CHAPTER 1 STUDYING URBAN SPRAWL IN NEW JERSEY

I. Introduction

Urban Sprawl: Shadow of the American Dream

Urban sprawl has become one of the most important issues facing many regions through the United States and the world at the onset of the twenty-first century. Housing developments and shopping malls infringe on lands that were formerly farm fields and forests (Figure 1-1). This urbanization is dramatically changing the physical as well as socioeconomic landscape with significant implications for quality of life, wildlife habitat, water quality, agricultural viability, taxation, and social equity and many other issues. While many landscape changes attributable to suburbanization such as spreading developments and diminishing farmland are evident to most, understanding these changes poses a significant challenge to land researchers, managers and planners. How fast and in what ways do landscapes change?

Even more challenging is quantifying landscape change in a manner that might provide meaningful insight into the development process. Are some forms of urbanization more problematic than other forms? Does something called "urban sprawl" really exist or is it just simply the same urbanization process that has been occurring for thousands of years? Perhaps sprawl is a more subjective term where one person's sprawl is another's "American dream"? If urban sprawl is something different, how does one decide which development is "sprawl" and which is "not sprawl"? At what scale is analysis of sprawl most meaningful; the development tract, the locality, the region or the state? How is sprawl different from one town to the next? From major subdivisions to minor subdivisions? From sewered areas versus non-sewered areas? Within different planning areas of a state plan?

If urban sprawl is indeed a uniquely distinguishable form of urbanization, the next question to be asked is "so what?" Isn't development an indicator of progress and economic growth? Isn't a larger house on a larger lot the essence of the American Dream? Or is there a dark side to the sprawling urban growth patterns that is a cause for serious concern? Is sprawl somehow more problematic, inefficient or dysfunctional than "not sprawl"? How can the problematic characteristics of sprawl be meaningfully quantified and potentially minimized? These are the questions upon which the following body of research attempts to shed light.

Figure 1-1 *Sprawling subdivision on a former peach orchard near Mullica Hill, Gloucester County, New Jersey. The negative consequences of sprawl have become an important issue for many communities in New Jersey.*

II. New Jersey as a Case-Study for Sprawl

The "Garden State", the state nickname of the nation's most densely populated state, seems to be an oxymoron for the stereotype many have of New Jersey. To those unfamiliar with the state, New Jersey seems to epitomize urban sprawl, conjuring the image of shopping malls, highways,

industrial complexes and residential subdivisions. But the New Jersey landscape is much richer than its reputation suggests - containing more ecological and environmental diversity within its relatively small area than many other states much larger in size. The garden state still enjoys remarkably intact natural resources including the globally significant Pine Barrens, hundreds of thousands of acres of forest and wetlands on the Atlantic Flyway, the environmentally sensitive highlands and hundreds of miles of coastal and estuary ecosystems.

As one of the wealthiest states in the nation situated in the heart of the northeastern American core, New Jersey's social and economic landscape is equally as complex and dynamic as its environmental landscape. Tourism and agriculture which are dependant on New Jersey's distinct natural resources are the second and third most significant sectors of the economy. The state's historical significance and rich cultural diversity make it a microcosm of country as a whole. While New Jersey is indeed challenged to deal with its rapidly changing landscape, particularly issues related to land use and land protection, the urgency of sound land management for the state is due to the value of what can still be lost. The New Jersey landscape may be more analogous to a managed garden than its "urban sprawl" reputation might have one believe. New Jersey's struggle with the complexities of urban sprawl and land management put it among the forefront of states striving to innovate land planning solutions and open space preservation (APA 1999).

This setting makes New Jersey an excellent case study for urban sprawl. From a research perspective, New Jersey also has excellent data resources available for geospatial analysis. Over the past several decades federal, state, county and local agencies as well as non-profit and private agencies have developed a rich data base of environmental and socioeconomic geospatial data. The most important data source employed in this research is the New Jersey DEP land use/land cover digital database, which contains detailed land use change information for the period of

1986 to 1995. This data set provides a unique window into the landscape changes that have been occurring in the Garden State at the end of the twentieth century.

The changes revealed in the data set are remarkable. Every year New Jersey adds nearly 16,600 acres of new development while losing more than 9,600 acres of farmland, 4,200 acres of forest, and 2,600 acres of wetlands. Impervious surface is being created at the rate of 4,200 acres per year. The net new land developed during the nine year 1986 to 1995 period of this analysis was 135,764 acres, an area equal to the total land area of New Jersey's Union and Essex counties combined. Put on a more comprehensible scale, the daily urban growth rate in New Jersey was equivalent to adding 41 football fields worth of new urban land every day while losing 20 football fields of farmland, 9 football fields of forest and 6 football fields of wetlands. Impervious surface was created at the rate of 9 football fields worth of coverage per day. The pressures that suburbanization are imposing on the landscape have far reaching implications. In all likelihood, New Jersey is on-track to become the first state in the nation to reach build-out.

Forces Driving NJ's Pattern of Growth

Many factors are responsible for driving the type of growth that is occurring in New Jersey. Some of the more significant variables include: 1) strong home-rule over zoning issues for municipalities, 2) a municipal tax structure that encourages the pursuit of high ratable land uses, 3) a robust economy spurring housing upgrades, 4) geographic proximity of New Jersey to Philadelphia and New York, 5) a highway network spanning the state, 6) strong property rights and anti-planning ideology, and 7) a historical legacy in which patterns of urban and suburban development began long before systems of land management matured.

New Jersey's persistent urban growth is largely a result of its historical and contemporary geographical setting. Being one of the wealthiest states wedged between New York and Philadelphia (the 1st and 5th most populated American cities), has resulted in New Jersey becoming the home to millions of highly educated, highly paid residents looking for quality housing in communities with good schools. There are few places in New Jersey that are more than 90 minutes commuting distance from business and cultural hubs of New York or Philadelphia. Many industries have located in suburban locations spreading quality employment/housing options throughout the entire state. Global headquarters for a number of multinational corporations are now located on rural New Jersey campuses. An extensive highway network traversing the state and navigable waterways surrounding 2/3 of its territory make most areas readily accessible. New Jersey is the only state in the nation in which all of its 21 counties are classified by the Census Bureau as occurring within a metropolitan statistical area (US Census Bureau 2000). In other words there are no longer any counties considered solely rural in New Jersey. New Jersey's unique geographical setting has led to development pressure throughout the state.

This mix of economic vibrancy, geographic location and limited land area has resulted in a land development process that will inevitably lead to all lands "improving" to their "highest and best use". The economic inertia of development under the current land use system is programmed for development. The question is not *if* New Jersey will reach build-out but *when.* The unavoidability of ubiquitous suburbanization consuming the entire state has deep roots and powerful momentum buttressed by real estate interests and consumer demand. Most lands are zoned for some level of development creating expectations for landowners to expect a financial return through development. Local governments in New Jersey rely on property taxes for municipal revenues which provides incentive to attract "ratable" development. Vacant lands are taxed at a level reflective of their potential development value creating a financial burden for

lands that remain vacant. Builders' associations, real estate interests and the farming lobby wield powerful political influence to maintain the status quo. The trends of New Jersey's land use system will not easily change. Nevertheless, in the face of the suburbanization steamroller a groundswell of change seems to be exactly what is happening in the Garden State.

III. Saving The Garden

New Jersey's sprawling urban growth patterns have not gone without redress. Over the past several decades a number of substantial land management initiatives have resulted in the protection and preservation of nearly 1 million acres of open space, 1/5 of New Jersey's land territory. Many land management programs evolved in the state to address problems associated with urban sprawl, recreational and open space needs, protection of the Pine Barrens, wetlands, and preservation of New Jersey's farmland heritage. Many of the initiatives have been established by state agencies. Others have involved non-governmental organizations (NGO's) as well as the non-profit sector. Many active citizens were key players in initiating and carrying through land preservation efforts. A summary of New Jersey's land management activities helps to shed light on the preservation side of the sprawl process to help provide a context for landscape change, and urban sprawl analysis.

State Land Preservation Efforts

Green Acres - The New Jersey Green Acres Program was created in 1961 to respond to land preservation and recreational needs. The program has been funded through bonds approved by electoral ballot. Nine separate Green Acres funding initiatives have been overwhelmingly

approved by New Jersey voters over four decades, spending over $1.4 billion to protect over 390,000 acres since its inception (NJDEP Green Acres Program 2000).

Pinelands Comprehensive Management Plan - The New Jersey Pineland Comprehensive Management Plan (PCMP) was created in 1979 in an effort to protect the unique ecosystem of the New Jersey Pine Barrens as well as the Kirkwood-Cohansey ground water aquifer that lies beneath it. The program designated over a million acres of land in southern New Jersey as falling under the management of a commission consisting of gubernatorial appointees, county representatives, and a member from the Department of the Interior (NJ Pinelands Commission 2000). The PCMP has not gone without controversy over takings issues and its designation as a *biosphere reserve* by United Nations. Nevertheless, studies have indicated that the PCMP has been effective in conserving land in the Pine Barrens (Walker and Solecki 1999, Luque et. al. 1995).

Wetlands Protection - Once viewed as wasteland, nearly half of wetlands that formerly existed have been drained and filled throughout the nation (USEPA 2000). In recent decades the importance of wetlands for habitat, breeding grounds, flood mitigation and water purification have been realized by the scientific community. New Jersey began regulating destruction of wetlands at the state level through the New Jersey Freshwater Protection Act of 1987. While wetlands loss continues to occur, the state requires that the destruction of significant wetlands must be compensated by the creation of new wetlands.

Farmland Preservation - As the state nickname indicates, farming has been a major part of New Jersey's heritage. The steady loss of farmland to urban growth led to the creation of the state's farmland preservation program. Under the program landowners are paid by the State to keep their property in permanent preservation. The program is funded through bond issues

administered through the State Board of Agriculture, a commission consisting of gubernatorial appointees and farmers. The program's initial limited funding resources resulted in the ability to preserve only a few dozen farms per year leaving many applicants out of the program. In order to fairly allocate the public funds of the program to the most viable farms, a ranking system was developed based on the agricultural potential of each farm. As of Fall 2000 the program has resulted in protecting nearly 62,000 acres of farmland preservation since the inception of the program in 1981(NJDA 2001). A recent increase in funding has led to a marked increase in farmland preservation over the past 2 years.

Coastal Areas Protection - The New Jersey coast is a well-known vacation haven for residents throughout the region. The recreational draw of the Jersey shore makes tourism the 2nd largest sector of the New Jersey economy. The pressure for residential development and the resulting impacts along New Jersey's bays and estuaries led to the passage of the Coastal Area Facilities Review Act (CAFRA) in 1973 which regulates development within the coastal region. The program requires all development proposals that are on a beach or dune or within 150 feet of high tide of a waterway to attain a special permit (NJDEP 2002).

State Development and Redevelopment Plan - A statewide initiative to manage land and curb sprawl began in the 1980's with the creation of the State Development and Redevelopment Plan (SDRP). Initially designed to be a plan designating growth and preservation areas, political opposition mounted over perceived state interference with local land use regulation. This backlash resulted in a plan substantially weakened from its initial vision with no regulatory control. The plan was generalized into suggested planning areas and designated community centers with local officials providing input through an iterative process call *cross acceptance*. The five planning areas include 1) urban 2) suburban 3) fringe 4) agricultural and 5) environmentally sensitive. While the plan only has the power to recommend suggested land use

for the five generalized planning areas, incentives such as faster permitting turn around and favorable treatment for grant applications are offered to developers and communities that follow the plan. A recent study indicated that if the plan was followed, significant environmental and social benefit would occur over the next several decades in comparison to the comparison to the current trend of development (Burchell 2000). Unfortunately the lack of regulatory control of the SDRP has resulted in limited success in curbing the previous trends of urban growth in New Jersey. While incremental strengthening of the plan in recent years has begun to significantly influence land management policy, the NJSDRP is still a long way from the comprehensive and enforceable growth management plan as it was initially envisioned.

Through these programs and other efforts New Jersey has succeeded in preserving an estimated 970,000 acres of publicly preserved lands to date. While this open space effort has been impressive and widely supported by the general population, the programs have suffered from a lack of consistent funding. Land preservation efforts did not keep pace with the increasing pace of urban growth upon New Jersey's remaining non-protected open land. Many felt more needed to be done.

One Million Acres of Additional Open Space: The Garden State Preservation Trust

In spite of its worthy goals, the New Jersey State Plan met with limited success in curbing sprawl through attempted regulation. In the late 1990's a new initiative began in an effort to counter sprawl through another approach, purchase of additional open space. The Garden State Preservation Trust (GSPT) was created with the goal of preserving a million acres of additional open space from the remaining undeveloped land in New Jersey. The program was funded through a constitutionally guaranteed dedicated portion of the sales tax to ensure long-term

success of the program. The GSPT is headed by a 9-member commission of executive and legislative government officials. The specific goal of the GSPT is to preserve a mix of open space lands including 500,000 acres of farmland, 200,000 acres of recreational lands, 200,000 acres of greenway corridors and 100,000 acres of watershed lands (NJDEP Green Acres 2000).

Rather than reinvent the land preservation wheel, the GSPT was designed to use the existing Historic Preservation Trust, Green Acres and Farmland Preservation programs to expedite land acquisition. To make the state funding go further most of the land acquisition requires matching funds from local, county and/or NGO entities. This partnering with community level organizations ensures that local knowledge and participation guides the process. Since the program began in 1999 two bond initiatives have passed through the process slating over $131,466,000 to preserve 19,700 acres of land.

Grass Root Heroes: NGO's Involved in Land Issues

New Jersey's land preservation efforts through the various state programs and initiatives have been impressive. However, the progress made over the past several decades in environmental protection and land management would likely have been less successful without the participation of many non-governmental organizations (NGO's) and dedicated individuals. An appreciation of the wide range of organizations and individuals working on landscape preservation in New Jersey can be gained though examination of a participant list for an annual land preservation conference sponsored by the New Jersey Conservation Foundation. Out of the over 300 participants representing 177 different government and non-government organizations, approximately 212 represented 84 Non Governmental Organizations. Some of the key NGO's involved in New Jersey land management issues include the Association of New Jersey Environmental Commissions, New Jersey Conservation Foundation, New Jersey Futures, NJ Natural Lands

Trust, the Sierra Club, the Nature Conservancy of NJ, the Trust for Public Land and scores of smaller local, watershed-based and regional organizations throughout the state.

Many individual citizens have also participated in the land preservation process and are often the catalyst for preservation initiatives. For example the Great Swamp of Morris County slated to be paved over for an international jetport was preserved in 1968 as the result of grassroots actions of local citizens and is now over 12,000 acres of preserved public land including the 7,410 acre Great Swamp National Wildlife Refuge and Wilderness Area. Countless other efforts by individuals and organizations alike have resulted in the hundreds of thousands of acres of open land that has been permanently preserved in New Jersey through out the past several decades.

This accumulation of public and protected private land has been a remarkable accomplishment considering that New Jersey began as a proprietary colony where all lands were initially in private ownership (Stansfield 1998). Unlike many western states which began with large areas of Federal public land, New Jersey public lands have been acquired under the constraints of a market arena. Combined with population pressures, the high cost of land and the magnitude of urban growth experienced throughout the state over the previous 50 years, New Jersey's land preservation history has been extraordinary. The multi-tiered efforts of state, county, municipal, non-governmental and private individuals have resulted in a substantial network of protected lands from High Point Monument in the northern corner of the state to the southern tip of Cape May. With the infusion of a stable source of funding through the GSPT and public attitudes and participation in land management seeming to grow, the prospects for a substantial amount of additional new open space are strong. The dichotomy between the trends of growing land preservation and trends of growing asphalt will be played out between these two forces as they race for New Jersey's remaining open land.

The dynamics in New Jersey's present day land use situation are fascinating. The state's vibrant economy and central geographic location insure momentum for continued suburban development. At the same time the strong movement for environmental protection and land management make New Jersey an excellent case study for analyzing patterns and processes underlying urban sprawl. New Jersey is in the midst of crystallizing a pattern of land use that will be imposed on its landscape for centuries to come with long-term implications for quality of life of many future generations. If more-sprawling patterns of growth will impact the landscape to a greater degree than less-sprawling patterns of growth then characterizing and quantifying these aspects of sprawl is of significant importance. This research hopes to help answer the question of "what urban sprawl *is*" and "why urban sprawl *is* a problematic pattern of human settlement".

IV. Scope of Dissertation

This dissertation is divided into two distinct sections. The first section (Chapters 1 and 2) sets the context of researching sprawl in the state of New Jersey. Chapter 1introduces the dynamic of New Jersey's current landscape setting, providing background on the state's land use system and an overview of its land management efforts. Chapter 2 focuses on trends of recent urban growth in New Jersey to develop a firm understanding of the broad patterns of urban growth in order to make the distinction between urban growth in general and urban *sprawl* in specific. The chapter presents an in-depth analysis of land use change that occurred between 1986 and 1995 at various geographic scales focusing particularly on patterns of urban growth and corresponding impacts to the landscape.

The second section (Chapters 3, 4, 5 and 6) focuses on measuring urban sprawl as a specific form of urban growth and the impact that sprawling patterns of development impart to a landscape.

Chapter 3 begins with a review of the literature on urban sprawl and smart growth and then explores a means of operationalizing a number of the theoretical spatial characteristics of urban sprawl to actual spatial measurements of land use change patterns within a GIS database. The question is posed of what makes sprawl, sprawl and a conceptual framework is developed for focusing in particular on the spatial characteristics of sprawl that are problematic to the healthy functioning of a landscape. A thorough discussion of the dysfunctional spatial characteristics of sprawl leads to the development of 12 Geospatial Indices of Urban Sprawl (GIUS). The GIUS indices are grouped into 3 families of measurement; 1) land use patterns, 2) transportation patterns, and 3) patterns of environmental resources impacts. Finally, the 12 GIUS measures are operationalized to evaluate the sprawling characteristics of 3 selected tracts of recent residential development that exemplify the spectrum of sprawling characteristics in a suburbanizing rural community.

In Chapter 4 the GIUS measures are automated and scaled from the tract-level analysis of Chapter 3 to a municipal-level extent. In Chapter 4 Hunterdon County, New Jersey, is utilized as a case study for automating the GIUS measures within a GIS and scaling the patch-level measures to a municipal level to enable town-to-town comparisons for the characteristics of sprawl. The 5th chapter scales the analysis up to the state level this time focusing on the Land Resource Impact subset of GIUS metrics to identify New Jersey's most highly sprawling municipalities regarding the impacts of urbanization to important land resources. The research concludes in Chapter 6 by focusing once again on Hunterdon County to analyze the relationship between urban sprawl and several socioeconomic variables including development tract size, sewer service area, New Jersey state planning areas and per capita impervious surface. The chapter ends with a summary and discussion of the GIUS measures in general, issues of sprawl at different scales and how the GIUS measures may evolve with future research.