, they argue, have unrealistic expectations about living in rural places, and “their unfulfilled dreams can quickly turn into nightmares that can impact their own quality of life and the lives of other rural residents” (p. 222). Walker and Fortmann (2003) and Duane (2000) also discuss conflict, describing it in terms of “competition between competing forms of rural capitalism” in the Sierra Nevada. Nesbitt and Weiner (2001) and Jarosz and Lawson (2002) also address conflict, treating it as the manifestation of social inequalities between locals and outsiders. Though conflict is theorized differently, the concept itself is a persistent theme that appears and reappears through the amenity migration literature (also see Smith and Krannich 2000, Hunter et al 2005, and Lichtenstein 2004 for other examples).

This paper does not doubt the notion of conflict itself, but rather challenges its binary treatment (i.e. presence or absence) within the literature. Though existing research provides meaningful insight about amenity migration and its associated conflict/tension, little consideration has been given to the significance of fine-scale distribution patterns and how they influence communities’ attitudes towards exurban development. The amenity migration literature is saturated in spatially explicit language (e.g. “shifts in populations” and “changing growth patterns”), yet the physical landscape remains largely
ignored by being treated as a homogenous field decoupled from meaning. This raises an important question: is conflict directly linked to in-migration and development, or is the correlation between the two influenced by the spatial configuration of exurban development? In other words, is conflict simply the result of exurban in-migration and development, or is it partly a matter of where and to what extent development occurs.

Beyers and Nelson (2000) write about this issue in terms of scale: “the complexity of development processes [are] not readily apparent from a macro level approach” (p. 460). Others have also written about oversimplification in terms of rural land use data specifically. “In light of explosive growth … it is striking how little is known about the explicit spatial configuration of exurban settlement” (p. 178) (Clark 2009). I find these observations quite salient. Despite a general consensus that rural land use change is linked to conflict, little has been done to interrogate the evolution or intricacies of the conflict. To understand why attitudes towards change and development emerge and persist, it seems intuitive that we acknowledge that development and change are not uniform across space and that the spatial relationship between land owners may well have a bearing on how conflicts and attitudes about land use, development, and the environment unfold. I argue that a scaling downwards is necessary to effectively theorize about the conflict in rural landscapes. By adding spatial resolution we can learn more about how and why conflict occurs, and in doing so we may gain new insight about how communities function.

Placing amenity migration: considering the spatial context
The goal of this paper is to go beyond prior, more aggregate descriptions of the conflict associated with amenity migration, and instead focus explicitly on the relationship between local residents’ perceptions of land use change and the spatial configuration of land ownership. I argue that examining the fine-scale heterogeneity of ownership and development patterns provides a framework through which the complexity and spatial context of conflict can be revealed. My work, in part, offers a response to Walker’s (2009) critique of the existing amenity migration literature. “To some degree,” he writes, “our methodologies of examining rural residential exurban land use fall along the lines of either geospatial representation, through GIS, or ethnographic research” (p. NA). I find his point particularly well founded. Looking across disciplines, we see two primary approaches to rural land use change and development – one which focuses on landscape ecology and spatial analysis and the other which focuses on social and cultural complexities (Table 1). Few, if any, however, seek to merge these methodologies in a way that adds depth to our understanding of these issues.

One of the barriers to merging methodologies is the resolution of data. Kevin St. Martin (2008) uses the term ‘missing layer’ to describe the absence of spatially-relevant human data. My experience working with county-level tax data enforces his assertion. These data are not particularly conducive for spatially and/or temporally sensitive analysis. Others who have also worked with these data echo this view (Knapp 1989; Compas 2007; Clark 2009). As Clark (2009) notes, “Despite pervasive exurban development in the United States (US) over the last several decades, a lack of relatively precise data has hindered basic research” (p. 178).
With advancements in technology and growing interest in interdisciplinary research, however, the barriers that have impeded mixed-method approaches are becoming obsolete. Taylor (2009) writes, the “task for exurbia studies is raised through amenity migration and is to investigate the impact of cultural preferences for natural landscapes and power relations manifest through landscape” (p. NA). To do this, there is need for intentionally designed. Taylor (2009), again, writes we should “utilize not just the spatial analysis, not just the motivations of exurbanites, and not just the ecological impacts wrought by their decisions but an intersection of these and more” (p. NA). It is within this context that this paper seeks to describe the heterogeneity of the rural landscape and explore the bearing it has on peoples’ perceptions of land use change and development.
Table 1. Growing interest, varying approaches: An overview of the 'rural change' literature

This table is not meant to be a comprehensive review of the ‘rural change’ literature, but instead, it is intended to provide a concise overview of the broad range of literature that focuses on this material.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Key Words</th>
<th>Method(s)</th>
<th>Précis</th>
<th>Primary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Clark 2009)</td>
<td>Exurban, Peri-urban, Landscape pattern, Decentralization</td>
<td>GIS Analysis</td>
<td>This paper uses geospatial tools to examine the extent and configuration(s) of exurban development across the US. Results suggest that &quot;the processes that lead to isolated and dispersed exurban settlement may be different from those that foster contiguous, concentrated exurban settlement&quot; (p. 178).</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td>Bureau of Census 2003 Metropolitan Statistical Areas</td>
</tr>
<tr>
<td>(Compas 2007)</td>
<td>Landscape metrics, Land subdivision, Rural residential development, Fragmentation, Landscape planning</td>
<td>GIS Analysis</td>
<td>This paper compares development patterns in rural Montana in an effort to better understand the effectiveness of regional planning. The author of this paper approaches this issue from an ecological perspective: &quot;Dispersed patterns of rapid rural, or 'exurban,' growth in the American West are recognized as key threats to the region's biodiversity through habitat loss and fragmentation&quot; (p. 56).</td>
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<td></td>
<td>County Parcel &amp; Road data; Digital Orthophoto Quarter Quadrangles (DOQQs)</td>
</tr>
<tr>
<td>(Shumway 2001)</td>
<td>Environmental amenities, Income migration, New West</td>
<td>GIS Analysis</td>
<td>Authors of this paper “address questions associated with whether patterns of population growth and income migration are associated with ‘new’ and ‘old’ West economies” (p. 492).</td>
<td>U.S Census Bureau</td>
</tr>
</tbody>
</table>
Table 1. (cont.)

<table>
<thead>
<tr>
<th>(Gosnell 2005)</th>
<th>Ranch sales, landowner typology, amenity buyer, ownership transition</th>
<th>Parcel Analysis, Semi-structured Interviews</th>
<th>Authors of this paper examine land ownership and ranch land sales as a framework to discuss rural change (e.g. amenity migration. The paper shows &quot;a significant ranchland ownership transition to a new type of owner is, indeed, underway&quot; (p. 191).</th>
<th>State Parcel data</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Nesbitt 2001)</td>
<td>Political ecology, Environmental politics, Environmental History, Participation</td>
<td>Semi-structured Interviews</td>
<td>Rooted in political ecology, this article examines the &quot;conflict that has flared between local land owners who view natural resources as a means for social reproduction and cultural survival, and government and environmental 'outsiders' who view local environmental resources in the context of recreational consumption&quot; (p. 333).</td>
<td>Participant observation and experiential transect walks; Discussion sessions and semi-structured interviews; County Parcel data</td>
</tr>
<tr>
<td>(Walker and Fortmann 2003)</td>
<td>Exurban, Cultural friction, Political ecology</td>
<td>Document Analysis</td>
<td>This paper describes the tensions between 'traditional' communities and 'newcomers.' Their work underscores the &quot;competition between different forms of rural capitalism, class conflict and social control, and cultural friction&quot; (p. 469).</td>
<td>County Planning document</td>
</tr>
</tbody>
</table>
METHODS

1. Study Area

This paper explores the affects of development configurations on individuals’ attitudes towards land use change and development. I use the eastern section of Carteret County, North Carolina (known locally as Down East) as a case study for my analysis. Down East (1,347 km²) is composed of nine low-lying, coastal townships east of the North River Bridge (Figure 1) and is made up by approximately 9,300 individual parcels. Of the nine townships, Harkers Island has undergone the most obvious transformation (Figure 2). The island’s proximity to North Carolina’s urban centers and its adjacency to Core Sound make it both accessible and aesthetically desirable to in-migrants. Here, the largest developments and most striking contrasts between ‘traditional’ and ‘exurban’ development can be observed. The communities of Marshallberg, Davis, Sea Level, and Atlantic have also experienced exurban development, but not to the same extent as Harkers Island. Though these communities are also adjacent to Core Sound, they are slightly further from North Carolina’s urban centers and lack the name recognition associated with Harkers Island. Cedar Island, like Harkers Island, has high amenity value, but it is far more isolated. Smyrna and Straits are more accessible than Harkers Island, but have less aesthetic value because they are not adjacent to the water. Collectively, these communities are comprised of a mix of residential development, small-scale businesses (e.g. boat yards, mechanic/gas stations, and seafood retailers), agricultural land, and undeveloped forest, grassland, and estuarine marsh. Approximately 18.9% of Down East is owned by federal or state government (e.g. US Fish & Wildlife Service: Cedar Island National Wildlife Refuge), 54.9% is owned by local residents, 15.3% is
owned North Carolina residents (outside Carteret County), and 10.7% is owned by out-of-state residents (County 2008).

**Figure 1: Down East, North Carolina**

![Map of Down East, North Carolina](image)

Figure 1. (Left) Research site relative to North Carolina. (Right) Dark gray area depicts Down East within Carteret County, North Carolina.

**Figure 2. Ownership distribution by Township**

![Map showing ownership distribution by township](image)

Figure 2. Graphic representation of the proportion of parcels owned by exurban residents by township.
2. Survey: Attitudes towards change

Two primary sets of data formed the basis of my analysis. To capture community members’ perceptions of land use change and development in Down East, North Carolina 20% of land owners were surveyed during the summer of 2008. This effort was part of a North Carolina State Sea Grant funded project (R/BS-18), Changing Coastal Communities: Perspectives from Down East. The survey was designed as a random, geographically stratified survey, and was administered in-person and via mail. Each township was weighted by the proportion of the total population. Survey participants were asked a series of likert-scale and open-ended questions about: (A) their communities; (B) their connections to the landscape/culture/people; (C) the local land use planning process; (D) and their opinions about growth and real-estate development. Survey methods are described at length by Bouquey et al (forthcoming). For the purpose of this work, only likert-scale responses were utilized. These questions were used (rather than then the open-ended questions) because they could be integrated with the spatial data and they are easily analyzed using statistical methods.

3. GIS Analysis: Determining landscape composition

To define development patterns, I utilized 2008 Carteret County tax assessor parcel data (the same data used to randomly select survey participants) (2008; County 2008). The county’s parcel layer, containing approximately 60,000 polygons, represents each parcel and includes attributes indicating area and ownership. Prior to analysis, parcels and their attributes where checked for inconsistencies, and several features were edited to correct for incorrect labeling and/or misspelling.
3.1 Typology: Defining development patterns Down East

Using Carteret County parcel data, I developed a spatial typology to describe the fine-scale composition and statistical heterogeneity of development in Down East, North Carolina. A typology, like an index, is a system of grouping in which classes and/or ‘types’ are defined by a unique attribute or set of attributes. Individual types may represent one attribute or several and need only include those features that are relevant to the problem at hand. The typology developed here, is meant to capture the spectrum of development – from rural to ‘exurban’ – that exists within the county (Figure 3).

The ‘development’ typography incorporated three principal attributes: (1) contiguity, (2) parcel area, and (3) percent adjacency. I defined contiguity as the spatial connectedness of parcels (Figure 4). Locally owned parcels that border exurban parcels (e.g. parcels that are owned by a resident outside the county) were classified as “contiguous,” those which don’t were classified as “isolated.” Contiguity can also be understood in terms of spatial clustering. Clark et al. (2009) developed a typology that includes clusters (e.g. groups of low density census blocks isolated from areas of higher density) to quantify and describe the total area and general configuration of exurban development across the US. Here, isolated parcels are essentially equivalent to clusters of low density census blocks. I defined parcel area as either small or large relative to the county’s median parcel size. I included the size as an attribute because parcel area is thought to be an indicator or rural transformation (i.e. as development increases, parcel size decreases) (Berube 2006) The third and final attribute included in the typology is adjacency. I defined percent adjacency as the proportion of a parcel bordering land owned by an exurban resident who resides outside the county (Figure 5b). Simply put,
percent adjacency can be understood as the ‘encroachment fact.’ Parcels with high adjacency values are surrounded by exurban development.
### Development Typology

#### Table: % Adjacency (ADJ)

<table>
<thead>
<tr>
<th>CON</th>
<th>PAR</th>
<th>ADJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated</td>
<td></td>
<td>1 2 3</td>
</tr>
<tr>
<td>Contiguous</td>
<td></td>
<td>4 5 6</td>
</tr>
<tr>
<td></td>
<td>7 8 9</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>10 11 12</td>
<td>Small</td>
</tr>
</tbody>
</table>

**Note:** Direction of arrow corresponds to an increase in rural development.

### Typology Description

#### Contiguity
- **Isolated:** A parcel that does **not** share a boundary with another parcel that is owned by an ‘exurbanite.’
- **Contiguous:** A parcel that shares a boundary with another parcel that is owned by an ‘exurbanite.’

#### % Adjacency
- Low < 5%
- Medium < 50%
- High > 50%

#### Parcel Area
- Size classification (Large or Small) of a given parcel was defined by median area.
3.2 Building a GIS Model: Data processing

The process of categorizing parcels by contiguity and adjacency deserves some explanation since I am unaware of prior research taking this approach. Using Arc Map 9.3, I built a simple three part toolbox that allows users to convert standard tax assessor parcel data (a commonly available source of data) into ‘ownership’ maps that describe contiguity and adjacency of each parcel.

The first section of the toolbox serves as the preparatory stage in readying county-level data for analysis. Raw data are input into the model and individual parcels are classified binaurally as either locally owned or exurban owned. Ownership classification itself is based on the mailing zip code associated with each parcel. Here, the assumption is that zip codes represent land owners’ actual residency. The second tool in the toolbox identifies the clustering/contiguity of parcels. To define clustering, the tool cycles through each parcel, looking at the ownership of each adjacent parcel. Parcels that do not border exurban owned parcels are classified as clusters (Figure 4). Road polygons were an obstacle in this process. When the model searched for adjacent parcels, it would include adjacent roads anytime a parcel shared its boundary. To avoid this problem (since I was interested in defining the adjacency of parcels and not roads, and I want to include parcels that were adjacent to one another, but intersected by a road) I removed all road polygons and applied a buffer to each parcel and then intersected each buffer with a parcels surrounding parcels. In doing so, I was able to exclude all roads and include all adjacent parcels (including parcels separated by roads) (Figure 5a). The final tool in the toolbox calculates the relative proportion of adjacency by calculating the ratio of exurban
land bordering local parcels relative to total adjacency (Figure 5b). Collectively, these tools were used to glean data that I then incorporated into the ‘development’ typology.

**Figure 4. Defining Contiguity**

Example 1. Isolated

Example 2. Contiguous

- Isolated parcel cluster
- Exurban ownership
- Local ownership

**Figure 4.** Each locally owned parcel was examined to see if it was bordered by an exurban parcel. Those that were, were defined as ‘contiguous,’ those that were not (Example 1) were defined as ‘isolated.’
Figure 5a. Defining Adjacency

To identify parcels separated by roads (but technically adjacent), a narrow buffer was applied to each parcel. Buffers were then used to define parcel adjacency.

Figure 5b. Defining Proportion Adjacent

Proportion of adjacency was defined as the ratio of exurban ownership to total ownership bordering a given parcel. The simplified diagram above shows four sceneries ranging from 25% adjacency to 100% adjacency.
4. Making the Link: Merging spatial with social

To explore the statistical relationship(s) between development composition and peoples’ perceptions of land use change and development, survey results were linked to the typology data. I was able to link these data sets (i.e. match the individual parcels and typology scores with survey results) because survey participants were initially identified from the parcel data. Mapping surveys onto the typology gave the data explicit spatial context (e.g. an exact location relative to other survey respondents and within the landscape at large).

To test for statistically significant relationships, I conducted a series of one-way ANOVAs and pairwise comparisons. I conducted these analyses at two-scales. First, I tested for statistical heterogeneity between respondents using township as a framework for classification. I then grouped townships by statistically relevant ‘typology’ groups to increase sample size (and reduce standard deviation). These groups emerged from the analysis of the development typology and are discussed in more detail in the results section. Though grouping the data by region limited my ability to examine fine-scale correlations between survey responses and typology, they were useful because they provided sufficient sample sizes to conduct statistical analysis.
RESULTS

1. Mapping the development patterns of Down East

Mapping the configuration of development in eastern Carteret County (2008) underscores the heterogeneity that exists within the region. The map below depicts the three-way ‘development’ typology of Down East and captures the variability of development visually at the parcel level. It shows that some areas remain relatively rural (e.g. with large parcel size, isolated clusters, and low levels of encroachment), while others appear substantially more built (Figure 6a-6b). The map indicates that the central region of Down East is far less developed than its periphery. This is consistent with existing knowledge of the area; nearly fifty thousand acres of central Down East is owned by Open Grounds Farm, one of the largest farms east of the Mississippi River.

The statistical analysis of the typology reaffirms the region’s heterogeneity. Data shows that the mean typology of townships varies significantly (p < 0.01), highlighting the irregularity of development across space. The graph figured here shows pairwise comparisons of typology scores between each township (Figure 7). These comparisons offer several meaningful results that underscore the fine-scale heterogeneity. First, we see that 56% percent (20 of 36) of the pairwise comparisons are statistically significant. Mean values ranges from a high of 9.8 (Harkers Island) to a low of 6.5 (Cedar Island). Second, three clear groups emerge from this analysis (Figure 8). Harkers Island forms the first group. Harkers Island’s mean typology is statistically higher than any other township. Marshallberg, Davis, Sea Level, and Atlantic form a second, middle group with less development. The third and least developed group is made up by Smyrna,
Straits, and Cedar Island. Stacy is the only township that does not definitively fit within a single group, but rather fits into two groups (two and three).

**Figure 6a. Development Typology: Down East, North Carolina**

Figure 6a. The natural neighbor interpolation above depicts the configuration of development in Down East, North Carolina based on the typology developed in this paper (n = 5,570). The areas of red reflect zones of exurban development, while those in green denote rural development.
Figure 6b. Development Typology: Down East, North Carolina (cont’)

Figure 6b. FOCUS AREAS. The natural neighbor interpolation above depicts the configuration of development in two contrasting townships. The areas of red reflect zones of exurban development, while those in green denote rural development.
Figure 7. The graph above is a pairwise comparison of mean typology between townships. Pairs that do not cross the dotted zero line are statistically different (p < 0.05) from each other. The greatest observed difference in development typology is between Harkers Island and Cedar Island.
Figure 8. Typology Groupings

Figure 8. Pairwise comparison of mean typology indicates three groups of communities, each with statistically disparate levels of development.

2. *The link between landscape and attitude*

The statistical variation between townships was used as a starting point to explore how peoples’ attitudes towards land use change and development are affected by patterns of development. To examine these relationships, I conducted a series of ANOVAs to test the correlation between townships’ mean typology and survey responses (i.e. peoples’ attitudes towards land use change and development). A number of ANOVAs were statistically significant (p < 0.05), but significance was lost when pairwise comparisons were conducted in an attempt to tease out more meaningful results. The loss of statistical
significance can be associated with the data itself. Dividing survey results by township, resulted in small sample sizes and greater statistical uncertainty.

To compensate for this shortcoming, I grouped townships into regional typology group (aggregating upwards). The new groupings were based on mean typology value; statistically similar townships were grouped. The graph below shows participants’ mean response to a series of likert-scale questions related to their connection to community, their attitudes towards preserving the environment, culture, and heritage, and their opinions about property rights for each of the three typology groups. These data indicate a decline in peoples’ connection to the community (Q2 & Q3) and reduced support for individual property rights (Q4 & Q1) as development increases. They also suggest that individuals show less concern for preserving the cultural and environmental integrity of the landscape as development increases (Figure 9).

Pairwise comparisons between typology groups were then conducted to test the statistical significance of these trends. These analyses indicate that all three groups are statistically significant, and that mean survey responses vary between groups (Table 2).
Figure 9. The mean response to six likert-scale questions within the three typology groups (low, medium, and high). Survey responses are negatively correlated with positive responses such that low values (1) indicate ‘strong’ agreement and high values (5) indicate ‘strong’ opposition.
Table 2. Pairwise comparison of Township Groups

<table>
<thead>
<tr>
<th>Survey Question(s)</th>
<th>Township Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium (G2) – Low (G3)</td>
</tr>
<tr>
<td>I feel connected because my family has been here a long time (Q2)</td>
<td>Y</td>
</tr>
<tr>
<td>An individual should be able to do whatever he/she wants with his/her property (Q4)</td>
<td>N</td>
</tr>
<tr>
<td>Should Down East focus on preserving the environment (Q5)</td>
<td>N</td>
</tr>
<tr>
<td>Should Down East focus on preserving culture &amp; heritage (Q6)</td>
<td>N</td>
</tr>
<tr>
<td>I value freedom to do what I want on my property (Q1)</td>
<td>N</td>
</tr>
<tr>
<td>I am part of the community here (Q3)</td>
<td>N</td>
</tr>
</tbody>
</table>

Table 2. Statistically significant differences between typology groups and attitudes towards land use change and development.
DISCUSSION

The results of these analyses can be discussed on a number of levels. Here, I focus on three key points: (1) the heterogeneity of rural development; (2) the link between place and attitude; and (3) the implications for land use planning.

1. The heterogeneity of rural development

The results of this work capture the heterogeneity of development in Down East, Carteret County at multiple scales of aggregation – from parcel to regional (multi-community) typology groups. In some areas, exurban development appears to be pervasive. In other places, development has formed uneven patches. The statistical variability observed across the landscape challenges existing assumptions of rural homogeneity. Challenging this assumption, I believe, is particularly important in terms of how we discuss the notion of conflict associated with rural development and change. By acknowledging the complexity of geospatial development patterns within the rural landscape we can refine our analyses. This is an opportunity to replace the commonly held binary (i.e. the idea that conflict is simply the result of exurban in-migration) with a more nuanced view that integrates where and to what extent development occurs.

This gets back to the title of this paper: Who’s your Neighbor? By adding detailed, geospatial relevant, social data to the discussion of rural conflict, we are poised to better understand the origin of these tensions. This approach provides a way to interrogate the scales and intensity at which development patterns prompt clashes between ontologically dissimilar groups (i.e. locals and exurbanites). In doing so, we can ask: Are individuals’ attitudes towards development and land use change affected by
regional development, community-scale development, or the fine-scale development that occurs in their back yard?

2. **A link between place and attitude**

Examining the relationship between development patterns and peoples’ attitudes towards change was limited by the sampling design of the survey (which initially ignored the geospatial distribution of survey participants). The analysis was most limited at the fine-scale (i.e. parcel level) due to the survey’s sample size. Despite this shortcoming, the analysis of typology groups produced interesting results. Results indicate that the composition of development – particularly at the regional (multi-community) level – affects peoples’ attitudes towards change. Though it is unclear what scale of development affects peoples’ attitudes most (i.e. parcel, community, or region), the analyses clearly illustrate a connection between place and perception.

3. **Implications for land use planning**

Planned development is not unusual. Planning schemes designed to minimize environmental impacts (e.g. storm water runoff, habitat fragmentation, etc) are an integral component of contemporary development. Land use planning (via zoning) is equally common, though seemingly less relevant in the rural landscape (since formal zoning does not generally occur). Despite the prevalence of environmental planning, however, existing planning efforts do little to assuage social/human tensions.

The research presented here reveals a quantifiable correlation between development patterns and attitudes towards change. These findings suggest that the geospatial composition of development affects peoples’ attitudes just as it alters the physical contours and/or hydrology of the landscape. Recognizing the social implications
of rural development, to some extent, changes the scope of planning. If we acknowledge that the impacts of development are not just ecological in nature, but ecological and social, than it seems clear that planning efforts ought to design rural development in a way that is both ecologically and socially sensitive.
CONCLUSION

There is growing interest in amenity migration, both from a biological and socio-cultural perspective. Ecologically, exurban development is linked to issues of water quality decline, changes in species composition, and altered habitat connectivity (Newburn 2006). Socially and culturally, it is associated with conflict between divergent views of landscape (Walker 2003). As the allure of the rural imaginary continues to attract people to these places, ecological and social conflicts seem nearly immanent.

To assuage future conflict (both ecological and social), there is growing recognition that interdisciplinary research is necessary. Results from this study show that a mixed-methods approach may offer useful insight. There are, however, several challenges that deserve consideration. Here, I offer three points:

1. *The ‘missing layer’*

   Kevin St. Martin uses the term ‘missing layer’ to describe the scarcity of spatially-relevant social data. My experience working with county-level tax data enforces his assertion. These data are not particularly well suited for spatially and/or temporally sensitive analyses.

2. *Intentional design*

   Funding for the project *Changing coastal communities: perspectives from Down East* included a research assistantship for a graduate student to assist with geospatial analysis. This money could have been better spent had spatial variables been intentionally integrated into the design of the social survey from the beginning. Treating the survey
and the geospatial analysis as distinctly different, compromised our ability to fully explore the interplay between people’s attitudes and the geospatial context. Integrating the two would not necessarily be difficult, but would have required preliminary spatial exploration and planning.

3. Can the binary be broken?

Political ecologists argue that systems of classification are often flawed in that they create discrete categories that obscure actual and/or existing continuums. I find this argument compelling, yet hard to escape. This work was motivated, in part, by a desire to challenge existing orthodoxies about perceived binaries between ‘local’ peoples and ‘newcomers.’ The narrative that exists in the literature, which I discuss above, goes like this: (1) local people are living in a rural place; (2) exurban settlers arrive; (3) the influx of newcomers leads to tension. My research attempts to integrate fine-scale spatial data into the folds of this discourse, in an effort modestly question the simplicity of this logic. Specifically, I use these data to draw attention to binary logic that suggests that tension is the result of in-migration (e.g. presence = tension; absence = no tension). Alternatively, I argue that tensions and/or attitudes towards land use and development are, at least in part, affected by where and how development occurs in the landscape and, in general, by the heterogeneous variability that exists at fine-scale resolution. The irony in doing this, of course, is that I base this argument on a second, equally narrow binary distinction. My research utilizes ownership data, which is in and of itself is a binary distinction (e.g. local versus newcomer). I use these data because they are the best available data to do a community-scale analysis, but I fully recognize that there is tremendous various within and between newcomers, and that their interactions with local residents likely varies.
widely. As such, I find myself facing somewhat of a paradox: this work, I believe, challenges one binary orthodox, by embracing another.
WORK SITED


APPENDIX I. GIS Model (A): Defining Parcel Ownership
APPENDIX I. GIS Model (B): Defining Parcel Clustering
APPENDIX I. GIS Model (C): Defining Proportion adjacency
APPENDIX II.

Proportion Adjacency

- 0 - 12
- 13 - 32
- 33 - 52
- 53 - 78
- 79 - 100
- Exurbanite Ownership

Straits

Harkers Island