Multi-agency Collaboration in Statewide Development Tracking

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Abstract
The Maine State Planning Office, the Maine Office of GIS and Maine's primary electrical utilities (Central Maine Power Company and Bangor HydroElectric) collaborated to produce multi-year metrics for measuring new development in the state since 1990. This effort yielded a cell-based analysis framework that accommodated both the utilities' requirements for customer confidentiality as well as the need for accurate spatial representations of these changes over time. Cell size in this array is 500 m, and cells are populated with absolute connection values year over year. These data present significant potential for monitoring development patterns and guiding multi-level and multi-jurisdictional planning as well as providing a development tracking model that allows for easy creation of animated series in ArcGIS.

Introduction
As part of a statewide GIS Needs Assessment and Requirements Analysis undertaken in 2002 (Legislative Resolve 23), Maine identified the need to more clearly and consistently identify and track areas of accelerated development within the state.

Development tracking (DT) is concerned with documenting changes in the landscape induced by human behavior. In its most basic form, DT concerns itself with monitoring the construction of buildings and the extension of directly related infrastructure such as roads and utilities. It may also involve the study of changes in how lands are used by humans, including changes in land cover related to alterations in agricultural and forest management practices, changes in residence patterns from seasonal to year-round occupancy, and the aggregate effects of individual land-use changes on the character of communities.

The *ResoIve 23 Study* recognized that DT is an integral component of the statewide GIS plan and offered specific guidance for the creation of a consistent and comprehensive statewide development tracking system:

1. Development tracking needs to be implemented statewide but must remain useful at municipal scales and accuracies.
2. The system should be operational in a short period of time (within 12 months).
3. The system must be economical to build, maintain and operate.
4. The system must integrate cleanly with higher accuracy data as such data become available.
5. The growth indication data must contain a temporal component. These must be compatible with a baseline going forward. Data from 2002 should be directly comparable with data from 2012 or 2020 and ideally should integrate with historical data collected prior to 2000.

6. All data utilized in development tracking must be retained in the Maine Public Library of Geographic Information: There is to be zero data loss and no stranded investment where state funding is used to create these products.

The Maine State Planning Office convened the Development Tracking Steering Committee (Committee) to assess available resources and identify cost effective strategies to leverage existing data into a statewide solution for tracking development.

Evaluation of Layers

Development tracking growth indicators can take many measurable forms. The following key data layers were evaluated by the Committee:

- Road Locations
- Buildings
- Utility Data – New electrical connections over time
- Parcels
- Land Use Change from Remote Sensing
- Simplified Land Cover
- Zoning/Shoreland Zoning
- Sewer/Water System Boundaries

Recognizing the practical and fiscal constraints to obtaining all key data layers, the Committee developed a decision matrix to evaluate these data resources. The purpose of the matrix was to frame the discussion and provide some reasoning for ranking one data layer higher than another. Three general criteria were used to rank the data layers: applicability for development tracking needs; feasibility and cost of acquisition; and cost of maintenance over time. The decision matrix included the following factors:

- Spatial Distribution
- Cost to Implement
- Cost to Process
- Cost to Maintain/Update
- Ease of Capture
- Compatibility with other Data
- Meets Development Tracking Needs
- Time to Input for Local Government
- Reliability

Electric Utility Connections

Data Properties and Capture Methodology

Electrical utility connections were ultimately chosen as the best all around DT data candidate. Representatives of Maine's major utilities were invited to participate in the DT Committee meetings and provided a great deal of constructive input during the evaluation of candidate layers.

Maine electric utilities currently maintain GPS location information identifying the nearest utility pole to both commercial and residential electrical connections. This is

extremely useful for the development tracking process as it provides a highly accurate proxy for where development exists and is occurring. Unfortunately, the utilities are restricted from releasing this data due to customer confidentiality requirements. In order to derive use of these data without interfering with confidentiality it was necessary to work out a compromise.

Utility Connections Grid

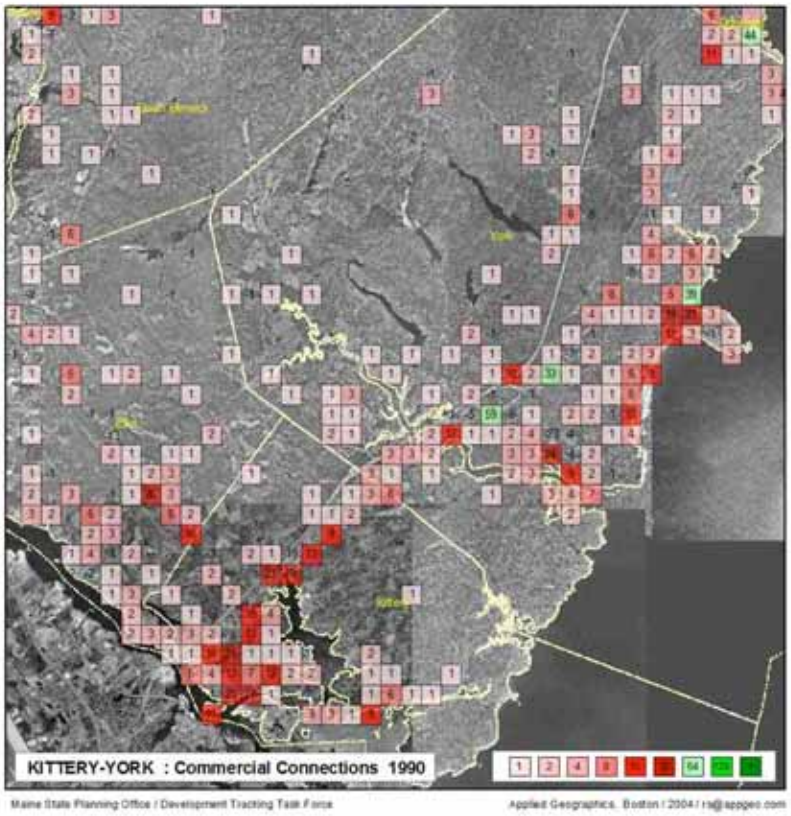
In order to satisfy the DT data requirements as well as comply with utility confidentiality, a 500 meter grid for the state was developed. Since the points themselves represented too much of a potential breach in confidentiality, the main question became how best to generalize the data without entirely draining it of its analytical value. A 500m cell size was deemed to be adequate to the needs of both parties. Each cell would be populated with attribute values that represent feature counts and the actual point locations would be obfuscated.

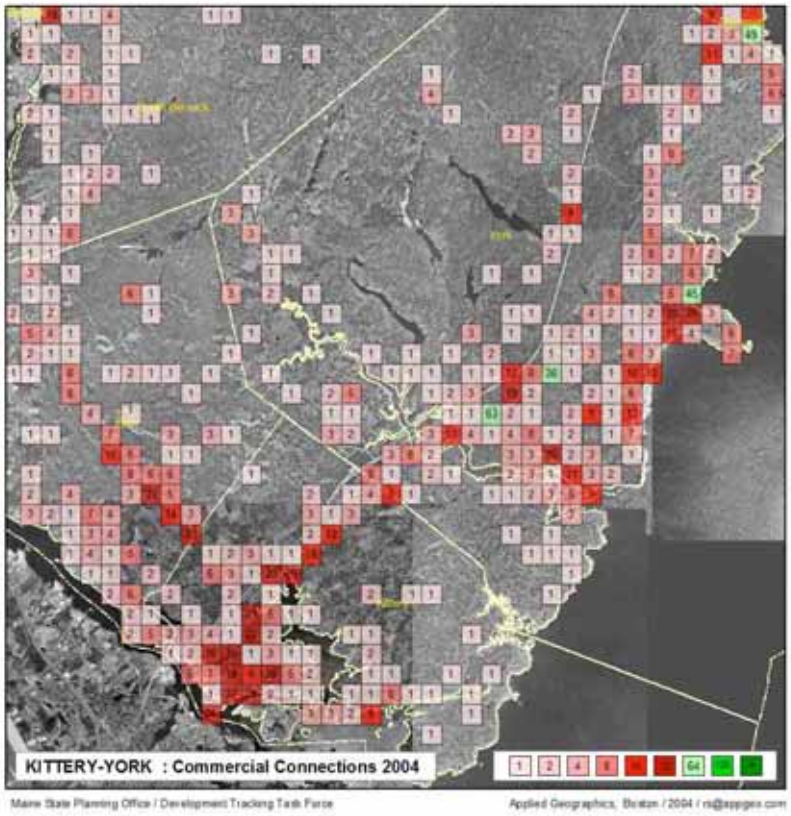
The utilities agreed to provide the following data to populate the table with the following fields on a yearly basis:

- GridID: identifier maintaining common reference year over year.
- # Residential Connections (year 1)
- # Commercial Connections (year 1)
- # Residential Connections (year 2)
- # Commercial Connections (year 2)
- # Residential Connections (year ..n)
- # Commercial Connections (year ..n)

The Maine Office of GIS has committed to process the data and upload them to the state web site. The utilities vary somewhat in their ability to provide legacy data (one company provided data back to 1990 but the other did not have archives of equal temporal depth). Grid cell arrays will be populated with two new fields of data (commercial and residential) once a year going forward.

The following graphics illustrate some of the capabilities of this dataset, where utility connections in 1990 are comparable with the same area (York, Maine) in 2004:





DT data in this format permit a wide array of downstream display and analysis. Their generic nature also allows them to be integrated with connections information for adjoining states and independent utilities for seamless analysis.

The data cover most areas of electrical services and therefore effectively provide a statewide census of development every year. This permits users to quickly pick out areas of intense activity and delve into these hot spots using higher accuracy, local sources.

Because of the great expense in acquiring high quality landuse/landcover or planimetric landbase data, especially over frequent, subsequent iterations to support change detection, an innovative and collaborative effort to generate this picture should be a welcome addition to the data resources of any planning agency. Development tracking using an electric utility connection grid of the nature described above provides such a cost effective and easily maintained metric for monitoring growth over a large, multi-jurisdictional area, and permits addition of data year over year with very minimal incremental effort or expense.

References

Maine State Planning Office, *"Development Tracking in Maine: Documenting the Changing Landscape,"* delivered to the State of Maine Development Tracking Steering Committee, March, 2005.

Sutton, Richard and Terner, Michael, *"Maine GIS Needs Assessment & Requirements Analysis and Strategic Plan"* delivered to the State of Maine Resolve 23 GIS Steering Committee, January, 2002.

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