IMAGIN SPPC 2016
Eastern Michigan University

Land Cover Change in Livingston County, Michigan

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Overview:

By utilizing National Land Cover Database rasters I analyzed the extent of urban sprawl in Livingston County, Michigan over time from 1992 to 2011. This data was compared to Census data from the same timeframe to determine the impact of population growth on land cover changes. As was expected, agricultural lands were converted to residential and commercial uses when population growth was extreme. Wetlands and forests were preserved in protected areas. Continued population growth could result in loss of farmland and environmental degradation if the local municipalities allow unrestricted development.

Study Area Introduction:

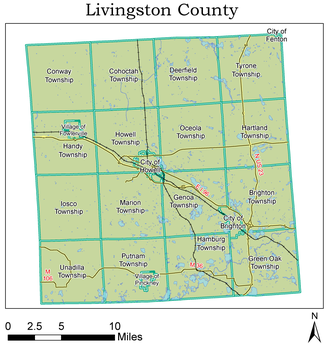
Situated in Southeast Michigan, Livingston County is a hub community, being the middle ground between Flint, Lansing, Ann Arbor and the Detroit metro region. The county is within the triangle of R-1 research institutions formed by Michigan State University, University of Michigan and Wayne State University. These institutions' home cities are also major leaders in other aspects, with Lansing being the center of government in the state, Ann Arbor being an important research and development center and Detroit being important for commerce and manufacturing. As center cities declined in the second half of the 20th century, surrounding suburban communities experienced a population boom. Livingston County's population doubled from 1970 to 1990 and continued to rise after that with the 2nd fastest population growth in the state from 2000 to 2010. Livingston County continues to attract residents who work in these larger cities but choose not to live in them.

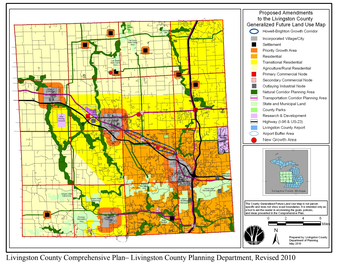
Southeast Michigan

Michigan Center for Geographic Information- Michigan Department of Technology, Management and Budget

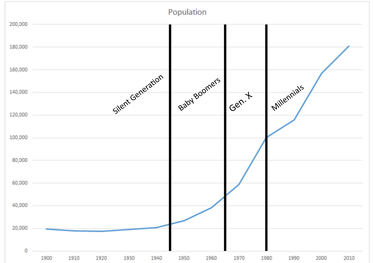
USA Major Cities-ESRI

Livingston County





Livingston County Comprehensive Plan- Livingston County Planning Department, Revised 2010



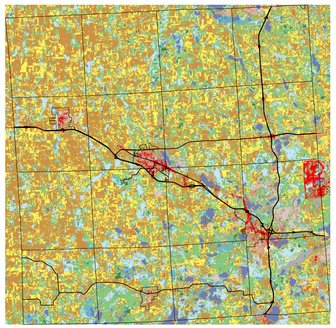
US Census Bureau

GIScience and Urban/Regional Planning

My analysis would have been impossible without using two vital and interrelated disciplines. The first is GIS or Geographic Information Systems. GIS is best described as using computer programs to create maps but the real power lies in its ability to manage, manipulate, and interpret geographically linked data by accounting for the spatial relationships between sets of data. Remote Sensing (RS) is acquiring information about a feature or phenomena without being in direct contact with it, typically with a camera or sensor on a satellite or airplane. This data can then be geocoded to be used in a GIS.

Urban planning is a technical and political process focused on regulating human land use for the protection of the environment and public well-being. Urban planning theory was the basis of my interpretation and conclusion.

NLCD 1992

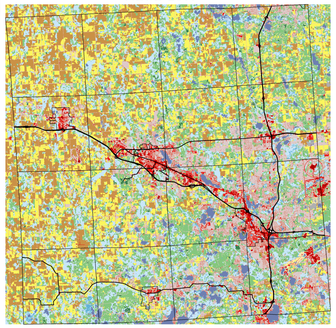


N 0 2 4 8 12 16 Miles

National Land Cover Class

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

NLCD 2011



Livingston County
Land Cover Change
1992-2011

Land Cover Class	Percent Change 1992-2011
Open Water	0%
Developed, Open Space	+12%
Developed, Low Intensity	+4%
Developed, Medium Intensity	+1%
Developed, High Intensity	+1%
Barren Land (Rock/Sand/Clay)	+1%
Deciduous Forest	-2%
Evergreen Forest	0%
Mixed Forest	+1%
Shrub/Scrub	N/A
Grassland/Herbaceous	+1%
Pasture/Hay	-2%
Cultivated Crops	-21%
Woody Wetlands	+7%
Emergent Herbaceous Wetlands	-1%

National Land Cover Database Explanation:

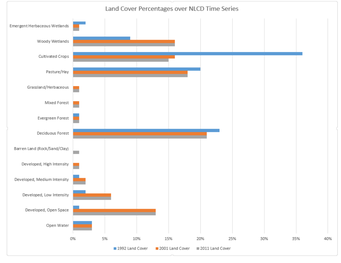
The core of my analysis was based around data derived from the National Land Cover Database. The NLCD was produced by a consortium of federal agencies who effectively mapped the land cover of the United States based off of interpretations from Landsat satellite imagery and ancillary GIS data. The NLCD data I used came from 1992, 2001, and 2011. This time series aligned approximately with the U.S. Decennial Census. NLCD1992 used a slightly different classification scheme but I was able to synchronize the classes without obfuscating the original data.

NLCD Classification Scheme		
NLCD1992 Classes	NLCD2001 (and beyond) Classes	Color
Open Water	Open Water	
Urban/Recreational Grasses	Developed, Open Space	
Low Intensity Residential	Developed, Low Intensity	
Commercial/Industrial/Transportation	Developed, Medium Intensity	
High Intensity Residential	Developed, High Intensity	
Quarries/Strip Mines/Gravel Pits	Barren Land (Rock/Sand/Clay)	
Transitional Barren	"	"
Deciduous Forest	Deciduous Forest	
Evergreen Forest	Evergreen Forest	
Mixed Forest	Mixed Forest	
--	Shrub/Scrub	
Grasslands/Herbaceous	Grasslands/Herbaceous	
Pasture/Hay	Pasture/Hay	
Row Crops	Cultivated Crops	
Woody Wetlands	Woody Wetlands	
Emergent Herbaceous Wetlands	Emergent Herbaceous Wetlands	

A Land Use And Land Cover Classification System For Use With Remote Sensor Data– Anderson et al.

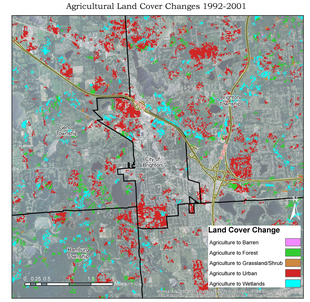
NLCD Fact Sheet– USGS

National Land Cover Database– Multi Resolution Land Consortium



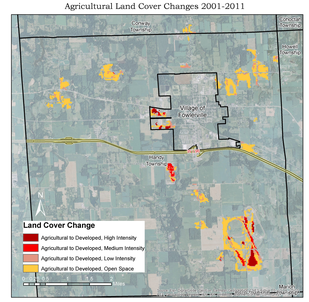
Brighton, Michigan
Southeast Livingston County

Agricultural Land Cover Changes 1992-2001



Fowlerville, Michigan
Northwest Livingston County

Agricultural Land Cover Changes 2001-2011



Minor Civil Divisions with Notable Land Cover Changes

Class	Hartland Twp.	Handy Twp.	City of Howell	Genoa Twp.	City of Brighton	Green Oak Twp.	Hamburg Twp.
Open Water	-0.6%	+.01%	+0.3%	-1.1%	-0.2%	-0.7%	-0.1%
Developed Land	+25.2%	+15.2%	+27.4%	+31.3%	+43.1%	+25.0%	+25.3%
Forest Land	-2.4%	-2.0%	-10.2%	-2.1%	-11.5%	-3.5%	-3.3%
Grassland/Herbaceous	-	-	-	-	-	+0.7%	-
Agricultural Land	-29.0%	-21.2%	-20.8%	-33.0%	-31.3%	-27.1%	-27.4%
Wetlands	+5.6%	+7.2%	+2.7%	+4.2%	-0.5%	+5.5%	+4.7%
Classes were consolidated to save space							

Change Interpretation:

Changes in open water may have resulted in natural fluctuations in lake or river levels or infill of shallow areas for development. Changes in developed land are the result of suburban land uses and are closely related to the population and economic growth. Reductions in forest and grassland is also a result of suburban development. Agricultural land was most impacted by residential development but also was effected by wetland conversion. While the growth of wetlands during this timeframe may seem anomalous, it is the result of increasing environmental concern and regulations and attempts at remediation due to wetlands' inherent ecological values and importance in stormwater management.

Conclusion:

The data shows a clear trend towards low density urban development on the peripheries of established communities and transportation corridors. This residential development coincided with population growth in the county, with most of land cover change actually occurring between 1992 and 2001 when population growth was at 35.7%. The land cover change came at a cost of farmland with 56% of the county being agricultural land in 1992 down to just 33% in 2011, a loss of about 86,000 acres (134.375 square miles). The Livingston County Comprehensive plan projected a 50% population increase between the years 2000 and 2020 so these land cover trends aren't likely to stop unless the local municipalities encourage more high density, compact development.

Future Work:

I plan on continuing this research in Livingston County to assess other relationships between population growth and land use dynamics. The changes in impervious surfaces, tree cover and the impacts of development on the soils in the region will be analyzed. Dasymetric mapping (a technique for disaggregating census block population data based on land cover patterns) to more accurately and realistically display population growth on time-series maps will be employed. Finally, I plan on analyzing patterns of development around the transportation corridors, commercial and social hubs as well as traditional community centers, such as downtowns.

Faculty Advisor:

Dr. William Welsh, Associate Professor of Geography, GIS Program

Special Thanks:

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