A Sprawl Pattern Assessment Tool Applied to Residential Development in Coastal North Carolina

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Center for Geographic Information Science
East Carolina University

Support from:

Sea Grant
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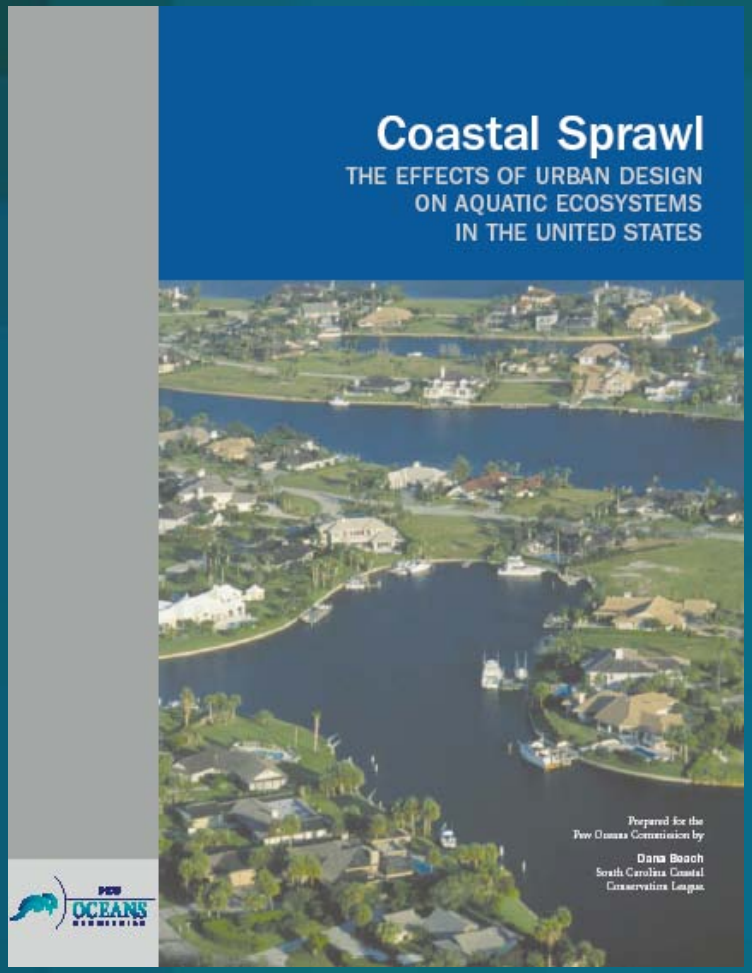
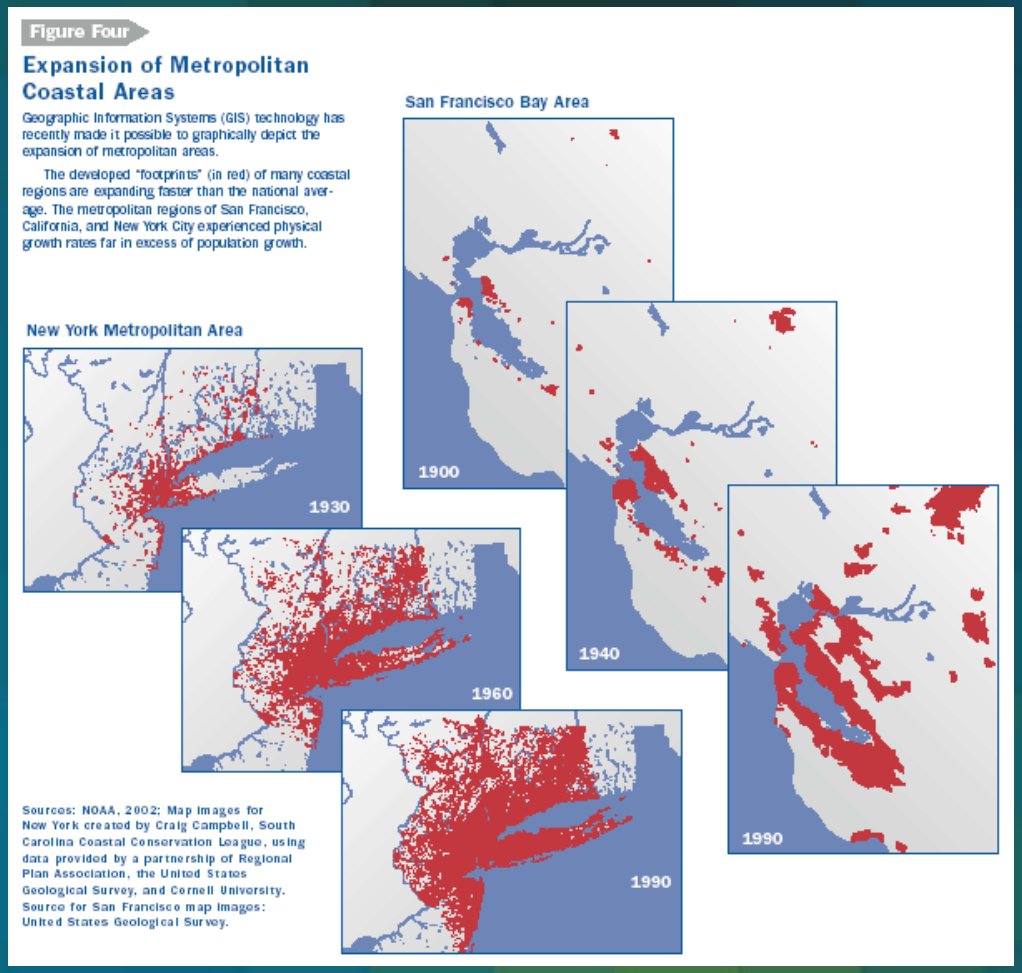
Coastal Development





Coastal Sprawl (Dana Beach, 2003)

The expansion of low density residential and commercial development scattered across large coastal areas.

Table 1. Environment impacts of sprawl.	
Loss of fragile lands	Excessive removal of vegetation
Reduced open space	Loss of farmland
Greater air pollution	Decreased aesthetics
Reduced species diversity	Ecosystem fragmentation
Increased stormwater runoff	Beach and shellfish closures*
Increased risk of flooding	* added by authors

Johnson 2001 (in *Environment & Planning A*).

Table 2. Spatial characteristics of sprawl.
Large areas of low density-development
Leapfrog development
Widespread commercial strip development
Segregation of land use types

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Where does the coast sprawl the most? Trajectories of residential development and sprawl in coastal North Carolina, 1971–2000

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Available online 12 July 2007

Abstract

High levels of population growth in coastal U.S. settings give cause for concern about development's effects. Urban sprawl, a potential manifestation of development, is known for its negative environmental and social impacts; however, there have been few efforts to define and measure it in coastal regions where beach-oriented tourism and amenity-driven population growth and land development are prominent. This study describes residential expansion patterns and identifies trajectories for a set of sprawl metrics in New Hanover County, North Carolina over a 30-year time period. Using parcel data and GIS techniques, I developed a set of metrics for nine townships that nest within three township groups classified as: most coastal, transitional, and least coastal. Metrics measuring land consumption, leapfrog distance, land use diversity, and highway strip development are quantified and compared across regions. Most of the metrics were weakly correlated with each other suggesting that they capture different dimensions of sprawl. Results demonstrate that transitional settings located near estuaries between the oceanfront and the interior mainland were consistently the most sprawling. Behaviors of many metrics had complex, non-linear trajectories that would be invisible using either a cross-sectional or two-date approach. The approach can be extended to other regions, both coastal and non-coastal, to determine if there are differences in sprawl patterns that are unique to other environments.
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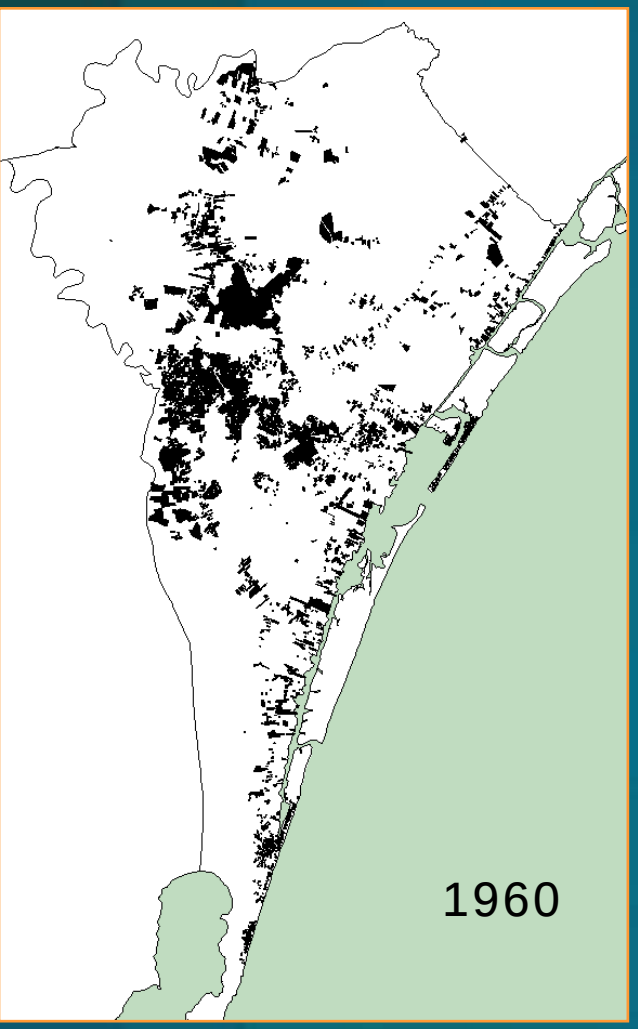
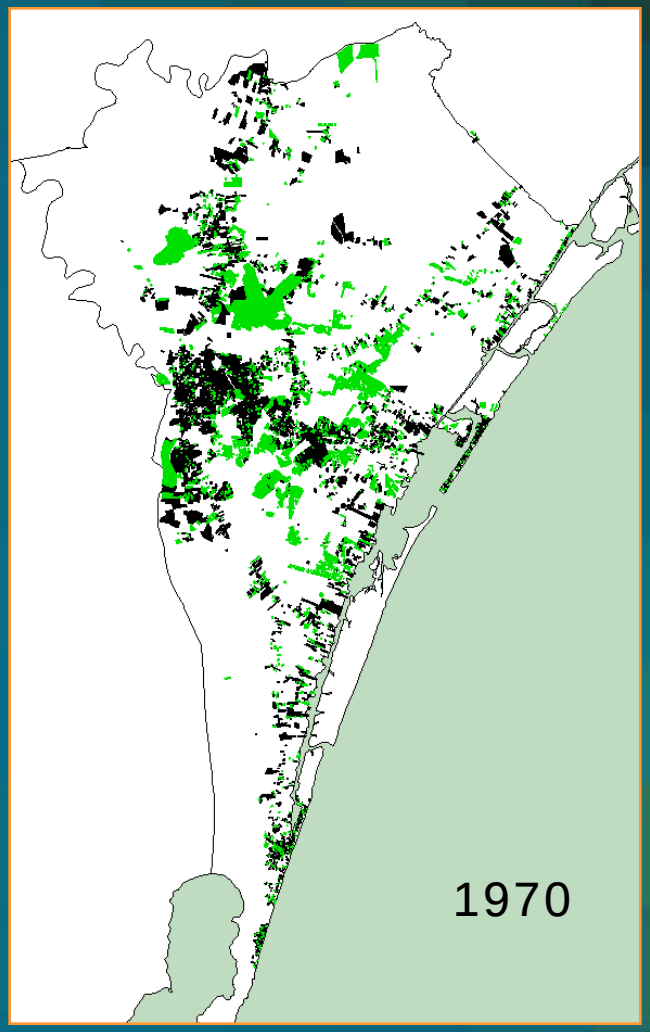
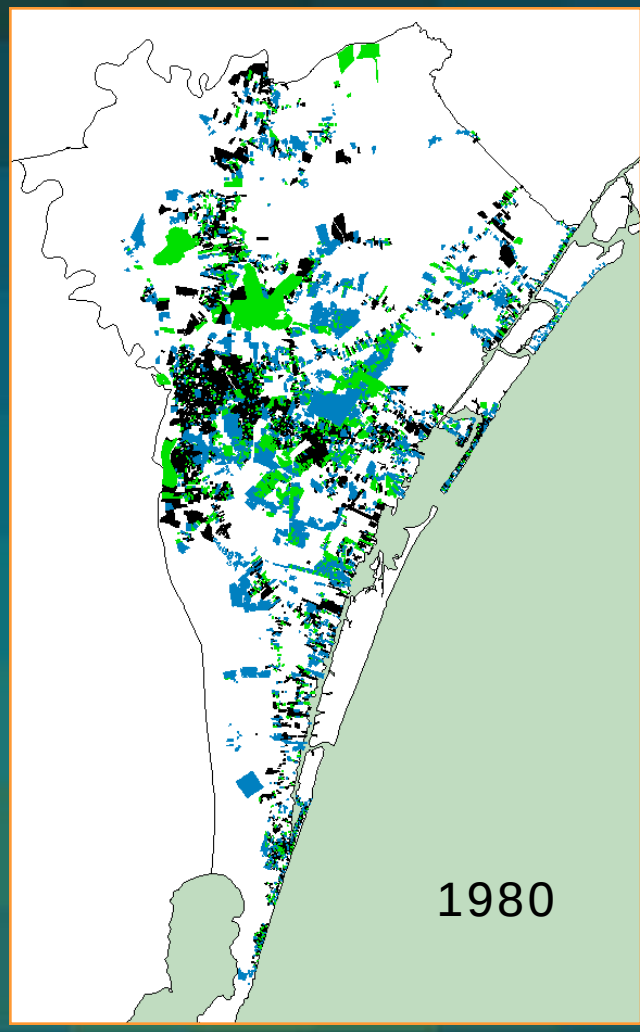
Keywords: Coastal; GIS; Land use change; Metrics; Parcel; Scale; Sprawl

New Hanover Development, 1960-2000

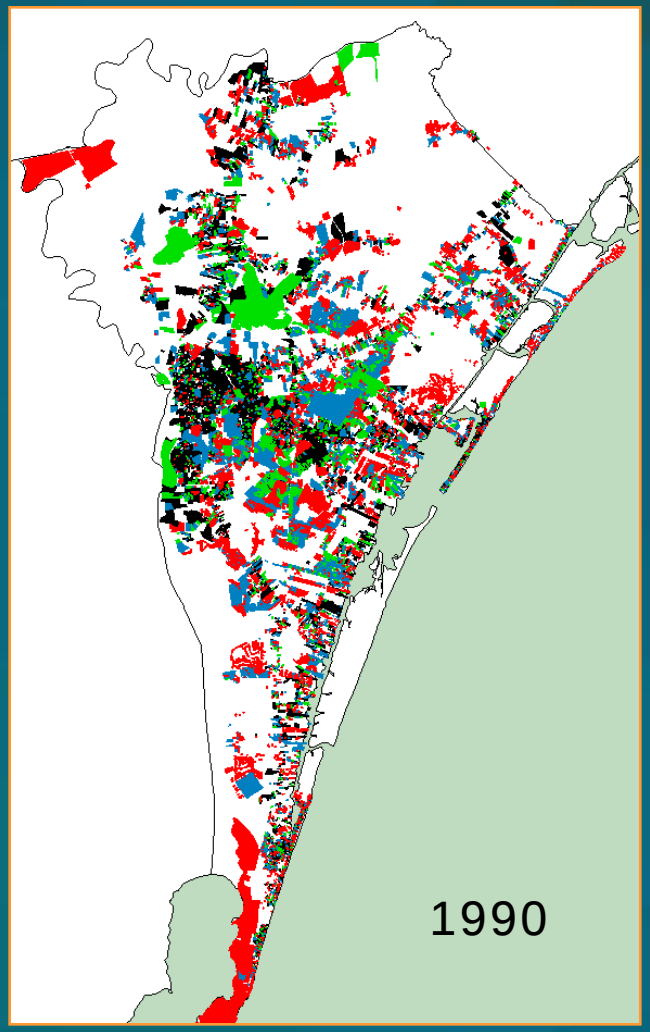


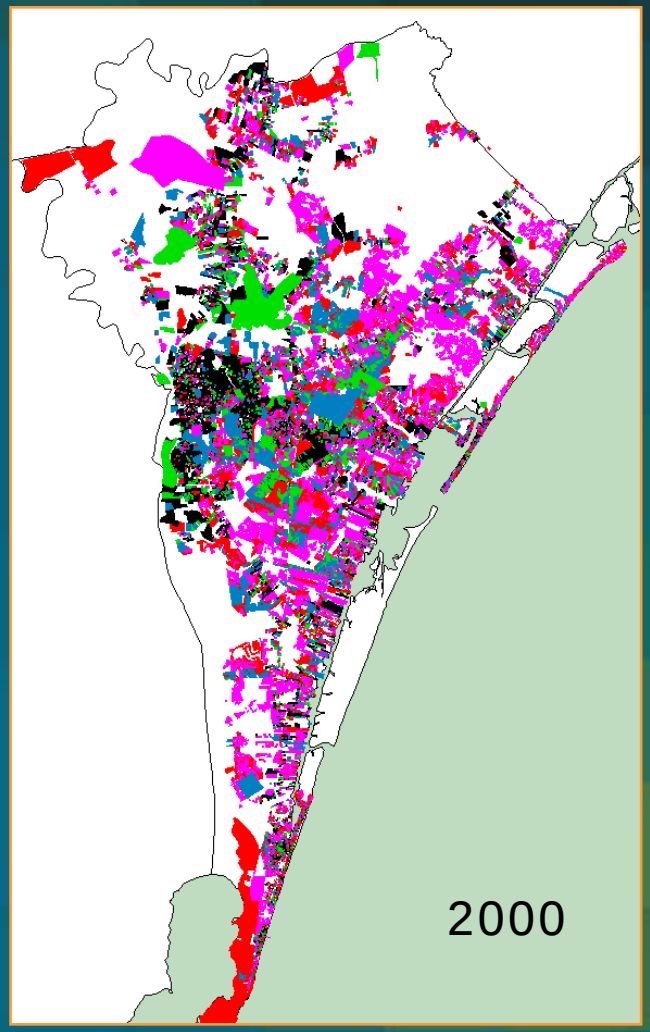




Data source: New Hanover County parcel database, GIS Dept.

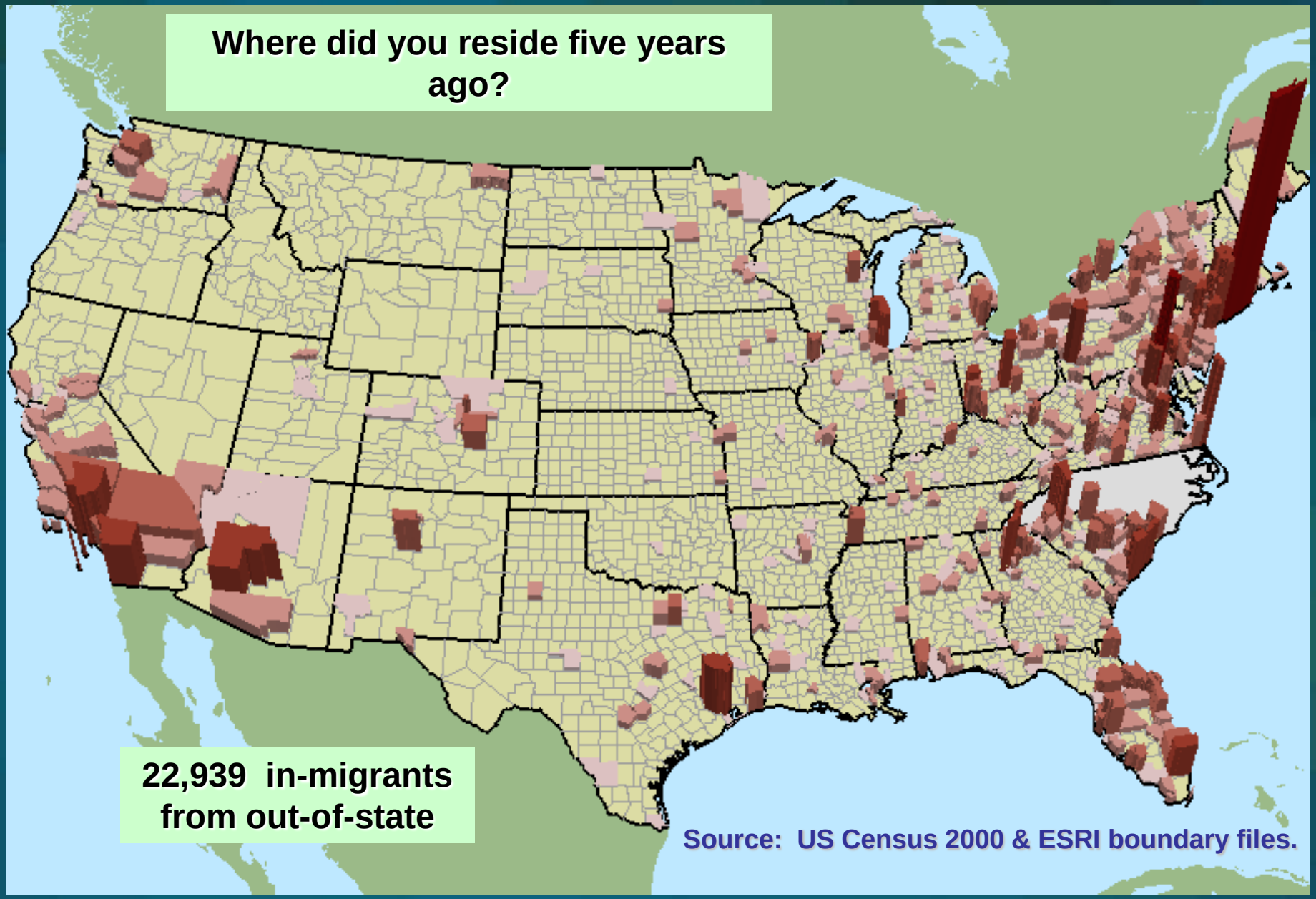
New Hanover Development, 1960-2000





Data source: New Hanover County parcel database, GIS Dept.

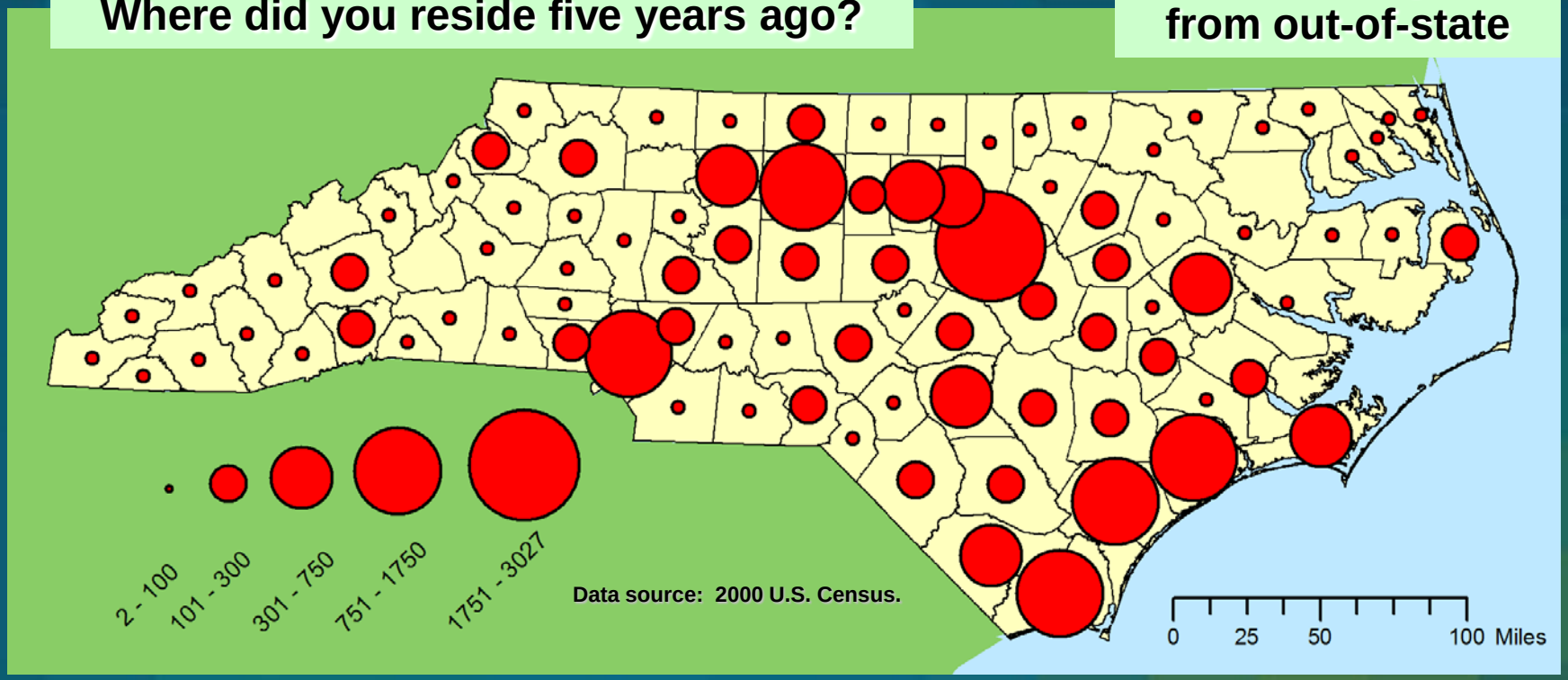
New Hanover County In-Migration Source Areas



New Hanover County In-Migration Source Areas

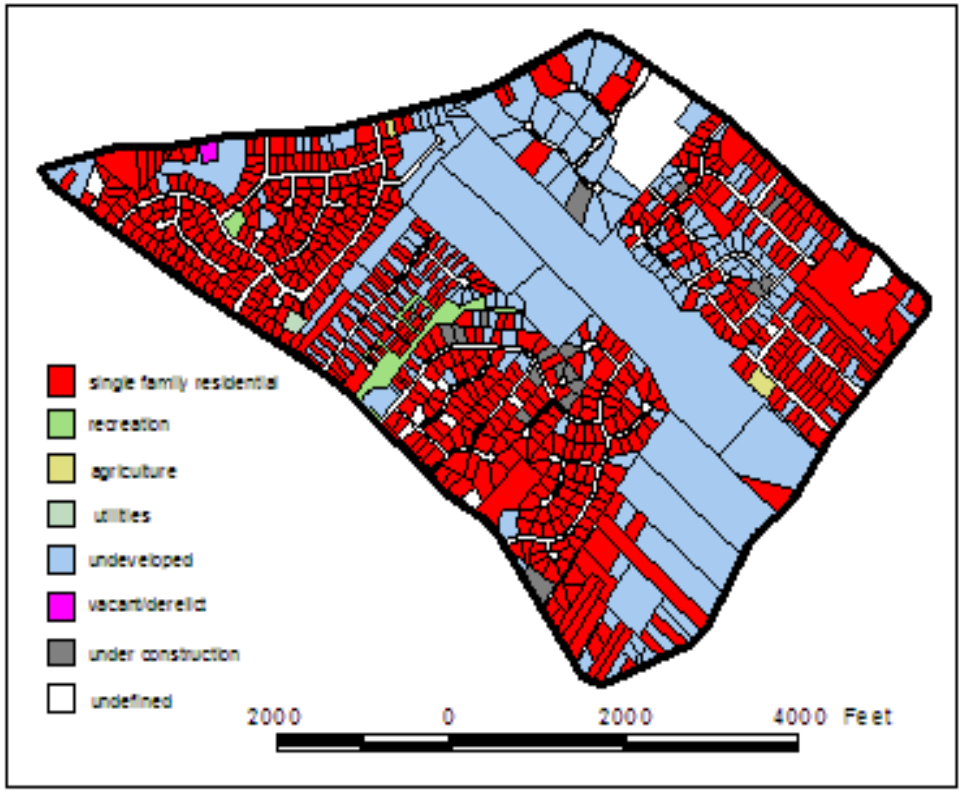
Where did you reside five years ago?

19,993 in-migrants from out-of-state



- **16.4% of total pop was out-of-state 5 years ago.**
- **14.3 % of total pop was in another NC county 5 years ago.**

Parcel-Based Sprawl Measures



Parcel polygons and derived centroids

- year built
- land use type

Focus is only on residential parcels.

Blue = existed in 1995

Red = built during 1996 - 2000

Parcel-Based Sprawl Measures

- **Land Consumption = parcel size**

Parcel-Based Sprawl Measures

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- **Leapfrog Distance** = distance to the nearest prior existing residential parcel

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- **Diversity** = how many different land uses are within a defined distance of the parcel?

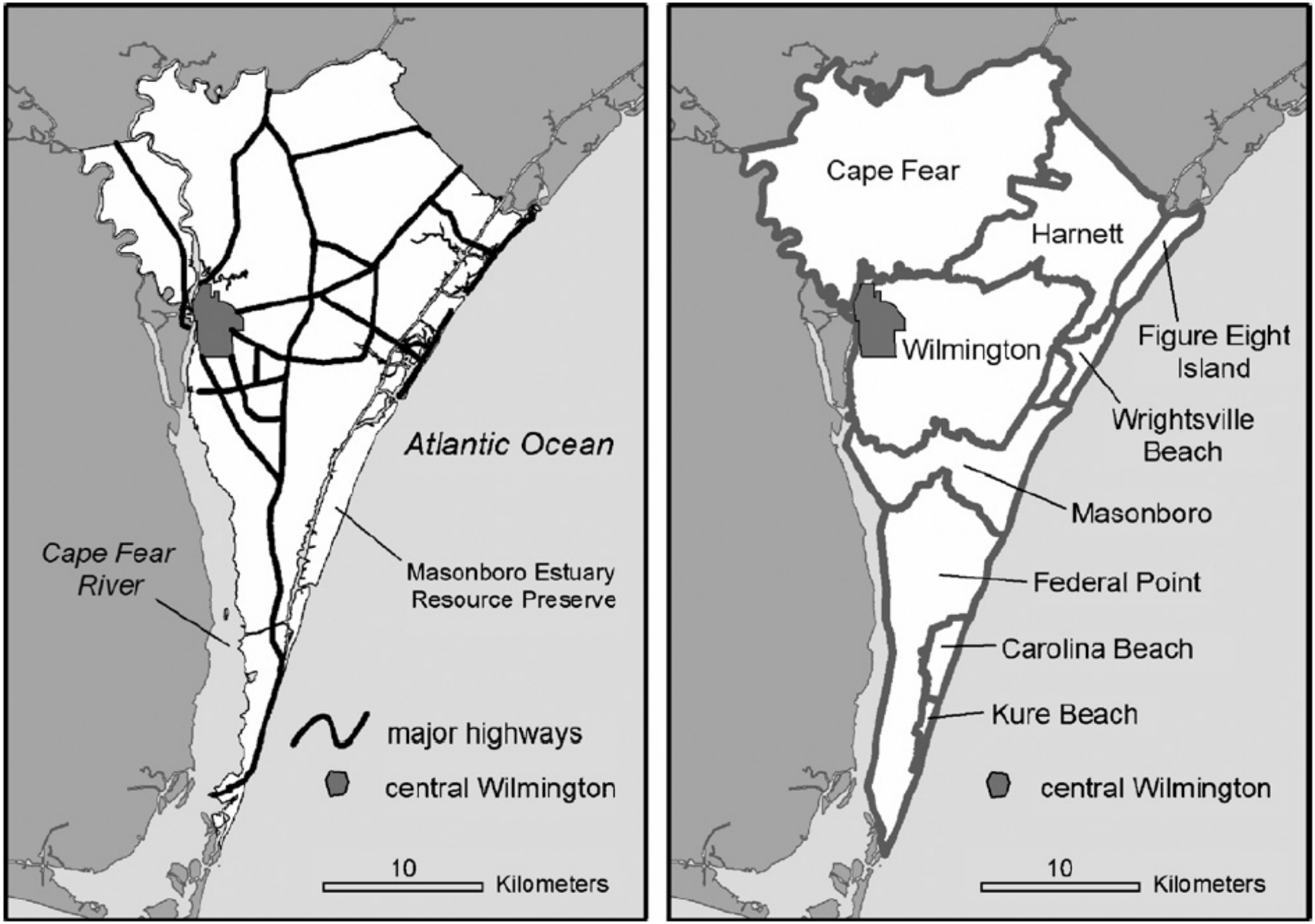
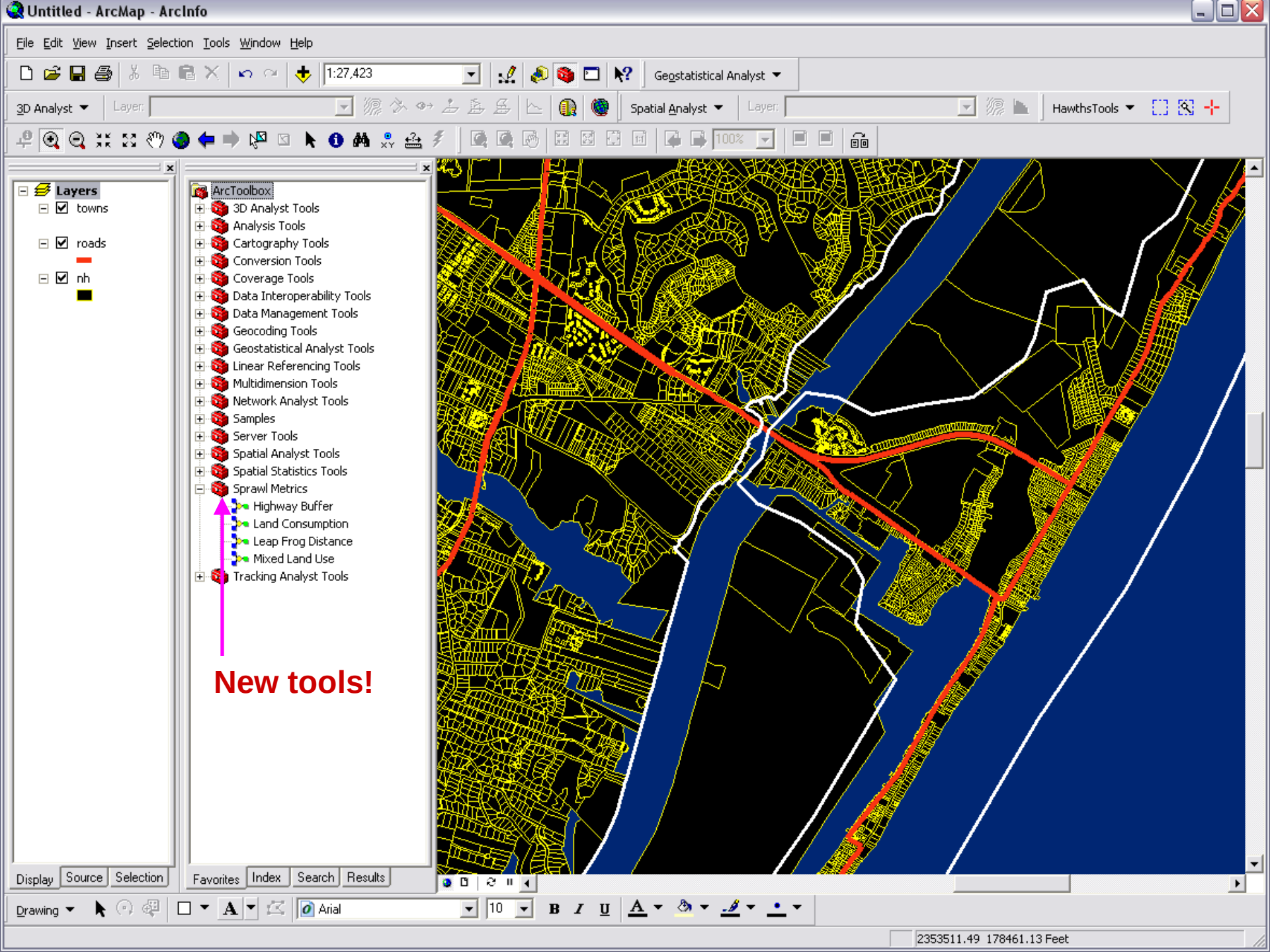


Fig. 2. New Hanover County study area townships and major roads.

Parcel-Based Sprawl Measures

- **Land Consumption** = parcel size
- **Leapfrog Distance** = distance to the nearest prior existing residential parcel
- **Highway Buffer** = is parcel centroid located within a defined distance of a major road?
- **Diversity** = how many different land uses are withing a defined distance of the parcel?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File Edit View Insert Selection Tools Window Help
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Geostatistical Analyst
3D Analyst
Layer:
Spatial Analyst
Layer:
HawthsTools
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ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Coverage Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Multidimension Tools
Network Analyst Tools
Samples
Server Tools
Spatial Analyst Tools
Spatial Statistics Tools
Sprawl Metrics
Highway Buffer
Land Consumption
Leap Frog Distance
Mixed Land Use
Tracking Analyst Tools
New tools!
Display
Source
Selection
Favorites
Index
Search
Results
Drawing
Arial
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2353511.49 178461.13 Feet

ArcCatalog - ArcInfo - D:\A3\proposals\research\coastal_seagrant\geotools_09\tools\Sprawl Metrics\Land Consumption

File Edit View Go Tools Window Help

Location: D:\A3\proposals\research\coastal_seagrant\geotools_09\tools\Sprawl Metrics\Land

Stylesheet: geoprocessing

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- data_census
- dataprep
- final_work
- geotools_09
  - ai
  - graphics
  - modelbuilder_pdfs
  - ppt
  - screencaps
  - tools
    - Sprawl Metrics
      - Highway Buffer
      - Land Consumption
      - Leap Frog Distance
      - Mixed Land Use
- lit
- lit_selected
- migration
- nhc_fieldwork
- nsf
- parcel_downloads
- prop
- proposal
- puma_edit_don
- sedaag08
- test
- test_northeast
- walmart
- web_page
- g3.shp
- nsf.mxd
- coastal_sprawl

Contents | Preview | Metadata

Name: **Land Consumption**
Type: **Toolbox Tool**

Land Consumption

Temporary workspace (optional)

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regions field (optional)

PLACE

INPUT PARCELS LAYER

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area field (optional)

acre

land use field (optional)

rescode

residential land use value (optional)

1

year built field (optional)

yrbuilt

start year value (optional)

1996

end year value (optional)

2000

OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

Temporary workspace (optional)

REQUIRED: Specify a tempory workspace that may be a folder or a geodatabase. Temporary files during processing will be placed there and deleted upon completion.

Land Consumption

Temporary workspace (optional)

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regions field (optional)

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D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

INPUT REGIONS LAYER

REQUIRED: Specify a regions feature class. This must be a polygon feature class and can be a coverage, shapefile, or geodatabase feature class.

Land Consumption

Temporary workspace (optional)

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INPUT REGIONS LAYER

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regions field (optional)

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OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

regions field (optional)

REQUIRED: Type in the name of the field containing values that define regions to be summarized.

NOTE: Take care to type the exact name of the field.

Land Consumption

Temporary workspace (optional)

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area field (optional)

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end year value (optional)

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OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

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Help

INPUT PARCELS LAYER

REQUIRED: Specify a parcels feature class. This must be a polygon feature class and can be a coverage, shapefile, or geodatabase feature class.

Land Consumption

Temporary workspace (optional)

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end year value (optional)

2000

OUTPUT Land Consumption table

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Help

area field (optional)

REQUIRED: Type in the name of the field representing parcel area.

NOTE: Take care to type the exact name of the field.

Land Consumption

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area field (optional)
acre

land use field (optional)
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rescode

residential land use value (optional)
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year built field (optional)
yrbuilt

start year value (optional)
1996

end year value (optional)
2000

OUTPUT Land Consumption table
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

land use field (optional)

REQUIRED: Type in the name of the field representing parcel land use type.

NOTE: Take care to type the exact name of the field.

Land Consumption

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regions field (optional)

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OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

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Help

residential land use value (optional)

REQUIRED: Type in the value indicating a residential land use.

Land Consumption

Temporary workspace (optional)

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land use field (optional)

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1996

end year value (optional)

2000

OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

year built field (optional)

REQUIRED: Type in the name of the field representing the year built for parcels that have been built on. This field must be an integer type and have values in the form of 4-digit years (e.g. 1996).

NOTE: Take care to type the exact name of the field.

Land Consumption

Temporary workspace (optional)

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INPUT REGIONS LAYER

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\towns

regions field (optional)

PLACE

INPUT PARCELS LAYER

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acre

land use field (optional)

rescode

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1

year built field (optional)

yrbuilt

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*

1996

end year value (optional)

2000

OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

start year value (optional)

REQUIRED: Type in the value indicating the start year for the time period of interest. To summarize parcels for the period 1996 -2000, you would type in 1996. In this example all parcels developed in 1996, 1997, 1998, 1999, and 2000 will be included.

Land Consumption

Temporary workspace (optional)

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INPUT REGIONS LAYER

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regions field (optional)

PLACE

INPUT PARCELS LAYER

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acre

land use field (optional)

rescode

residential land use value (optional)

1

year built field (optional)

yrbuilt

start year value (optional)

1996

* end year value (optional)

2000

OUTPUT Land Consumption table

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

OK | Cancel | Environments... | << Hide Help

Help

end year value (optional)

REQUIRED: Type in the value indicating the end year for the time period of interest. To summarize parcels for the period 1996 -2000, you would type in 2000. In this example all parcels developed in 1996, 1997, 1998, 1999, and 2000 will be included.

Land Consumption

Temporary workspace (optional)

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INPUT REGIONS LAYER

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regions field (optional)

PLACE

INPUT PARCELS LAYER

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area field (optional)

acre

land use field (optional)

rescode

residential land use value (optional)

1

year built field (optional)

yrbuilt

start year value (optional)

1996

end year value (optional)

2000

OUTPUT Land Consumption table

*

D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lc9600

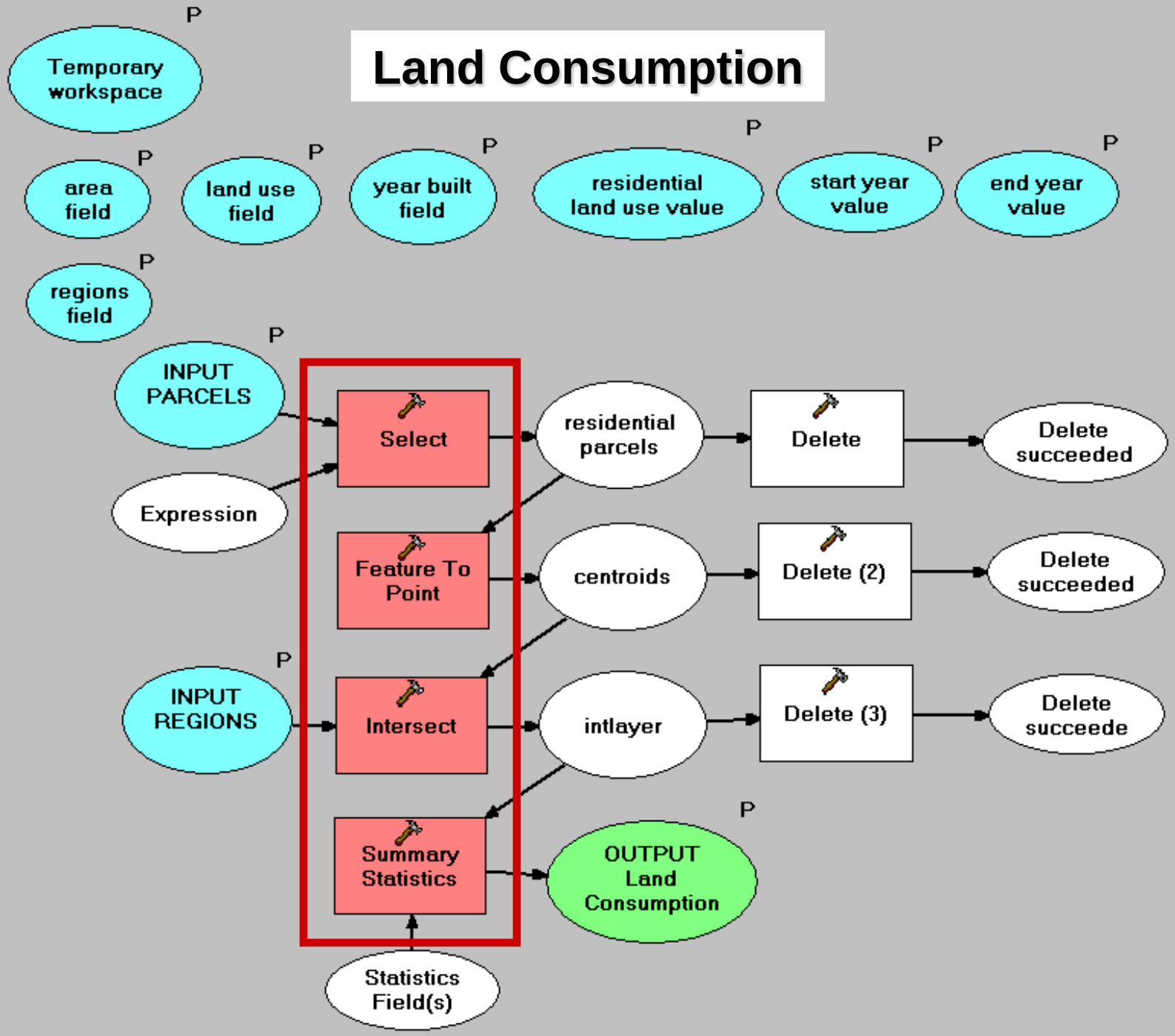
OK | Cancel | Environments... | << Hide Help

Help

OUTPUT Land Consumption table

REQUIRED. Specify the location and name of the output table. To create a dbf table, you must type the .dbf suffix. You may save output within a geodatabase. If not saving as a .dbf file or as a table in a geodatabase and if not specifying .dbf, the ouput will be saved as an INFO table in the directory you specify.

Land Consumption



Results: Land Consumption

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1	Cape Fear	777	426.264684	0.000033	45.008999	0.548603	1.916718
3	Federal Point	1543	560.658716	0.000002	9.59192	0.363356	0.467482
8	Wilmington	2670	920.774504	0.006624	26.2714	0.344859	0.920537
5	Harnett	2549	809.279357	0.011669	8.17391	0.317489	0.371718
7	Masonboro	1096	342.513304	0.022889	17.9112	0.312512	0.608622
9	Wrightsville Beach	85	14.785609	0.048957	0.79973	0.173948	0.118334
2	Carolina Beach	346	56.183499	0.014439	0.574649	0.16238	0.098122
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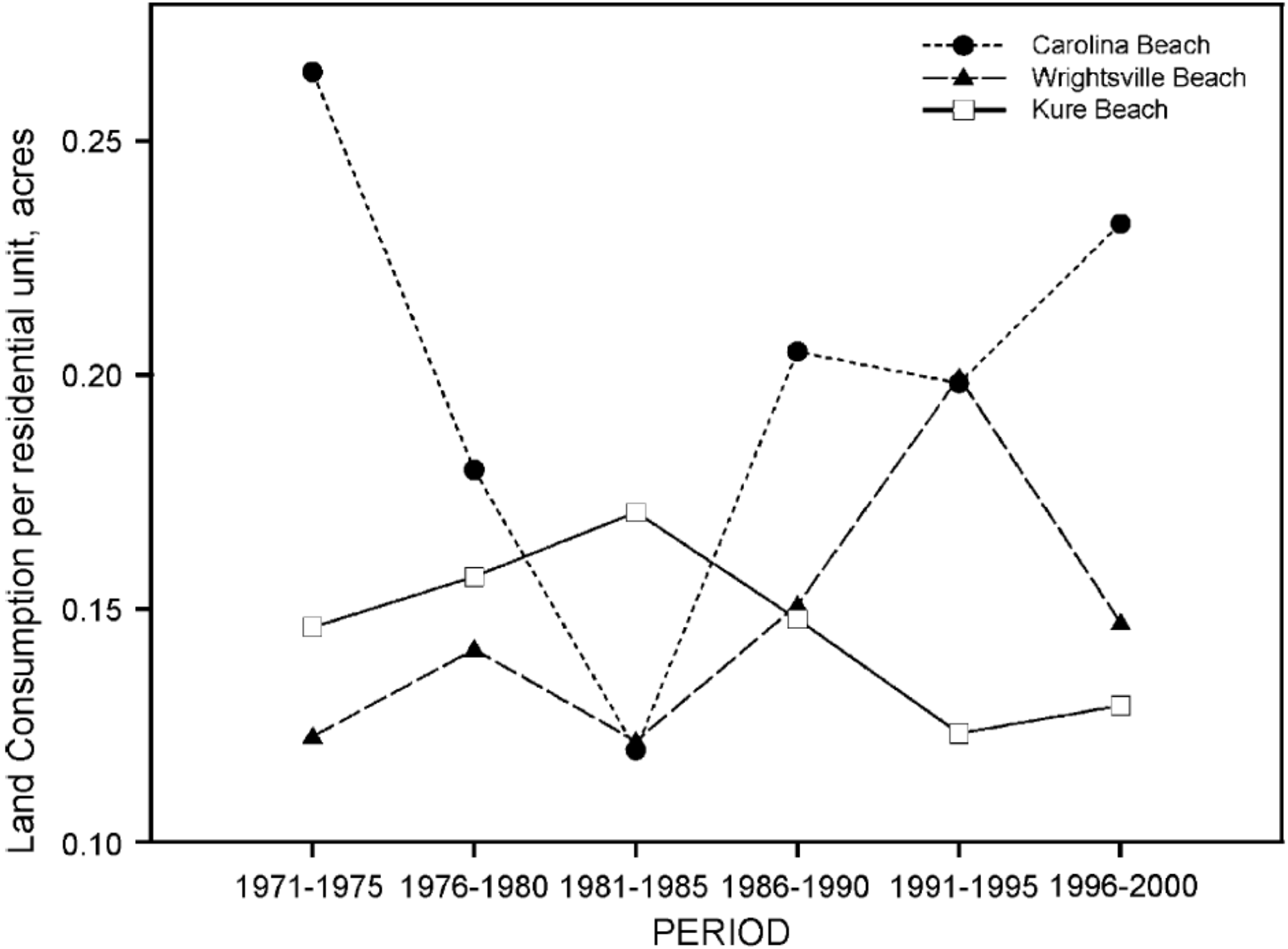
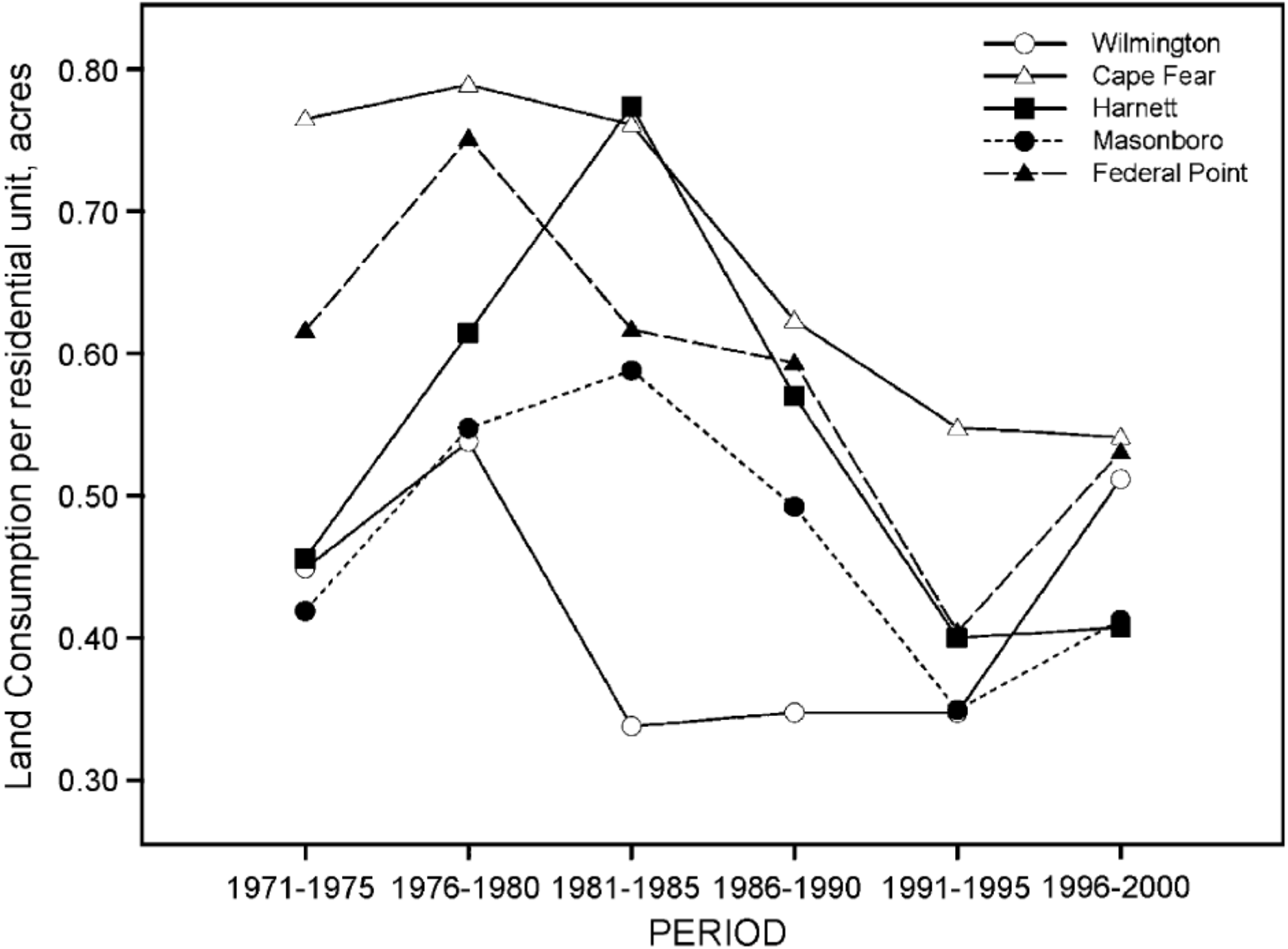

Carolina Beach
Wrightsville Beach
Kure Beach
Land Consumption per residential unit, acres
0.25
0.20
0.15
0.10
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
PERIOD


Wilmington
Cape Fear
Harnett
Masonboro
Federal Point
Land Consumption per residential unit, acres
0.80
0.70
0.60
0.50
0.40
0.30
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
PERIOD

Leap Frog Distance

Temporary workspace (optional)
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INPUT REGIONS LAYER
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regions field (optional)
PLACE

INPUT PARCELS LAYER
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\nh

area field (optional)
acre

land use field (optional)
rescode

residential land use value (optional)
1

year built field (optional)
yrbuilt

start year value (optional)
1996

end year value (optional)
2000

OUTPUT Leap Frog table
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\lf9600

Search Radius (optional)
2500 Feet

*

OK | Cancel | Environments... | << Hide Help

Help

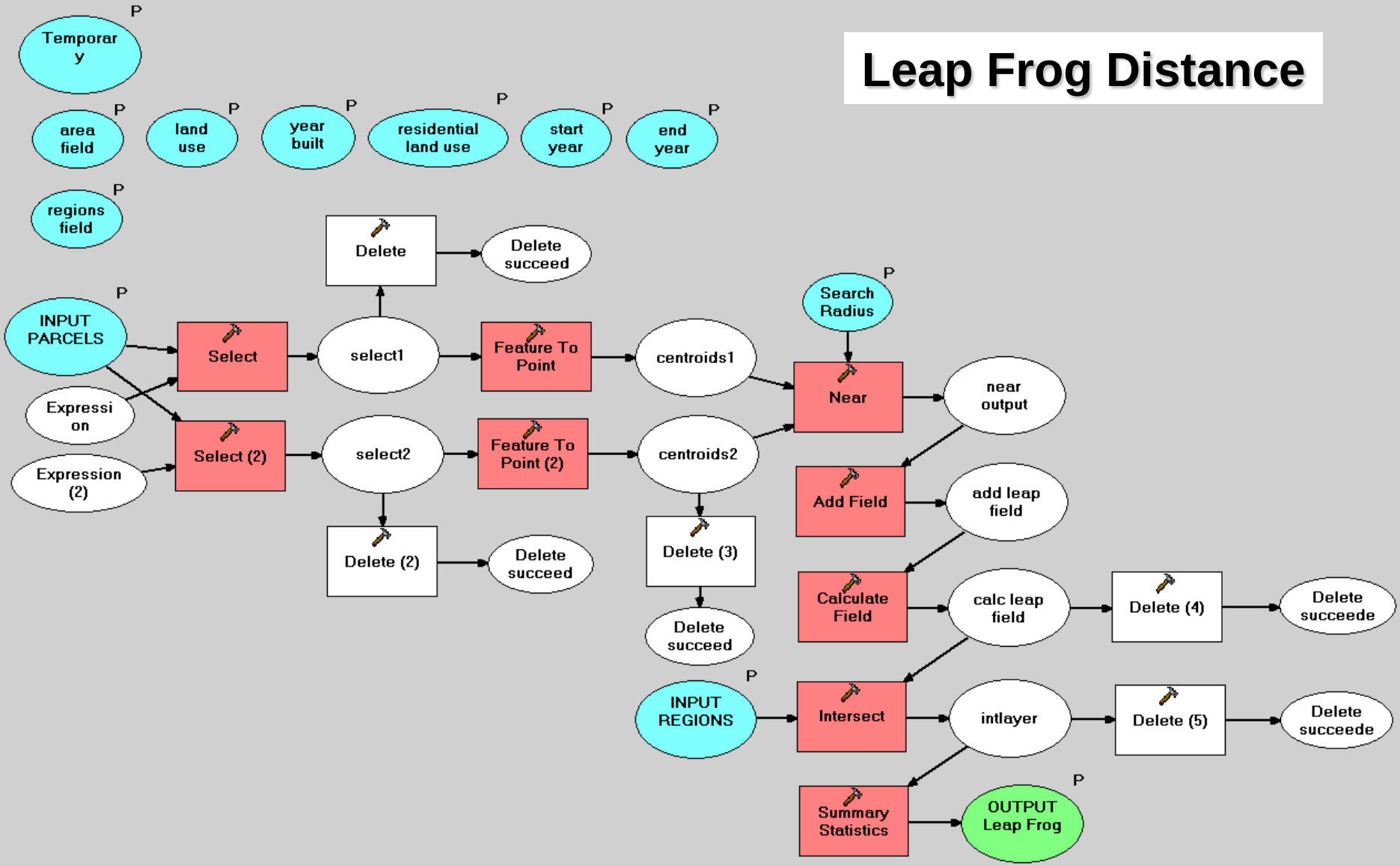
Search Radius (optional)

OPTIONAL: You may limit the search distance. For each parcel in the period of interest, the nearest distance to a residential parcel existing prior to the period of interest is calculated. Not setting a search distance can take longer to process since every prior existing parcel is examined. Setting a search distance limits the maximum possible distance to prior existing parcels.

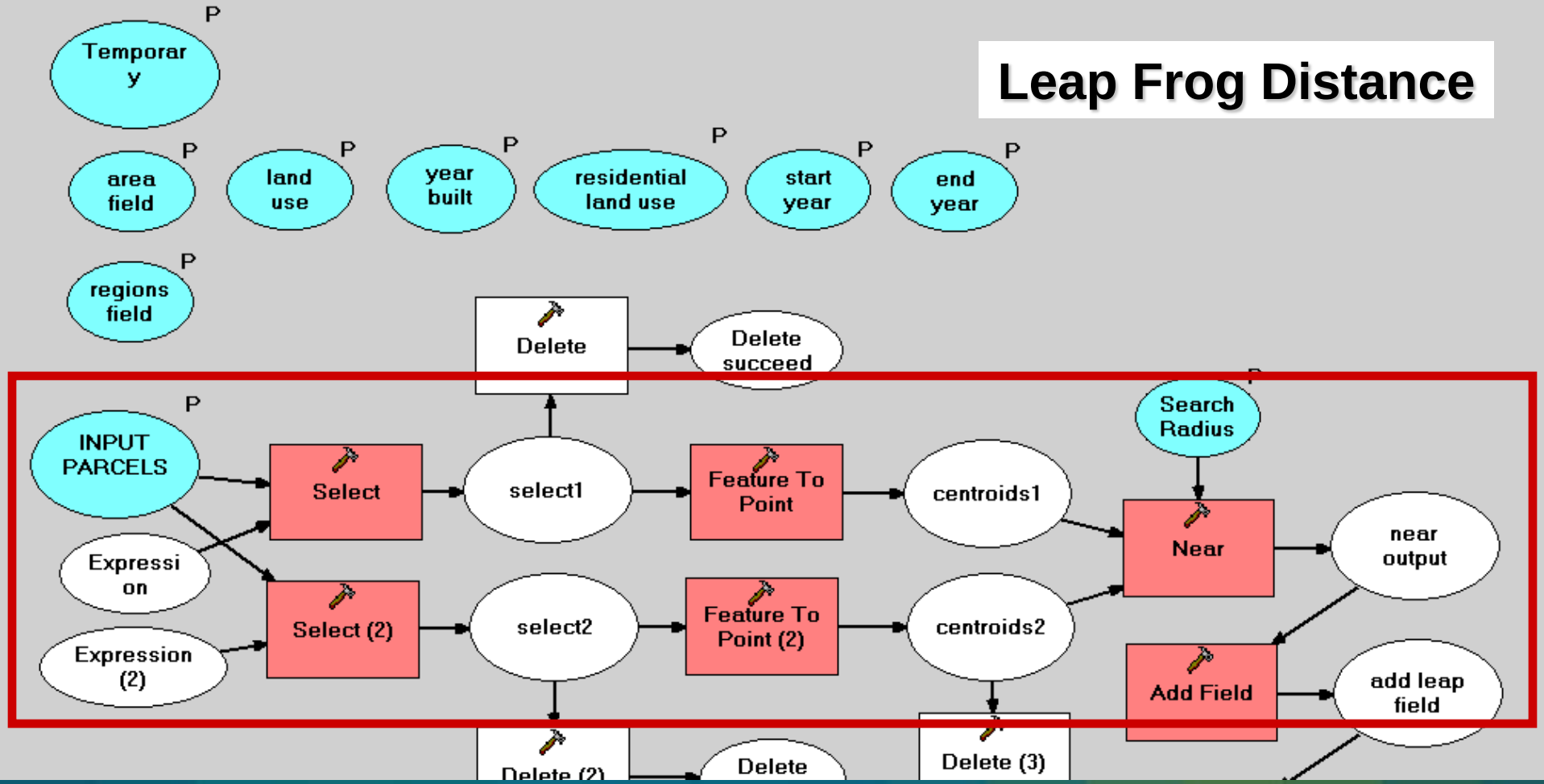
Setting a distance will speed processing time.

An appropriate distance can be estimated via familiarity with the study area or via trial and error.

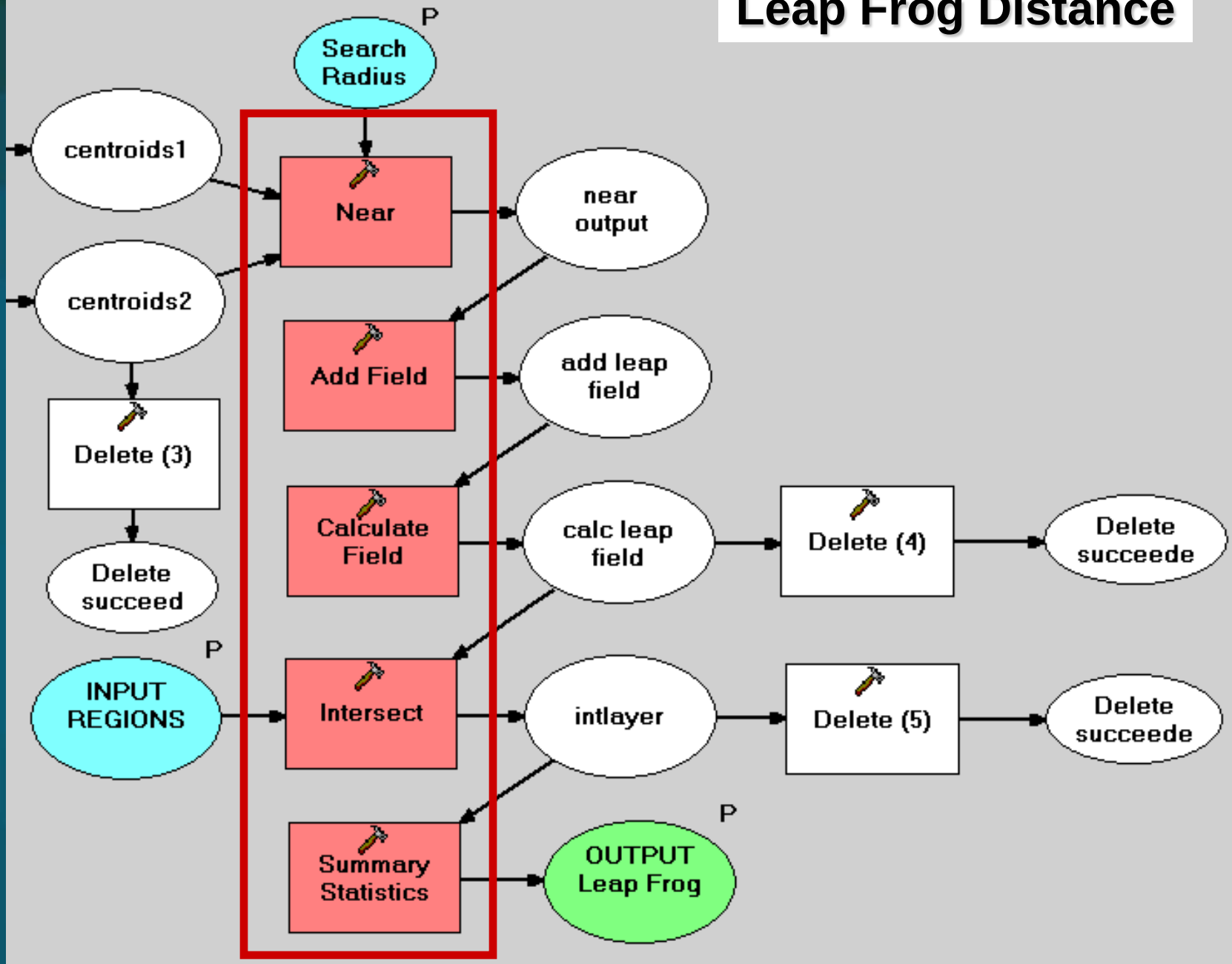
Leap Frog Distance



Leap Frog Distance



Leap Frog Distance

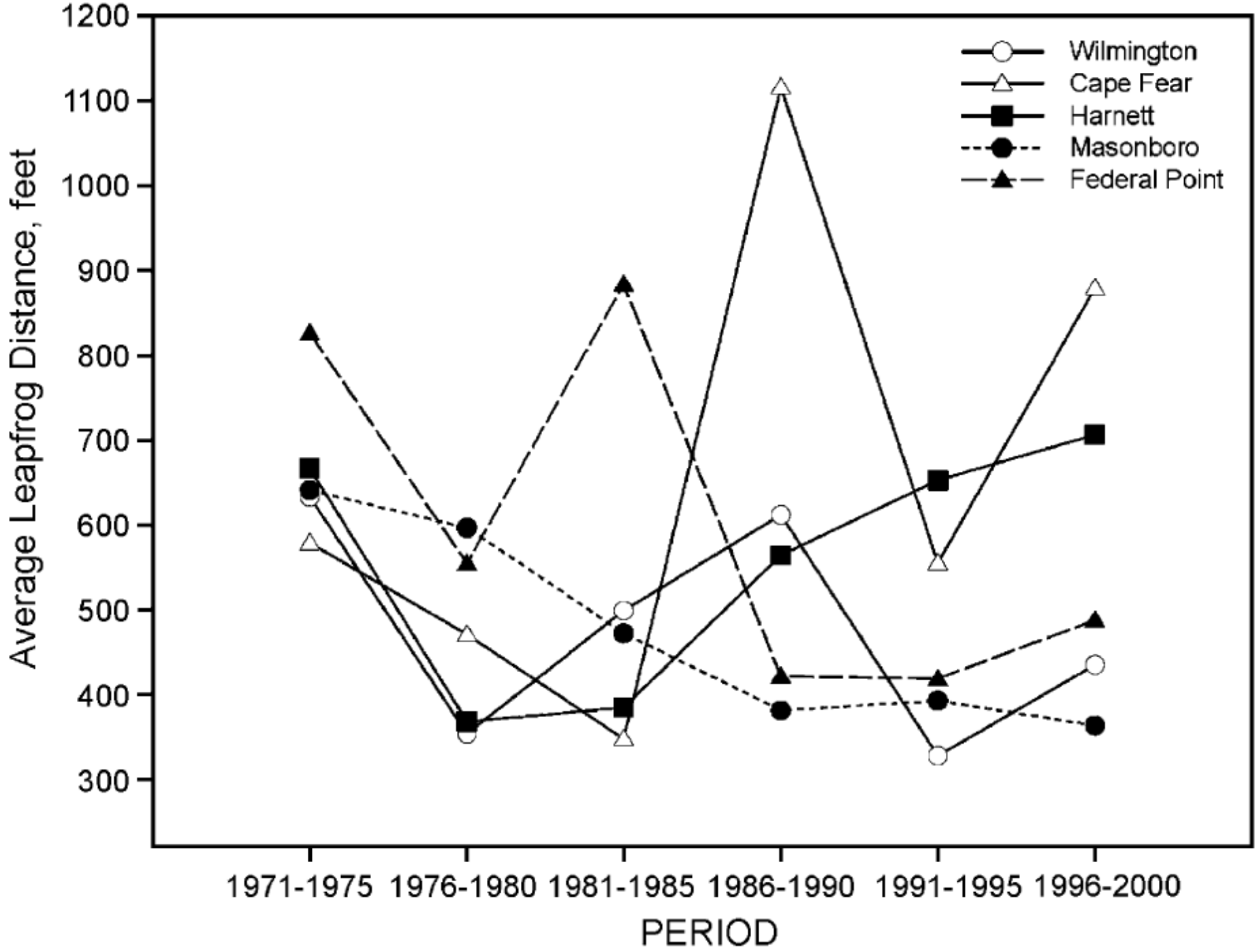


Results: Leap Frog

Attributes of lf9600

OBJECTID *	PLACE	FREQUENCY	SUM_leap	MIN_leap	MAX_leap	MEAN_leap	STD_leap
5	Harnett	2549	1722974.666157	54.551601	2428.719971	675.941415	529.416713
3	Federal Point	1543	676544.630199	53.630299	2108.929932	438.460551	363.127167
7	Masonboro	1096	460417.335293	44.286701	1480.540039	420.08881	269.798739
1	Cape Fear	777	307543.456379	53.7864	1529.949951	395.808824	297.176464
8	Wilmington	2670	771554.54002	16.1626	2407.899902	288.971738	270.321391
6	Kure Beach	239	59479.428688	36.2537	909.757019	248.867902	226.419824
2	Carolina Beach	346	64830.721889	37.502102	708.929993	187.372029	168.801941
4	Figure Eight Island	47	6445.961761	74.412003	321.890015	137.148123	55.000953
9	Wrightsville Beach	85	6562.209183	40.8223	563.036011	77.202461	59.383056

Record: 0 Show: All Selected Records (0 out of 9 Selected) Options


Wilmington
Cape Fear
Harnett
Masonboro
Federal Point
Average Leapfrog Distance, feet
1200
1100
1000
900
800
700
600
500
400
300
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
PERIOD

Highway Buffer

Temporary workspace (optional)
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\temp

INPUT REGIONS LAYER
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\towns

regions field (optional)
PLACE

INPUT PARCELS LAYER
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\nh

area field (optional)
acre

land use field (optional)
rescode

residential land use value (optional)
1

year built field (optional)
yrbuilt

start year value (optional)
1996

end year value (optional)
2000

OUTPUT Highway buffer table
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\hb9600

INPUT ROADS (optional)
D:\A3\proposals\research\coastal_seagrant\geotools_09\ai\test.mdb\roads

Search Distance (optional)
300 Unknown

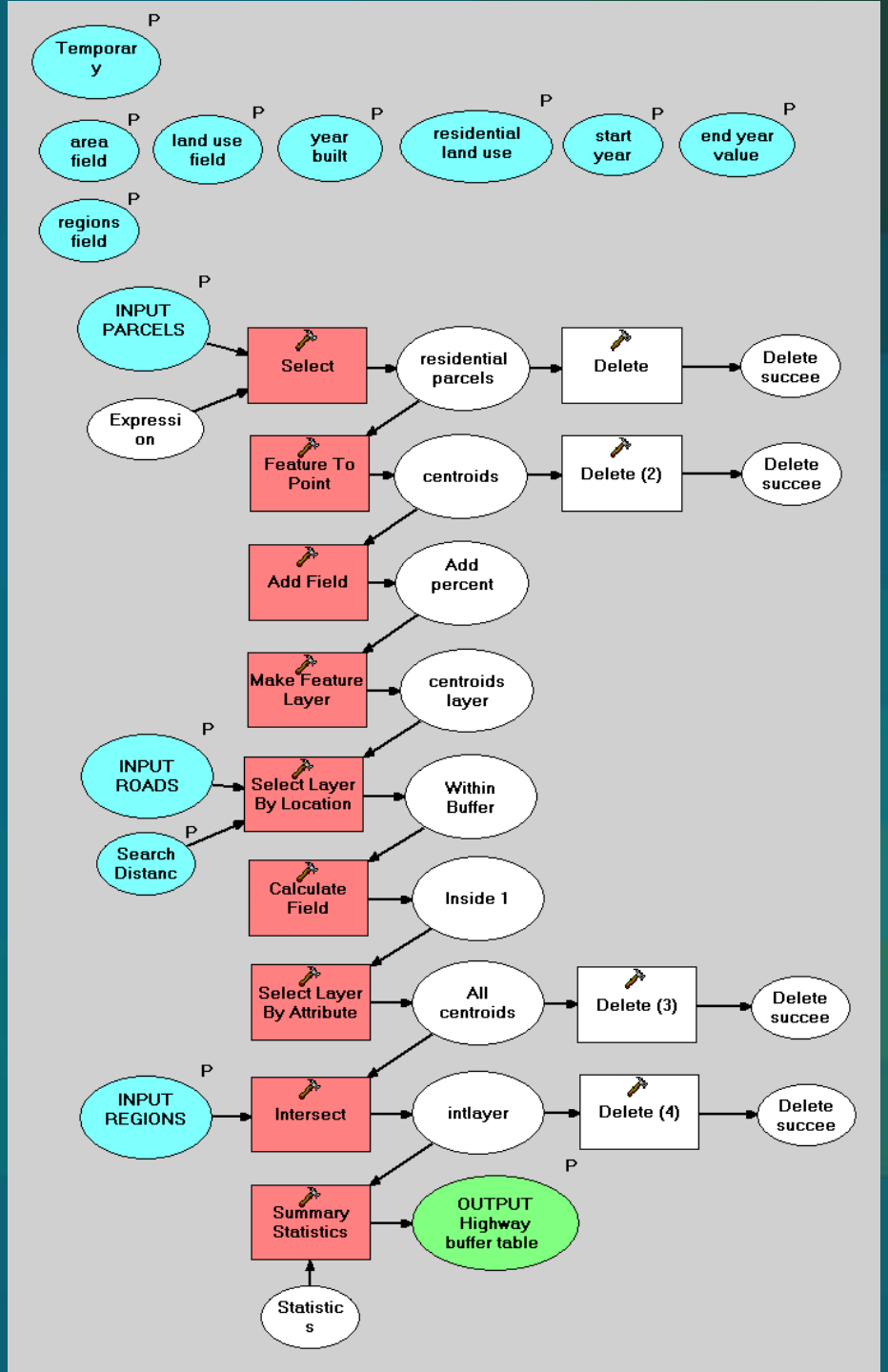
OK | Cancel | Environments... | << Hide Help

Help

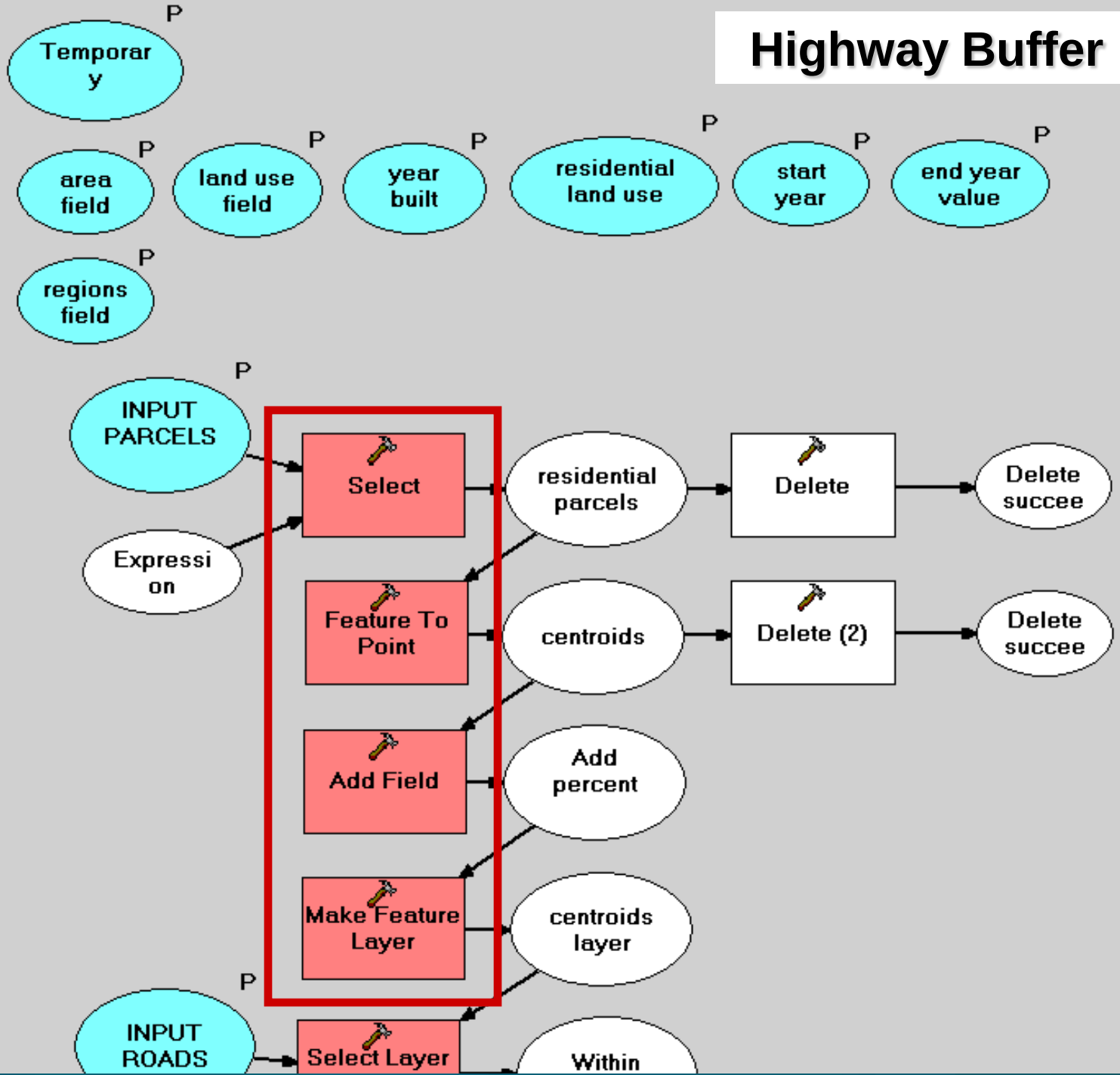
Search Distance (optional)

REQUIRED: Type a buffer distance that will be applied to the roads layer. Parcels developed during the period of interest whose centroids are within this distance are identified and descriptive statistics for these parcels are output..

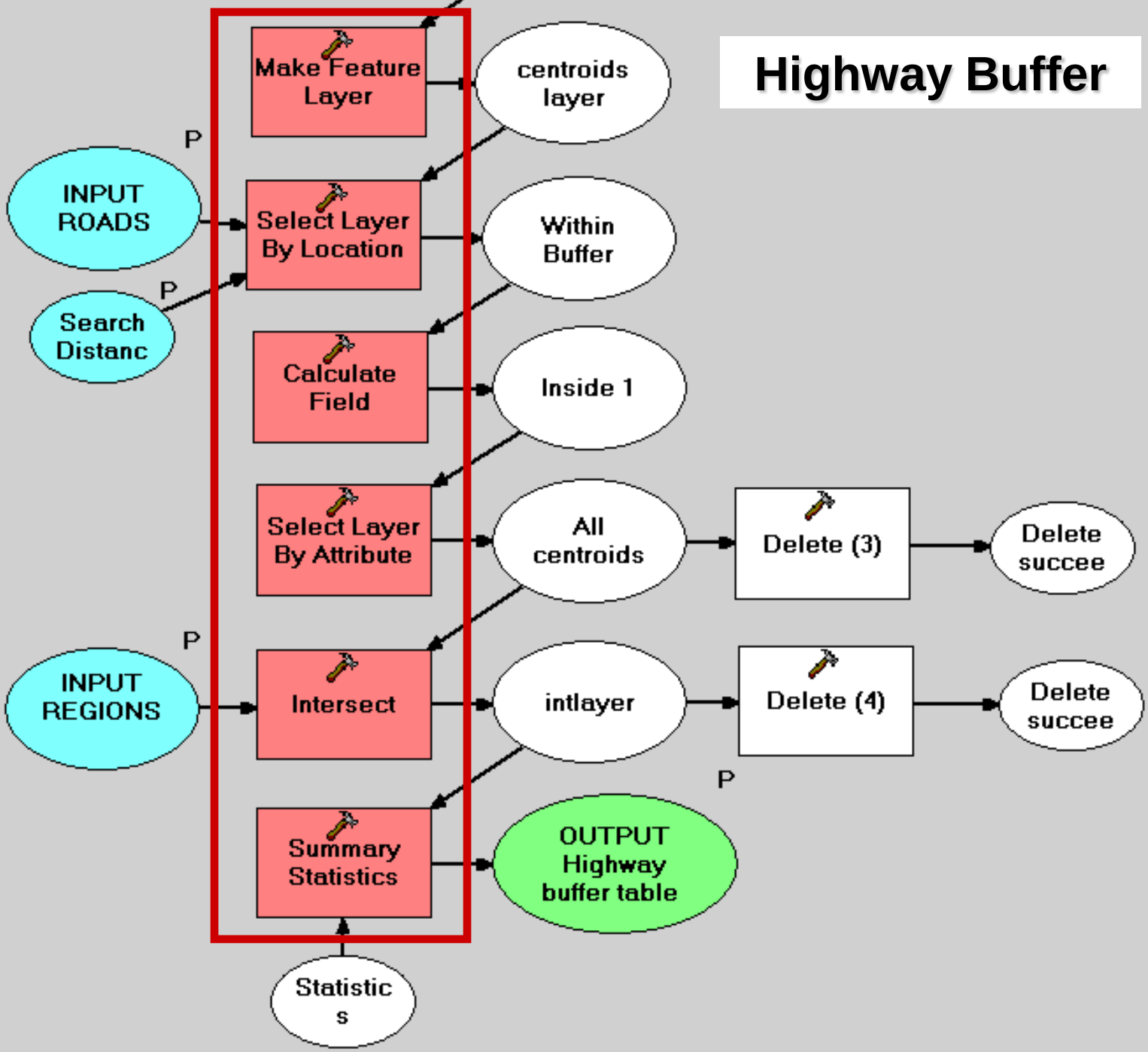
Highway Buffer



Highway Buffer



Highway Buffer

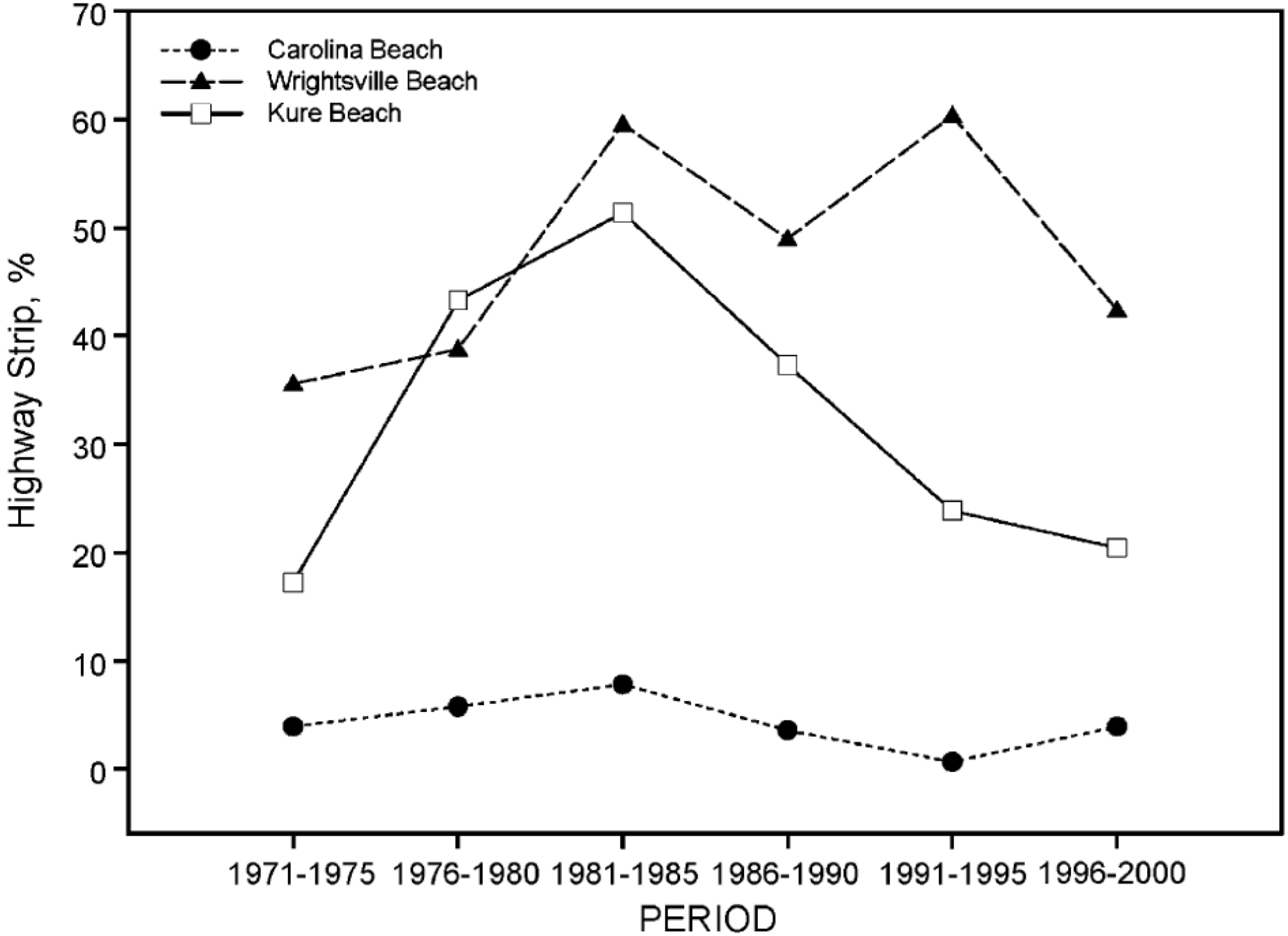


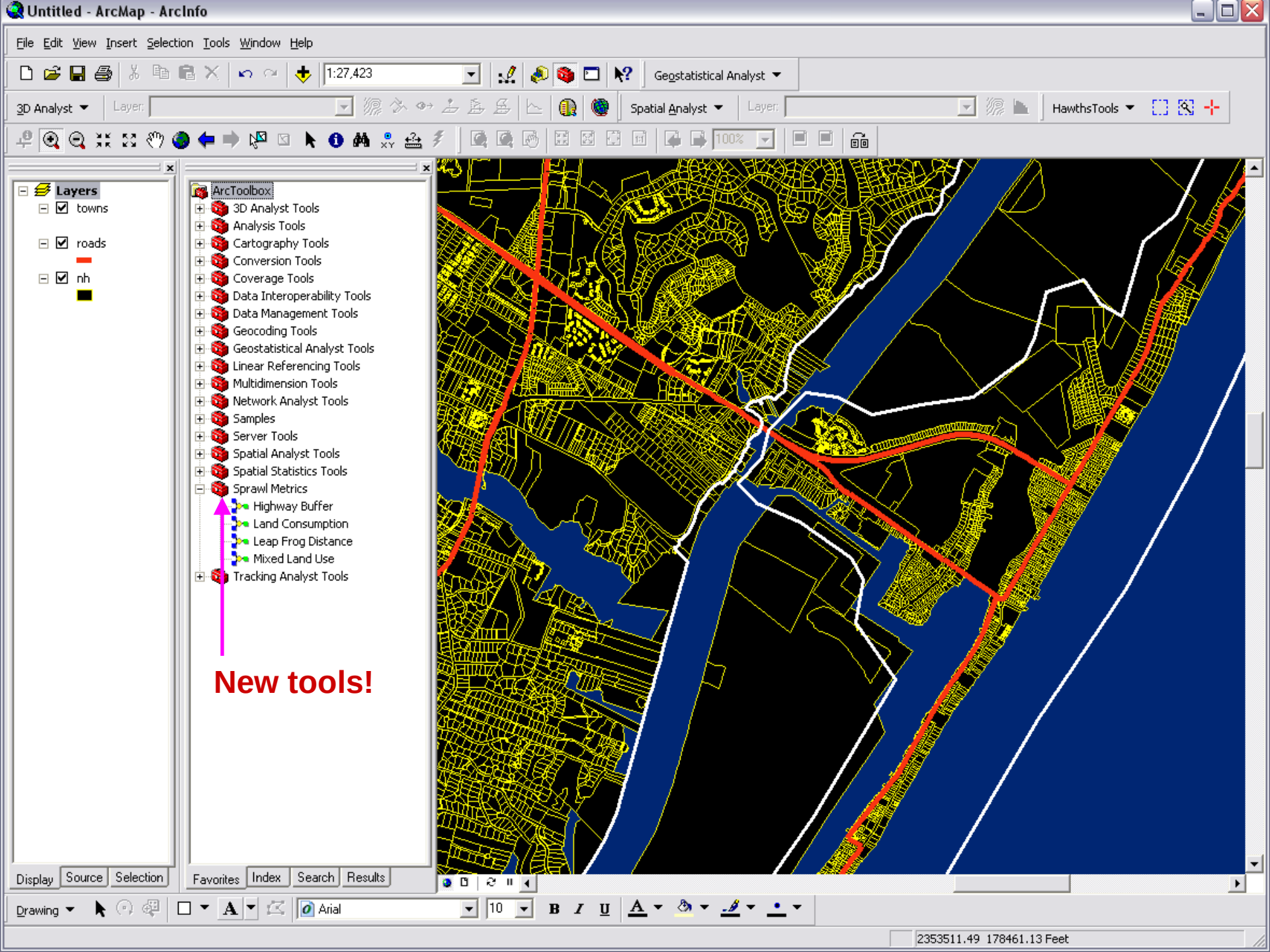
Results: Highway Buffer

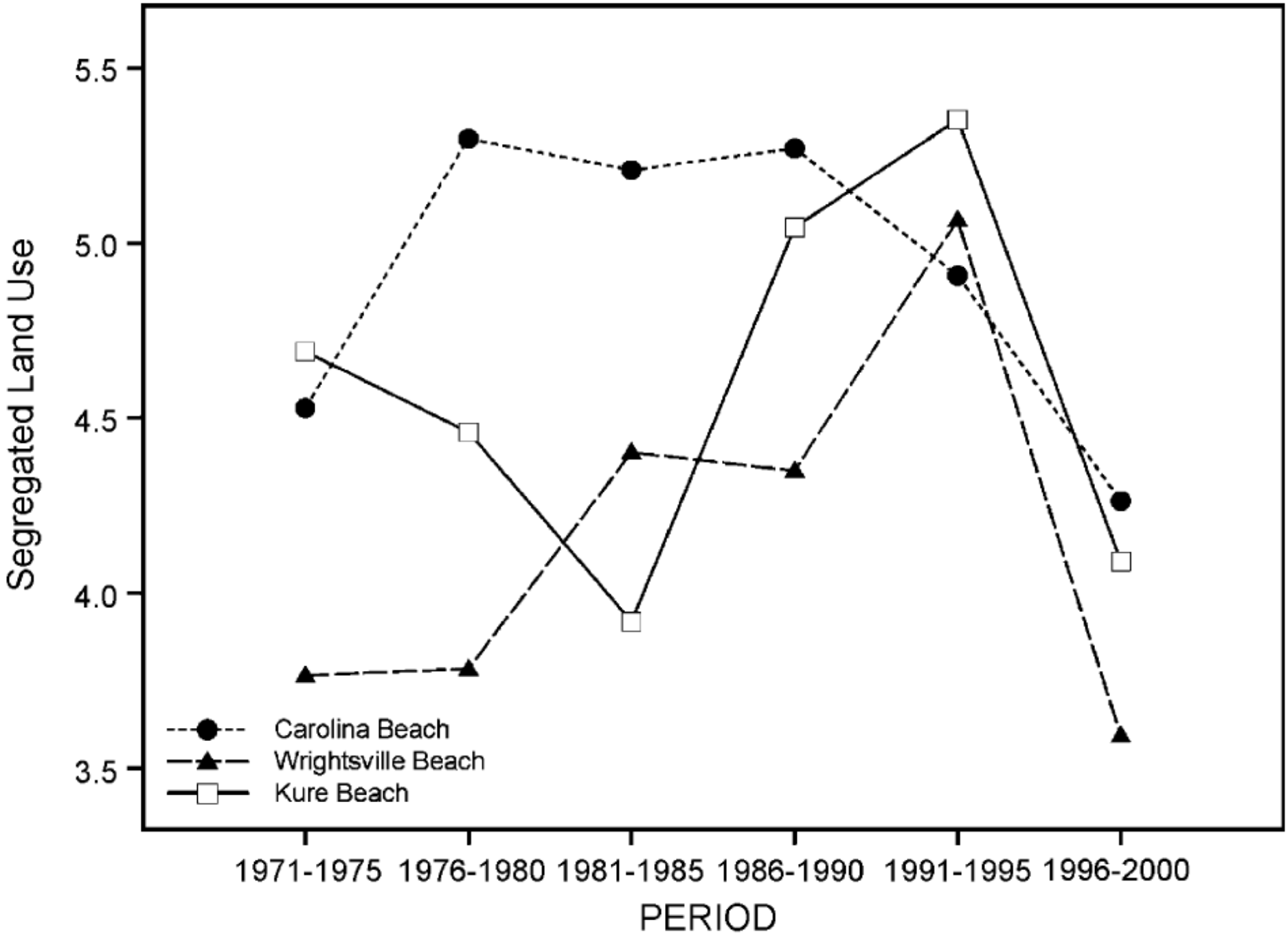
Attributes of hb9600

OBJECTID *	PLACE	FREQUENCY	SUM_in	MEAN_in
9	Wrightsville Beach	85	45	0.529412
4	Figure Eight Island	47	23	0.489362
6	Kure Beach	239	62	0.259414
3	Federal Point	1543	72	0.046662
1	Cape Fear	777	36	0.046332
2	Carolina Beach	346	15	0.043353
8	Wilmington	2670	96	0.035955
7	Masonboro	1096	35	0.031934
5	Harnett	2549	53	0.020792

Record: 0 Show: All Selected Records (0 out of 9 Selected) Options


Carolina Beach
Wrightsville Beach
Kure Beach
Highway Strip, %
70
60
50
40
30
20
10
0
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
PERIOD


Untitled - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:27,423
Geostatistical Analyst
3D Analyst
Layer:
Spatial Analyst
Layer:
HawthsTools
100%
Layers
towns
roads
nh
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Coverage Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Multidimension Tools
Network Analyst Tools
Samples
Server Tools
Spatial Analyst Tools
Spatial Statistics Tools
Sprawl Metrics
Highway Buffer
Land Consumption
Leap Frog Distance
Mixed Land Use
Tracking Analyst Tools
New tools!
Display
Source
Selection
Favorites
Index
Search
Results
Drawing
Arial
10
2353511.49 178461.13 Feet


Segregated Land Use
5.5
5.0
4.5
4.0
3.5
Carolina Beach
Wrightsville Beach
Kure Beach
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
PERIOD

Home - Microsoft Internet Explorer provided by East Carolina University

http://core.ecu.edu/crawfordt/seagrant/nccoast.htm

File Edit View Favorites Tools Help

Home

LINKING DEMOGRAPHIC PATTERNS TO LANDSCAPE INDICATORS OF COASTAL DEVELOPMENT: A Spatial Characterization of Changing Land Use/Cover Metrics Associated with Tourism and In-Migration

NOTE: Internet Explorer browser required for full access to links.

Sea Grant North Carolina

- HOME
- Research Team
- Presentations & Pubs
- Map & Data Products

North Carolina Coastal Counties

Beaufort
Bertie
Brunswick
Camden
Carteret
Chowan
Craven
Currituck
Dare
Gates
Hertford
Hyde

EAST CAROLINA UNIVERSITY
Dr. Thomas W. Crawford, Department of Geography
Dr. Don E. Bradley, Department of Sociology
Dr. Bob Edwards, Department of Sociology

EAST CAROLINA UNIVERSITY

Project Home

PROJECT SUMMARY. Coastal population growth and the growth of tourism economies are features of coastal development that impact coastal ecosystems in various ways. Land use behaviors associated with coastal development are manifested as land cover change that increases impervious surface, alters hydrological regimes, impairs water quality, disturbs natural habitats through areal reduction, fragmentation and degradation, alters aesthetic viewscapes, and impacts regional sense of place. Regional change also threatens the social sustainability of populations engaged in traditional economies due to market forces brought on by amenity driven migration and development. It is therefore important to understand the linkages between coastal development and land use and cover change (LUCC) in order to promote sustainable coastal development. Portions of the North Carolina coastal region have experienced some of the highest rates of population growth in the state during the period 1990-2000 that have altered land cover patterns via land use decisions and behaviors related to residential/commercial development and tourism. Little work exists that examines these issues at sub-county resolutions over a fairly broad extent. Data and results from this project will be of interest to coastal zone managers in North Carolina and throughout the southeast.

The regional focus is on North Carolina's coastal counties as defined by the NC General Assembly in the 1974 Coastal Area Management Act (CAMA). These counties are referred to throughout as CAMA counties.

View Proposal (PDF)

EXTERNAL LINKS

Sea Grant North Carolina

Sea Grant National Sea Grant College Program

ECU - Dept. of Geography

ECU - Dept. of Sociology

My Computer 100%

LINKING DEMOGRAPHIC PATTERNS TO LANDSCAPE INDICATORS OF COASTAL DEVELOPMENT - Microsoft Internet Explorer p...
D:\A3\proposals\research\coastal_seagrant\final_work\web_fall\data_download_pages\p
File Edit View Favorites Tools Help
Home
LINKING DEMOGRAPHIC ...
Page Tools

LINKING DEMOGRAPHIC PATTERNS TO LANDSCAPE INDICATORS OF COASTAL DEVELOPMENT: A Spatial Characterization of Changing Land Use/Cover Metrics Associated with Tourism and In-Migration

Sea Grant North Carolina

Parcel Data

BACK to Data & Products page

Property parcel GIS data with information on residential development are available for download for selected counties. Parcel data and related tax assessor data concerning parcel type (i.e. residential vs non-residential) and year built for residential parcels are included. The data originated from county GIS and tax office departments. Detailed personal information and attributes have been stripped out to focus attention on residential development patterns. GIS users can use these data to perform queries and to map trajectories of residential growth.

Downloads are broken down by county and include a metadata .pdf document and a zip file containing the parcel shapefile and related attribute files.

Downloadable Files

County	Metadata	Shapefile
Brunswick (130,988 parcels)	pdf metadata	zip (26 MB)
Carteret (58,852 parcels)	pdf metadata	zip (27 MB)
Craven (56,111 parcels)	pdf metadata	zip (11 MB)
Currituck (23,844 parcels)	pdf metadata	zip (8 MB)
Dare (42,264 parcels)	pdf metadata	zip (23 MB)
New Hanover (88,714 parcels)	pdf metadata	zip (47 MB)
Onslow (75,245 parcels)	pdf metadata	zip (25 MB)
Pender (45,891 parcels)	pdf metadata	zip (16 MB)

BACK to Data & Products

My Computer 100%

parcel_newhanover.pdf - Adobe Acrobat Professional

File Edit View Document Comments Forms Tools Advanced Window Help

Create PDF Combine Files Export Start Meeting Secure Sign Forms Review & Comment

1 / 1 Find 100%

Data Dictionary: parcel_newhanover

Created by: Dr. Tom Crawford, Dept. of Geography, East Carolina University
Contact: Dr. Tom Crawford, crawfordt@ecu.edu, 252-328-6082

Description: A shapefile format vector polygon layer representing New Hanover County, NC property parcels. The data originated from New Hanover County government which was subsequently processed. Intended use is to explore historical patterns of residential development. Selected parcels details are only available for residential parcels. Thus, it is not intended for a full exploration of the various other types of land use. Users can subset via queries to select residential parcels and map them by year of development.

The layer can be opened using ESRI GIS software (ArcView, ArcInfo, ArcExplorer). Various other GIS softwares have capabilities to import shapefiles.

This product development was supported by a grant from North Carolina SeaGrant.

Temporal Currency: These data were acquired in September 2008 and reflect conditions at the time of acquisition.

Coordinate System:

North Carolina State Plane Coordinate System, NAD83, units feet.

8.50 x 11.00 in

parcel_newhanover.pdf - Adobe Acrobat Professional
File Edit View Document Comments Forms Tools Advanced Window Help
Create PDF Combine Files Export Start Meeting Secure Sign Forms Review & Comment
1 / 1 Find 100%

Temporal Currency: These data were acquired in September 2008 and reflect conditions at the time of acquisition.

Coordinate System:

North Carolina State Plane Coordinate System, NAD83, units feet.

Attribute Information for parcel_newhanover (parcel_newhanover.dbf contents)

Attribute Name	Description	Data type
FID	Feature ID, unique number generated by software	integer
Shape	Feature geometry type (polygon)	text string
PARCEL_ID	Parcel identification code from source data	text string
yrbuilt	Year structure built for residential parcels; for non-residential parcels yrbuilt = 0	year
rescode	Binary code (1 = yes, 0 = no) indicating residential parcel status	binary (0,1)
county	County name	text string
acre	Area in acres for parcel	float

8.50 x 11.00 in

Future Directions & Comments

- Finalize the Mixed Land Use tool.
- Put the .tbx file on web site for download.
- Improve metadata.
- Convert it to Python.
- Code for error checking.
- Deploy as a web-based geoprocessing service (?)
- Enables historical and prospective analysis

Thanks:

Sea Grant
North Carolina

East Carolina University
Center for Geographic Information Science

Renci
Renaissance Computing Institute

@East Carolina University

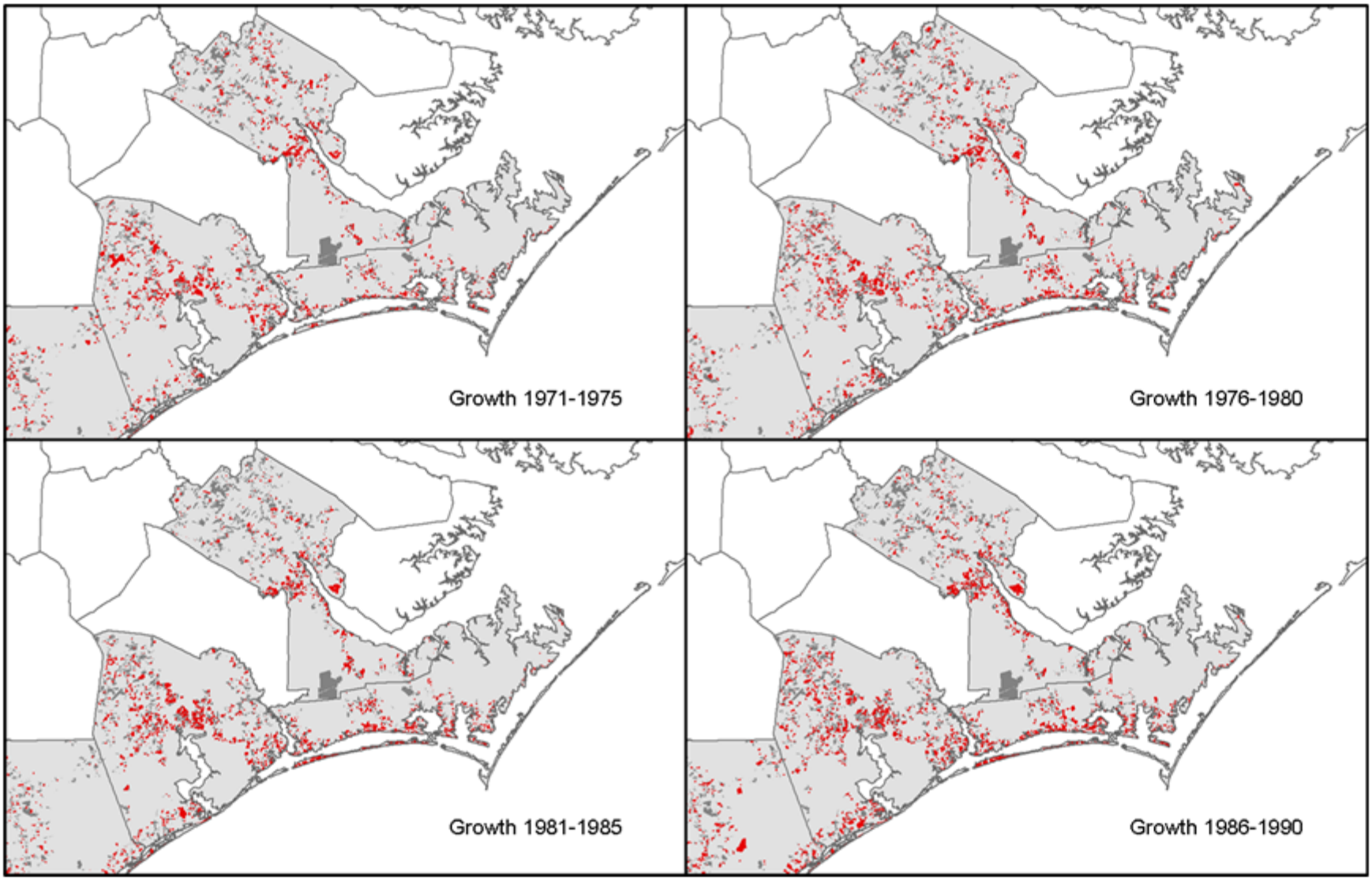


Figure 24. New parcel development 1971-1990, central region. Existing parcels (gray), new parcels (red).

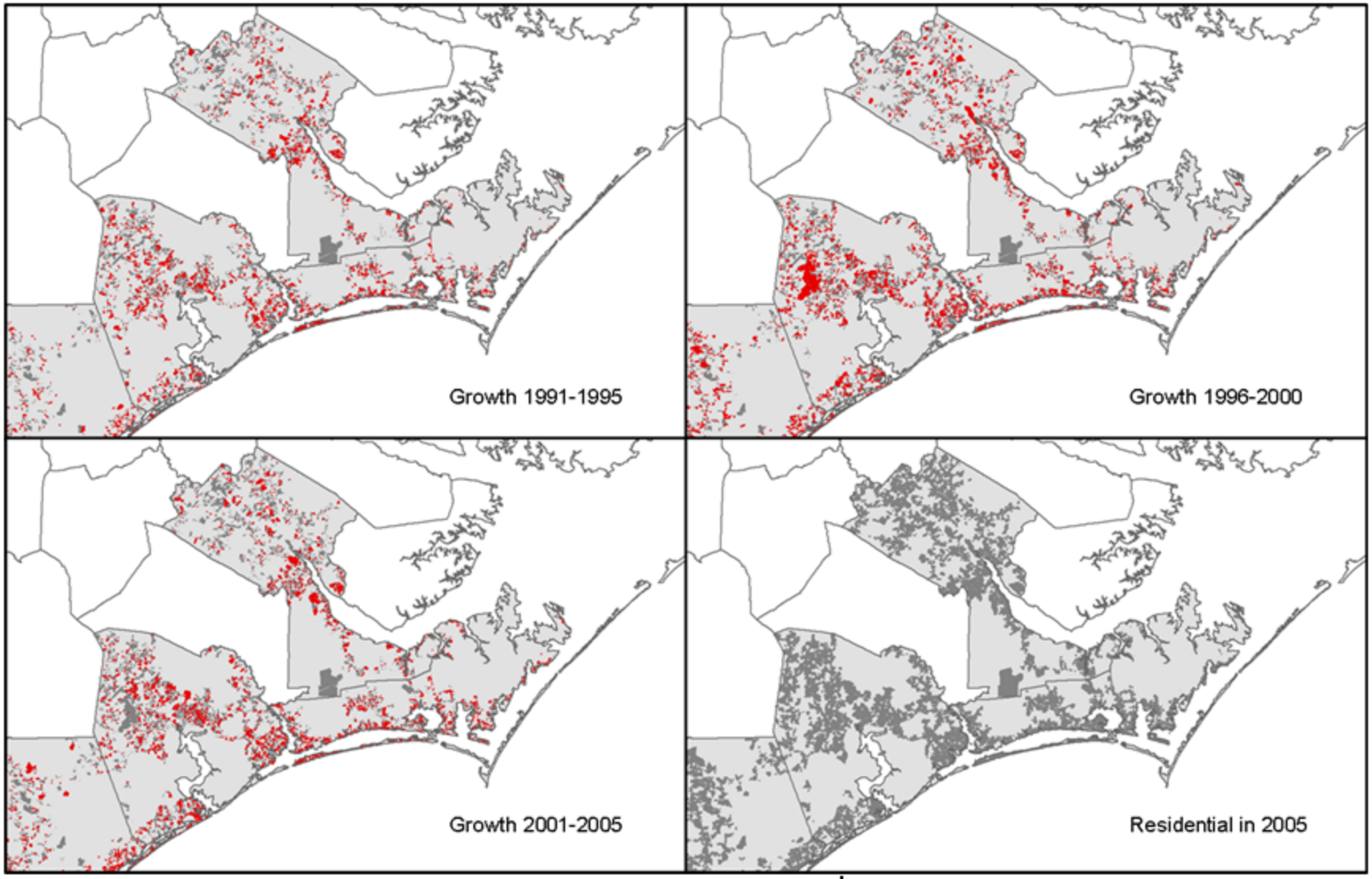
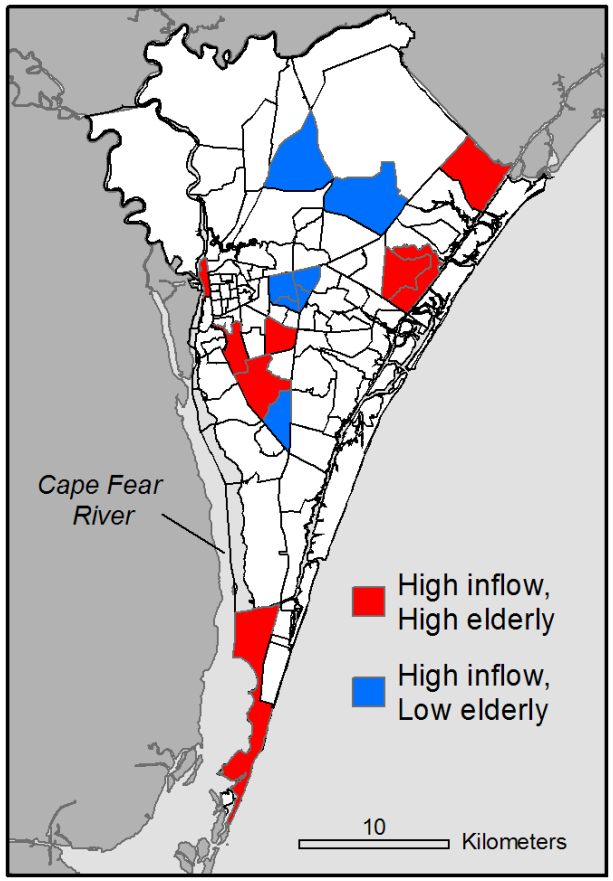


Figure 25. New parcel development 1991-2005, central region. Existing parcels (gray), new parcels (red).

TARGET: NORTH CAROLINA'S 'INNER BANKS'

The new development boom is reaching nearly every community along the mainland coast from Virginia to South Carolina. What it means is as varied as the dozens of places it's touching, from nd bustling cities orated fishing erry in Onslow.



Chowan (Edenton)

Ecological footprint analysis via spatially stratified household interviews

Craven/Pamlico (New Bern)

Brunswick (Greater Wilmington)

Video clips

From: Raleigh New & Observer

Table 4. Recent and Projected Population Change.

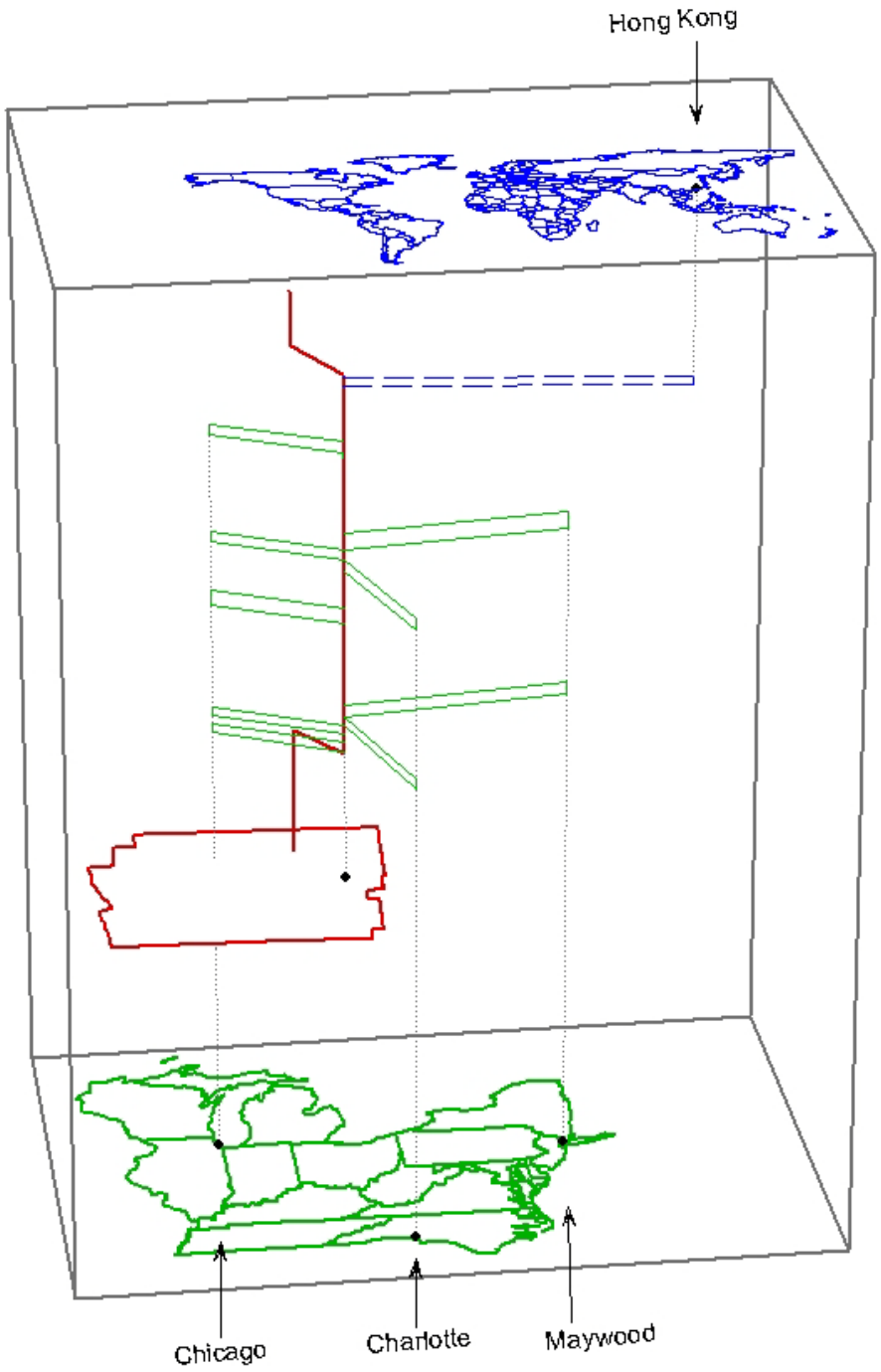
County	1990 population	2000 population	% change 90-00*	% change 00-10**
Brunswick	50,985	73,143	43.5	35.6
Pender	28,855	41,082	42.4	25.1
New Hanover	120,284	160,307	33.3	21.3
Currituck	13,736	18,190	32.4	41.2
Dare	22,746	29,967	31.7	30.8
Camden	5,904	6,885	16.6	45.7
Pamlico	11,372	12,934	13.7	4.3
Carteret	52,556	59,383	13.0	9.3
Craven	81,613	91,436	12.0	2.3
Pasquotank	31,298	34,897	11.5	15.3
Perquimans	10,447	11,368	8.9	9.1
Gates	9,305	10,113	8.7	10.2
Hyde	5,411	5,826	7.7	-3.8
Tyrrell	3,856	4,149	7.6	3.3
Chowan	13,506	14,526	7.5	4.5
Beaufort	42,283	44,958	6.3	5.1
Onslow	149,838	150,355	0.3	11.6
Bertie	20,388	20,044	-1.7	-1.6
Washington	13,997	13,723	-2.0	-4.3
Hertford	22,317	21,533	-3.5	5.9

* Ranked by % change 90-00. Selected focus counties in boxes.
** Projected change for 2000-2010 from the North Carolina State Demographics unit.

Table 7
Sprawl metrics for the entire 1971–2000 period for township groups and Figure Eight Island

Region	Number of parcels	Land consumption	Leapfrog	Segregated land use	Highway strip
Most coastal	2,704	0.24	281	5.03	26.3
Transitional	13,555	0.49	560	6.11	3.3
Least coastal	16,240	0.35	523	5.77	3.5
Figure Eight Island	355	0.74	514	7.40	56.3

Land use diversity not shown due to redundancy with segregated land use.



Different scales and modes of contacts

(y-axis = time)

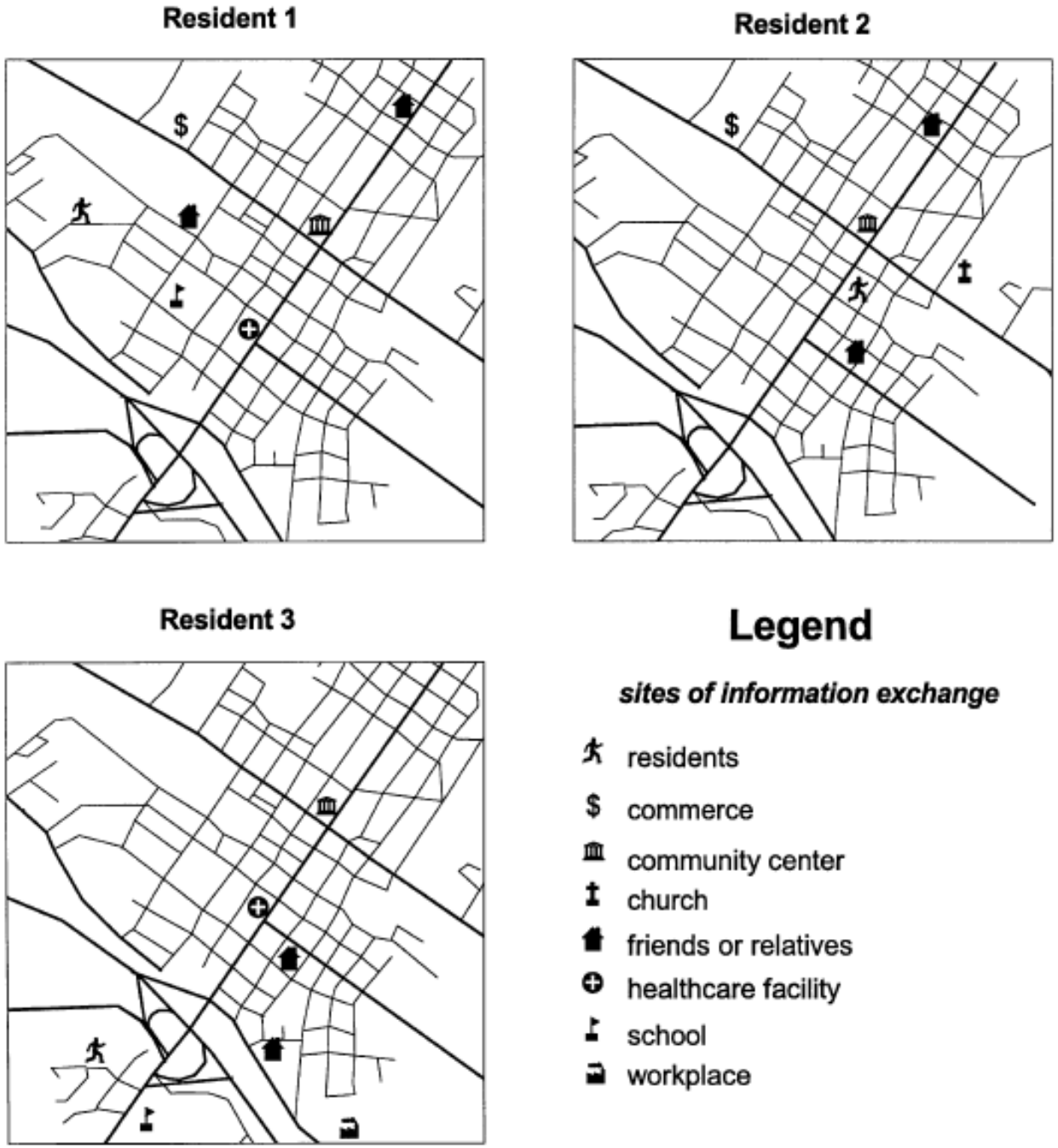


Fig. 1. Activity spaces of three residents.

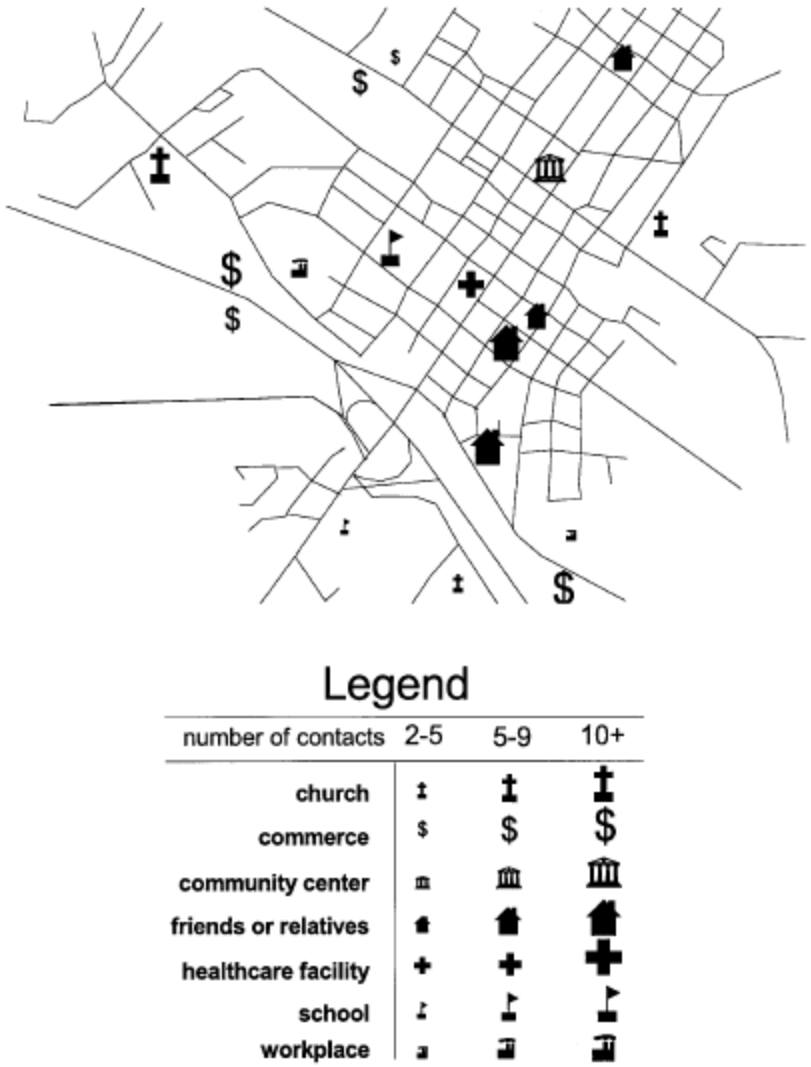


Fig. 2. Aggregate map of activity spaces.

Table 4
Network node classification

	Visit	Rating	Info	Type 2
Strong	Yes	High	Yes	?
Primary	Yes	High	No	Yes
Secondary	Yes	High	No	No
Reluctant	Yes	Low	Yes	?
Latent	No	High	Yes	?
Isolated	No	Low	Yes	?

Dare County Pilot Test

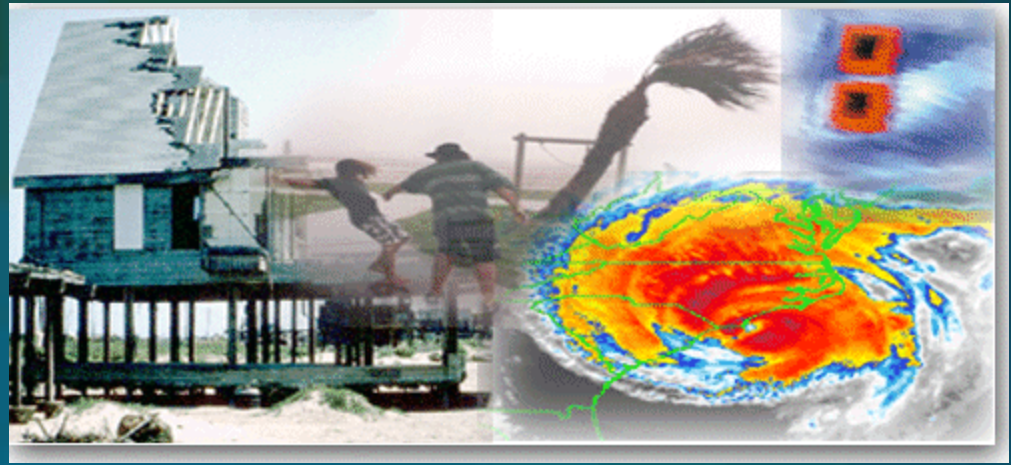
- Phone survey
- In-person interviews
- 2 very different neighborhoods
- Expand to more respondents

Building Socio-spatial Knowledge Networks for Hurricane Information Flows

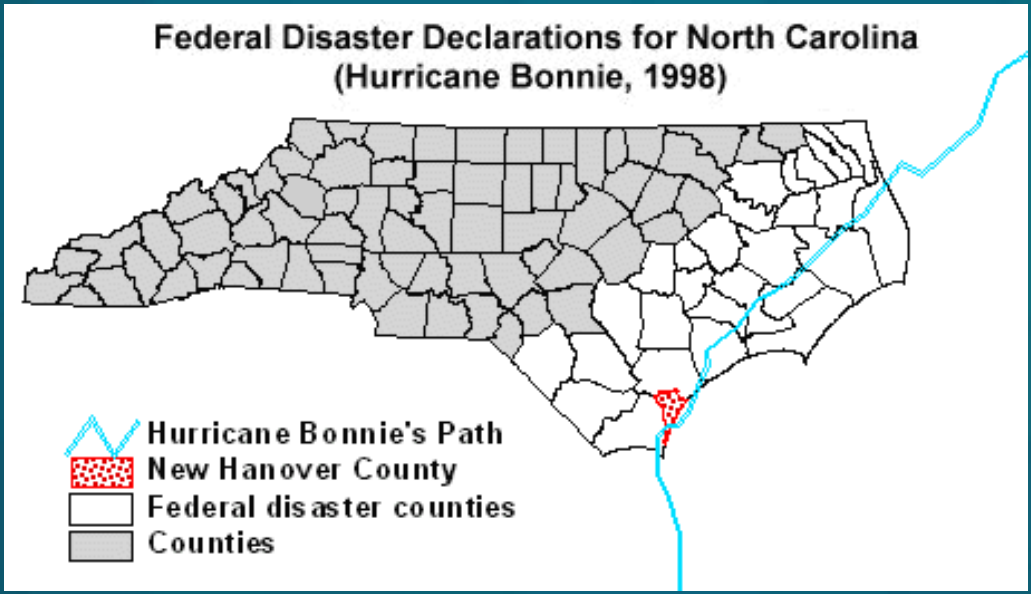
- Demographics.
- Activity spaces.
- From whom & where do you get information regarding storms?
- How do you rate this information?
- Qualitative & quantitative geographic analysis of knowledge networks.

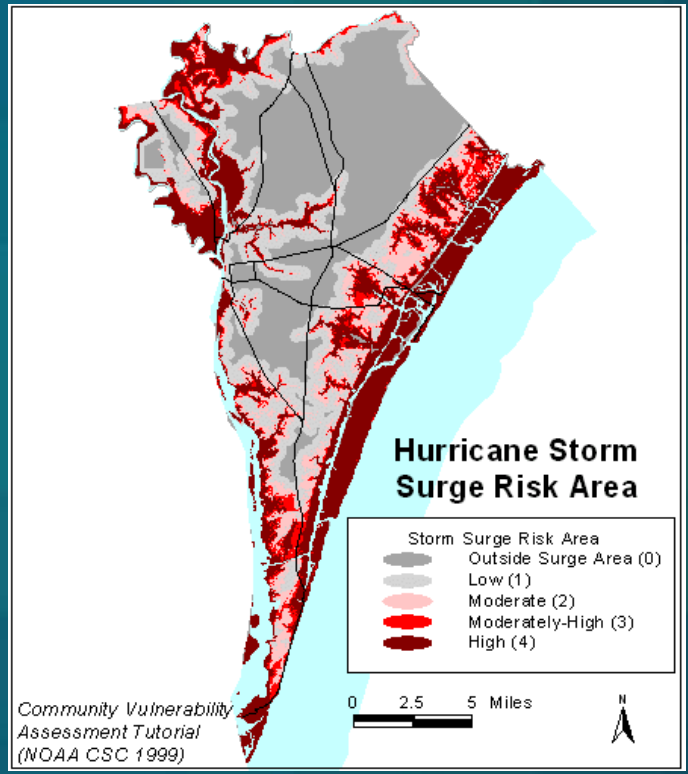
Interesting questions …

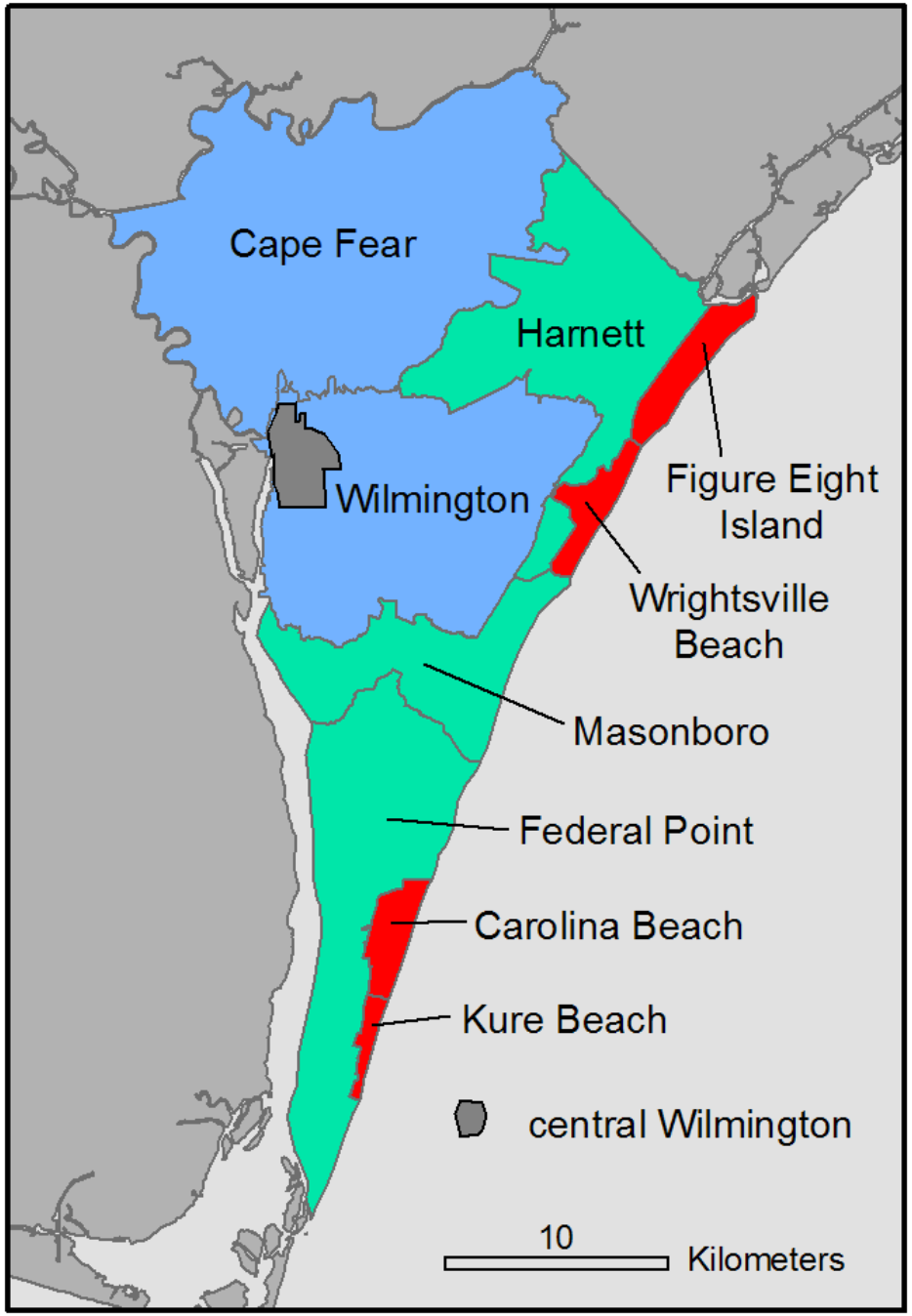
- Do networks differ by age, race, gender, economic status, etc?
- What are the scales of information networks from local to national?
- Can we identify “Strong”, “Latent”, etc. types of nodes?
- How can we use results to improve information flow to populations?



HAZSUS


Federal Disaster Declarations for North Carolina
(Hurricane Bonnie, 1998)
Hurricane Bonnie's Path
New Hanover County
Federal disaster counties
Counties

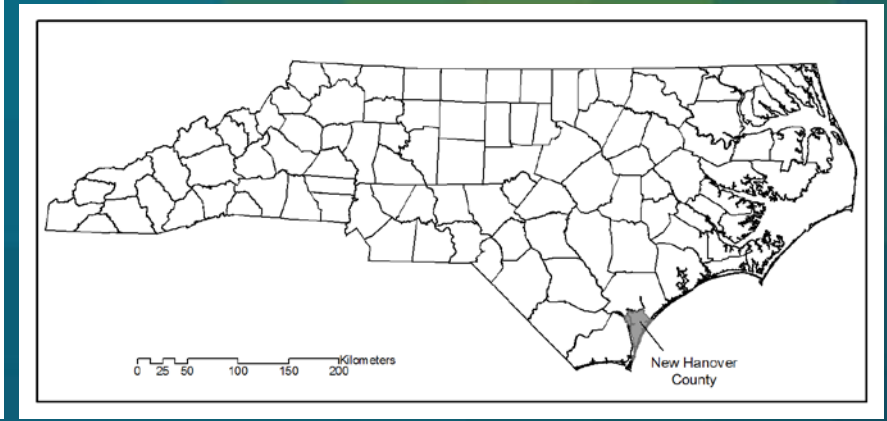

Hurricane Storm
Surge Risk Area
Storm Surge Risk Area
Outside Surge Area (0)
Low (1)
Moderate (2)
Moderately-High (3)
High (4)
0 2.5 5 Miles
N
Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)



New Hanover County, North Carolina

Regions

RED: Most coastal

GREEN: Transitional

BLUE: Least Coastal