Introduction

The idea for organizing a cooperative market on Waterville Main Street was proposed by Aime Schwartz in the fall of 2008. The Co-op would entail an open market located on Main Street to provide fresh, local produce and crafts to town locals. Through shorter delivery distances and agreements with local farmers, the Co-op theoretically will offer consumers lower prices on produce that can be found in conventional grocery stores, as well as an opportunity to support local agriculture.

One of the tasks involved with organizing the Co-op is to source all of the produce from among the hundreds of farmers located in Maine. The purpose of this project is to show how Geographic Information System (GIS) tools can be used to help the Co-op and other business sites locate farms that carry desired produce and products, and to determine which farms are closest to the business site. Using GIS for this purpose will make it easier and more efficient to source produce suppliers, and reduce the workload on business planners.

GIS Network Analyst is a tool that provides network-based spatial analysis, and can be used in conjunction with traditional GIS technologies to determine not only the geometric distance between points, but also distance over existing networks (like roads). We will show how Network Analyst can be used to find the three closest produce suppliers to the Co-op for specific produce items, and compute how far they are over existing roads. This will enable business planners to source potential suppliers by distance before contacting individual farmers, allowing for more efficient use of their time and a faster planning process.

Methods

Data on farm locations from the Maine Organic Farmers and Gardeners Association (MOFGA) was compiled into a database. Eight specific produce varieties were selected for this model analysis: blueberries, tomatoes, greens, potatoes, milk, beef, eggs, and maple products. Which if any of these products a farm produced was also added to the database with the addresses.

Using GIS, the farm addresses and the location of the Co-op were geocoded on to a layer of Maine streets. Farms producing each individual item were selected out from all farms, and Network Analyst was used to determine the three closest suppliers to the Co-op of each product, and how far from the Co-op that supplier is. Routes were mapped from the Co-op to each close supplier farm (shown at right).

Lit. Cited

ME Office of GIS Data Catalog, accessed from http://megis.maine.gov/catalog/

Acknowledgements

We would like to thank the Oak Foundation for providing the GIS software and equipment used in this project. We would also like to thank Philip Nyhus and Manny Gimond for their assistance.

Results

- The closest three farms for all produce types were located within 30 miles of the Waterville Co-op (Table 1).
- Farms supplying blueberries, eggs, and maple products were located farthest from the Co-op, averaging between 26.4 miles and 27.7 miles away (Table 1).
- Of the farms closest to the Waterville Co-op, Lupine Farm had the greatest variety (see maps).

<table>
<thead>
<tr>
<th>Produce Type</th>
<th>Farm 1</th>
<th>Farm 2</th>
<th>Farm 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blueberries</td>
<td>15.3</td>
<td>15.3</td>
<td>13.2</td>
</tr>
<tr>
<td>Greens</td>
<td>15.3</td>
<td>14.1</td>
<td>10.7</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>22.7</td>
<td>21.8</td>
<td>13.4</td>
</tr>
<tr>
<td>Beef</td>
<td>15.3</td>
<td>13.4</td>
<td>13.4</td>
</tr>
<tr>
<td>Eggs</td>
<td>23.3</td>
<td>10.7</td>
<td>10.7</td>
</tr>
<tr>
<td>Milk</td>
<td>23.3</td>
<td>20.6</td>
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<tr>
<td>Potatoes</td>
<td>13.4</td>
<td>19.8</td>
<td>10.7</td>
</tr>
<tr>
<td>Maple Products</td>
<td>15.3</td>
<td>14.1</td>
<td>10.7</td>
</tr>
</tbody>
</table>

Mean Distance

- Blueberries: 27.2 miles
- Greens: 10.5 miles
- Tomatoes: 6.3 miles
- Beef: 9.4 miles
- Eggs: 8.2 miles
- Milk: 15.8 miles
- Potatoes: 20.4 miles

Discussion/Conclusion

- This project serves as a model that demonstrates the potential utility of Network Analyst to a new business searching for suppliers. From a given data set, the program was able to identify the closest farms by produce type, which could help identify which supplier and produce types are best suited for the organization. For example, the coop could use this tool to find the closest farm that supplied all 8 products to combine a hypothetical need to minimize suppliers but maximize produce selection.

- This analysis could also be expanded to include any number and type of products by adding more attributes to the farm database. If the coop wanted to find closest farms that can supply above a certain quantity of produce, the value assigned to each attribute (a value of 0 or 1 was used in this analysis to indicate whether or not a farm had the produce type in question) could increase to represent higher production levels at different farms.

- Unmatched addresses and MOFGA farms listed in the MOFGA farm directory with PO boxes were not considered in the analysis. This could be problematic when searching for suppliers for a business, since only geocoded farms would be considered by Network Analyst. The roads layer used to geocode farm addresses lacked data for some townships, including Fairfield, which borders Waterville and could be a source of farm suppliers. However, unmatched farms can be geocoded manually.