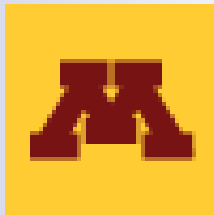




EXAMINING THE SOCIOECONOMIC FACTORS LINKED TO THE DENSITY OF LAND-COVER INTERFACE: A METHODOLOGICAL EXPLORATION



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Research Question

- What economic and ecological insights can be gained by evaluating land cover patterns along the interface of distinctive land-cover types?
- How can GIS and statistical analysis contribute to this endeavor?
- Focus is on the methodology



Edge Phenomena

- Wildland-urban interface
 - Applies traditionally to fire management
- Key themes
 - Exposure (disturbance, nuisance)
 - Access (natural amenities)
- Key indicator
 - Explicit: Degree of edge between types of land cover
 - Implicit: Fragmentation



Edge Density

- The interface is most dense where there is the highest adjacency of two land cover types
 - Relevant to
 - Inter-specific dynamics along edge, inc. predation, parasitism, physical disturbance, migration barriers
 - How are socioeconomic factors most closely associated with these patterns
 - Assumption that humans are key drivers of the land cover patterns and changes

Biogeographical Application

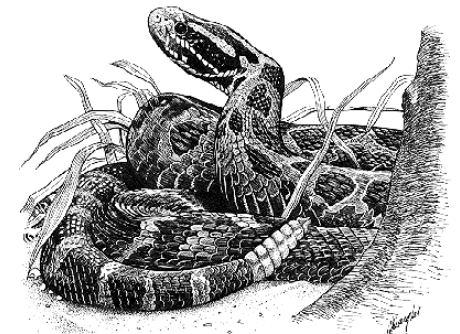
■ Edge effects

- Physical disturbances
- Invasive species and predators



■ Fragmentation

- Decreased connectivity between habitat
- Greater effect on good competitors than colonizers



Cleveland-Akron-Elyria CSA

- Located in Northeast Ohio
- Includes the Cleveland and Akron Metropolitan Areas



Identifying the URI in the CSA



Cleveland



Cuyahoga Valley
National Park



Akron

How do we determine where the URI exists based on land cover maps of the CSA?

Where do we find the greatest rate of transition between forest/wetlands and developed land?

Reclassification

1992

Urban

Low-Intensity Residential
High-Intensity Residential
Commercial/Industrial/Residential
Bare/Rock/Sand/Clay
Quarries/Strip Mines/Gravel Pits
Transitional
Urban/Recreational Grasses

Agriculture

Pasture/Hay
Row Crops

Undeveloped

Open Water
Deciduous Forest
Evergreen Forest
Mixed Forest
Grasslands/Herbaceous
Woody Wetlands
Emergent Herbaceous Wetlands

2001

Urban

Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land

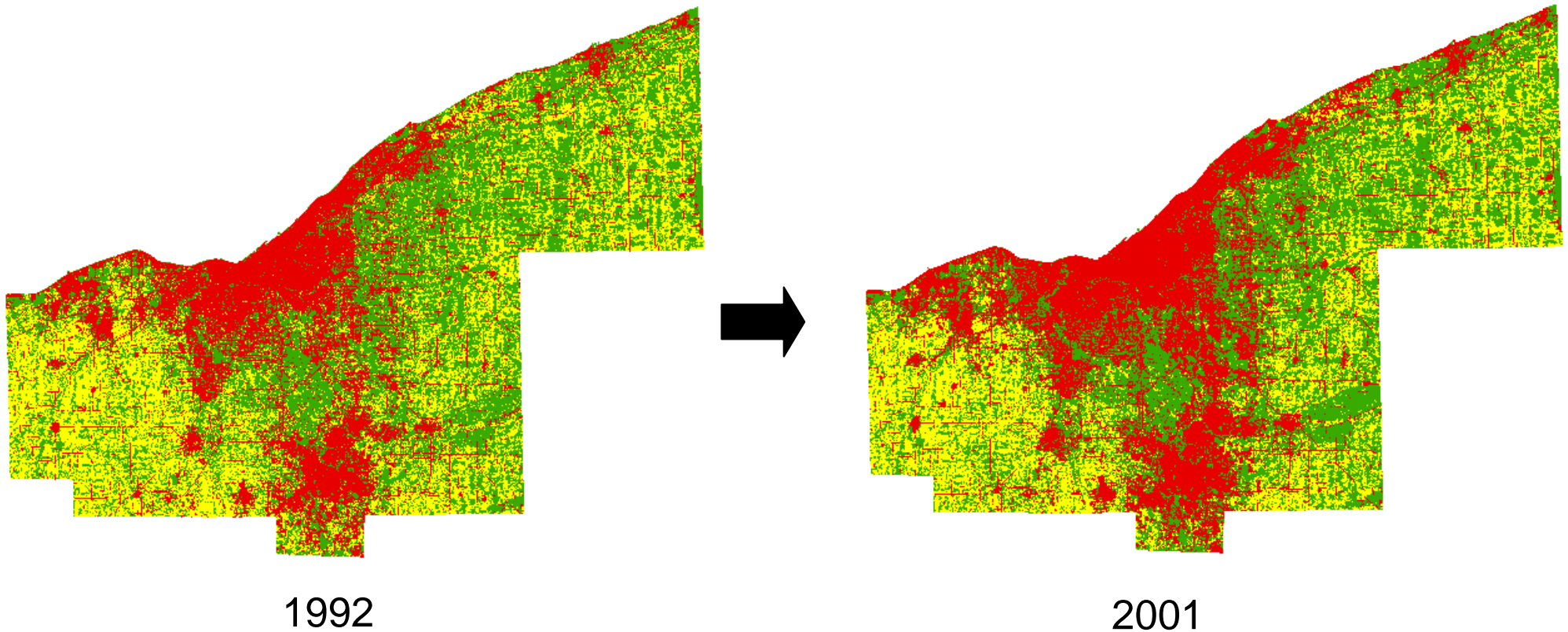
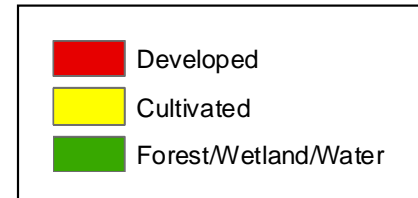
Agriculture

Pasture/Hay
Cultivated Crops

Undeveloped

Open Water
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Woody Wetlands
Emergent Herbaceous Wetlands

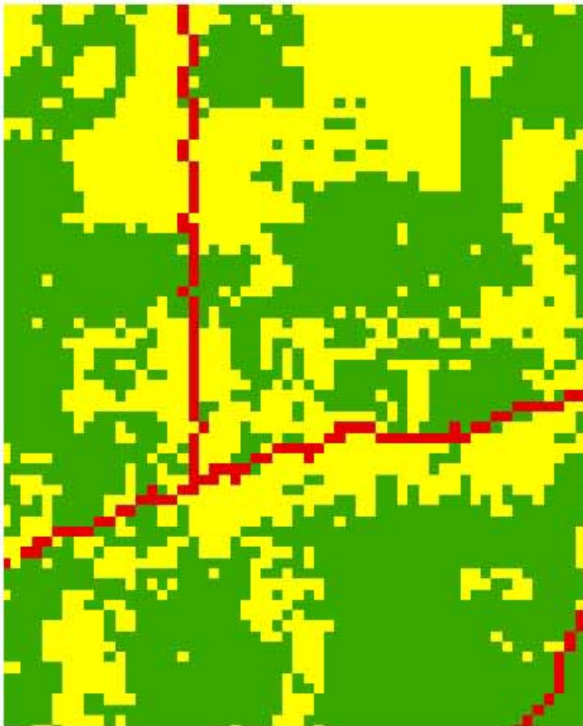
Land Cover Change



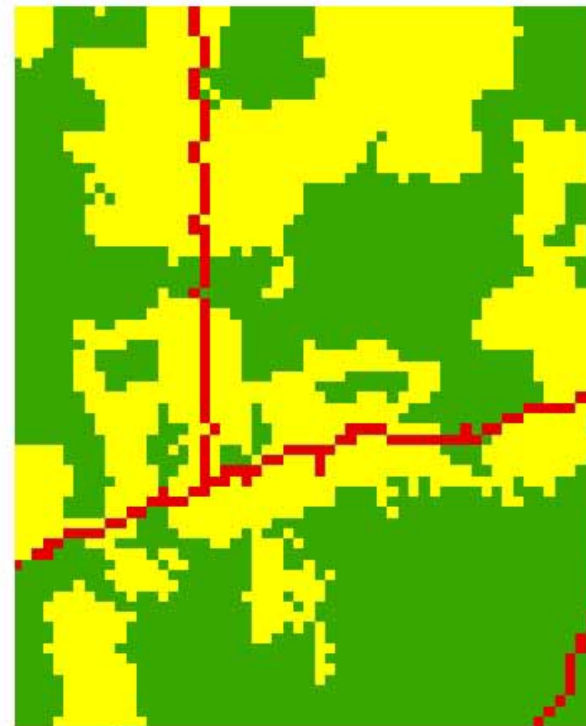
NLCD data used only as a testing ground. Discrepancies between the two data sets, due to differences in spectral capture, classification schemes, and post-production.

Post-Production

1992



2001



NLCD 2001 uses minimum mapping unit of five pixels.
Differences prohibit direct quantitative comparison.



Measuring Interface Density

- Contagion provides one metric for determining where fragmentation is
 - Pixel-based, not patch-based
 - The lower the contagion value, the higher the amount of edge between land-cover types
 - The mean contagion value is determined for each census tract, using Zonal Statistics

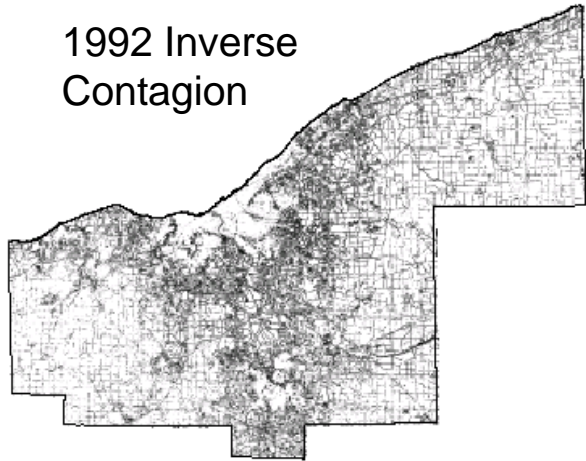


Socioeconomic Variables

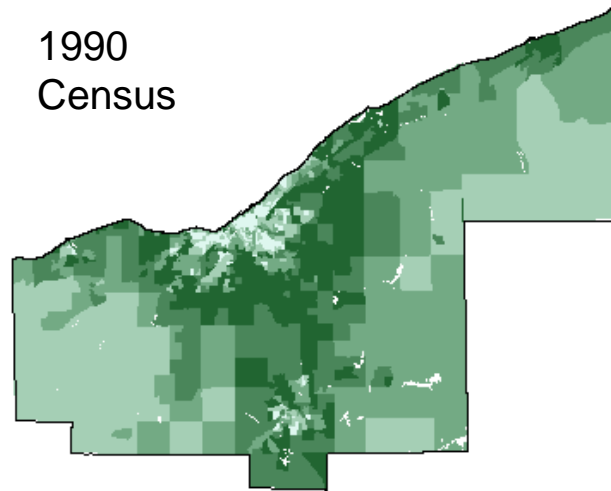
- Average household income
- Percent of population that is non-white
- Percentage of workers (16+) with 40-minute commuting time or greater
- Percentage of adults (25+) with a bachelor's degree
- Percentage of houses built at least 40 years earlier
- Percentage of people (5+) who moved from a city center within previous five years
- Percentage of people (5+) who moved from another suburb within previous five years

Integrating Landscape Metrics with Census Data – Urban/Undeveloped

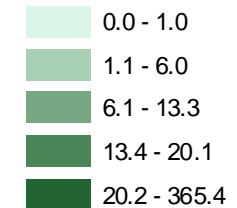
1992 Inverse Contagion



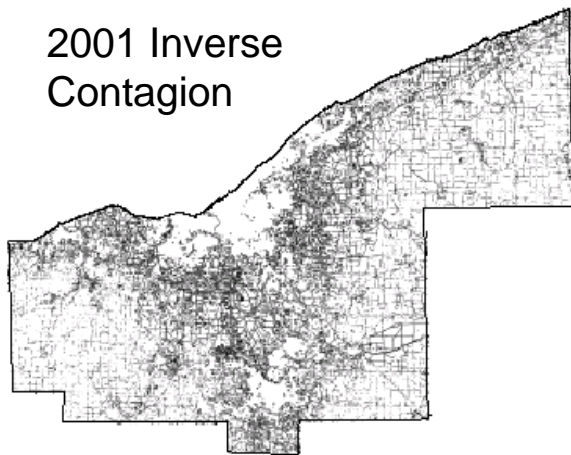
1990 Census



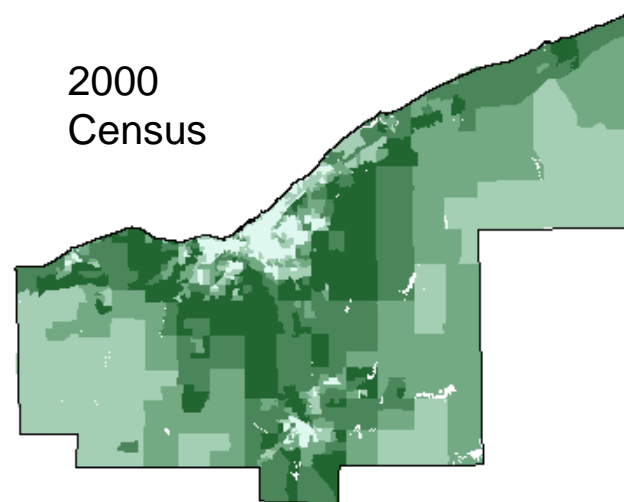
Interface Density
Per Tract



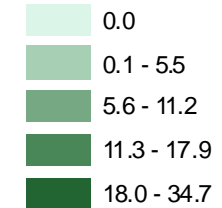
2001 Inverse Contagion



2000 Census



Interface Density
Per Tract



Linear Regression: Urban/Undeveloped

- Independent variable: contagion (transformed as SQRT(101-Contagion))
- Dependent variable: Percentage of population that is non-white, proportion of houses at least 40 years old, proportion of adults (25+) with a bachelor's degree, average household income, percentage of workers (16+) with 40-minute commuting time or greater, percentage of people (5+) who moved from a city center within previous five years, percentage of people (5+) who moved from another suburb within previous five years

1990

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.014	.274		14.676	.000
	PCTWHT9N100M_LN1	-.001	.038	-.001	-.029	.977
	BLT49PC_SQRT	-2.107	.221	-.357	-9.551	.000
	EDUC169PC_LN1	.010	.081	.006	.125	.901
	AVHHIN9	1.08E-005	.000	.162	3.644	.000
	COMMUTX9PCT	-2.683	.935	-.095	-2.869	.004
	POSTSUB5YRPCT	.016	.005	.132	3.007	.003

a. Dependent Variable: MEAN_OA_SQRT

2000

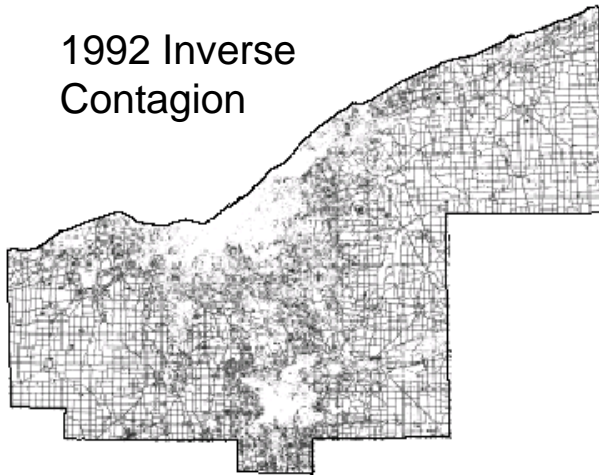
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.607	.362		9.972	.000
	PCTWHT0N100M_LN1	-.039	.045	-.036	-.879	.380
	BLT59PC	-1.562	.219	-.310	-7.127	.000
	EDUC160PC_LN1	.143	.097	.078	1.484	.138
	AVHHIN0	6.04E-006	.000	.152	3.076	.002
	COMMUTX0PCT	-2.125	1.011	-.085	-2.102	.036
	POSTSUB5YRPCT	-.003	.005	-.028	-.622	.534

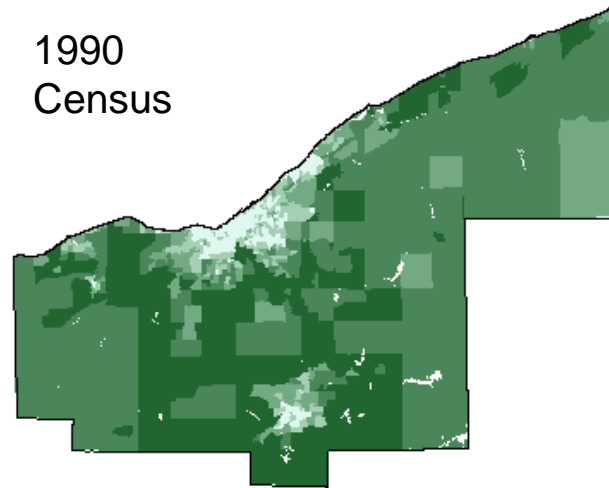
a. Dependent Variable: MEAN_OA_SQRT

Integrating Landscape Metrics with Census Data – Urban/Agricultural

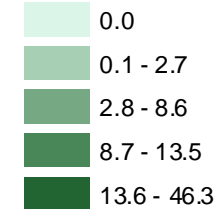
1992 Inverse Contagion



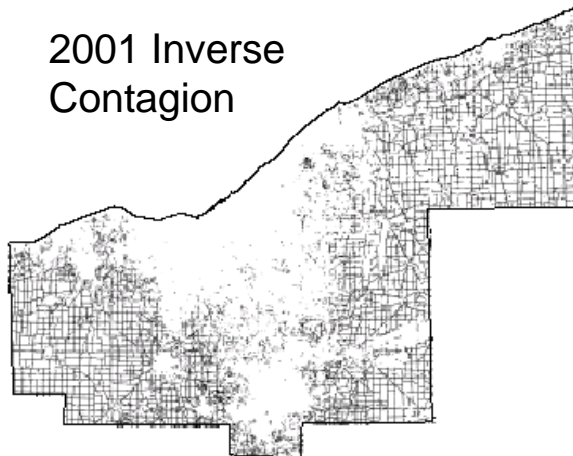
1990 Census



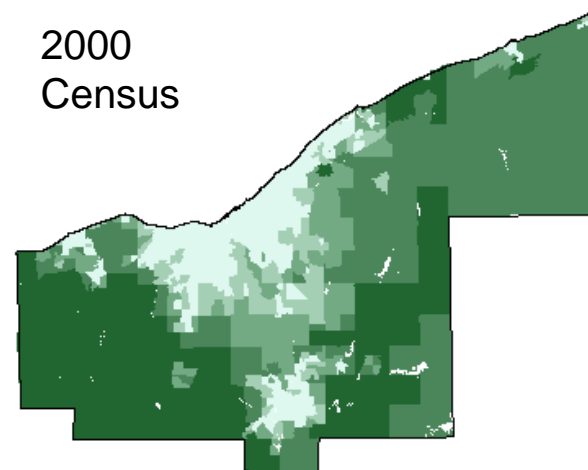
Interface Density
Per Tract



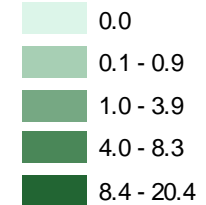
2001 Inverse Contagion



2000 Census



Interface Density
Per Tract



Linear Regression: Urban/Agricultural

- Independent variable: interface density (inverse of contagion)
- Dependent variable: Percentage of population that is non-white, proportion of houses at least 40 years old, proportion of adults (25+) with a bachelor's degree, average household income, percentage of workers (16+) with 40-minute commuting time or greater, percentage of people (5+) who moved from a city center within previous five years, percentage of people (5+) who moved from another suburb within previous five years

1990

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.366	.321		10.477	.000
	PCTWHT9N100M_LN1	-.223	.044	-.230	-5.125	.000
	BLT49PC_SQRT	-1.514	.220	-.274	-6.868	.000
	AVHHIN9	3.05E-007	.000	.005	.133	.894
	COMMUTX9PCT	2.297	.963	.089	2.384	.017
	POSTCITY5YRPCT_LN1	-.017	.076	-.011	-.216	.829
	POSTSUB5YRPCT	.014	.005	.134	3.052	.002

a. Dependent Variable: MEAN_0A_SQRT

2000

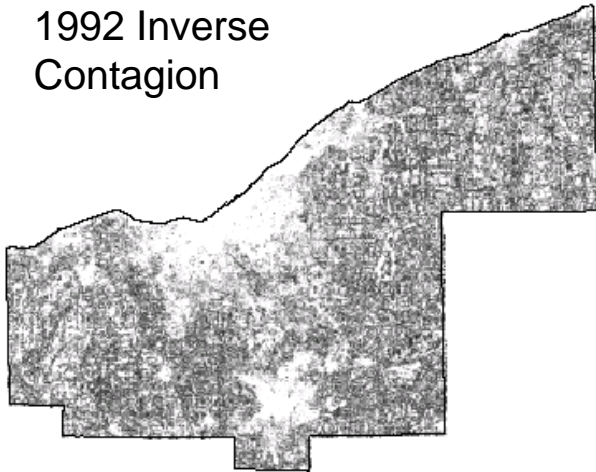
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.046	.494		8.193	.000
	PCTWHT0N100M_LN1	-.321	.062	-.278	-5.193	.000
	BLT59PC	-.886	.353	-.151	-2.509	.013
	EDUC160PC_LN1	-.488	.100	-.290	-4.884	.000
	COMMUTX0PCT	4.399	1.202	.213	3.660	.000
	POSTSUB5YRPCT	-.010	.006	-.091	-1.657	.099

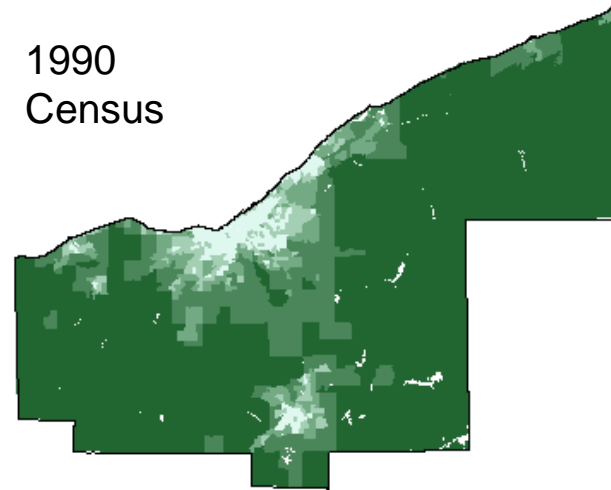
a. Dependent Variable: MEAN_0A_SQRT

Integrating Landscape Metrics with Census Data – Agricultural/Undeveloped

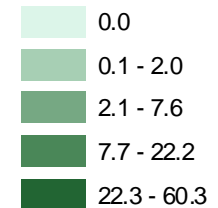
1992 Inverse Contagion



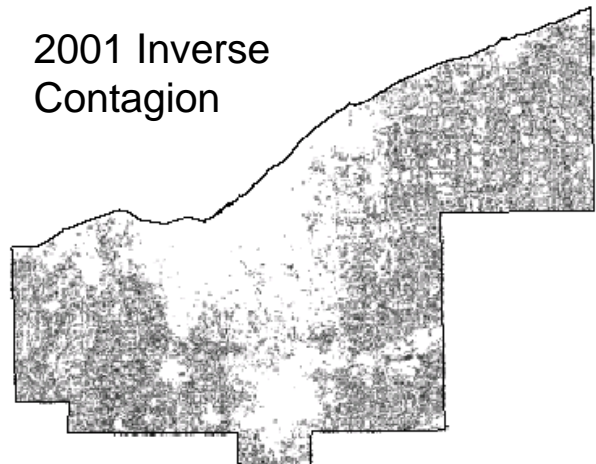
1990 Census



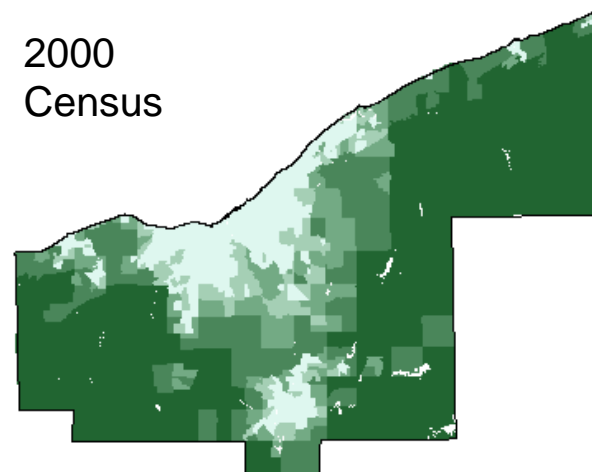
Interface Density Per Tract



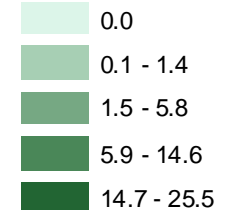
2001 Inverse Contagion



2000 Census



Interface Density Per Tract



Linear Regression: Agricultural/Undeveloped

- Independent variable: contagion (transformed as SQRT(101-Contagion))
- Dependent variable: Percentage of population that is non-white, proportion of houses at least 40 years old, proportion of adults (25+) with a bachelor's degree, average household income, percentage of workers (16+) with 40-minute commuting time or greater, percentage of people (5+) who moved from a city center within previous five years, percentage of people (5+) who moved from another suburb within previous five years

1990

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.278	.467		7.019	.000
	PCTWHT9N100M_LN1	-.335	.066	-.226	-5.061	.000
	BLT49PC_SQRT	-.422	.328	-.050	-1.284	.200
	AVHHIN9	1.24E-006	.000	.015	.380	.704
	COMMUTX9PCT	9.740	1.337	.274	7.283	.000
	POSTCITY5YRPCT_LN1	-.389	.110	-.170	-3.532	.000
	POSTSUB5YRPCT	.016	.007	.103	2.420	.016

a. Dependent Variable: MEAN_0A_SQRT

2000

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.371	.667		6.553	.000
	PCTWHT0N100M_LN1	-.396	.088	-.265	-4.513	.000
	BLT59PC	-.796	.443	-.101	-1.797	.073
	EDUC160PC_LN1	-.629	.124	-.286	-5.094	.000
	COMMUTX0PCT	8.564	1.520	.317	5.634	.000
	POSTCITY5YRPCT_LN1	-.020	.117	-.011	-.175	.861

a. Dependent Variable: MEAN_0A_SQRT



Future Research

- Inclusion of other variables, such as housing value, proximity to the cities, and proximity to Lake Erie
- Case studies concerning what settlers of high-interface areas value most about their residences, what political conflicts are most prevalent



Thank You!



Thanks to:

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Paul Hoeffler, OSU (for technical advice)