

## **Using ArcGIS to Develop and Analyze Smart Growth Strategies**

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### **ESRI UC 2005 Paper Abstract**

**Paper title:** Using ArcGIS to Develop and Analyze Smart Growth Strategies

#### **Paper Description**

The Smart Growth Initiative in professional planning circles has been a steadily growing one over the last decade. The premise is growth management; everything from building design and mixed-use development to preservation of open space and protecting the distinctive characteristics of a community. We will examine how ArcGIS was used in New Jersey to manage a rural county's smart growth planning principles. Through customization in ArcObjects, we are able to preview parcel-level buildout that conforms to the county's environmental and zoning constraints, as well as identify better ways for existing development to improve its use of the land.

**Paper Category:** GIS in Planning

**My Topic Will Be Most Useful For:** A Specific Industry or Application Area

**This paper will feature the following software:** ArcGIS (ArcView GIS 9.0)

**Using ArcGIS to Develop and Analyze Smart Growth Strategies**  
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## **Overview**

Hunterdon County is located in the western region of New Jersey, one of the most densely populated states in the United States. While the 2000 Census indicates Hunterdon County has one of the lowest population densities in New Jersey, its growth rate of 13.2% between 1990 and 2000 was among the highest in New Jersey. The State's growth rate was 9% during this same time period.

Hunterdon County is a rural, agricultural community that is traversed by one of the most rapidly growing corridors in the State. Situated halfway between New York and Philadelphia, it is bisected east to west by Interstate 78, a major thoroughfare linking New York City with central Pennsylvania. As a result, places like Hunterdon County are increasingly feeling development pressures.

"Smart Growth" is a term that describes growth patterns at both the municipal and regional levels that reflect sensible investment decisions and minimize environmental impacts. Generally speaking, Smart Growth does not promote sprawl, it preserves open space and farmland and develops land in an efficient manner that protects community character. The State Planning Commission and the Office of State Planning carry out New Jersey's Smart Growth Initiative.

Hunterdon County's communities of forests, farms, small villages and towns have undergone a dramatic transformation over the past three decades. Many factors have contributed to the volume and pattern of growth, including improved highway systems, sewers, increased access to employment centers in nearby counties, and desirable qualities of life. In 1972, only 4.5% of the County was developed; by 1995 that amount had increased to nearly 22%.

## **Implementing Smart Growth Principles in a Rural Community**

A build-out analysis delineates the maximum amount of development permitted by existing zoning regulations. Depending on the type of analysis done, it can provide a visual snap shot, showing where and how properties might develop in the future. It can also estimate the amount of remaining open space, the number of homes or square feet of commercial space to be built, and the increase in amount and cost of additional services necessitated (such as schools, emergency services, roads, etc.). There are many different ways of conducting a build-out analysis, some more comprehensive than others. But in the end, a build-out analysis enables a community to decide whether its zoning regulations truly reflect its master plan goals.

Hunterdon County covers an area of approximately 430 square miles and contains twenty-six (26) municipalities. In 1993, Hunterdon County prepared the *East Amwell Township Zoning Build Out Analysis*, a "build-out" of East Amwell Township, a rural community with moderate density, as a means of graphically showing municipalities how current zoning could impact the landscape. This was an intense effort that involved many staff hours. This undertaking led the County to pursue a more automated *County Transportation Model* in 2001. This model used the newly developed, countywide GIS-based parcel data

and municipal zoning information to estimate traffic impacts at full build-out. Using ArcView, this model was an improvement in build-out capabilities in that it was automated. However, it lacked certain fundamental needs, a comprehensive build-out tool must address a broader gamut of smart growth issues. This includes impacts on the natural environment, land consumption and community character. Hunterdon County was searching for a way to preserve the character of its communities, accommodate growth and implement the Smart Growth mandate from the State.

## **ArcGIS as a Planning Resource for Growth Management**

In 2001, the Hunterdon County Planning Board was awarded a Smart Growth Grant from the New Jersey Department of Community Affairs. A portion of this grant was utilized to contract with Geographic Information Services, Inc. (G/I/S) to create a powerful planning tool known as the BuildOut Simulator (BOS). G/I/S representatives worked closely with County Planning and GIS staff to develop a computer program that would address a recognized need in county and municipal planning efforts.

An exciting tool was developed under the Smart Growth Grant, the Build-Out extension for ArcMap 9.0. Utilizing information already in Hunterdon County's state-of-the-art Division of GIS (Geographic Information System), the County and G/I/S worked to develop a tool that could systematically build visual GIS map representations of development that could occur on vacant parcels of land. This visualization reflects both current zoning and design standards that apply to a parcel and provides representations of both residential and commercial development.

This program was designed with both the planning professional and existing computer technology in mind. It allows the user to create various residential, commercial and mixed-use development scenarios, while taking into consideration local zoning and basic environmental constraints. Local planners and municipal officials now have the ability to view build-out impacts on a parcel-based level, a planning approach not easily accomplished without a visualization tool like the BuildOut Simulator (BOS). As designed, the program is especially useful in exploring various development alternatives community-wide. The resulting products will provide everyone, residents included, with the means to understand the patterns of development that will result from the policies that are currently in place. Additionally, it can be used to estimate the increase in population and housing units, square footage of impervious cover, and remaining open space.

Hunterdon County utilized the BOS to create the *2020 Build-out* and visually demonstrate build-out potential for each municipality. This build-out helped to support and verify the County's population projections for 2020. Population projections are contained in Hunterdon County's Master Plan and will be used to generate future municipal fair-share housing obligations. Using Hunterdon's GIS-based parcel coverage and County tax data for background information, local zoning information and environmental constraints were incorporated into the BOS thus allowing the County to show the build-out capacity for each municipality by creating parcels on existing lots where the increased population could be accommodated.

The BOS allows a more realistic build-out by incorporating municipal zoning requirements and environmental constraints into the build-out process. The BOS is a versatile tool that can be used to illustrate different development patterns. Smart Growth strategies emphasize preservation of open space and natural resources through compact, clustered community design. The BOS can be used to

show how these different development patterns can help re-enforce Smart Growth principles and achieve the overall vision of the community.

The 1993 East Amwell Township build-out covered an area of 28.7 square miles and the build-out map was hand-drawn. The countywide Transportation Model incorporated a GIS-based, automated process that took over three years to complete. The BOS build-out improved the automated Transportation Model by incorporating municipal zoning requirements and environmental constraints. It is estimated that the 20-year, countywide build-out projection was completed in less than 150 staff hours. The BOS allowed us to generate GIS-based, parcel level build-out scenarios for the entire County much more quickly and efficiently than the hand-drawn build-out completed in 1993.

### **Return on Investment**

Smart Growth strategies promote open space and natural resource preservation. By incorporating municipal open space requirements and environmental constraints into the BOS, these Smart Growth strategies can be realized. The BOS can be used to demonstrate different development scenarios for a particular site, building consensus by providing a visual display of how clustering or lot averaging can be used to preserve large tracts of open space.

The BOS allows us to test different scenarios for a given community or region; the “old-fashioned” hand drawn approach was far too labor intensive to test alternatives, at least at the township or regional level. For example, we can show the impact of 5-acre lots along side clustering down to 1-acre lots, or the impacts of changing the zoning to 10-acre lots as opposed to commercial development. Often discussions about build-out are limited to residential impacts; BOS allows us to perform both residential and nonresidential build-out analysis. New commercial development has equally significant impacts on communities, if not greater. Along the I-78 corridor alone, the build-out potential is more than 16 million square feet of commercial development. Using BOS, the visual build-out can provide compelling images of what that amount of development would look like in terms of land consumption.

Communities respond best to visual queues. The BOS extension provides an effective communication tool in a simplistic but understandable visual result that people can understand and respond to. BOS is a bottom-up approach to conducting build-out and in that sense, seems to be somewhat unique. It starts at the parcel level to produce more “believable” results than models that rely on regional level data. While it is not intended to produce site-specific results with meaningful accuracy (it really is most useful at the community-wide or regional level), the inputs are at a parcel level and that gives it a higher degree of “credibility” among the public. In addition, the model can be used in any community, not just those in Hunterdon; however, the BOS is most useful in rural communities with open, developable land.

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## **References**

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