

Measuring urban pressure on rural communities: A key variable to understanding and anticipating change in rural areas

Adam Bonnycastle, M.Sc. (Geog.), Spatial Analyst
abonnyca@uoguelph.ca

Dr. Brady Deaton
Food, Agricultural & Resource Economics
University of Guelph

Introduction & background

- Understanding “rural” ↔ Understanding “urban”
- In Ontario link is well known and documented
 - Urban areas provide employment, final goods markets
 - Rural areas influence environmental character, local food attributes, spatial patterns that affect well being of urban residents
- How to define “rural”?
 - Population density? Not “urban”? Distance to certain cities?

Introduction & background

- How to define “urban”?
 - Population density? Built-up areas? Presence of infrastructure?
- Around the world, many definitions of “urban”:
 - Population, administrative units or boundaries, physical characteristics, major economic activities
- Canadian “urban” definition based on population:
(Statistics Canada)
 - Core population > 1000 and
 - Population density > 400 persons/km²

Introduction & Background

- Characteristics of Canadian cities:
 - Pre-1945: Central Business District, zone of transition, industry located along water/railways, high density residential neighbourhoods; spatially dense urban areas
 - Post WWII – 1975: Expanding suburban municipalities, distinct spatial division between pre- and post-WWII development, increasing use of cars and large single-family homes starts urban sprawl
 - Post 1975: Suburban areas dominate, sprawl continues, the car is king

Introduction & Background

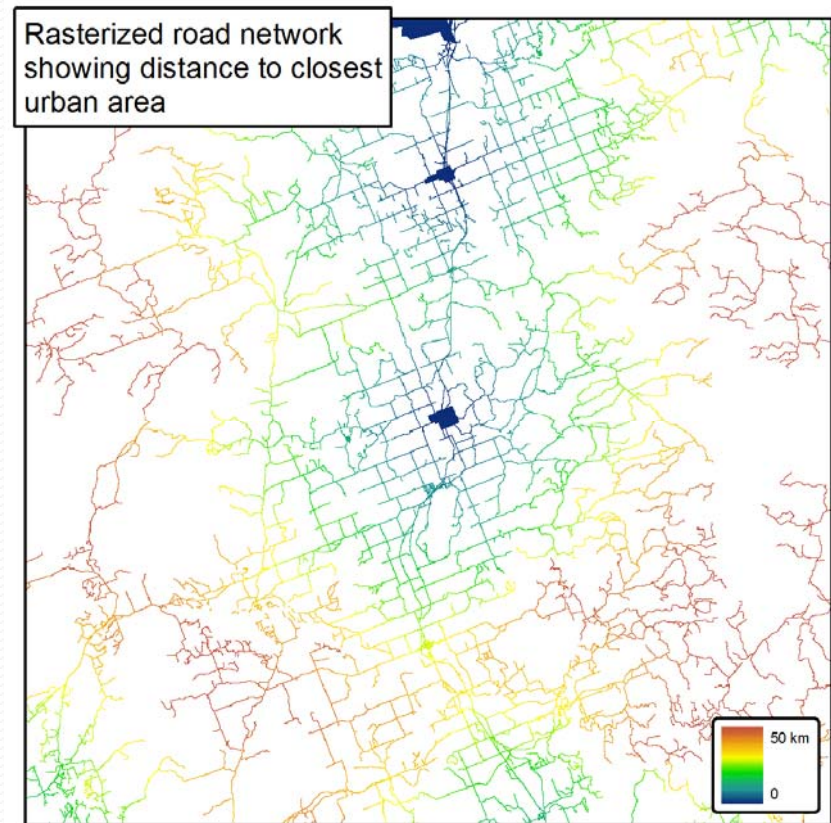
- Detecting urban development particularly suited for GIS & remote sensing technologies
- Remote sensing techniques:
 - classify aerial/satellite imagery into broad landcover categories
 - Compare temporal classifications to detect changes over time
- GIS techniques:
 - Analyze spatial features associated with urban areas
 - Spatial & temporal analysis

General Methodology

- Data – We chose to use available datasets (Statistics Canada urban areas data, DMTI Spatial road network data) to assess the distance from each Ontario municipality to the closest urban area.
- Measure to urban area – Using GIS, we calculated the distance, by road, from each municipality to the closest urban area.
- Temporal resolution – Based on available urban areas data, we conducted the calculation for the 1996, 2001, and 2006 census years.

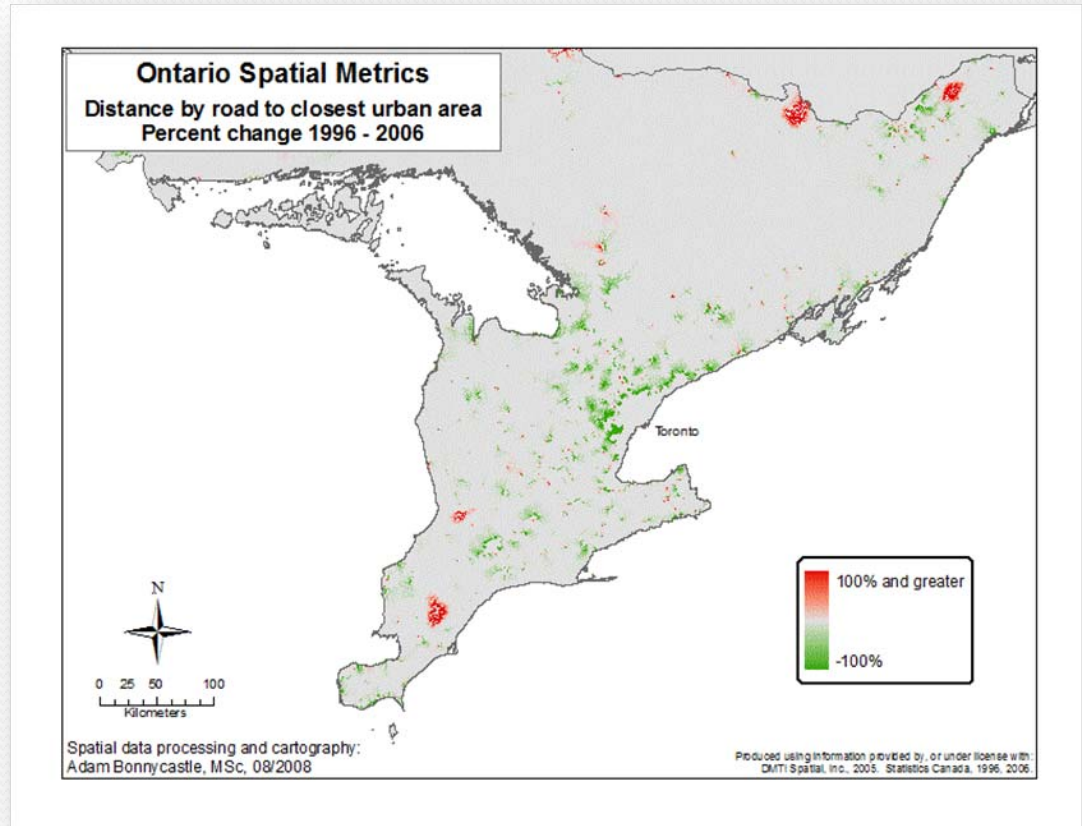
Distance Calculations

- Convert road vectors to raster cells
 - Cell size = 20 m
- Calculate “cost” distance
 - From each cell to closest urban area polygon, following a continuous path of cells
- Overlay municipal boundary polygons on cost cells.
- Extract mean cost (distance) within each municipal boundary



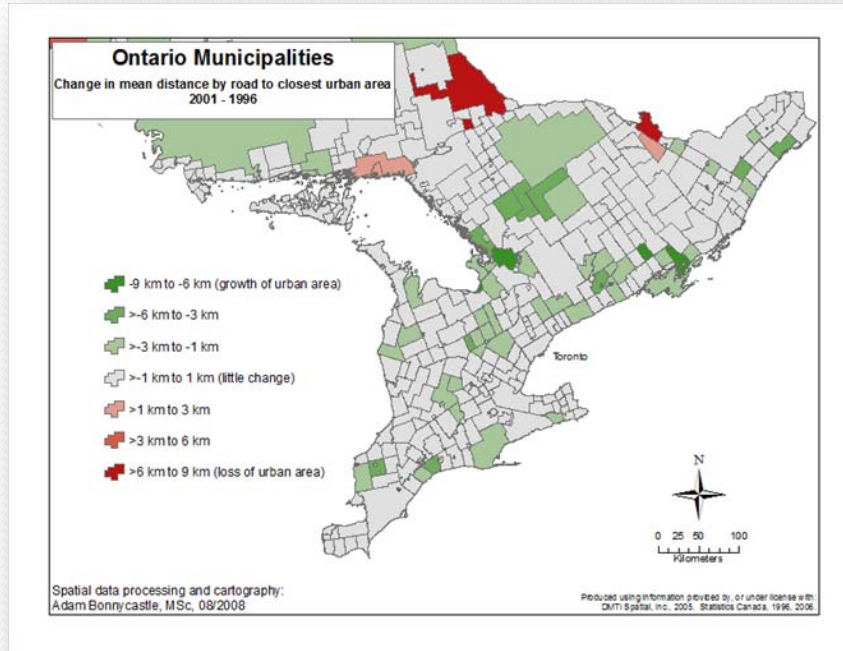
Urban change in Ontario

- Statistics Canada Urban Areas data, 1996 – 2006
- Distance by road to closest urban area
- Calculate difference relative to 1996 results
- Large values
 - Loss of urban area
 - Distance increases
- Small values (GTA)
 - Urbanization
 - Distance decrease



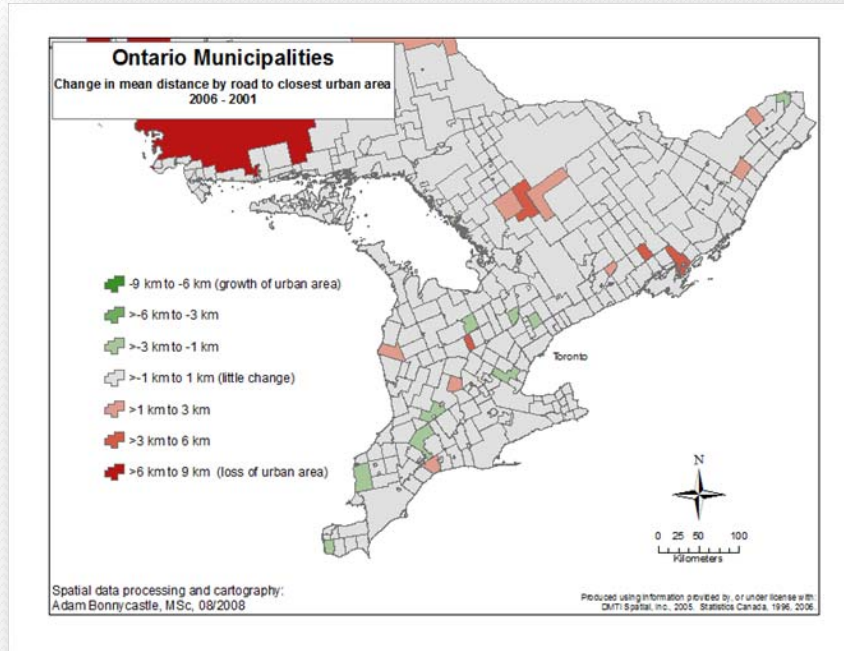
Urban change in Ontario

- 1996 – 2001 period indicates that many municipalities in Ontario experienced a decrease in distance to the closest urban area



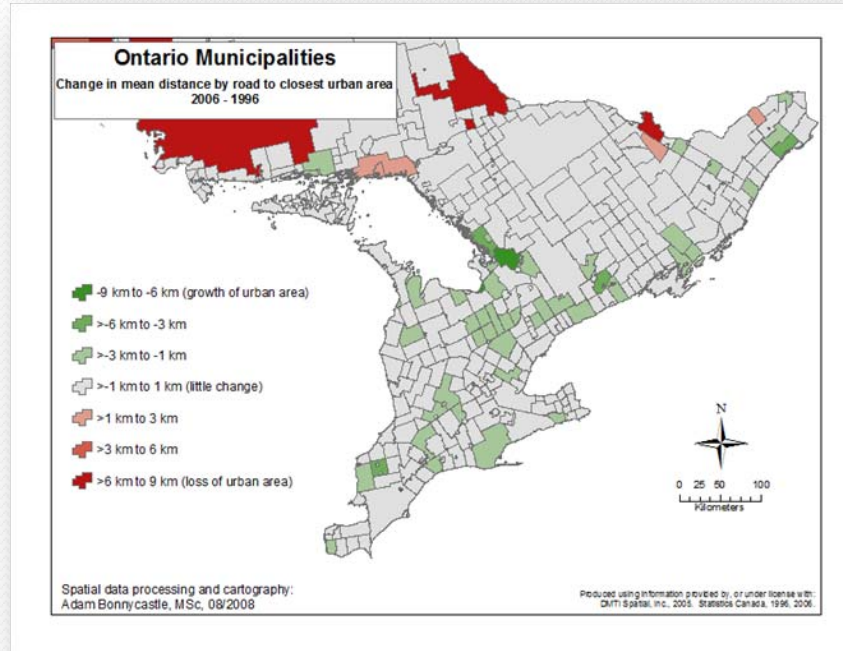
Urban change in Ontario

- 2001 – 2006 period shows less change in distance to closest urban areas
- Increasing distance to closest urban area indicates urban contraction



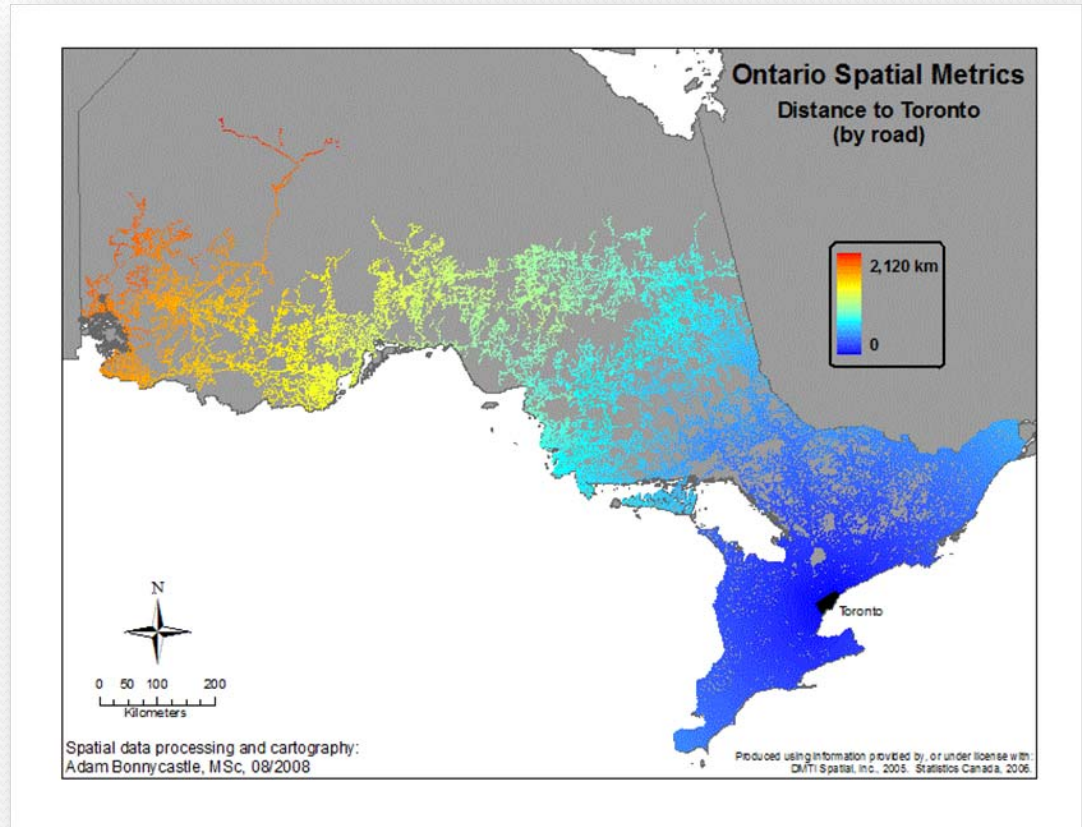
Urban change in Ontario

- 1996 – 2006 period shows urban growth mainly around Greater Toronto Area and south-western Ontario



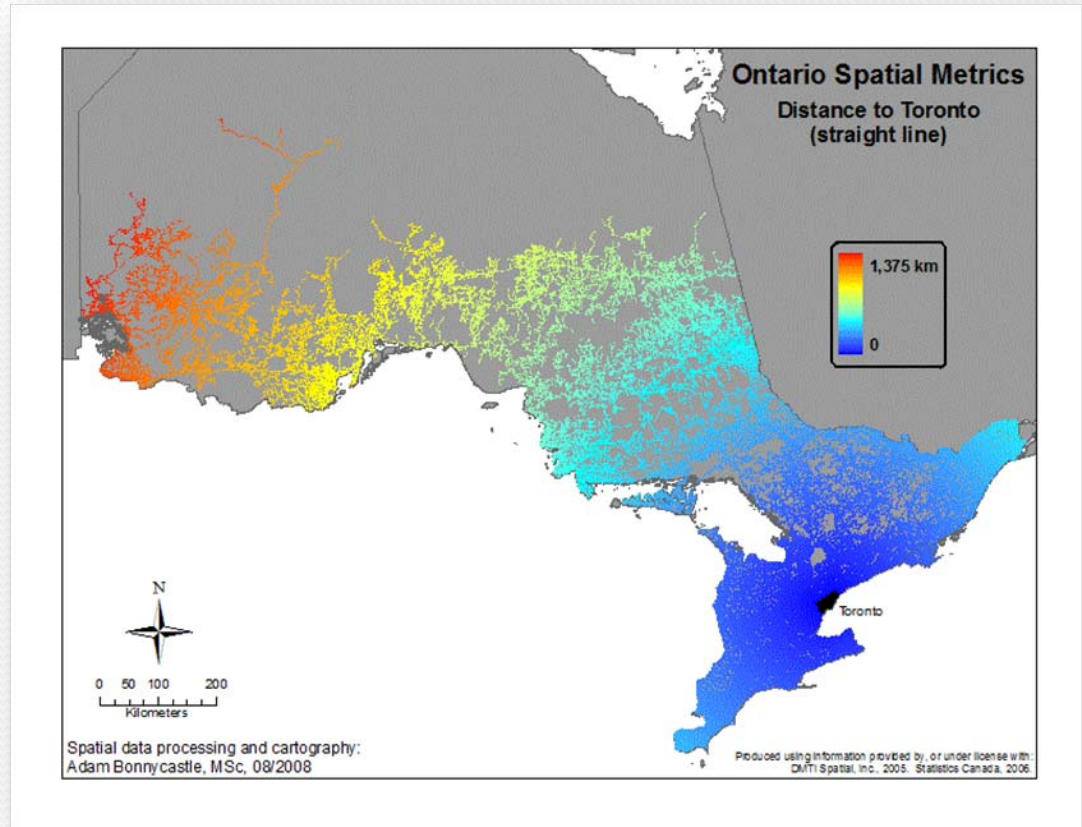
Measuring by road vs. straight line

- Max distance by road:
 - 2,120 km



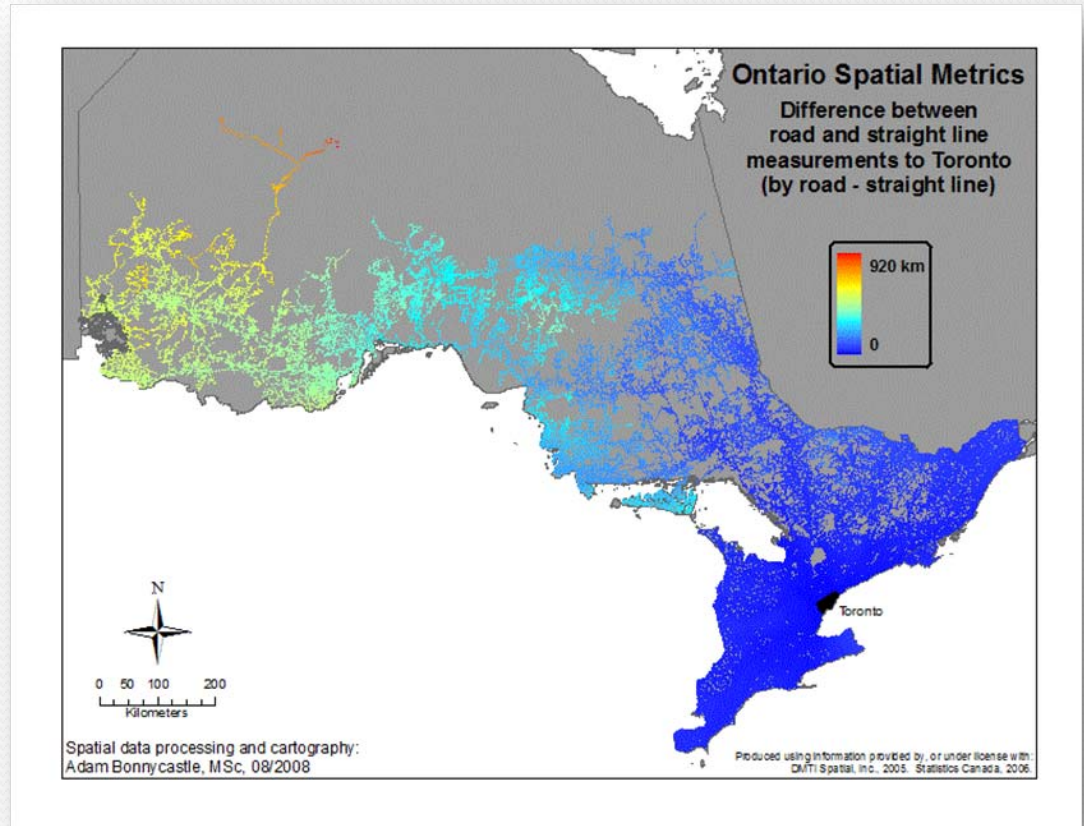
Measuring by road vs. straight line

- Max distance by road:
 - 2, 120 km
- Max distance straight:
 - 1, 375 km



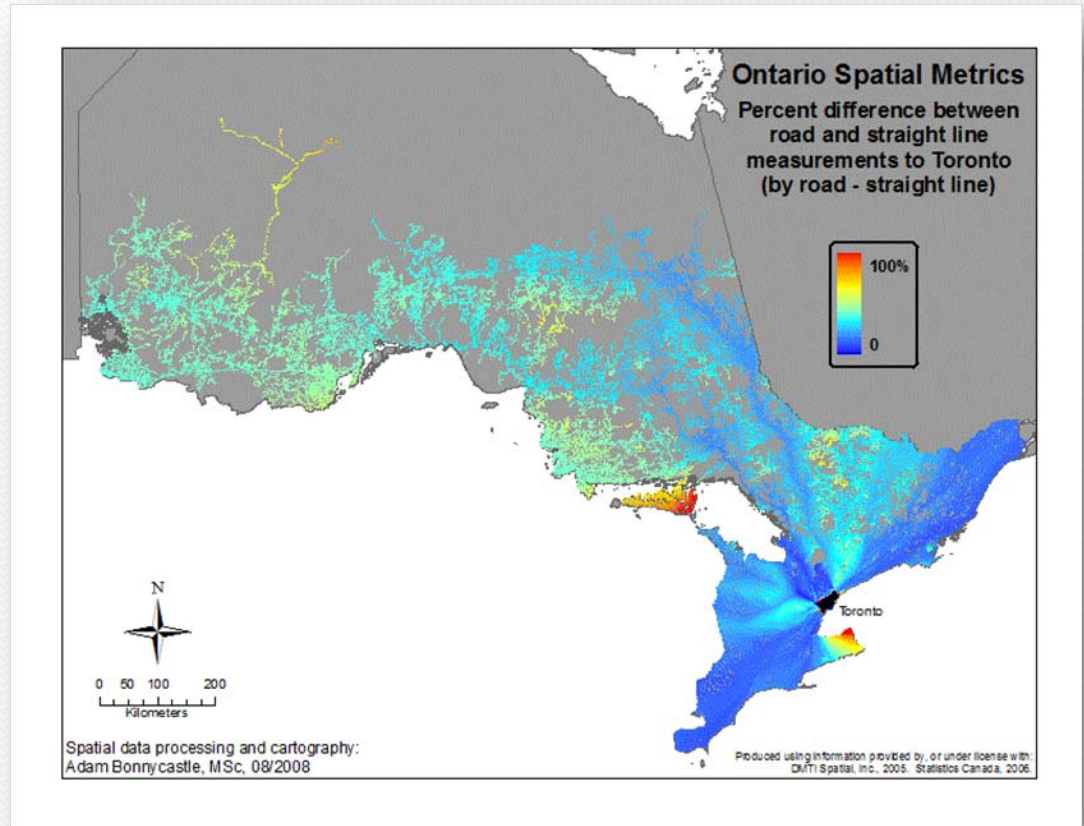
Measuring by road vs. straight line

- Max distance by road:
 - 2,120 km
- Max distance straight:
 - 1,375 km
- Max difference:
 - 920 km



Measuring by road vs. straight line

- Max distance by road:
 - 2, 120 km
- Max distance straight:
 - 1, 375 km
- Max difference:
 - 920 km
- Percent difference:
 - Spatial features do not allow straight travel
 - Little diff. along major corridors



Measuring by road vs. straight line

- Accounts for travel across/around actual spatial features
- May improve economic modelling of travel-related variables
- However may be scale dependent

Emerging themes

- Physical urban growth in Ontario is not evenly distributed, spatially or temporally, even around densely populated regions such as the GTA.
- Measuring distance by road may be superior to typical straight line measurements, especially around features such as the great lakes.
- Geomatics technologies show promise for assessing urban growth and pressures on rural areas. Remotely sensed imagery may prove useful for these types of analyses if efficient methods to process large areas are developed.