

Rate and Hot Spot Analysis for Smoking During Pregnancy

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Outline

- Project overview
- Quick Stats
- Workflow
- DMAP and Hot Spot Analysis
- Examples
- Conclusion

Project Overview

- Addresses efforts to prevent smoking during pregnancy by providing multi-year spatial analyses and consultation to a state-wide March of Dimes / South Carolina Tobacco Collaborative Grant Project
- Utilizes spatial data to intelligently target project interventions to high geographic concentrations of women who reported smoking during pregnancy to health care providers
- Distance (Disease) Mapping and Analysis Program (DMAP) to calculate smoking rates and Hot Spot analysis for cluster detection.
- 19 priority Counties are selected using local and regional criteria
- 2004 and 2005 birth data were utilized (ongoing project)

Quick Stats

Reported SMK during PREG from Vital Records data (2003 US Birth Certificate revision)

- 2005: SC 1 in 7
- 2005: US 1 in 8
- ❖ HP 2000 Goal: 1 in 10
- ❖ HP 2010 Goal: 1 in 100 (!!!)

Quick Stats

Reported SMK during PREG from Vital Records data

Actual 1990 (1989 US Birth Certificate revision) **Actual 2002**

SC 1 in 5.1

SC 1 in 7.7

US 1 in 5.4

US 1 in 8.8

HP 2000 Goal: 1 in 10

Actual 2005

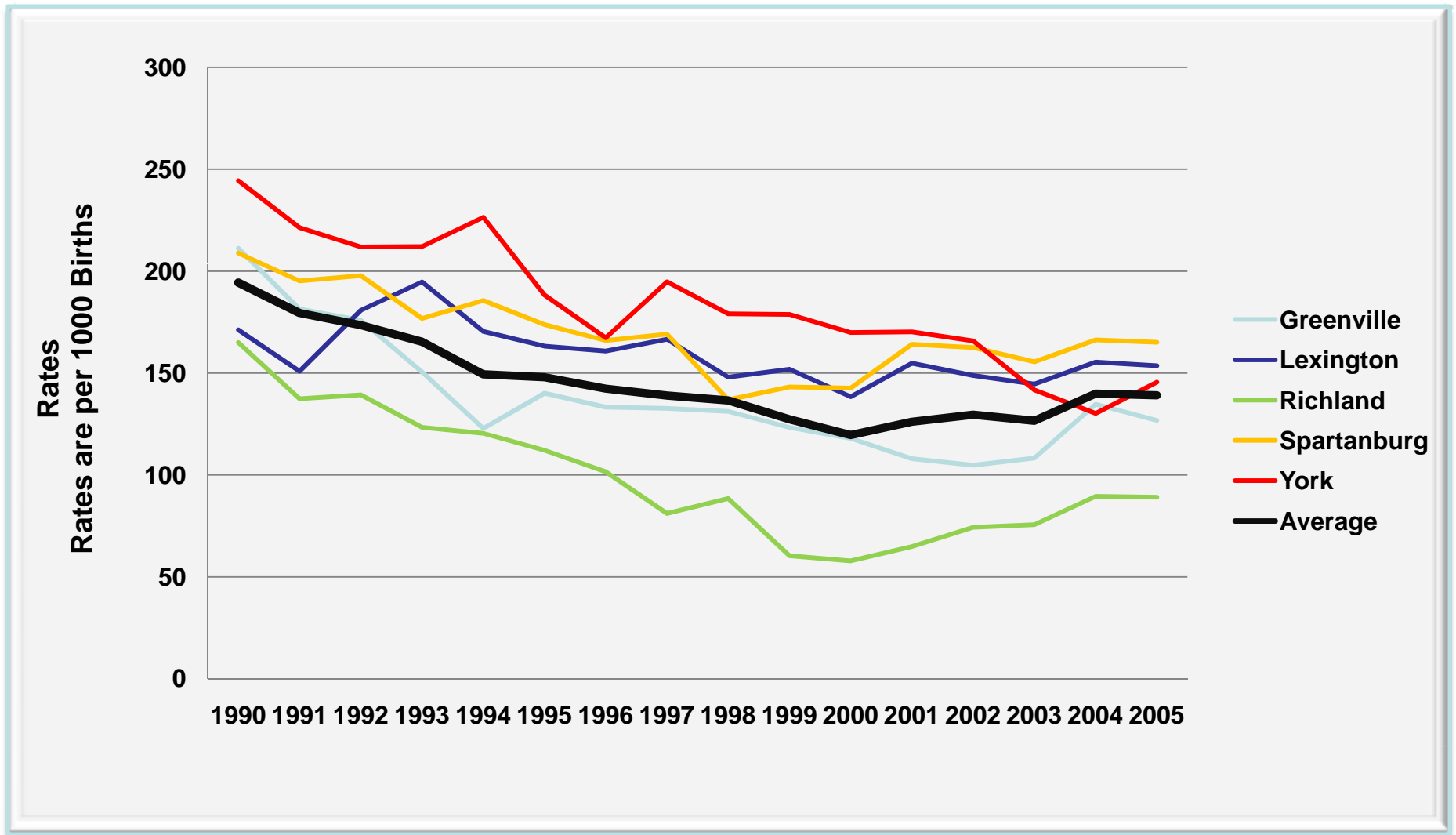
SC 1 in 7.1 (2003 US Birth Certificate revision)

US 1 in 9.3 (1989 US Birth Certificate revision—represents 56% of all 2005 births)

US 1 in 8.1 (2003 US Birth Certificate revision —represents 25% of all 2005 births)

HP 2010 Goal: 1 in 100 (!!!)

Rates of Live Births to Mothers Who Reported Smoking During Pregnancy Between 1990 to 2005, South Carolina



Workflow

- Birth information stored in Vital records database
- Statistical Analysis - Biostatistics
- Geocode addresses - Public Health Informatics
 - Run composite Address geocoding service
 - Add Method and Tier
- Calculate rates for reported smoking during pregnancy using DMAP
- Run Hot Spot analysis for reported smoking during pregnancy

DMAP

- Calculates rates (**Smoking rates** are per **1000** live births)
- Input: **individual** or aggregated records (control (numerator), risk (denominator, min 30), grid points (reference))
- 0.5 mile grid point
- 1.5 mile spatial filter
- Input format: .prn (numerator and denominator), .csv (grid)
- Output: .dat
- Developed at University of Iowa - freeware

Hot Spot Analysis

- Calculates the Getis-Ord G_i^* statistics to identify spatial clusters in high and low values (hot and cold spot)
- Input: Points, line and **polygon** features (**aggregated/weighted**)
- 0.5 mile fishnet grid
- 1.5 mile threshold distance
- Input format: Feature class
- Output: Feature class and layer
- ESRI's basic spatial statistics tool

Hot Spot Analysis

Model 1

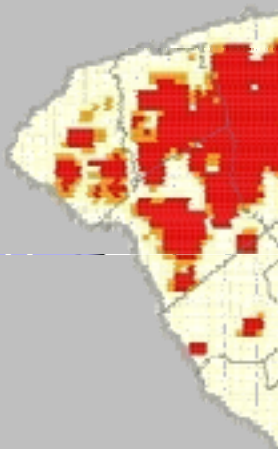
Birth

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DMAP Analysis

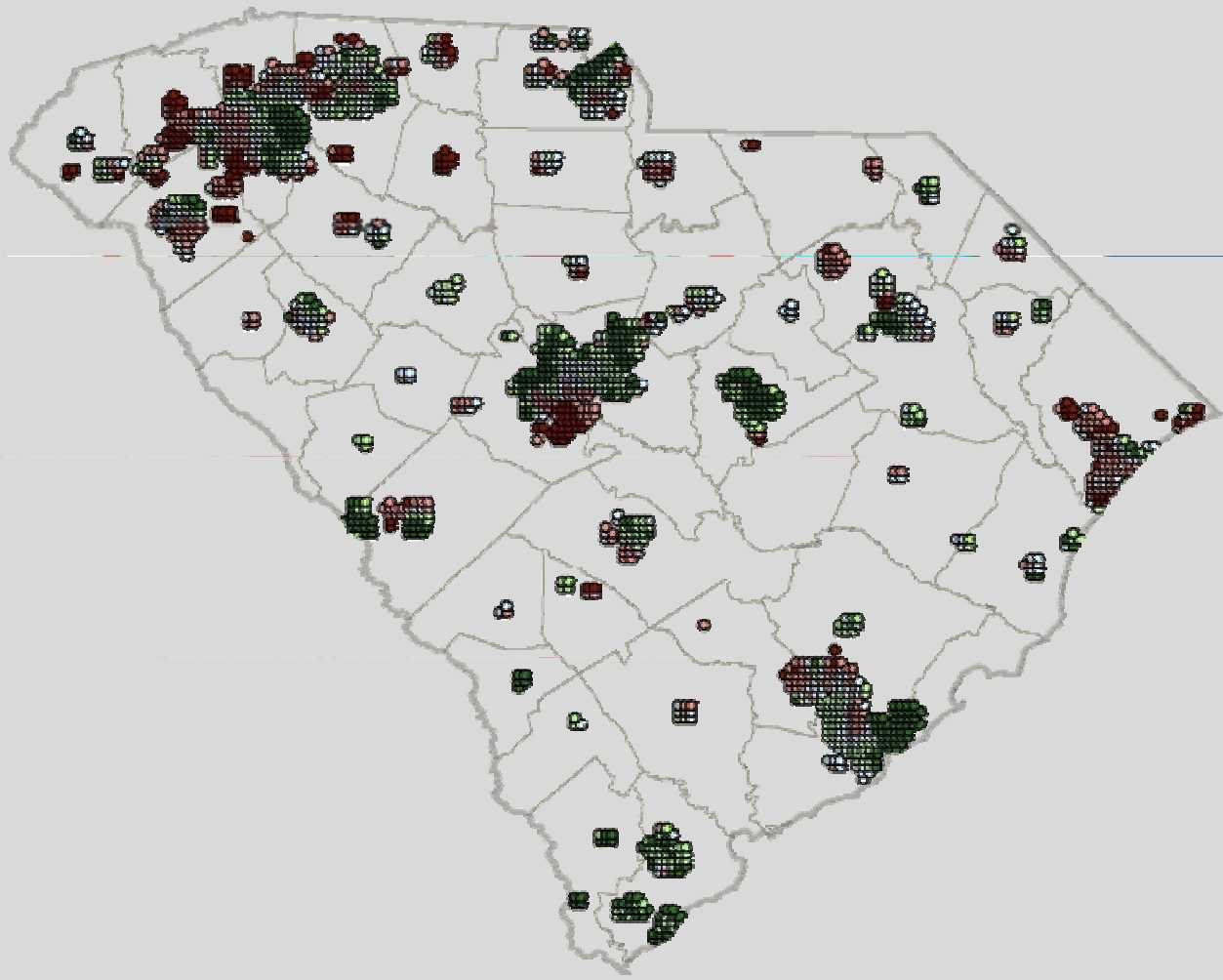
Model 2

Numerator

Birth

Denominator

Birth



n

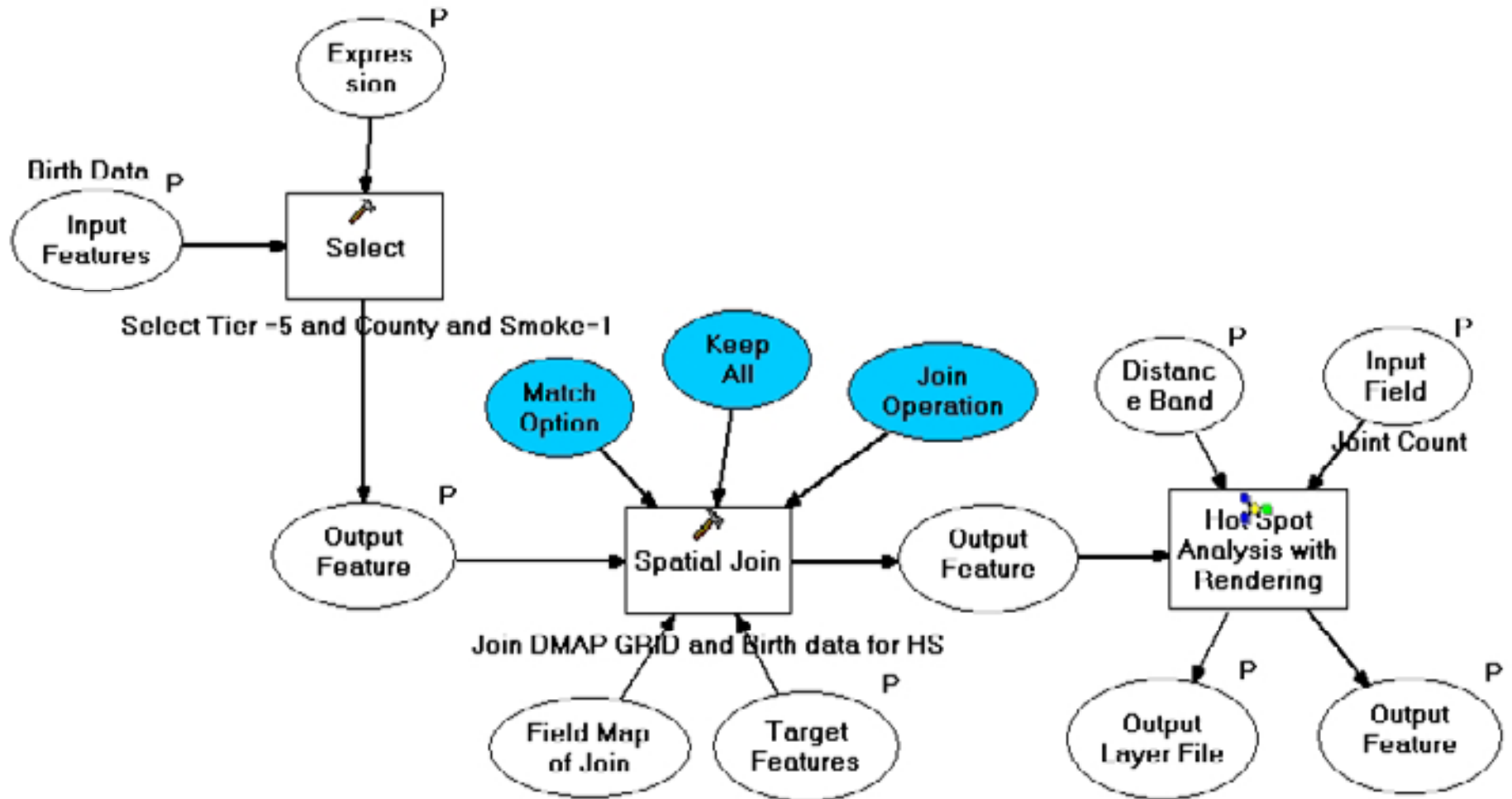
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.dat

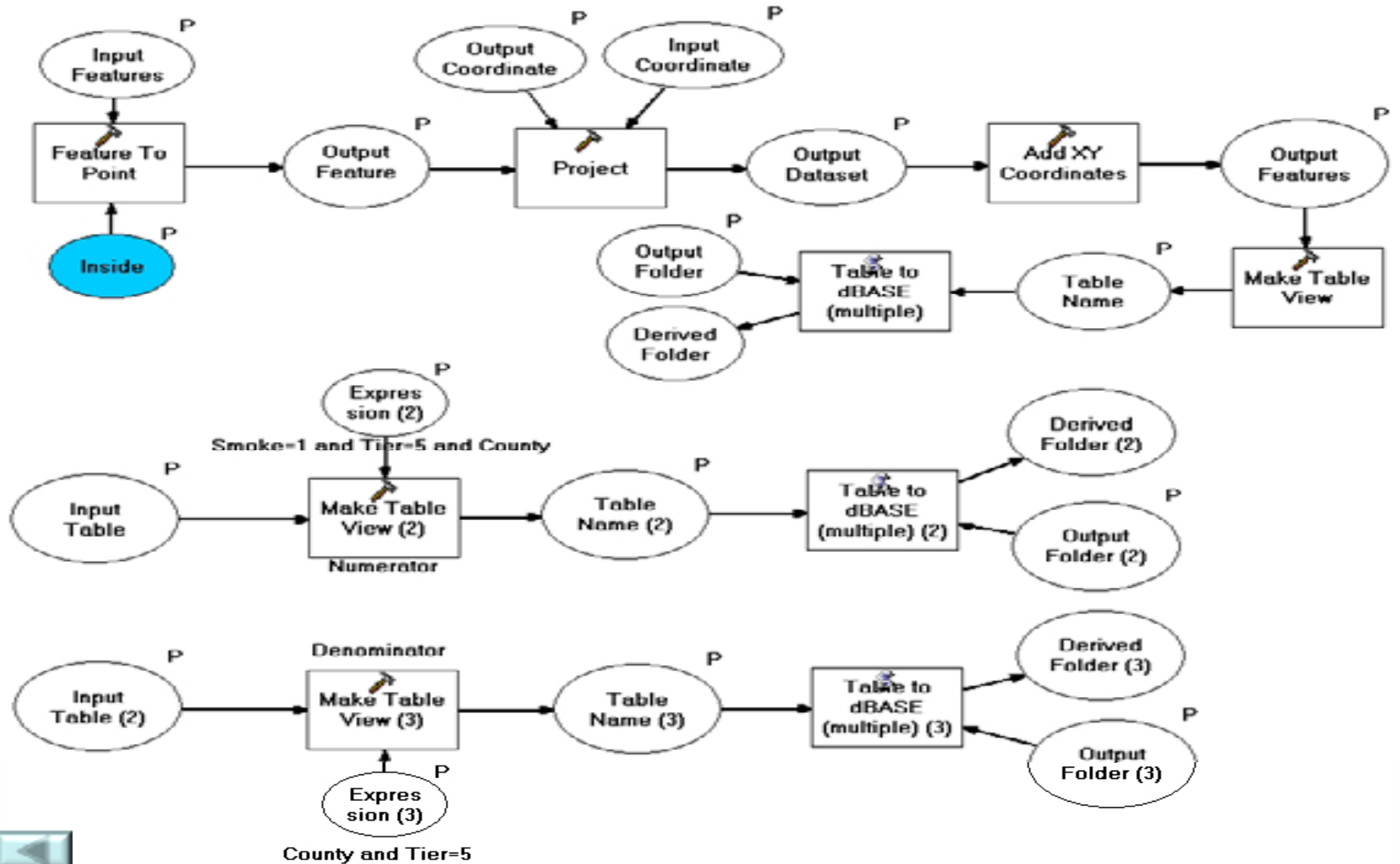
AP

.CSV

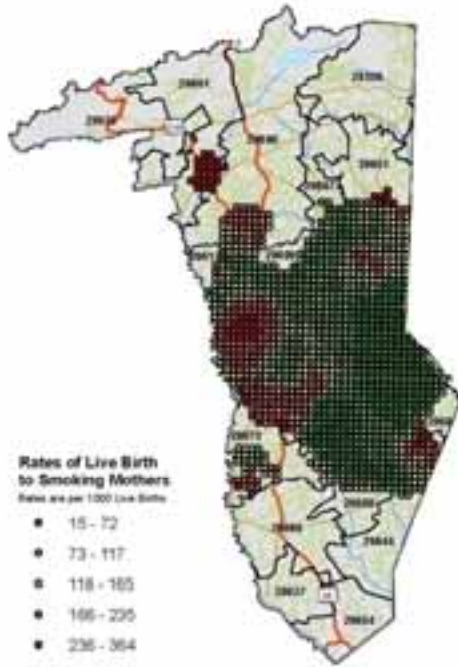
Hot Spot Analysis Model



DMAP Analysis Preparation Model



Live Births to Mothers Who Reported Smoking During Pregnancy for 2004 and Who Resided in Greenville County, South Carolina at the Time of Delivery



Only births with an exact address match were used. Addresses that were matched to a street, ZIP code centroid or county centroid were not used (e.g. Rural Routes and PO Boxes).

Exact address match numbers:
Live Births: n = 5259 out of 5619 (93.6%)
Smoking Mothers: n = 685 out of 732 (93.6%)



ZIP Code	Count	Rate (per 1000)
29601	1	0.1
29602	1	0.1
29603	1	0.1
29604	1	0.1
29605	1	0.1
29606	1	0.1
29607	1	0.1
29608	1	0.1
29609	1	0.1
29610	1	0.1
29611	1	0.1
29612	1	0.1
29613	1	0.1
29614	1	0.1
29615	1	0.1
29616	1	0.1
29617	1	0.1
29618	1	0.1
29619	1	0.1
29620	1	0.1
29621	1	0.1
29622	1	0.1
29623	1	0.1
29624	1	0.1
29625	1	0.1
29626	1	0.1
29627	1	0.1
29628	1	0.1
29629	1	0.1
29630	1	0.1
29631	1	0.1
29632	1	0.1
29633	1	0.1
29634	1	0.1
29635	1	0.1
29636	1	0.1
29637	1	0.1
29638	1	0.1
29639	1	0.1
29640	1	0.1
29641	1	0.1
29642	1	0.1
29643	1	0.1
29644	1	0.1
29645	1	0.1
29646	1	0.1
29647	1	0.1
29648	1	0.1
29649	1	0.1
29650	1	0.1
29651	1	0.1
29652	1	0.1
29653	1	0.1
29654	1	0.1
29655	1	0.1
29656	1	0.1
29657	1	0.1
29658	1	0.1
29659	1	0.1
29660	1	0.1
29661	1	0.1
29662	1	0.1
29663	1	0.1
29664	1	0.1
29665	1	0.1
29666	1	0.1
29667	1	0.1
29668	1	0.1
29669	1	0.1
29670	1	0.1
29671	1	0.1
29672	1	0.1
29673	1	0.1
29674	1	0.1
29675	1	0.1
29676	1	0.1
29677	1	0.1
29678	1	0.1
29679	1	0.1
29680	1	0.1
29681	1	0.1
29682	1	0.1
29683	1	0.1
29684	1	0.1
29685	1	0.1
29686	1	0.1
29687	1	0.1
29688	1	0.1
29689	1	0.1
29690	1	0.1
29691	1	0.1
29692	1	0.1
29693	1	0.1
29694	1	0.1
29695	1	0.1
29696	1	0.1
29697	1	0.1
29698	1	0.1
29699	1	0.1
29700	1	0.1

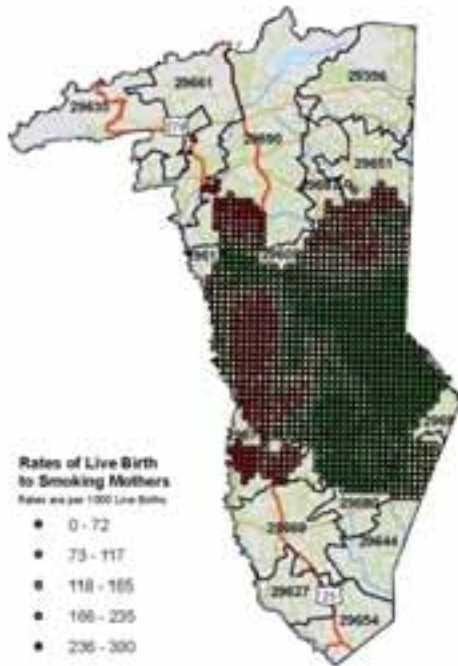


Rates were calculated using the Distance Mapping and Analysis Program (DMAP) developed at the University of Iowa. A 0.5 mile grid that covered Greenville county was used to calculate the rates. Rates at each grid point were calculated by dividing the sum of numerator (total number of live birth to smoking mothers) and denominator (total number of live birth) events within in a specified radius of 1.5 mile, given by the filter size. To calculate the rate, a minimum denominator size of 40 events was required at each grid point.

Numeric values in blue represent total number of live births within a specific ZIP code area. Only live births with an exact address match were used for this analysis.



Live Births to Mothers Who Reported Smoking During Pregnancy for 2005 and Who Resided in Greenville County, South Carolina at the Time of Delivery



Only births with an exact address match were used. Addresses that were matched to a street, ZIP code centroid or county centroid were not used (e.g. Rural Routes and PO Boxes).

Exact address match numbers:
Live Births: n = 5424 out of 5786 [93.7%]
Smoking Mothers: n = 682 out of 732 [93.2%]



ZIP Code	Total Live Births	Live Births to Smoking Mothers
29601	10	0
29602	10	0
29603	10	0
29604	10	0
29605	10	0
29606	10	0
29607	10	0
29608	10	0
29609	10	0
29610	10	0
29611	10	0
29612	10	0
29613	10	0
29614	10	0
29615	10	0
29616	10	0
29617	10	0
29618	10	0
29619	10	0
29620	10	0
29621	10	0
29622	10	0
29623	10	0
29624	10	0
29625	10	0
29626	10	0
29627	10	0
29628	10	0
29629	10	0
29630	10	0
29631	10	0
29632	10	0
29633	10	0
29634	10	0
29635	10	0
29636	10	0
29637	10	0
29638	10	0
29639	10	0
29640	10	0
29641	10	0
29642	10	0
29643	10	0
29644	10	0
29645	10	0
29646	10	0
29647	10	0
29648	10	0
29649	10	0
29650	10	0
29651	10	0
29652	10	0
29653	10	0
29654	10	0
29655	10	0
29656	10	0
29657	10	0
29658	10	0
29659	10	0
29660	10	0
29661	10	0
29662	10	0
29663	10	0
29664	10	0
29665	10	0
29666	10	0
29667	10	0
29668	10	0
29669	10	0
29670	10	0
29671	10	0
29672	10	0
29673	10	0
29674	10	0
29675	10	0
29676	10	0
29677	10	0
29678	10	0
29679	10	0
29680	10	0
29681	10	0
29682	10	0
29683	10	0
29684	10	0
29685	10	0
29686	10	0
29687	10	0
29688	10	0
29689	10	0
29690	10	0
29691	10	0
29692	10	0
29693	10	0
29694	10	0
29695	10	0
29696	10	0
29697	10	0
29698	10	0
29699	10	0
29700	10	0

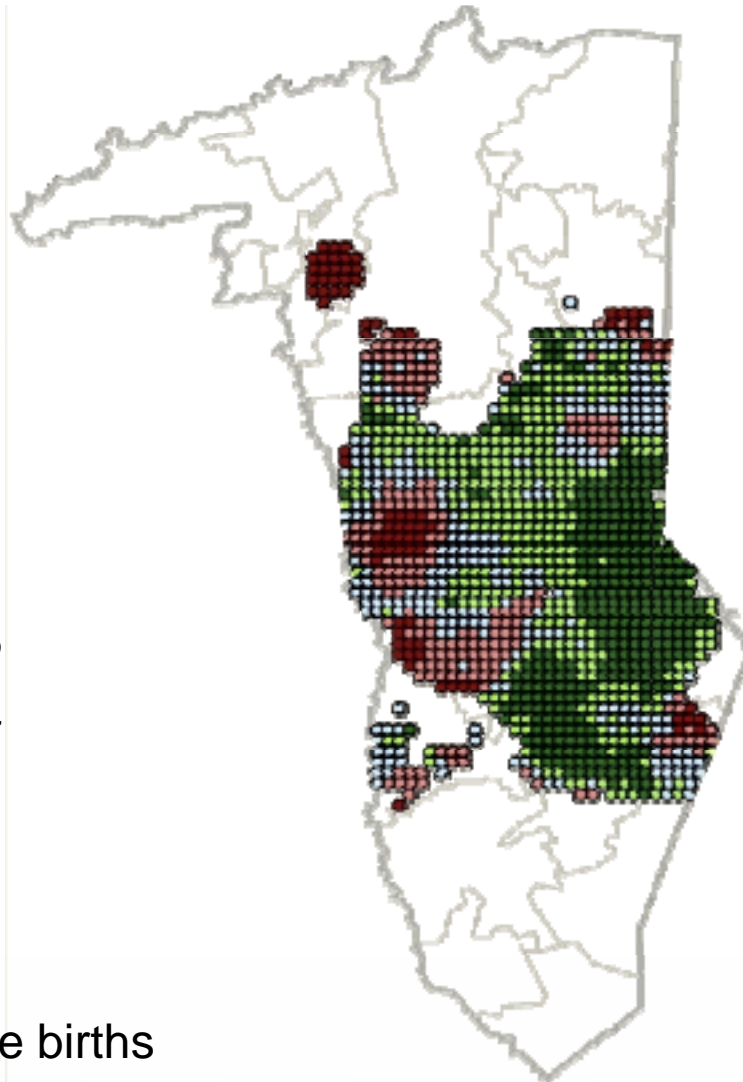
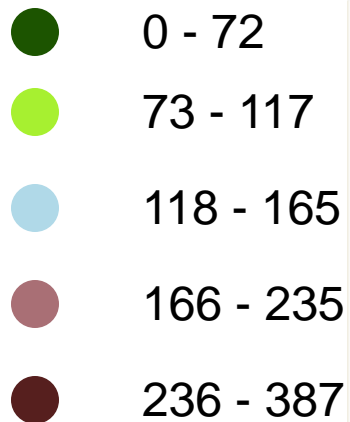
Rates were calculated using the Distance Mapping and Analysis Program (DMAP) developed at the University of Iowa. A 0.5 mile grid that covered Greenville county was used to calculate the rates. Rates at each grid point were calculated by dividing the sum of numerator (total number of live birth to smoking mothers) and denominator (total number of live birth) events within a specified radius of 1.6 mile, given by the filter size. To calculate the rate, a minimum denominator size of 40 events was required at each grid point.

Numeric values in blue represent total number of live births within a specific ZIP code area. Only live births with an exact address match were used for this analysis.



2004 Rates of Live Births to Mothers who Reported Smoking Greenville County, SC

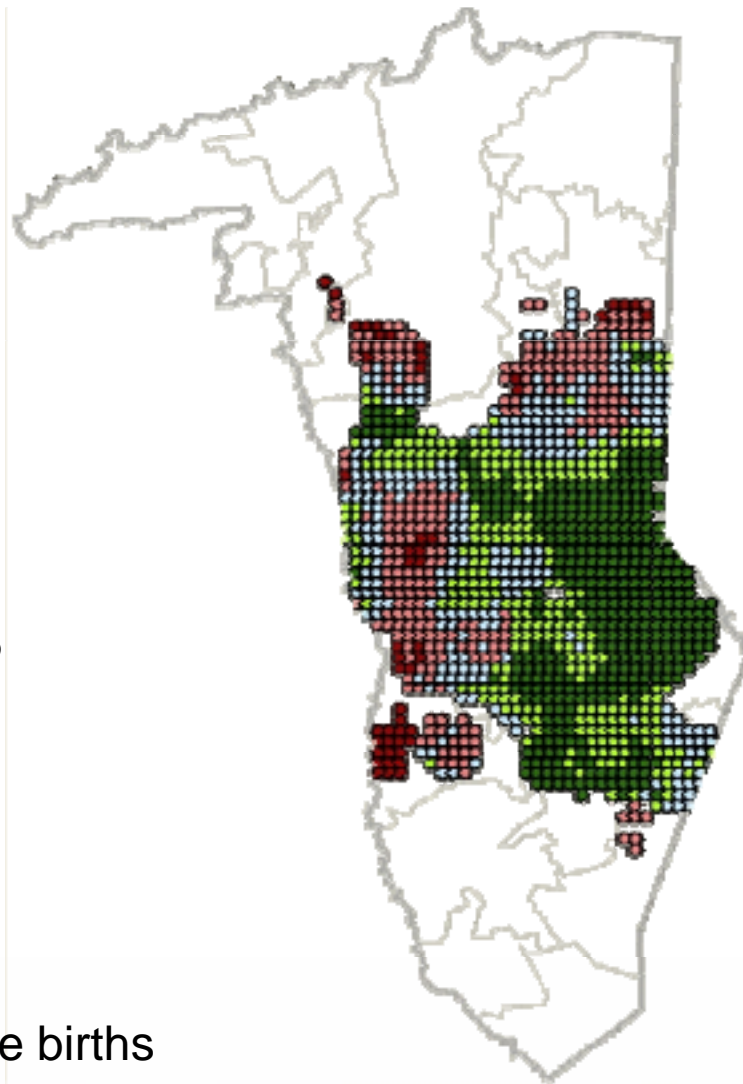
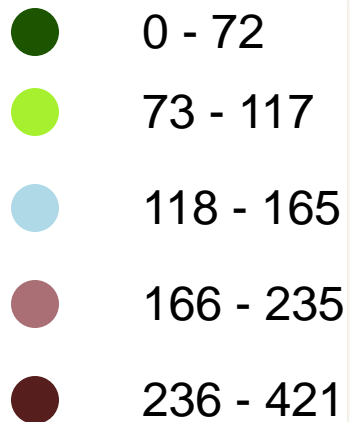
Rates



Rates are per 1000 live births

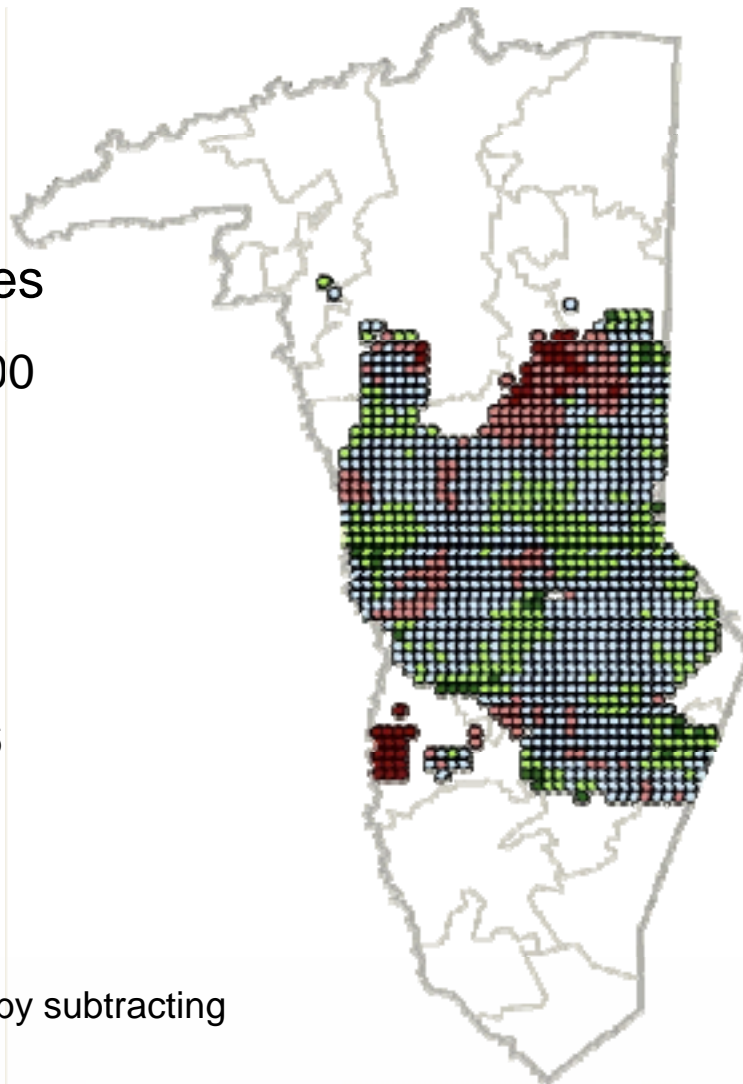
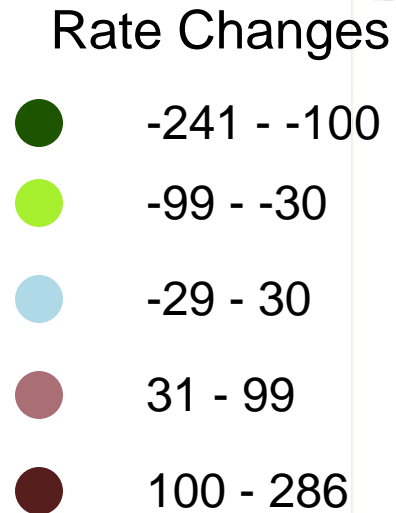
2005 Rates of Live Births to Mothers who Reported Smoking Greenville County, SC

Rates



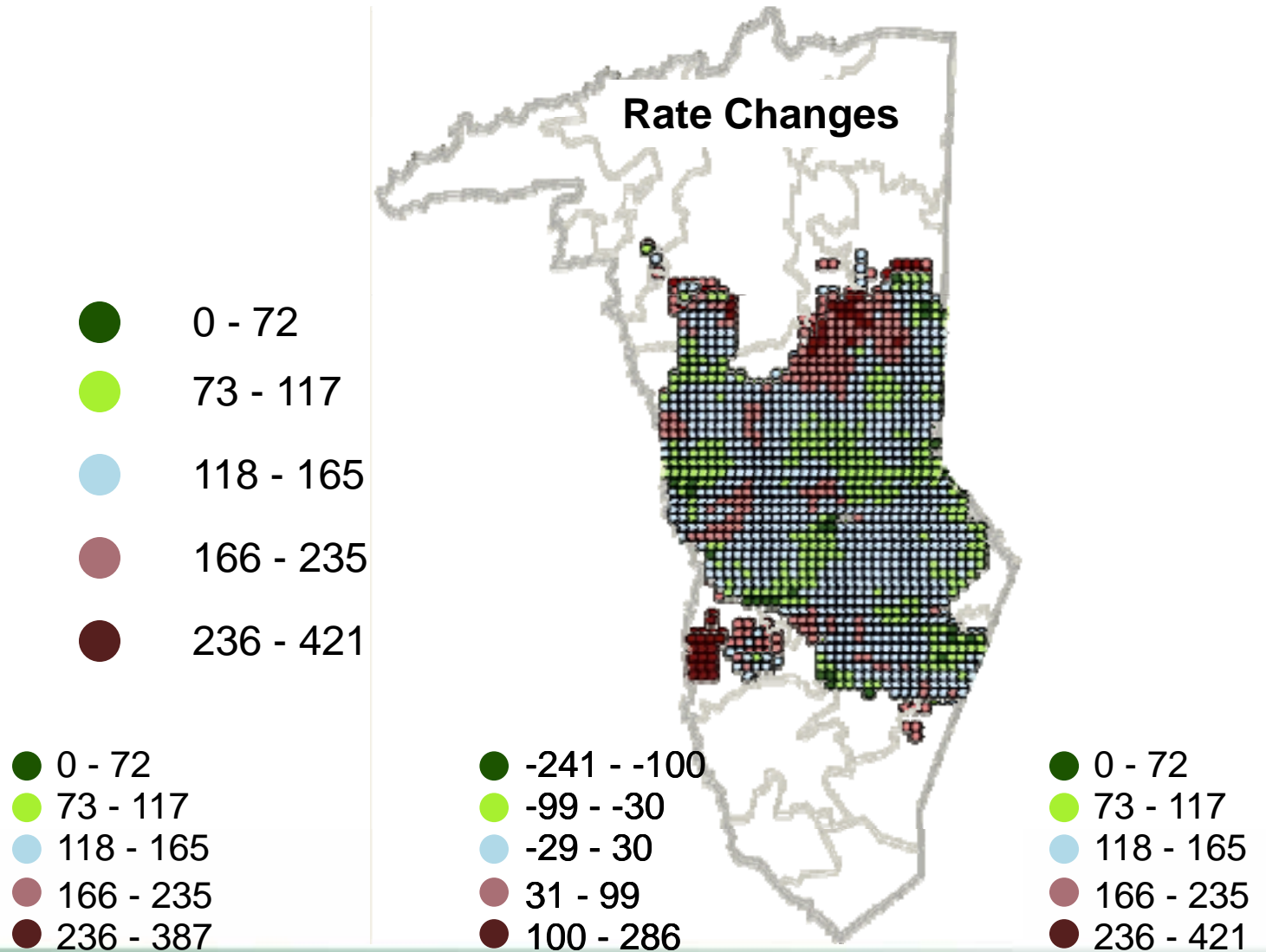
Rates are per 1000 live births

Rate Changes between 2005 and 2004 Greenville County, SC

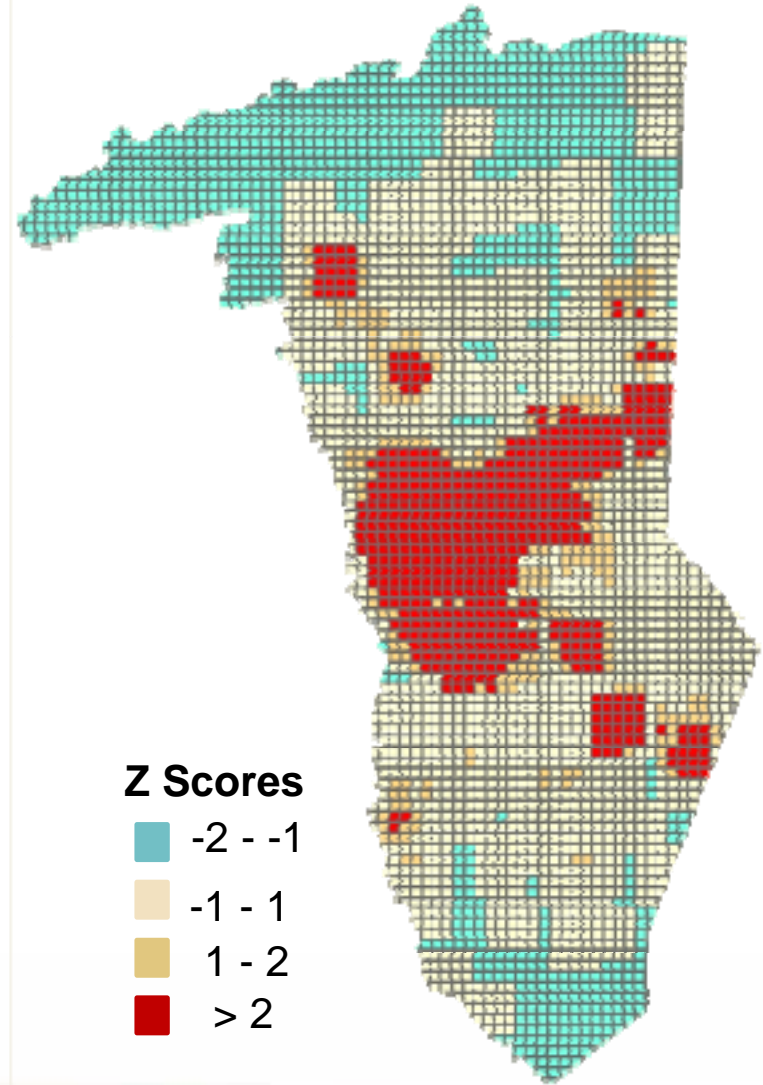
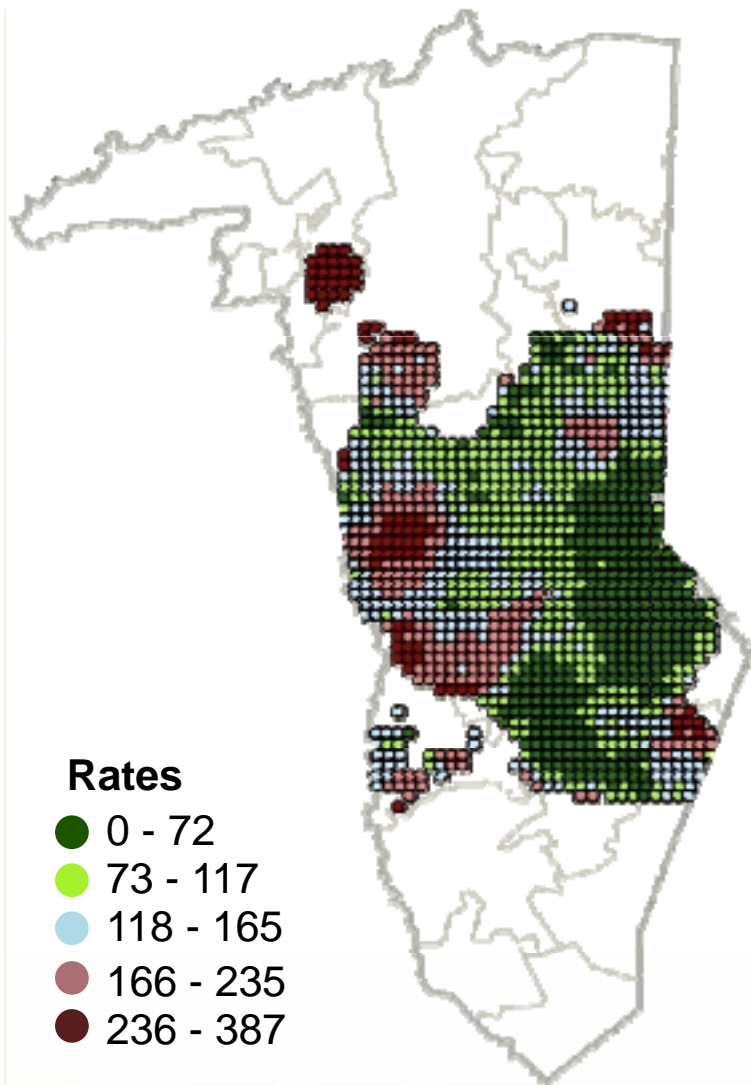


Rate changes are calculated by subtracting 2004 rates from 2005 rates

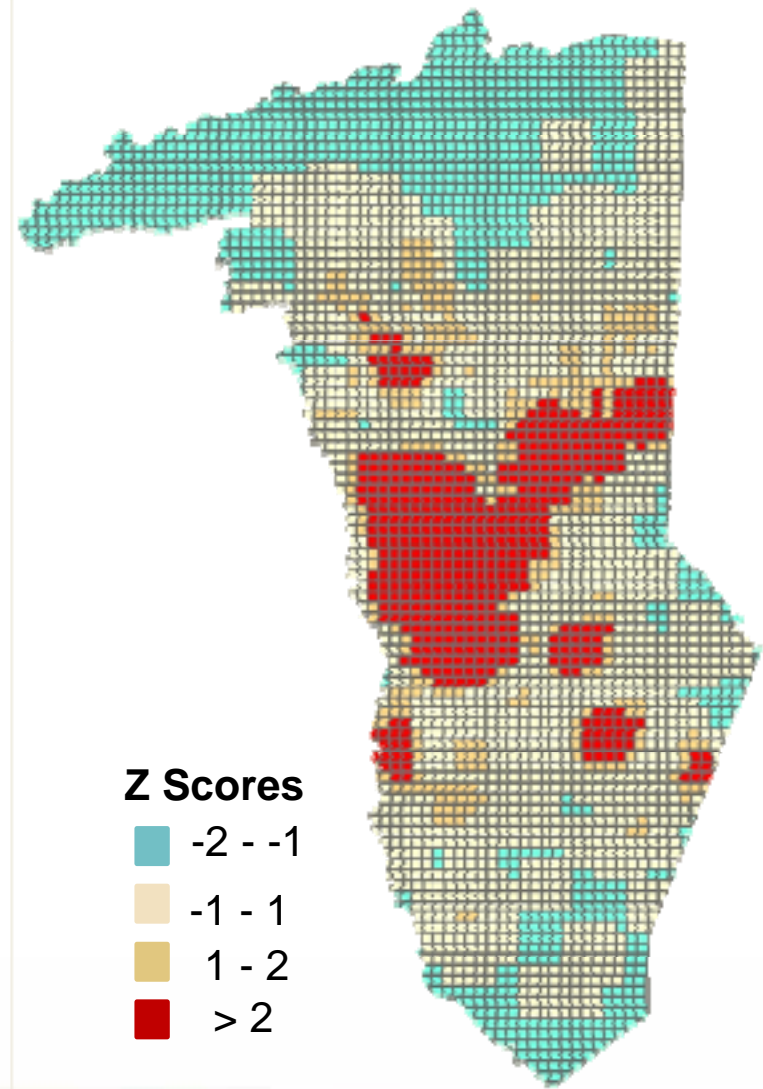
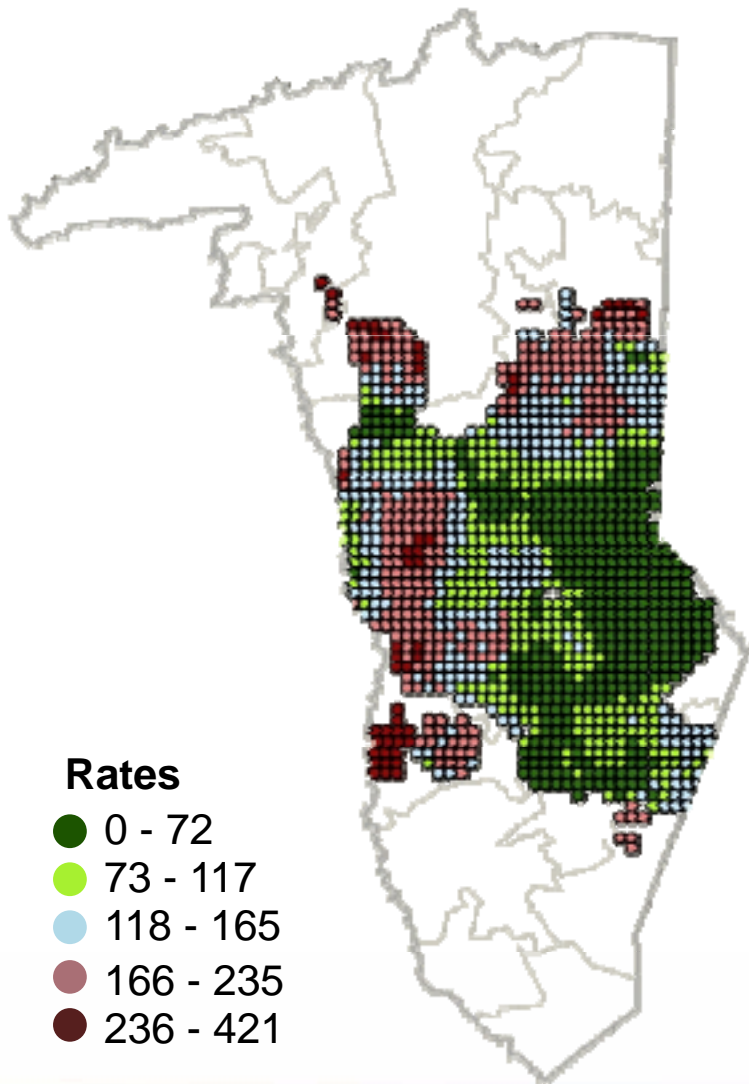
**Rates of Live Births to Mothers who Reported Smoking
 2004 Greenville County, SC 2005**



2004 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Greenville County, SC

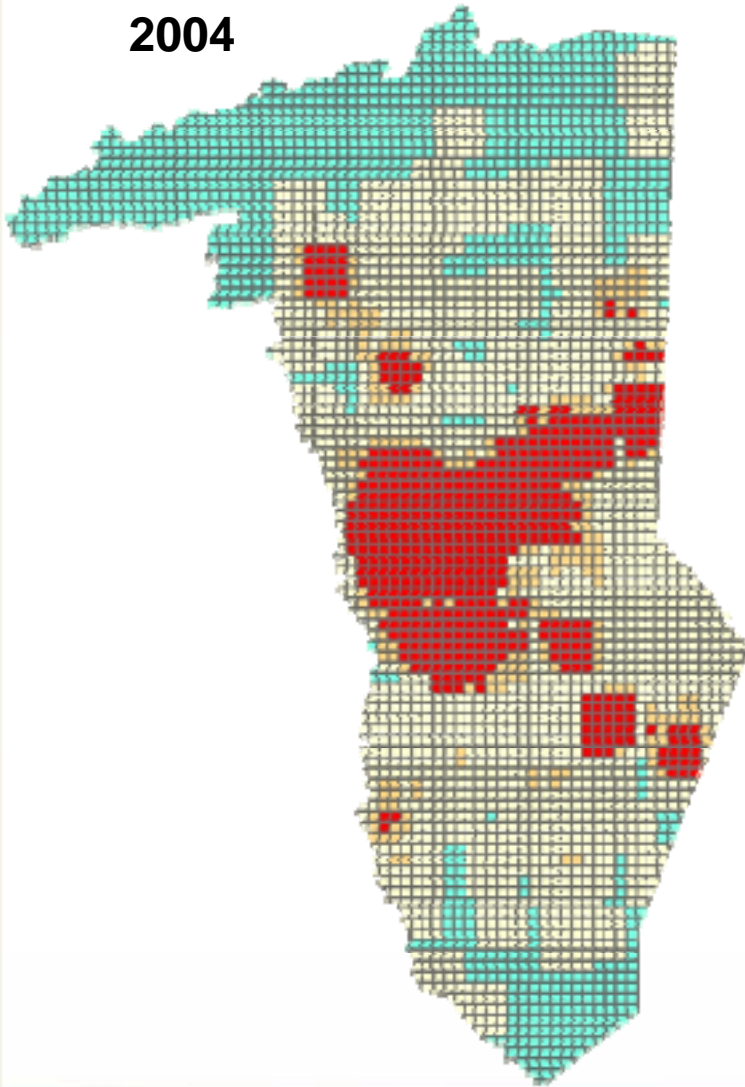


2005 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Greenville County, SC

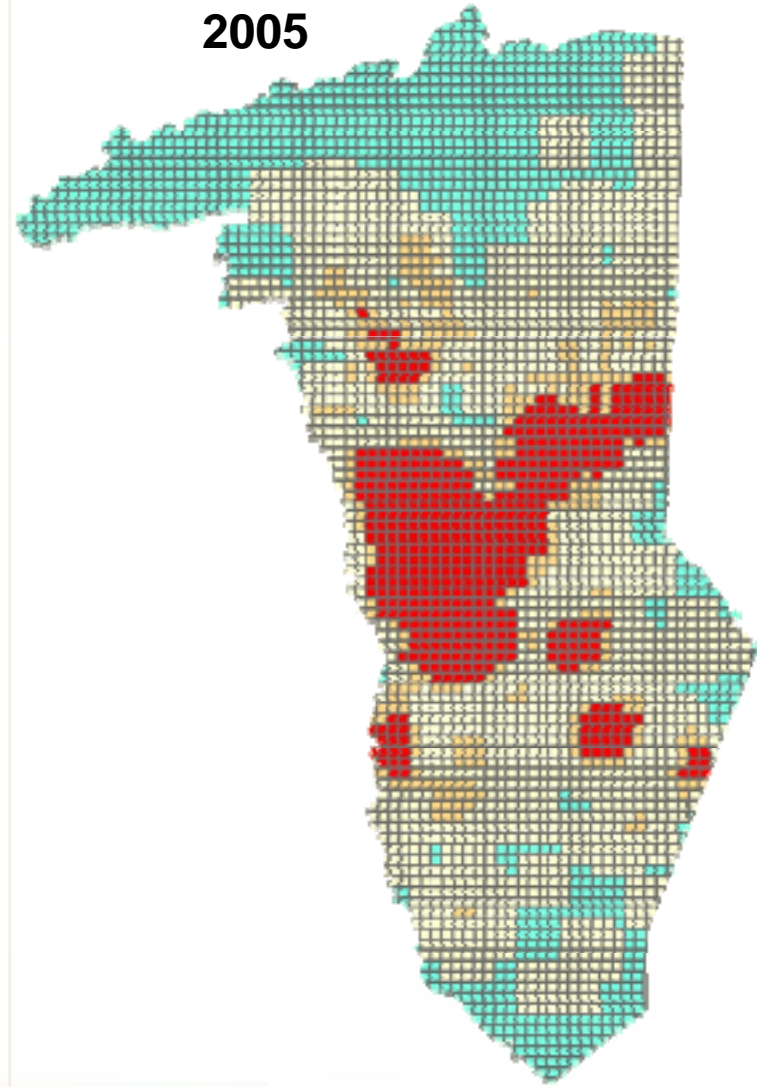


Hot Spot of Live Births to Mothers who Reported Smoking Greenville County, SC

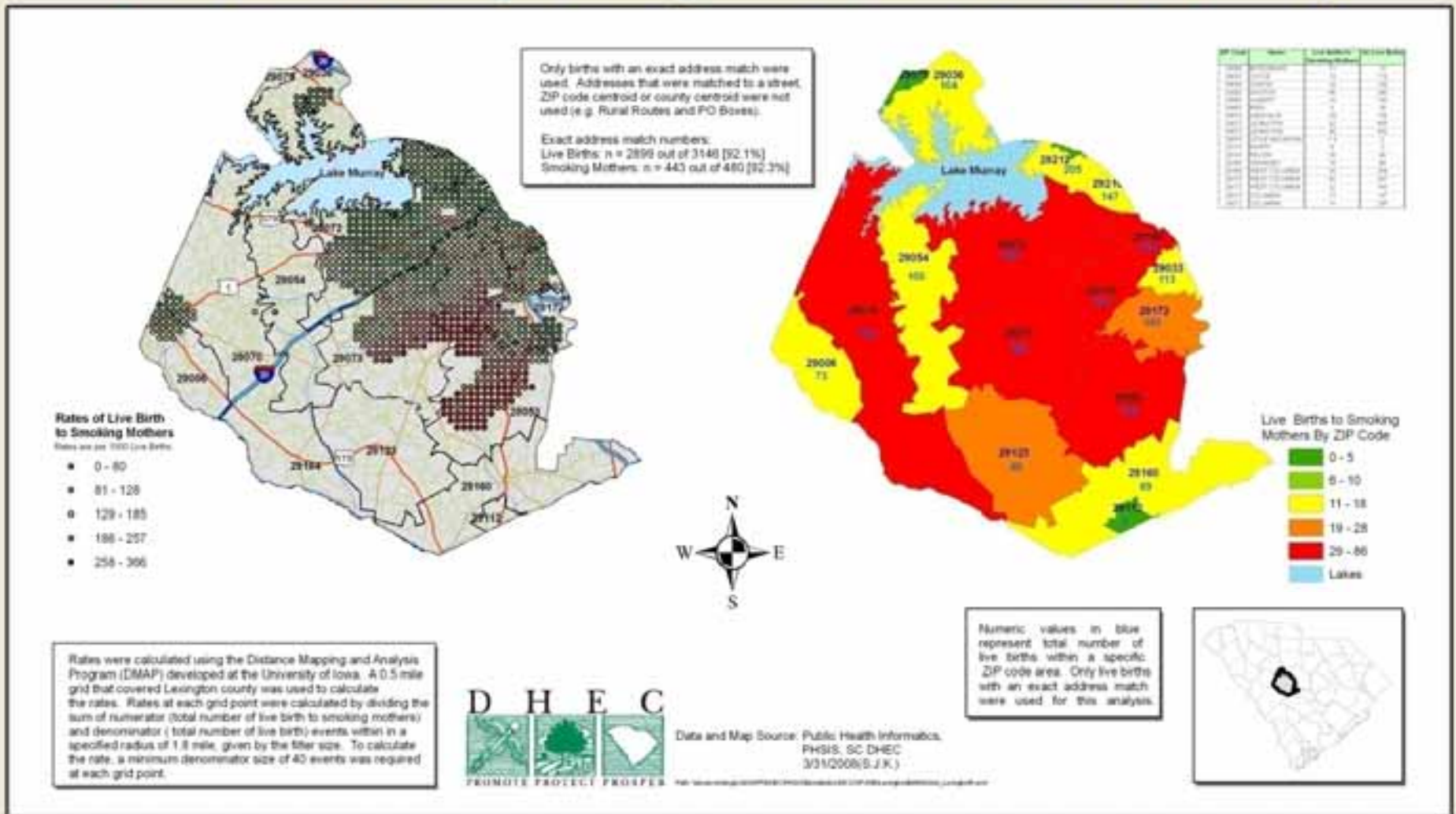
2004



2005

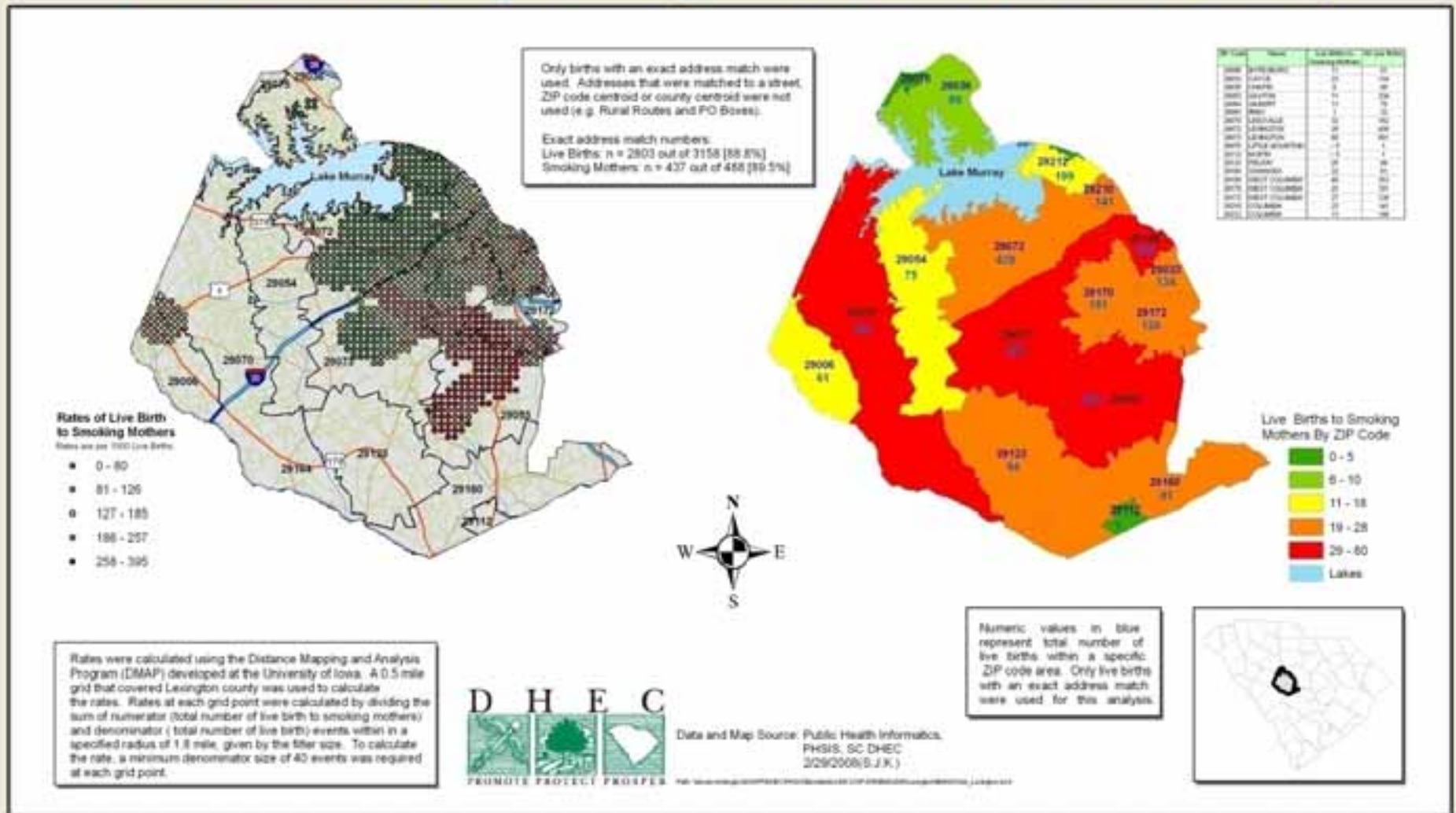


Live Births to Mothers Who Reported Smoking During Pregnancy for 2004 and Who Resided in Lexington County, South Carolina at the Time of Delivery

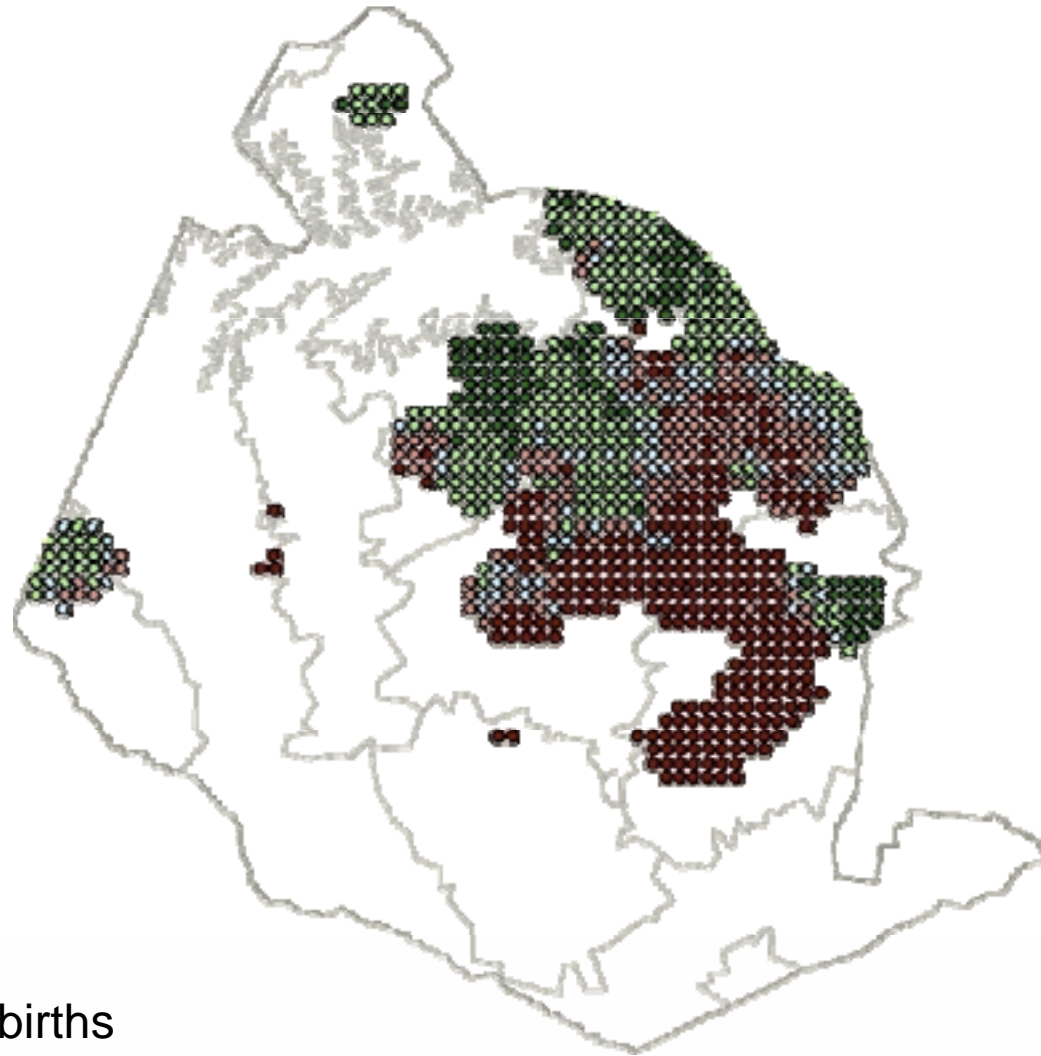
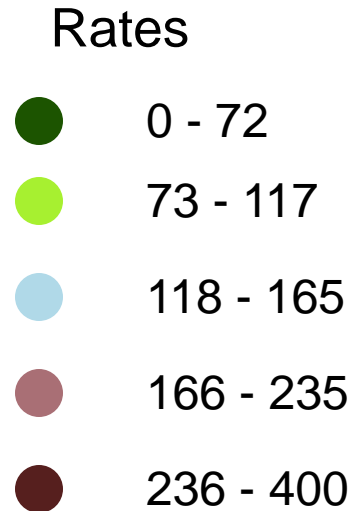


ZIP Code	Name	Live Births	Smoking Mothers
29006	154		
29017	205		
29021	147		
29054	103		
29073	128		
29076	117		
29084	113		
29090	111		
29108	85		
29112	100		
29121	86		
29133	111		
29172	101		
29184	117		
29185	117		
29186	117		
29187	117		
29188	117		
29189	117		
29190	117		
29191	117		
29192	117		
29193	117		
29194	117		
29195	117		
29196	117		
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29211	117		
29212	117		
29213	117		
29214	117		
29215	117		
29216	117		
29217	117		
29218	117		
29219	117		
29220	117		
29221	117		
29222	117		
29223	117		
29224	117		
29225	117		
29226	117		
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29228	117		
29229	117		
29230	117		
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29232	117		
29233	117		
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29245	117		
29246	117		
29247	117		
29248	117		
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29260	117		
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29262	117		
29263	117		
29264	117		
29265	117		
29266	117		
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29296	117		
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29299	117		
29300	117		

Live Births to Mothers Who Reported Smoking During Pregnancy for 2005 and Who Resided in Lexington County, South Carolina at the Time of Delivery

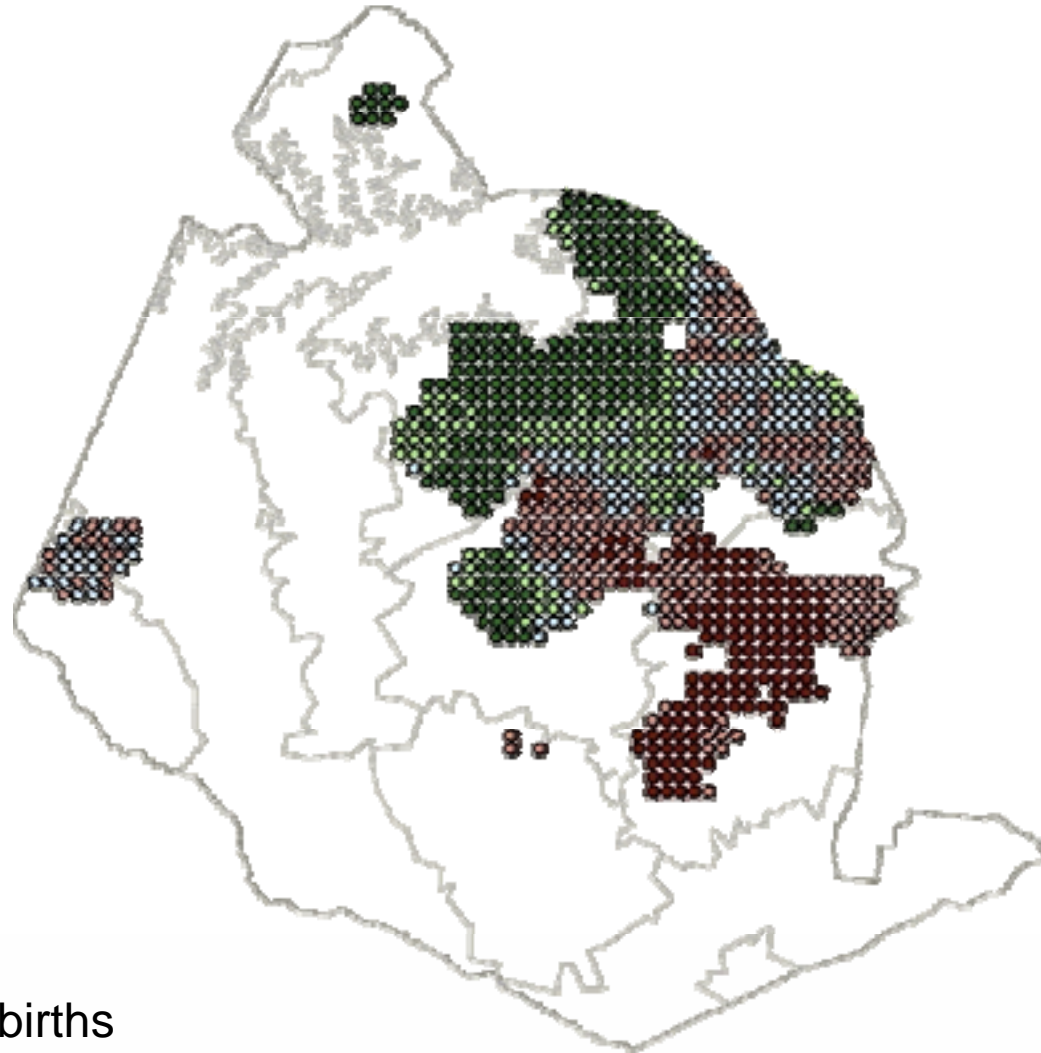
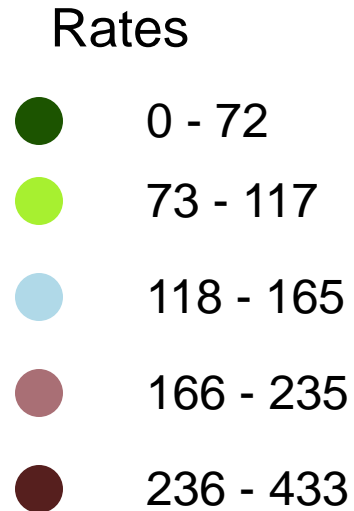


2004 Rates of Live Births to Mothers who Reported Smoking Lexington County, SC



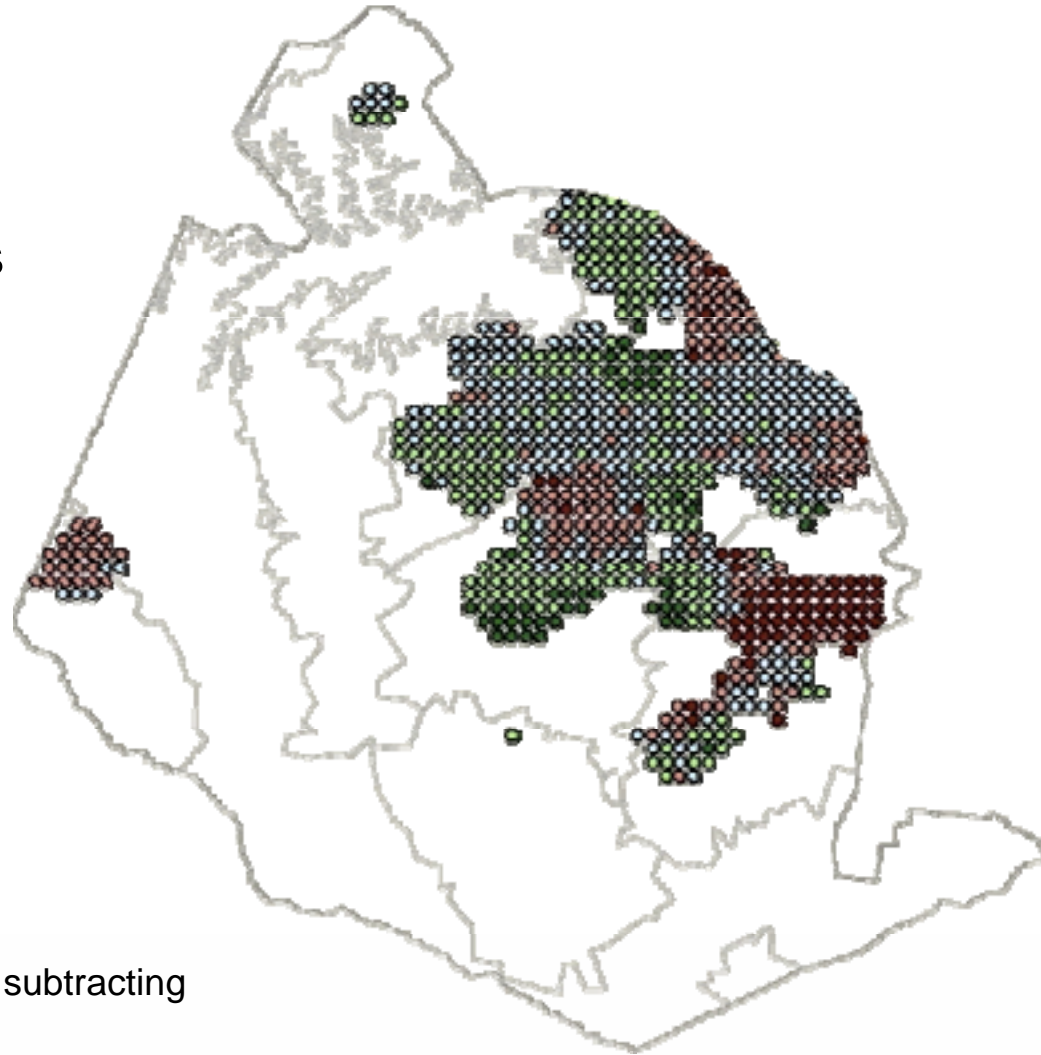
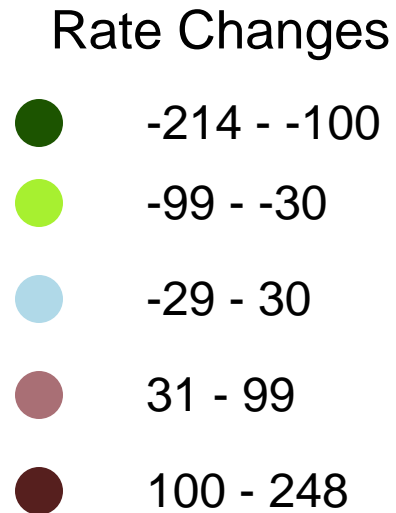
Rates are per 1000 live births

2005 Rates of Live Births to Mothers who Reported Smoking Lexington County, SC



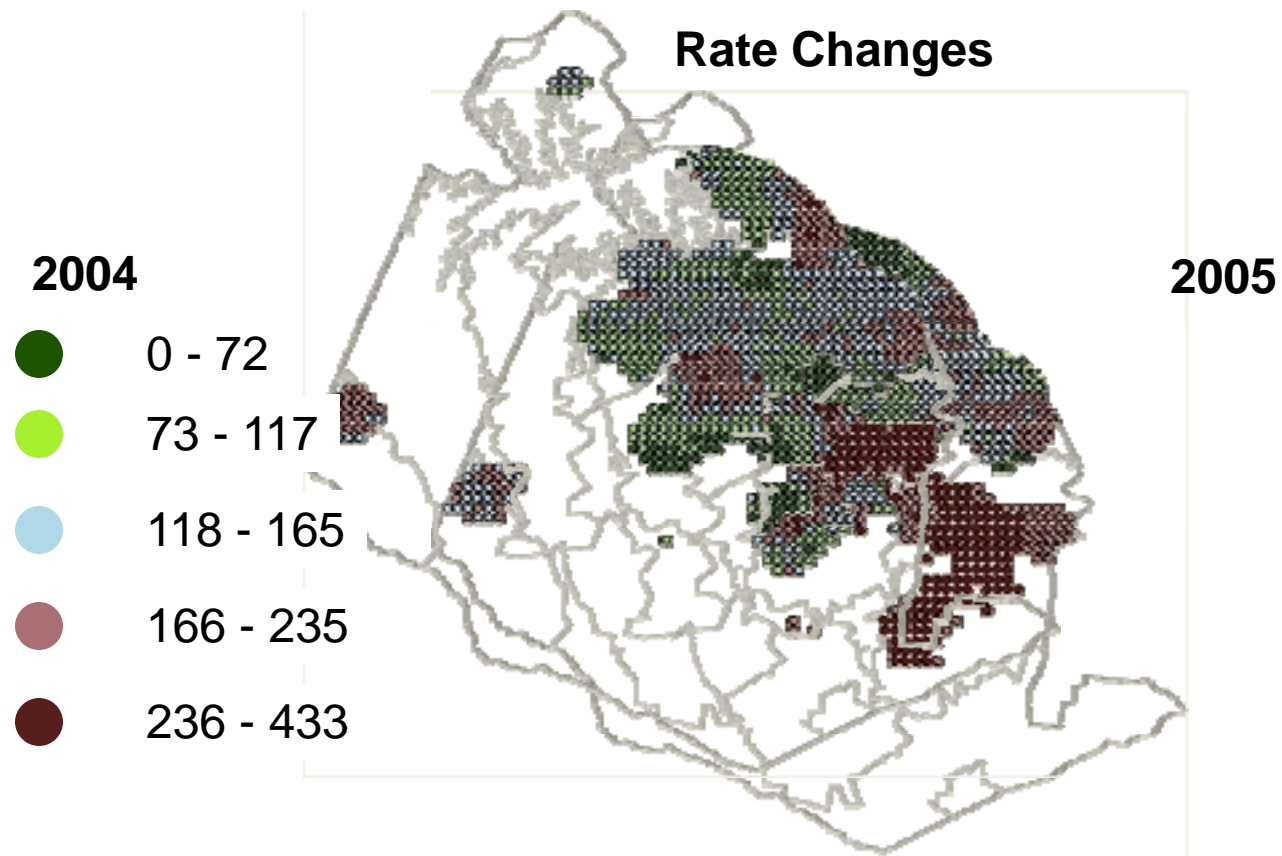
Rates are per 1000 live births

Rate Changes between 2005 and 2004 Lexington County, SC

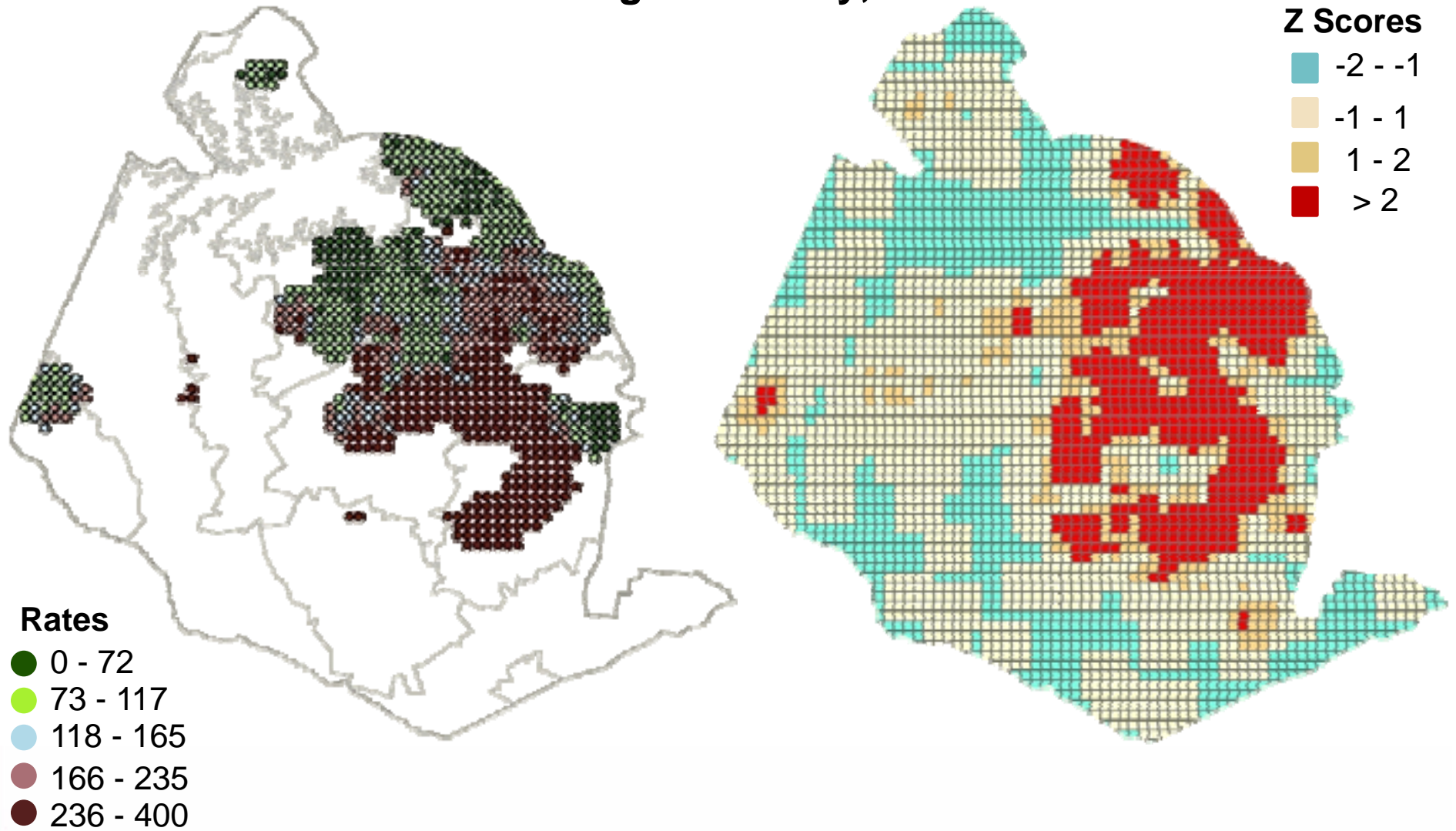


Rate changes are calculated by subtracting 2004 rates from 2005 rates

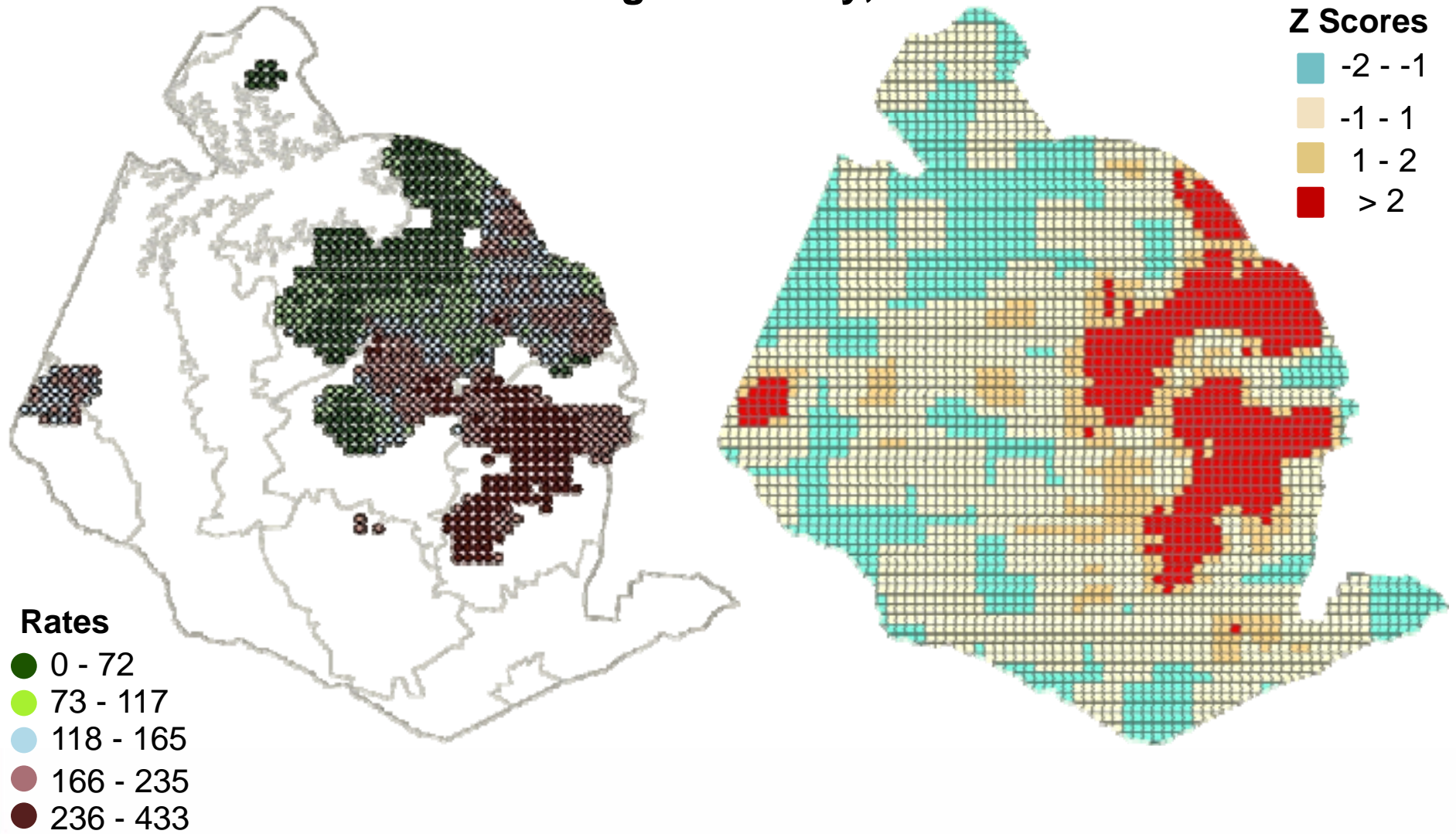
Rates of Live Births to Mothers who Reported Smoking Lexington County, SC



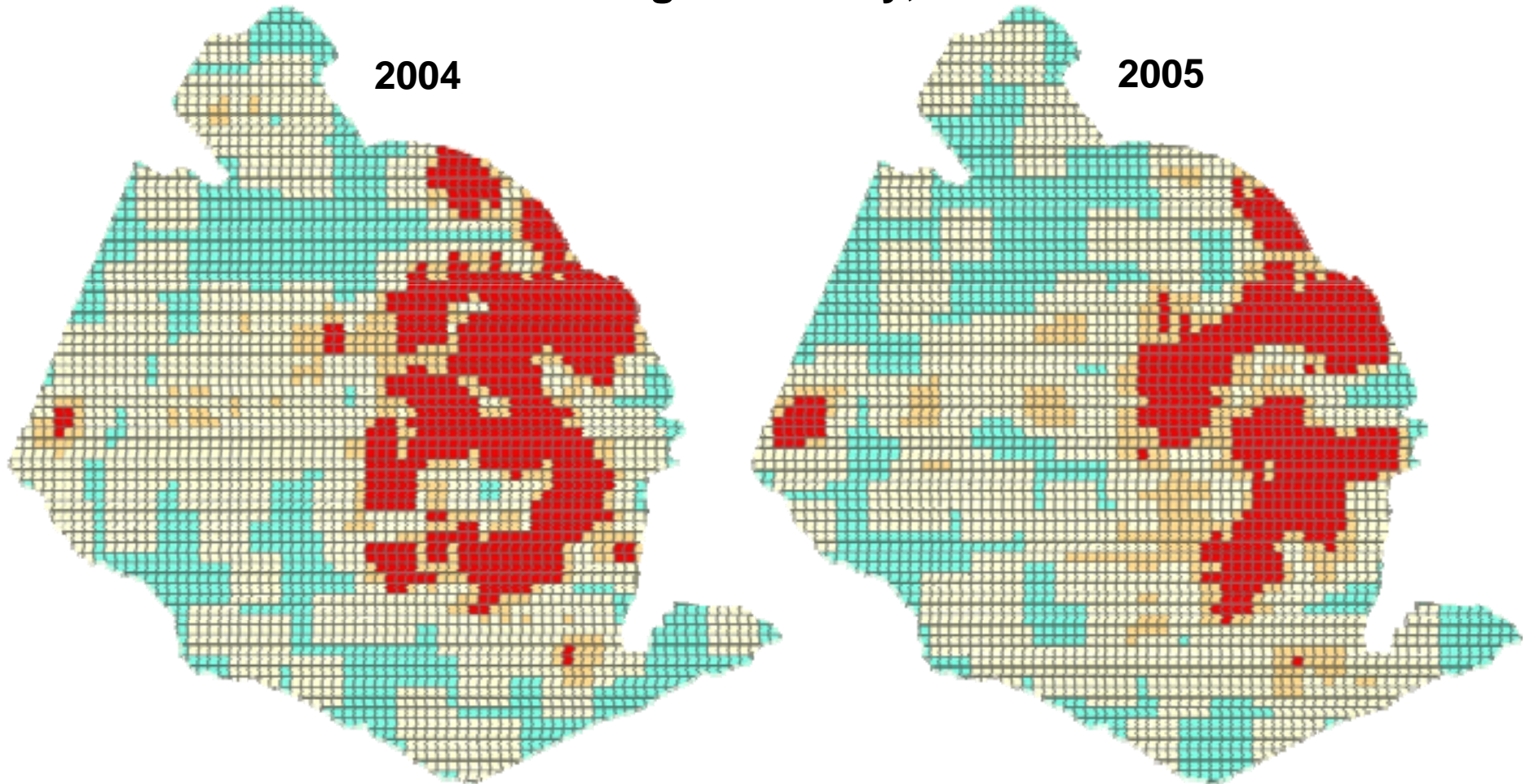
2004 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Lexington County, SC



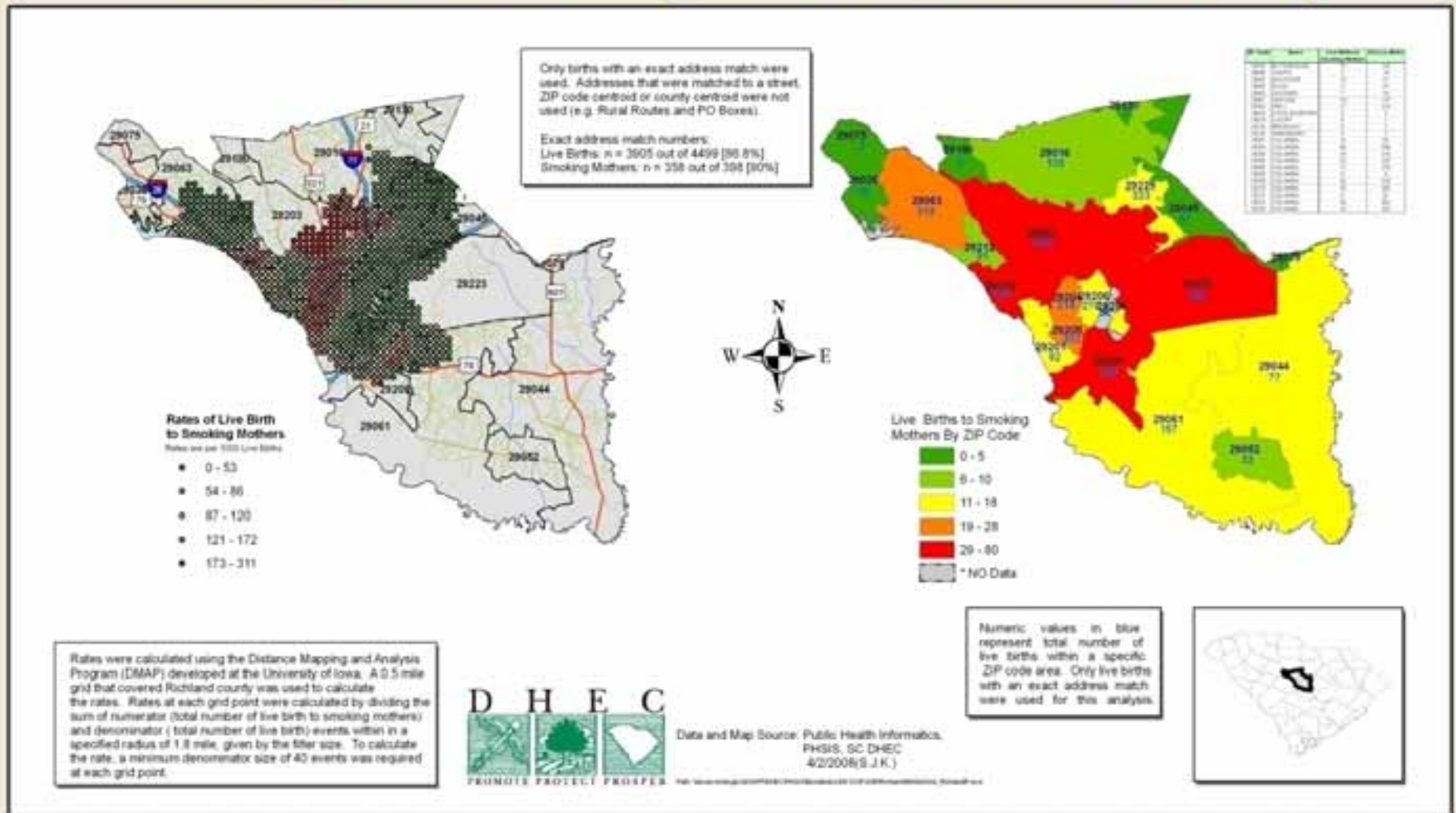
2005 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Lexington County, SC



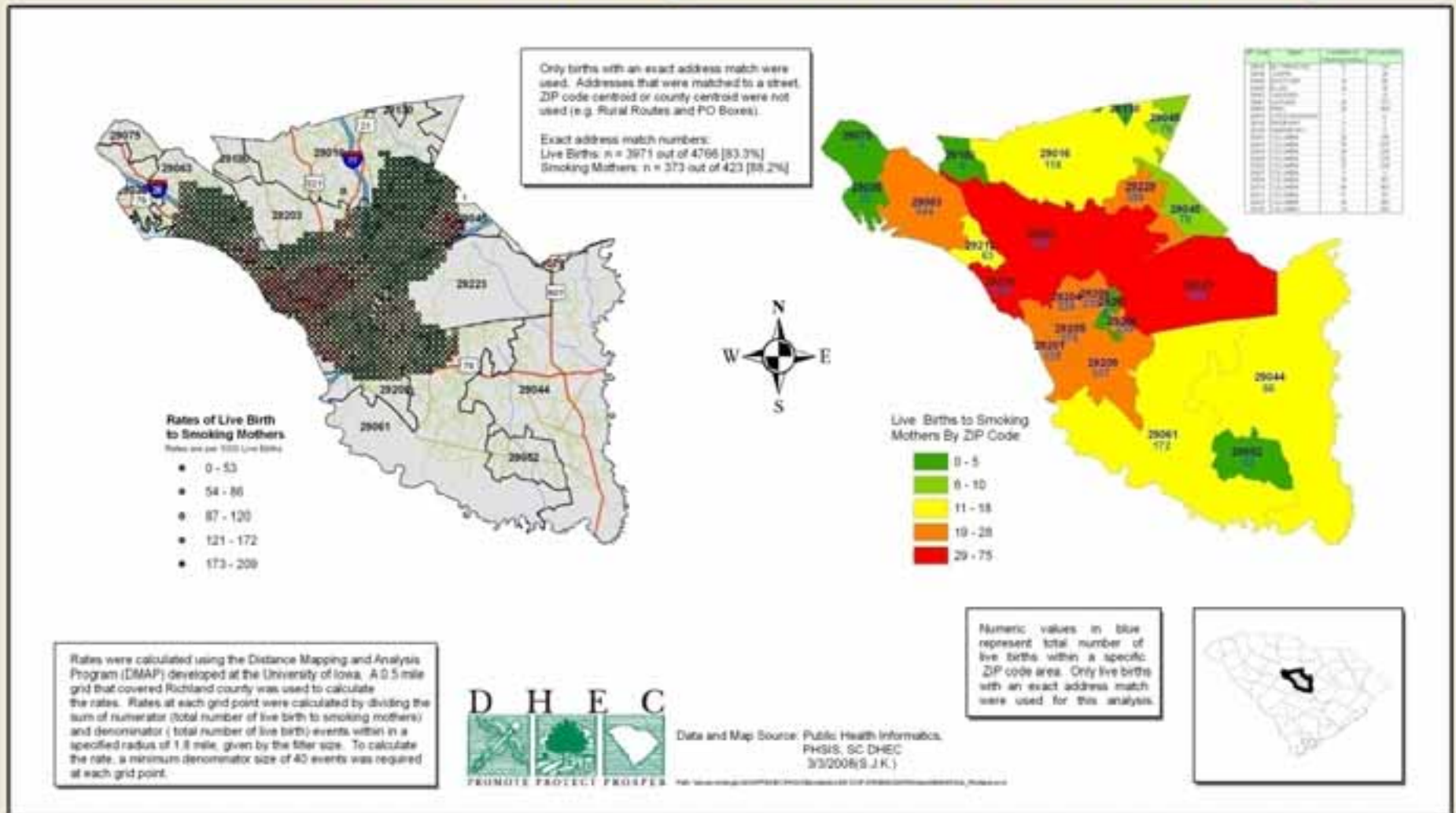
Hot Spot of Live Births to Mothers who Reported Smoking Lexington County, SC



Live Births to Mothers Who Reported Smoking During Pregnancy for 2004 and Who Resided in Richland County, South Carolina at the Time of Delivery



Live Births to Mothers Who Reported Smoking During Pregnancy for 2005 and Who Resided in Richland County, South Carolina at the Time of Delivery

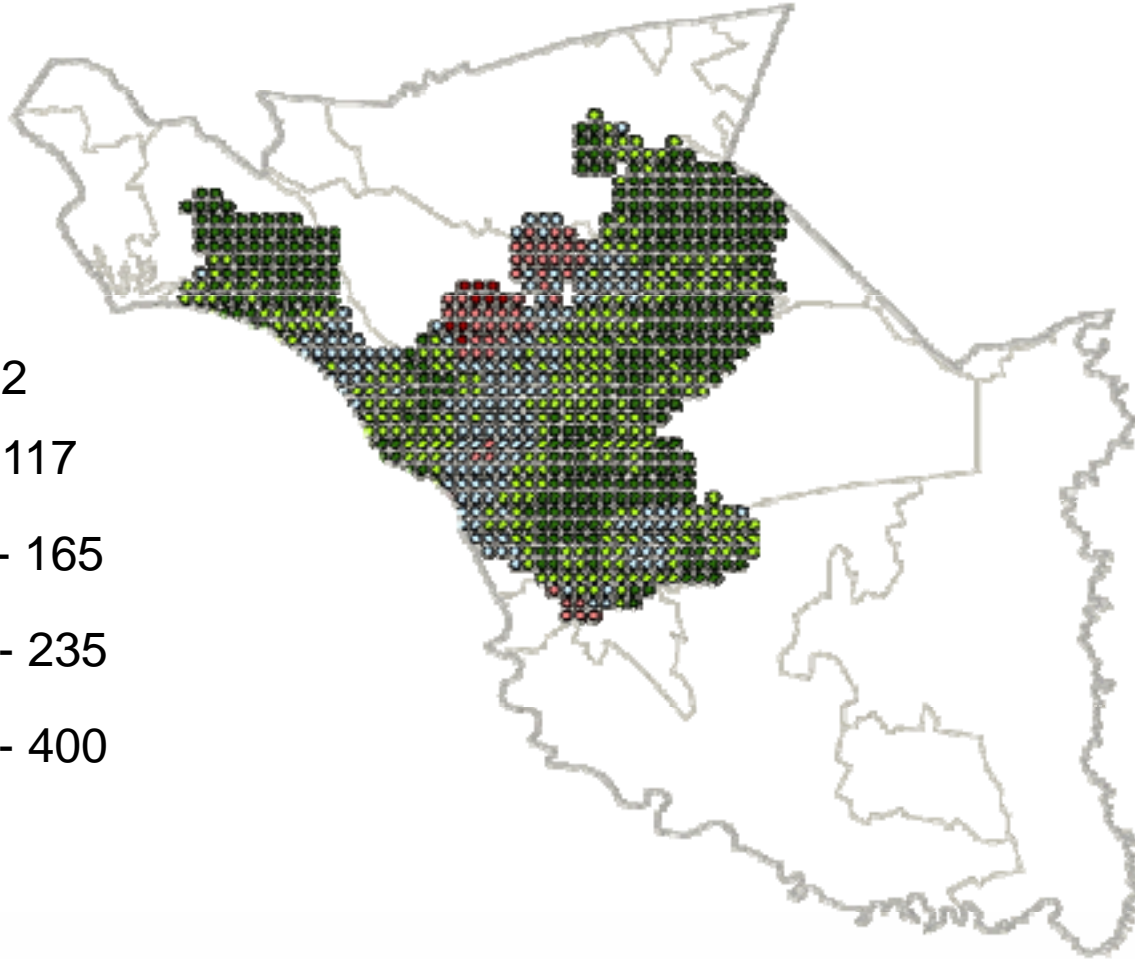


ZIP Code	Live Births	Smoking Mothers
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29002	1	0
29003	1	0
29004	1	0
29005	1	0
29006	1	0
29007	1	0
29008	1	0
29009	1	0
29010	1	0
29011	1	0
29012	1	0
29013	1	0
29014	1	0
29015	1	0
29016	114	15
29017	1	0
29018	1	0
29019	1	0
29020	1	0
29021	1	0
29022	1	0
29023	1	0
29024	1	0
29025	1	0
29026	1	0
29027	1	0
29028	1	0
29029	1	0
29030	1	0
29031	1	0
29032	1	0
29033	1	0
29034	1	0
29035	1	0
29036	1	0
29037	1	0
29038	1	0
29039	1	0
29040	1	0
29041	172	22
29042	1	0
29043	1	0
29044	98	12
29045	1	0
29046	1	0
29047	1	0
29048	1	0
29049	1	0
29050	1	0
29051	1	0
29052	1	0
29053	1	0
29054	1	0
29055	1	0
29056	1	0
29057	1	0
29058	1	0
29059	1	0
29060	1	0
29061	1	0
29062	1	0
29063	1	0
29064	1	0
29065	1	0
29066	1	0
29067	1	0
29068	1	0
29069	1	0
29070	1	0
29071	1	0
29072	1	0
29073	1	0
29074	1	0
29075	1	0

2004 Rates of Live Births to Mothers who Reported Smoking Richland County, SC

Rates

- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 235
- 236 - 400

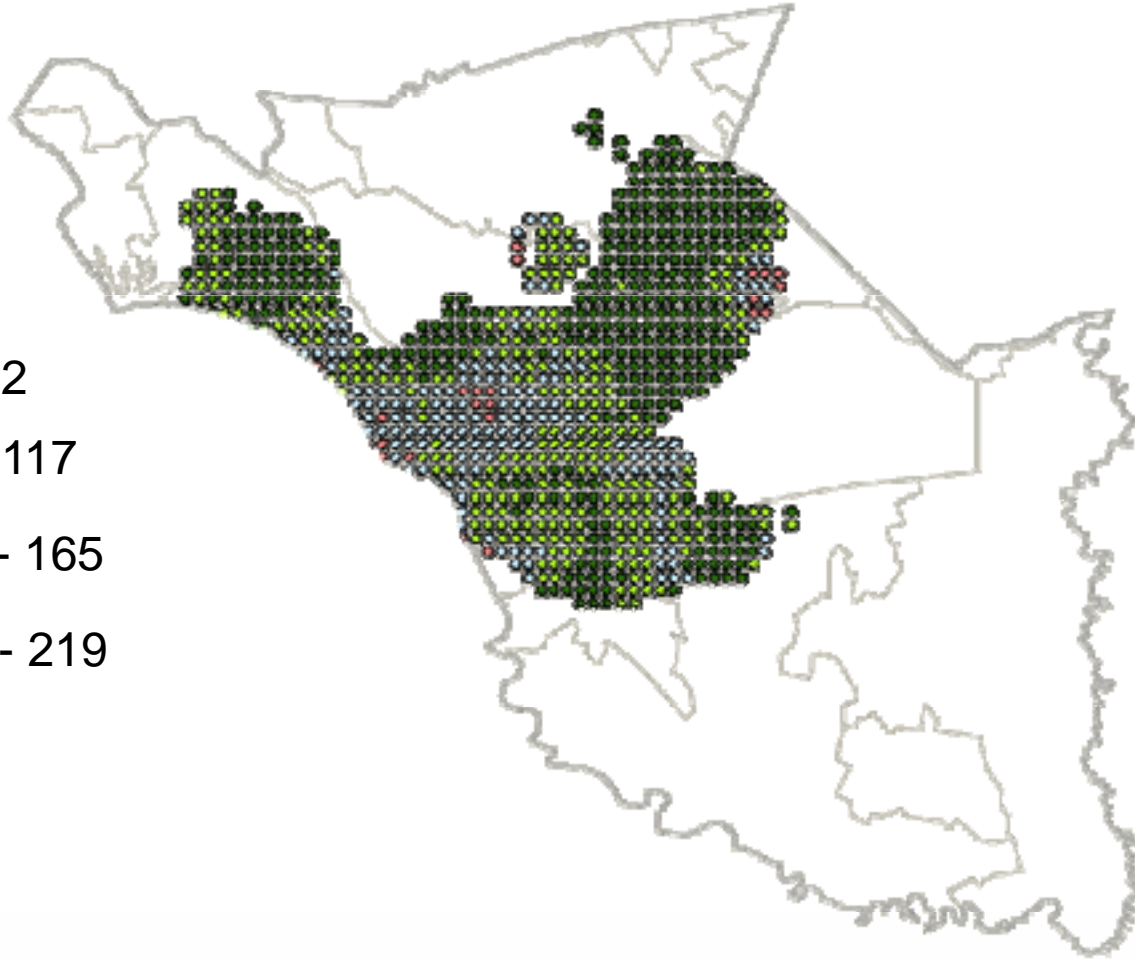


Rates are per 1000 live births

2005 Rates of Live Births to Mothers who Reported Smoking Richland County, SC

Rates

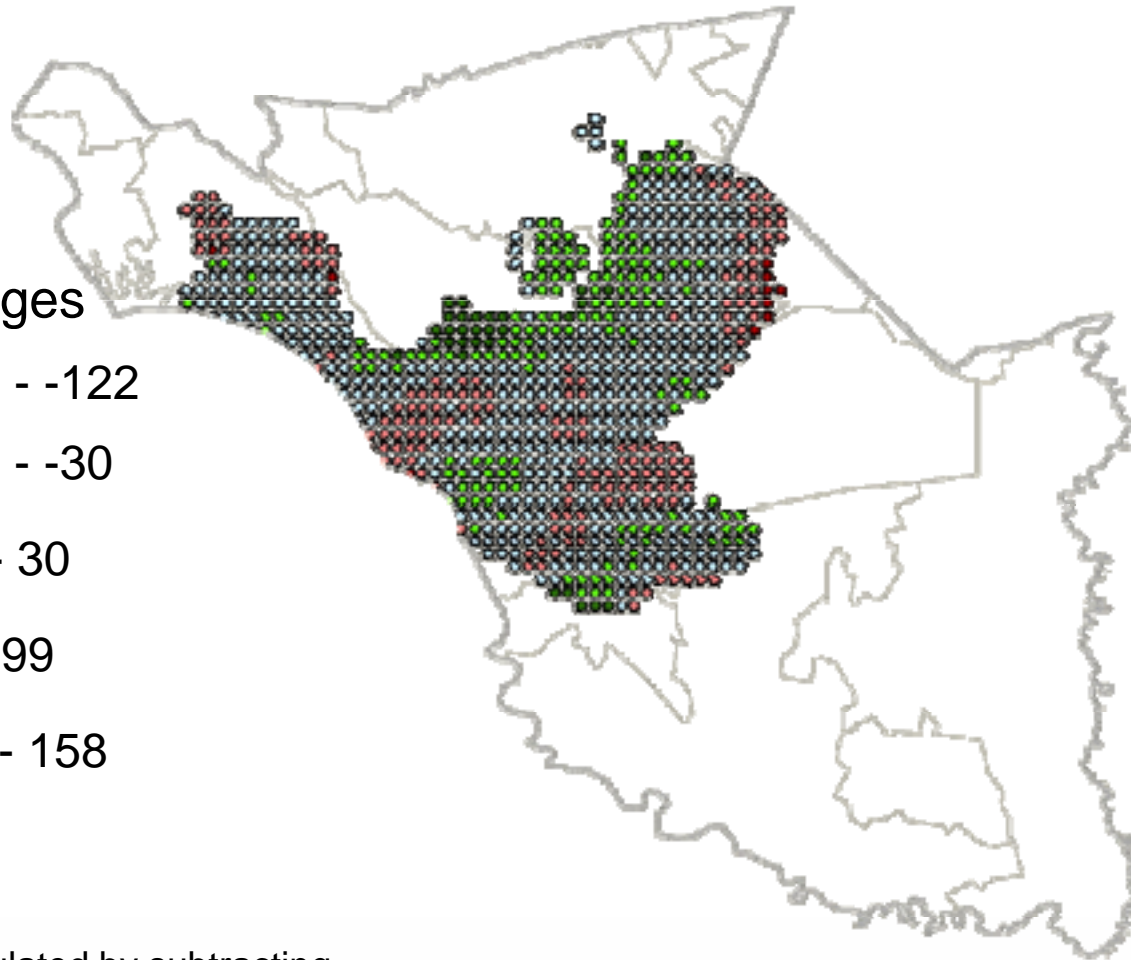
- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 219



Rates are per 1000 live births

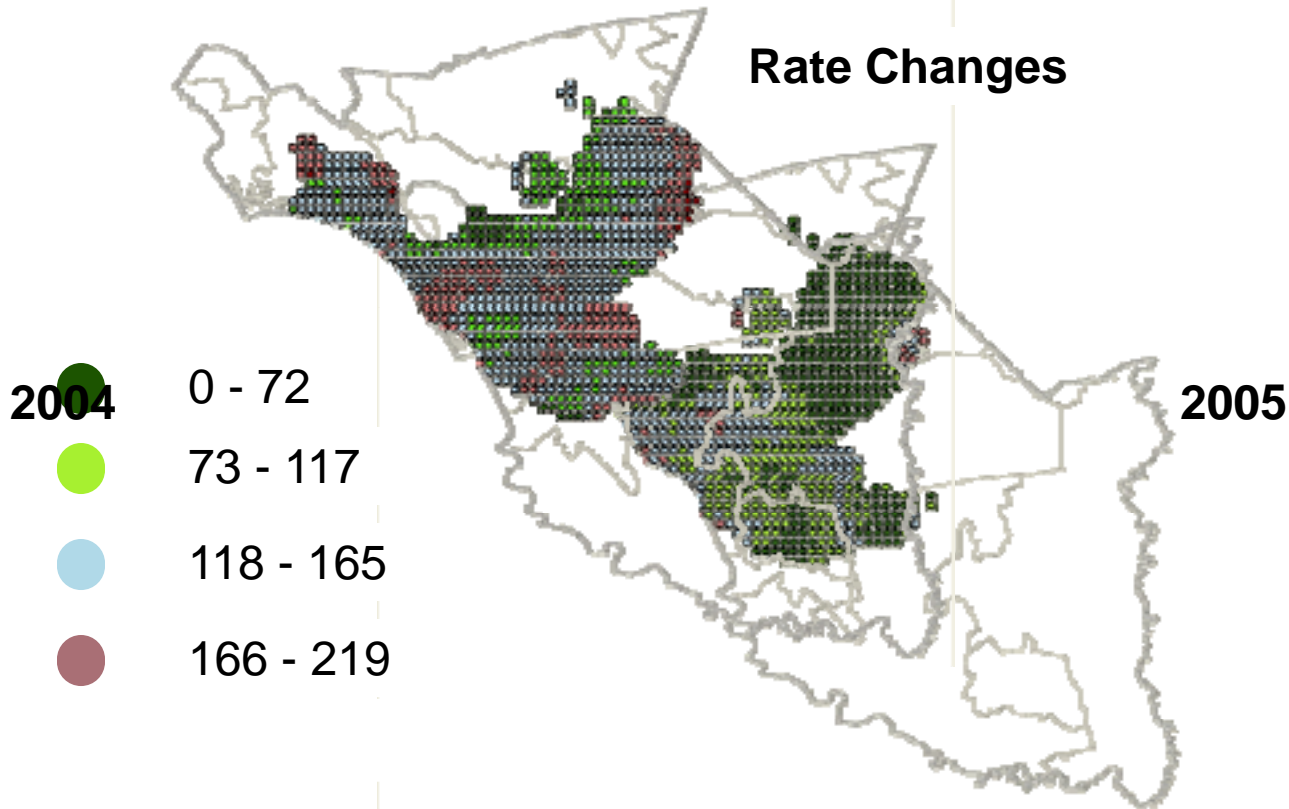
Rate Changes between 2005 and 2004 Richland County, SC

Rate Changes

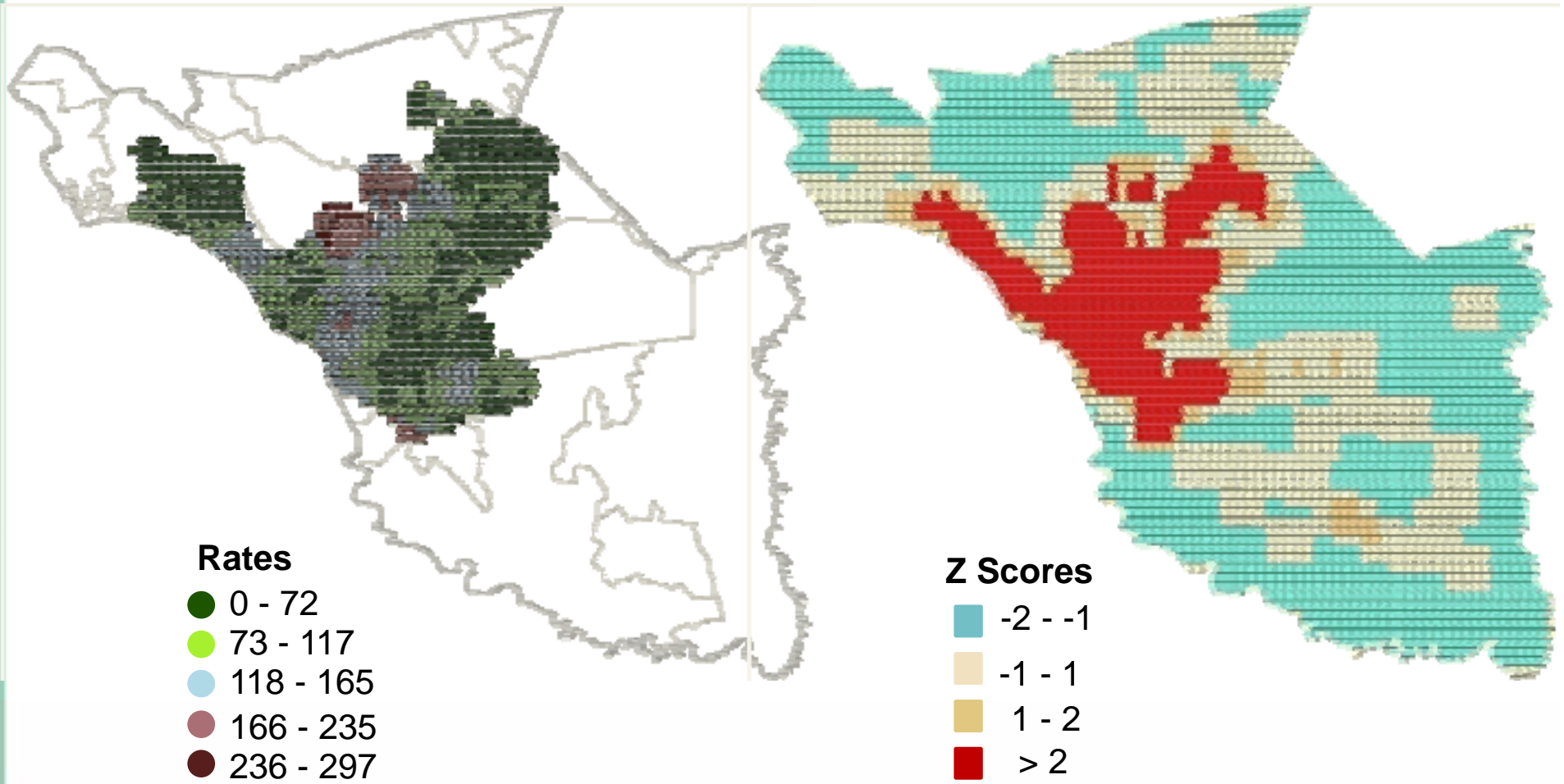


Rate changes are calculated by subtracting 2004 rates from 2005 rates

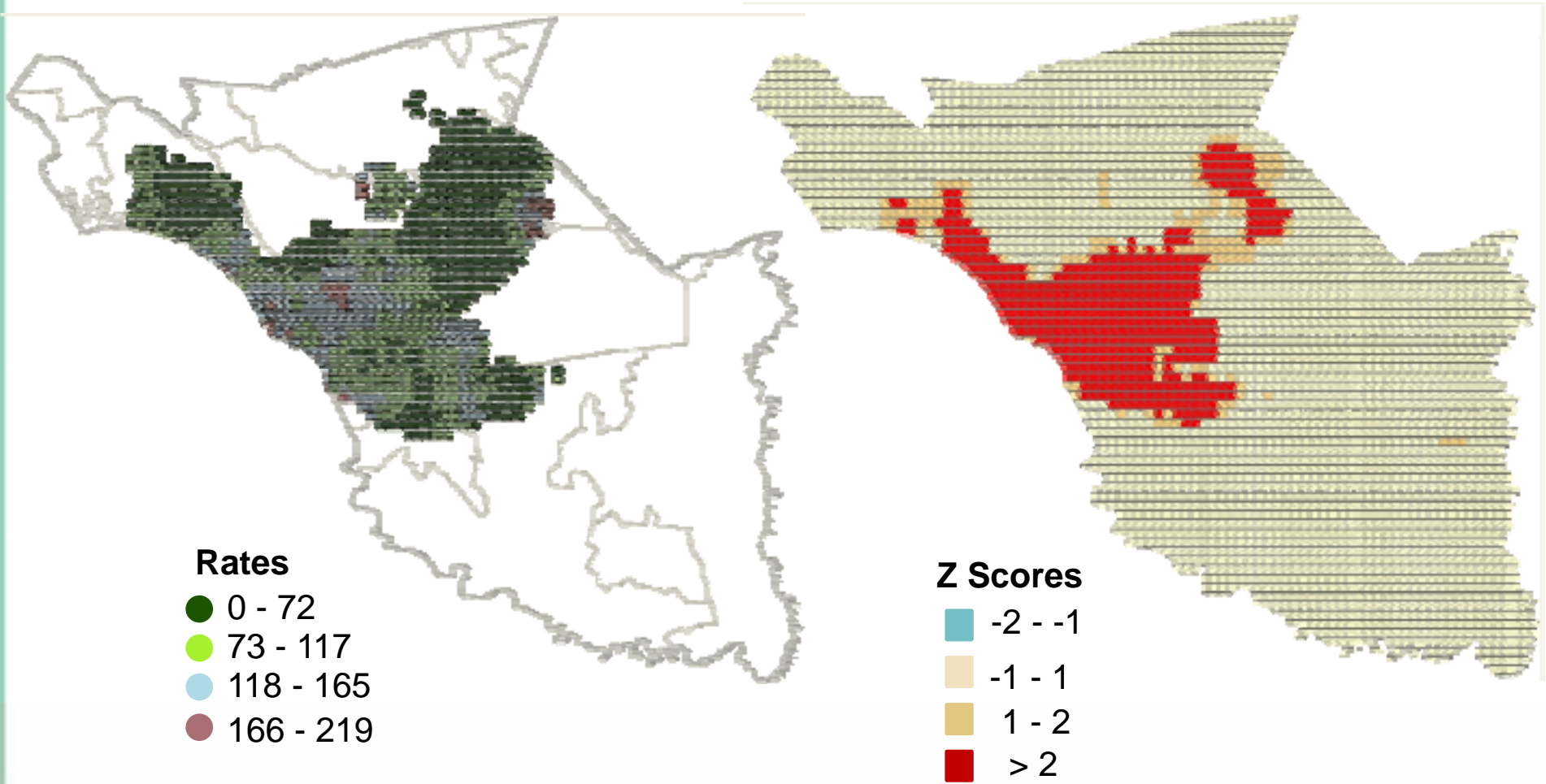
Rates of Live Births to Mothers who Reported Smoking Richland County, SC



2004 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Richland County, SC

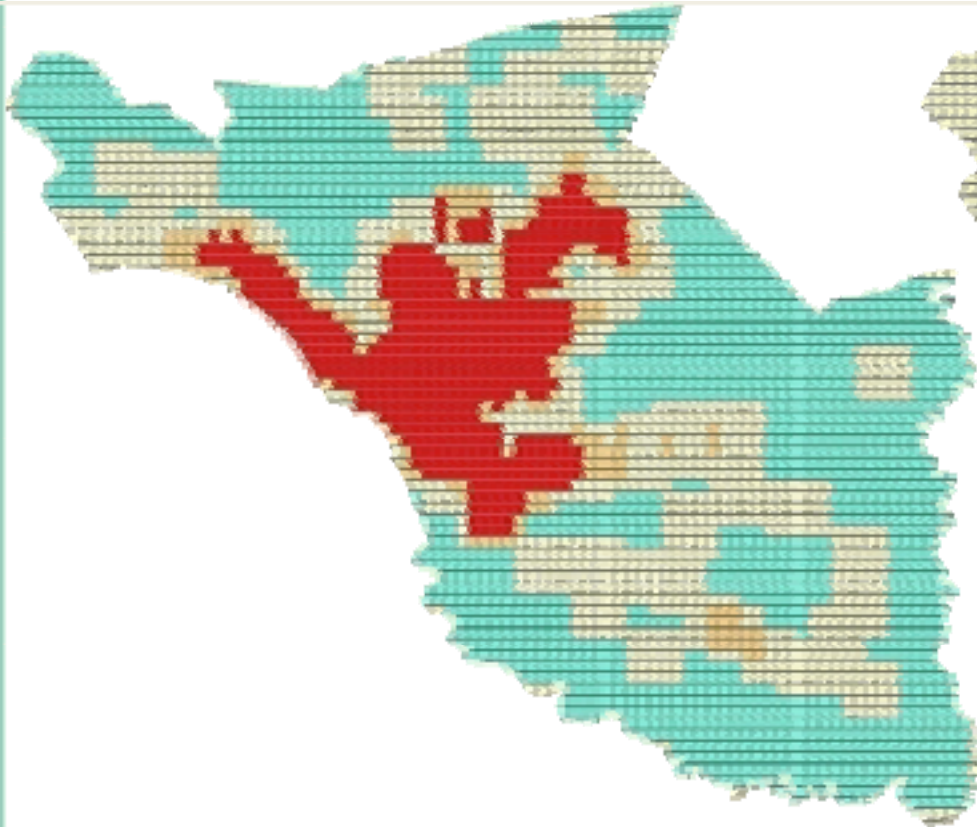


2005 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Richland County, SC

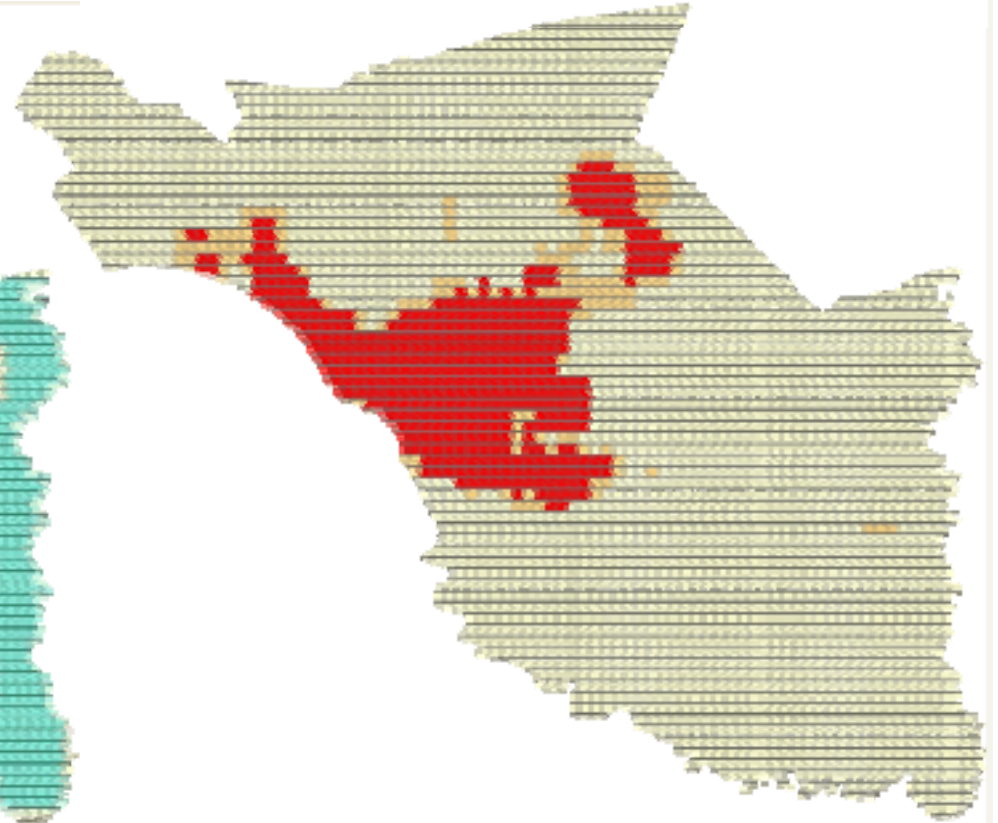


Hot Spot of Live Births to Mothers who Reported Smoking Richland County, SC

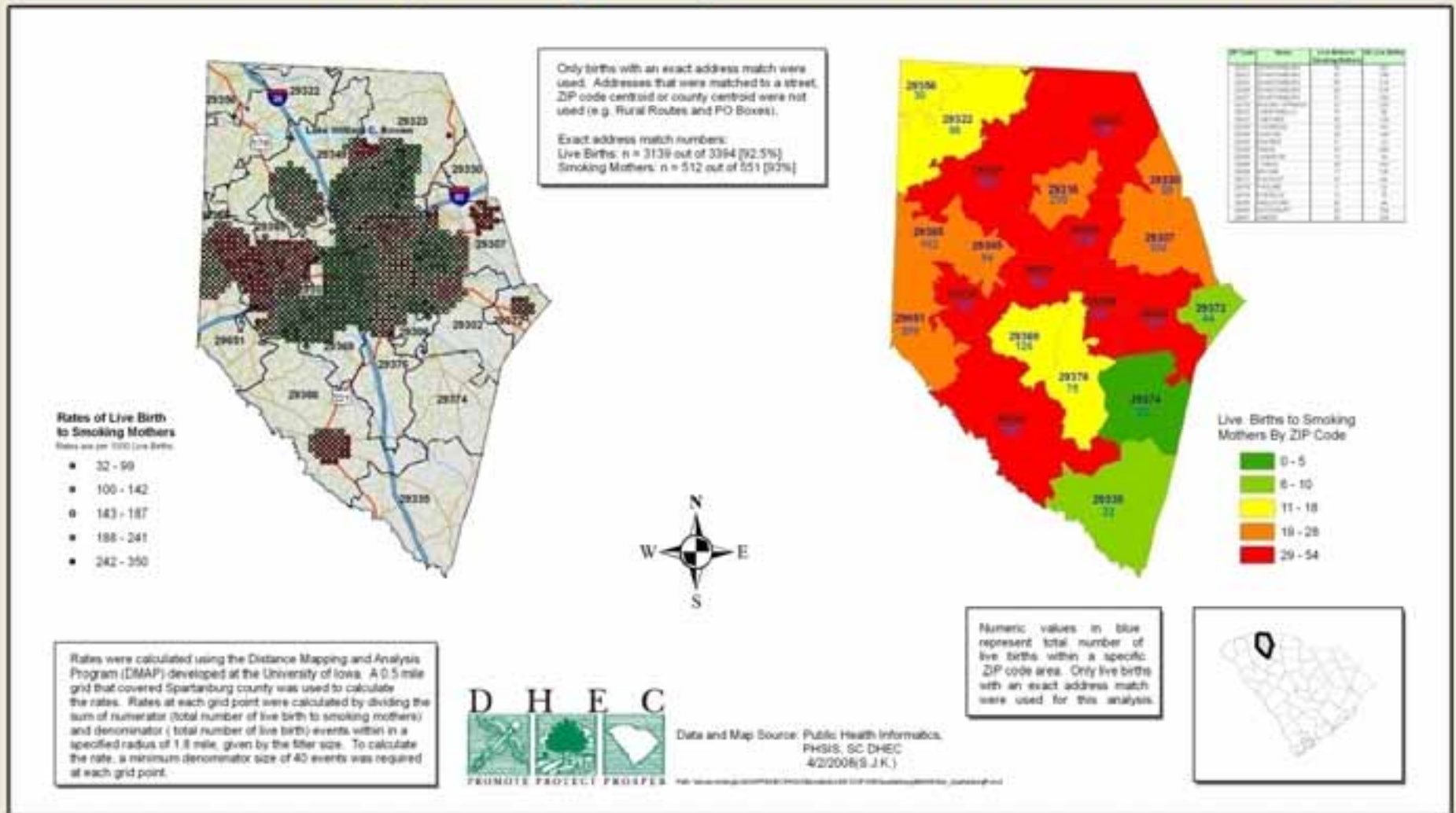
2004



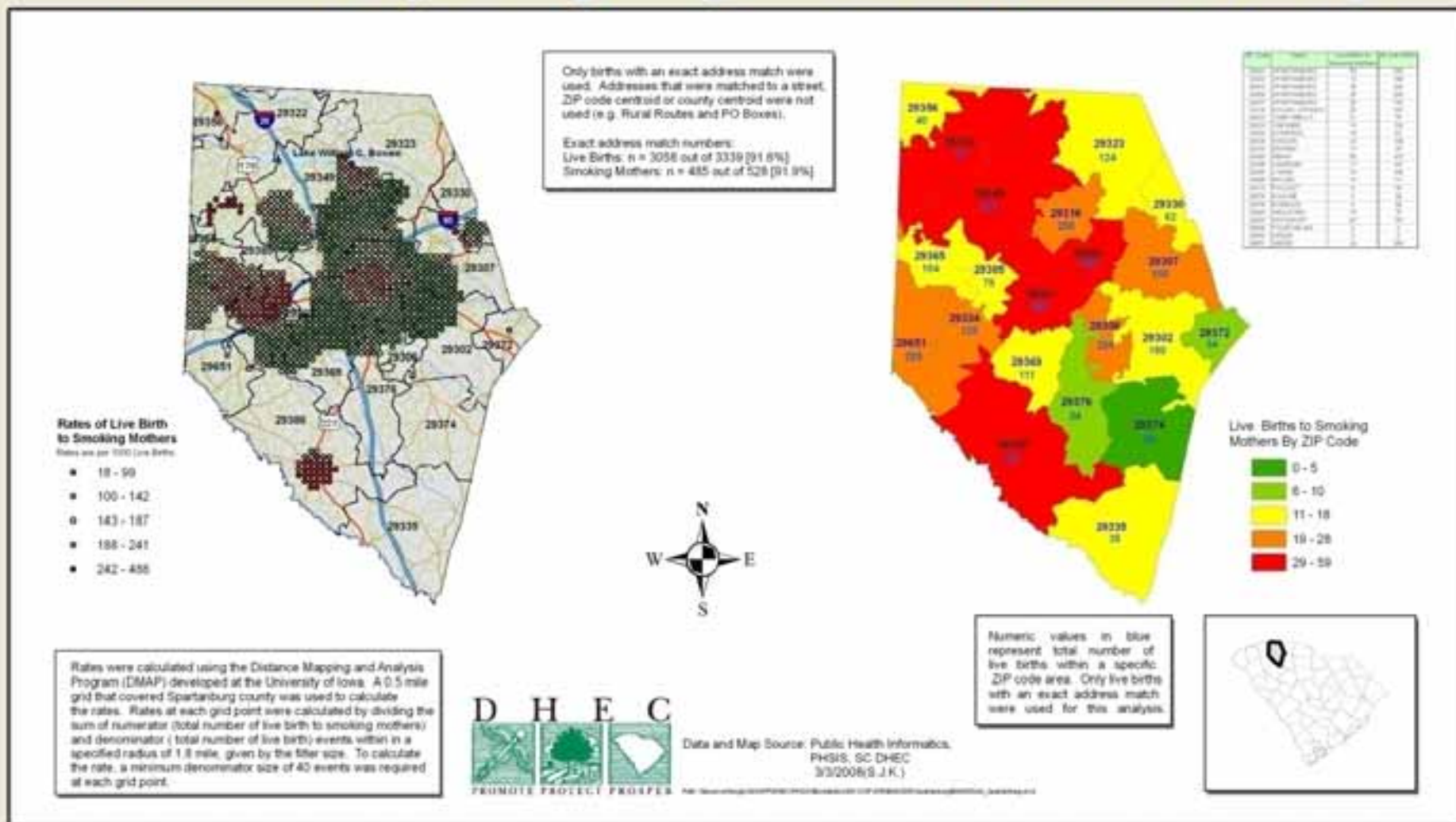
2005



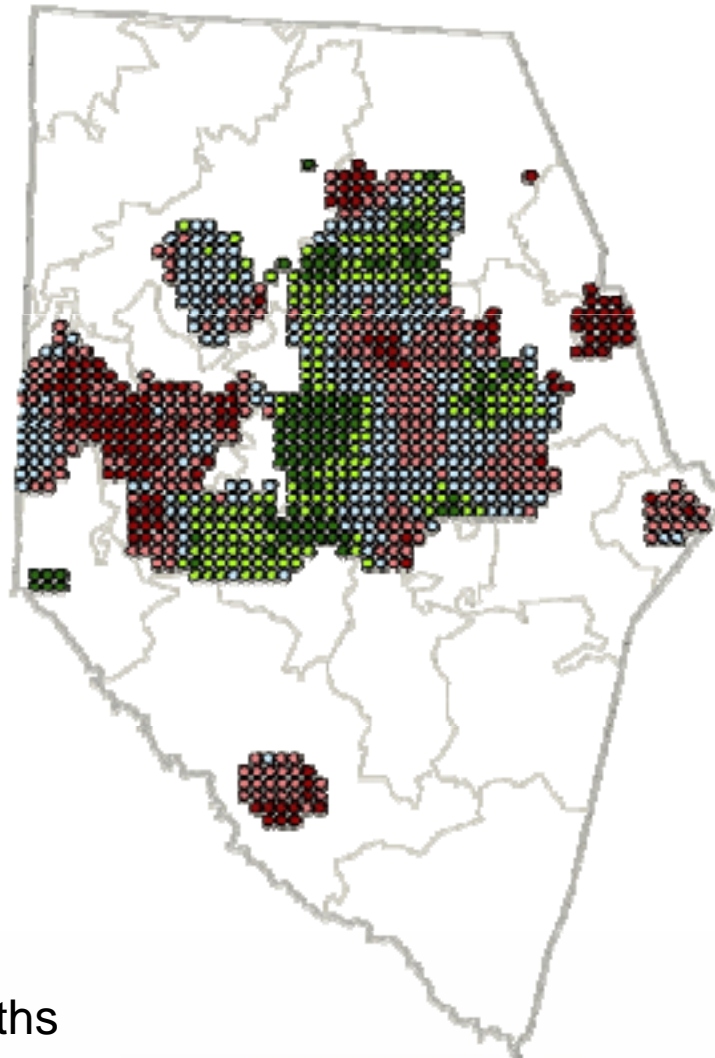
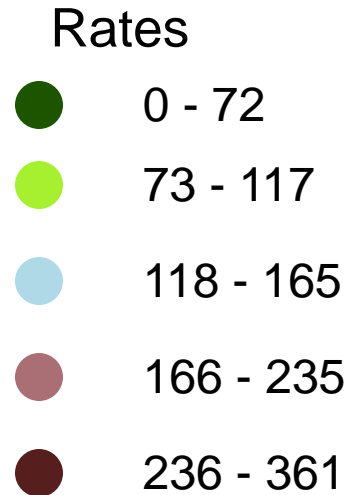
Live Births to Mothers Who Reported Smoking During Pregnancy for 2004 and Who Resided in Spartanburg County, South Carolina at the Time of Delivery



Live Births to Mothers Who Reported Smoking During Pregnancy for 2005 and Who Resided in Spartanburg County, South Carolina at the Time of Delivery

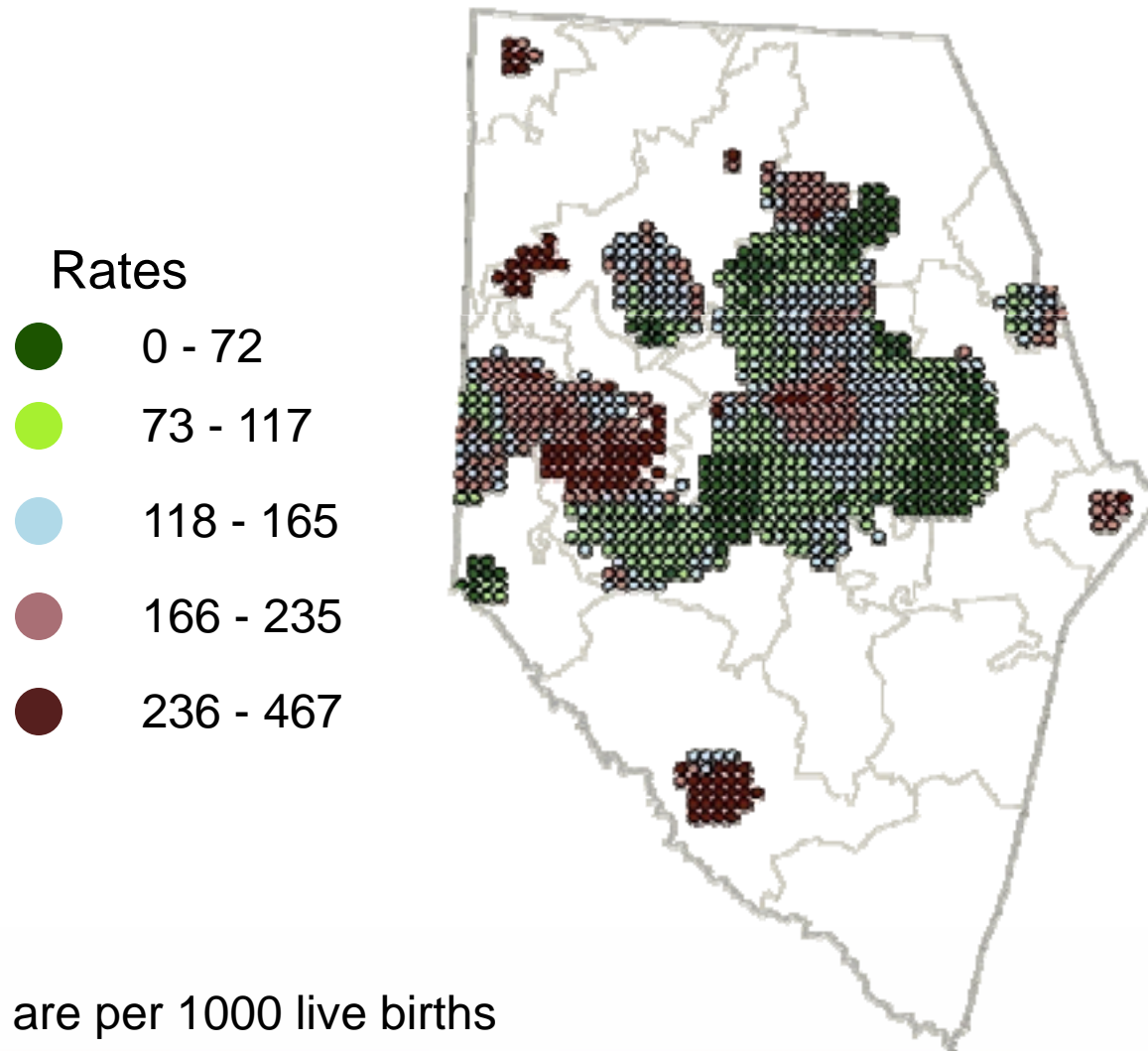


2004 Rates of Live Births Mothers who Reported Smoking Spartanburg County, SC



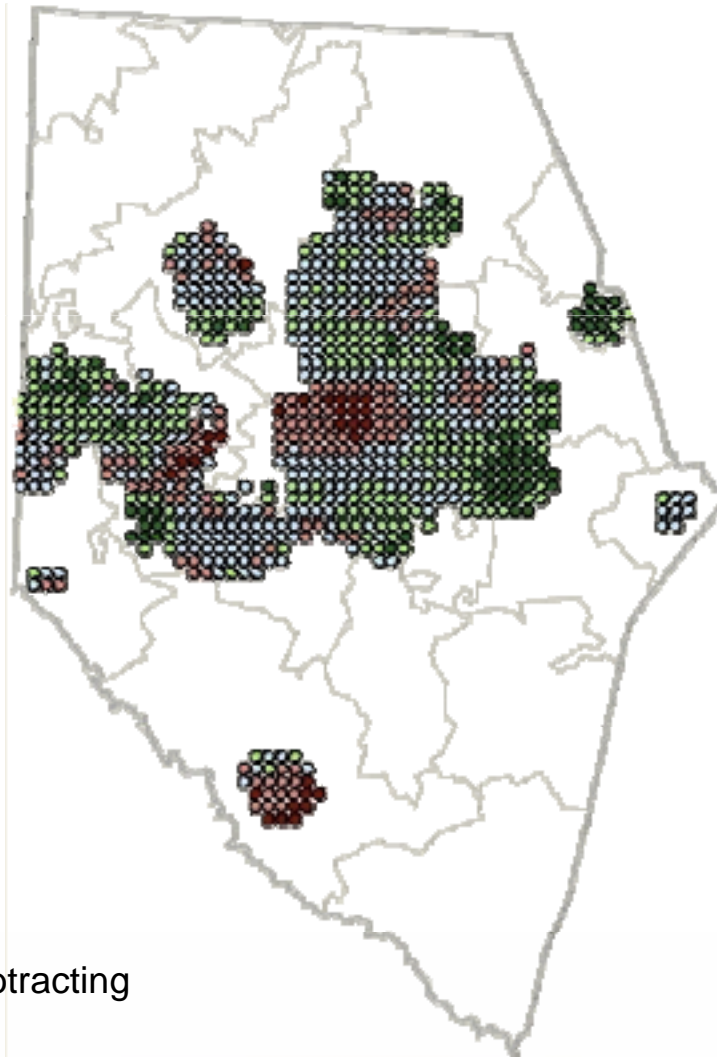
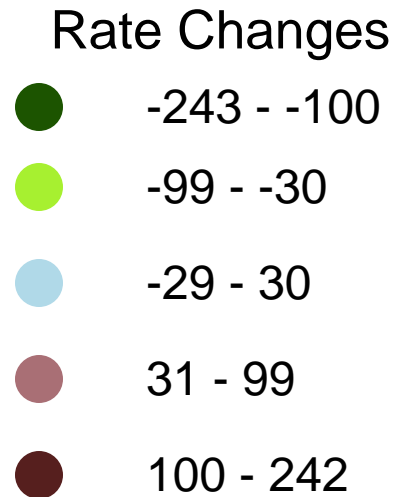
Rates are per 1000 live births

2005 Rates of Live Births Mothers who Reported Smoking Spartanburg County, SC



Rates are per 1000 live births

Rate Changes between 2005 and 2004 Spartanburg County, SC



Rate changes are calculated by subtracting 2004 rates from 2005 rates

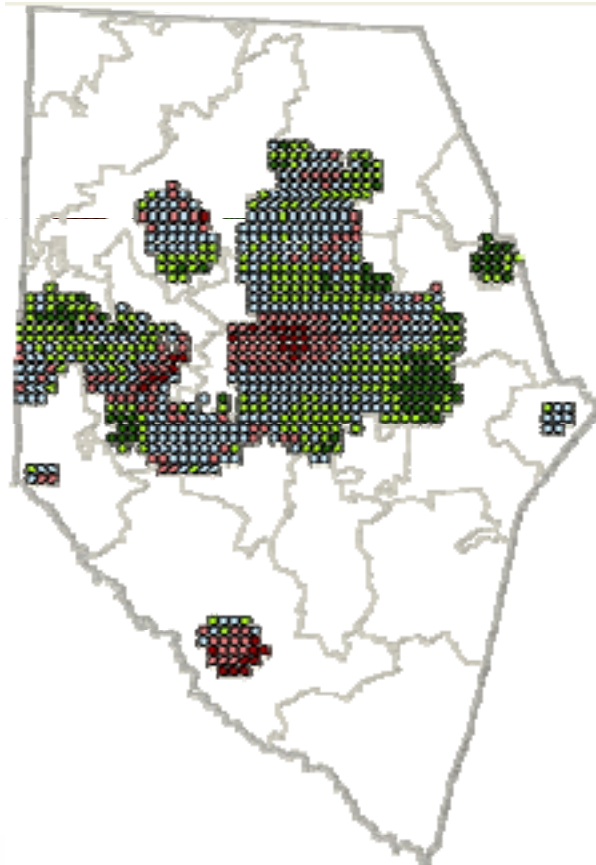
Rates of Live Births to Mothers who Reported Smoking Spartanburg County, SC

2004

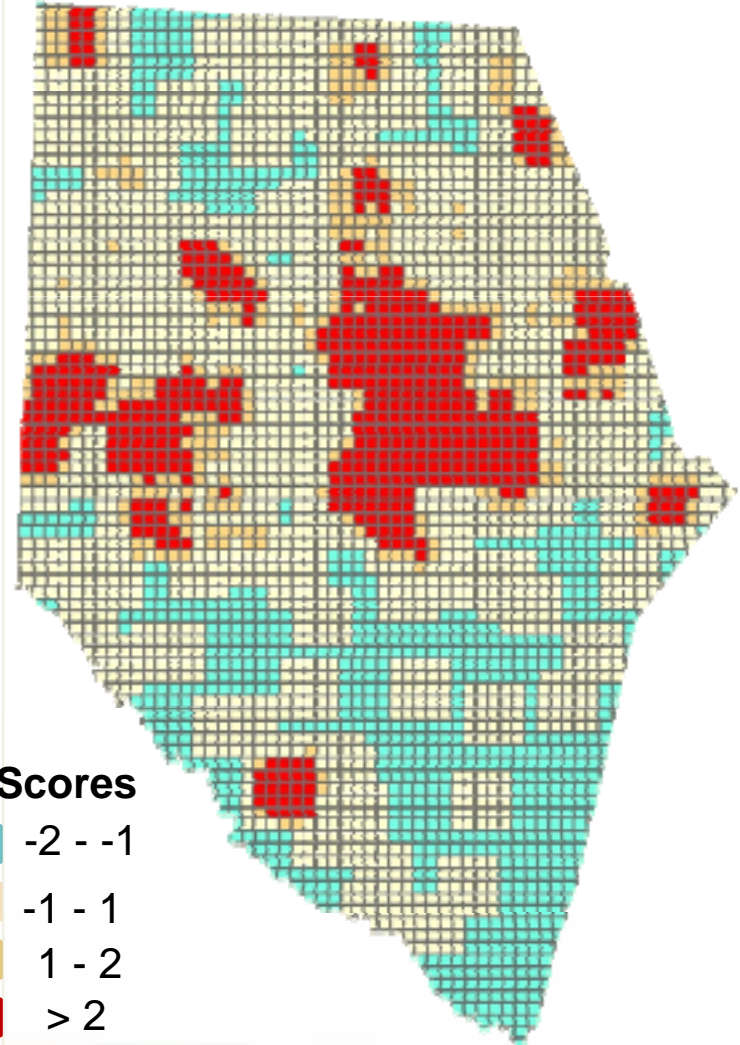
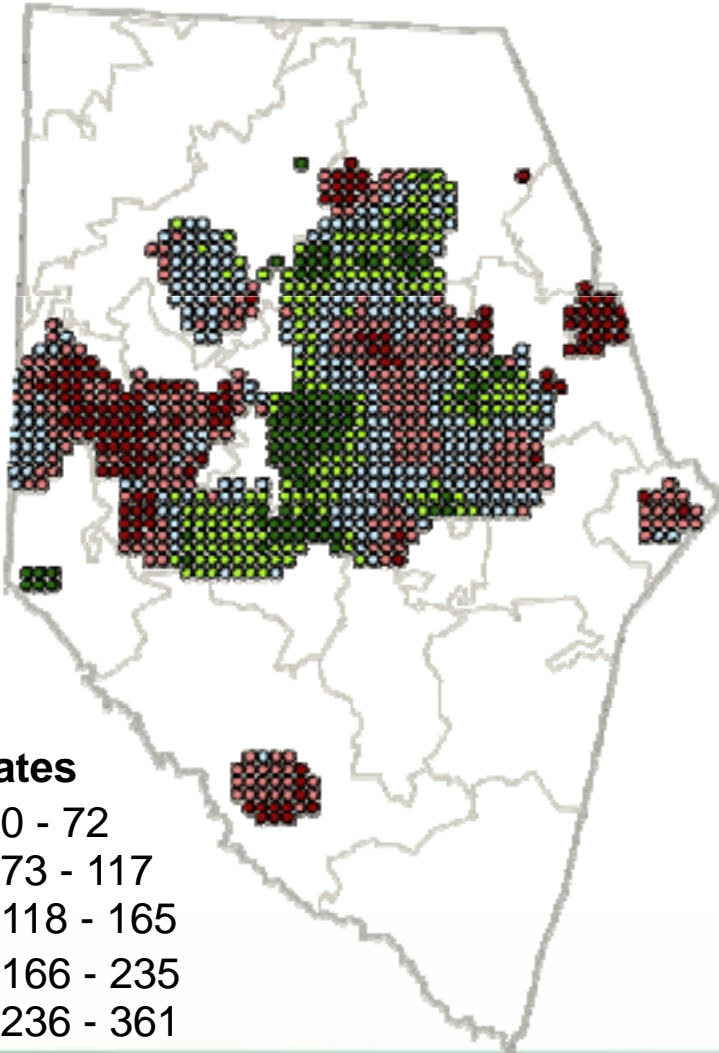
Rate Changes

2005

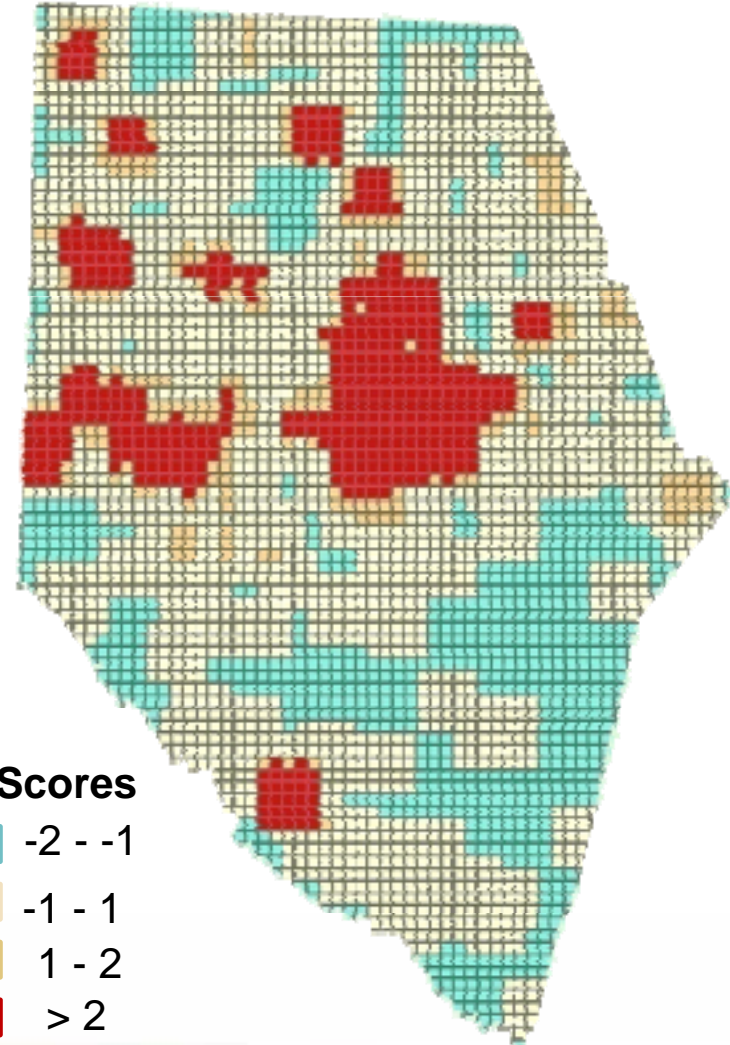
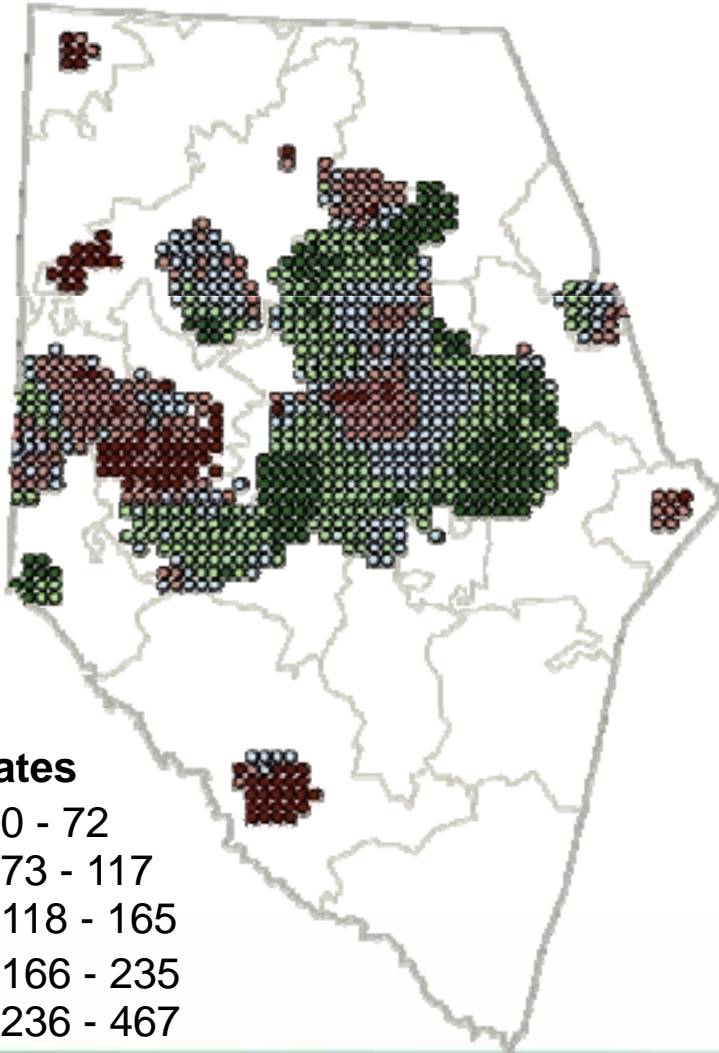
- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 235
- 236 - 467



2004 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Spartanburg County, SC

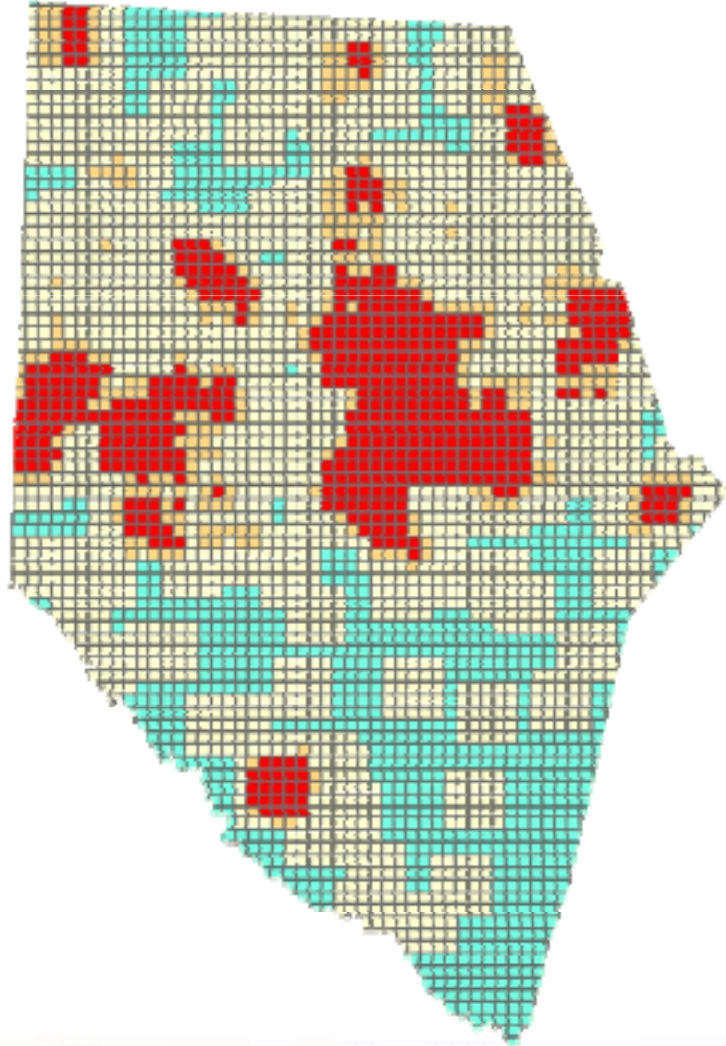


2005 Rates and Hot Spot of Live Births to Mothers who Reported Smoking Spartanburg County, SC

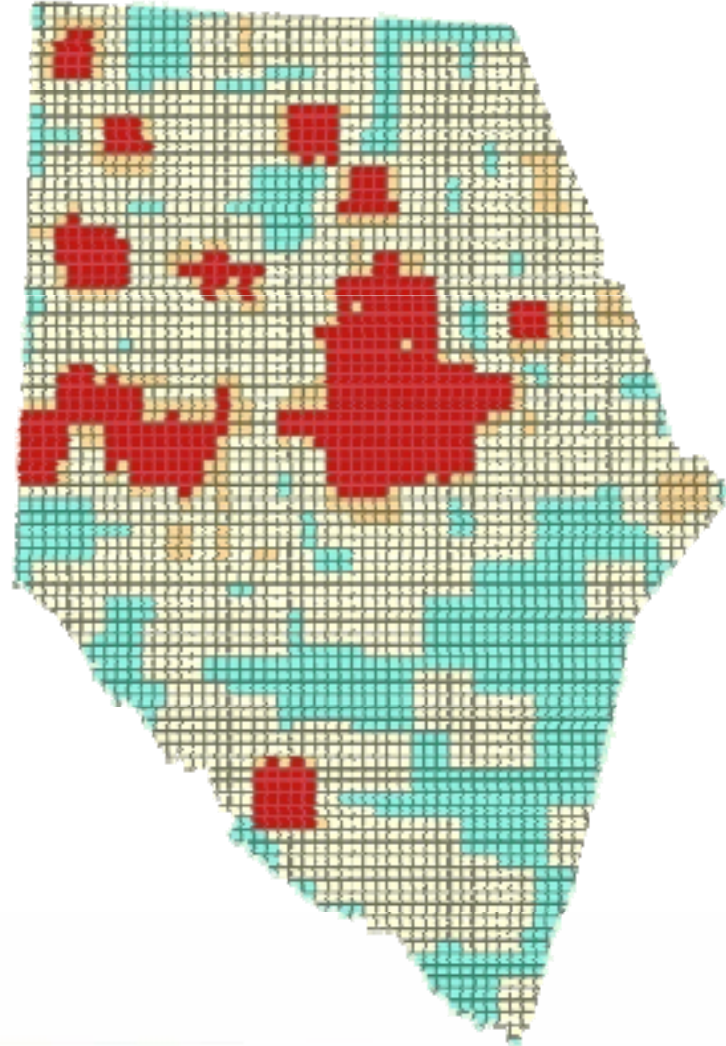


Hot Spot of Live Births to Mothers who Reported Smoking Spartanburg County, SC

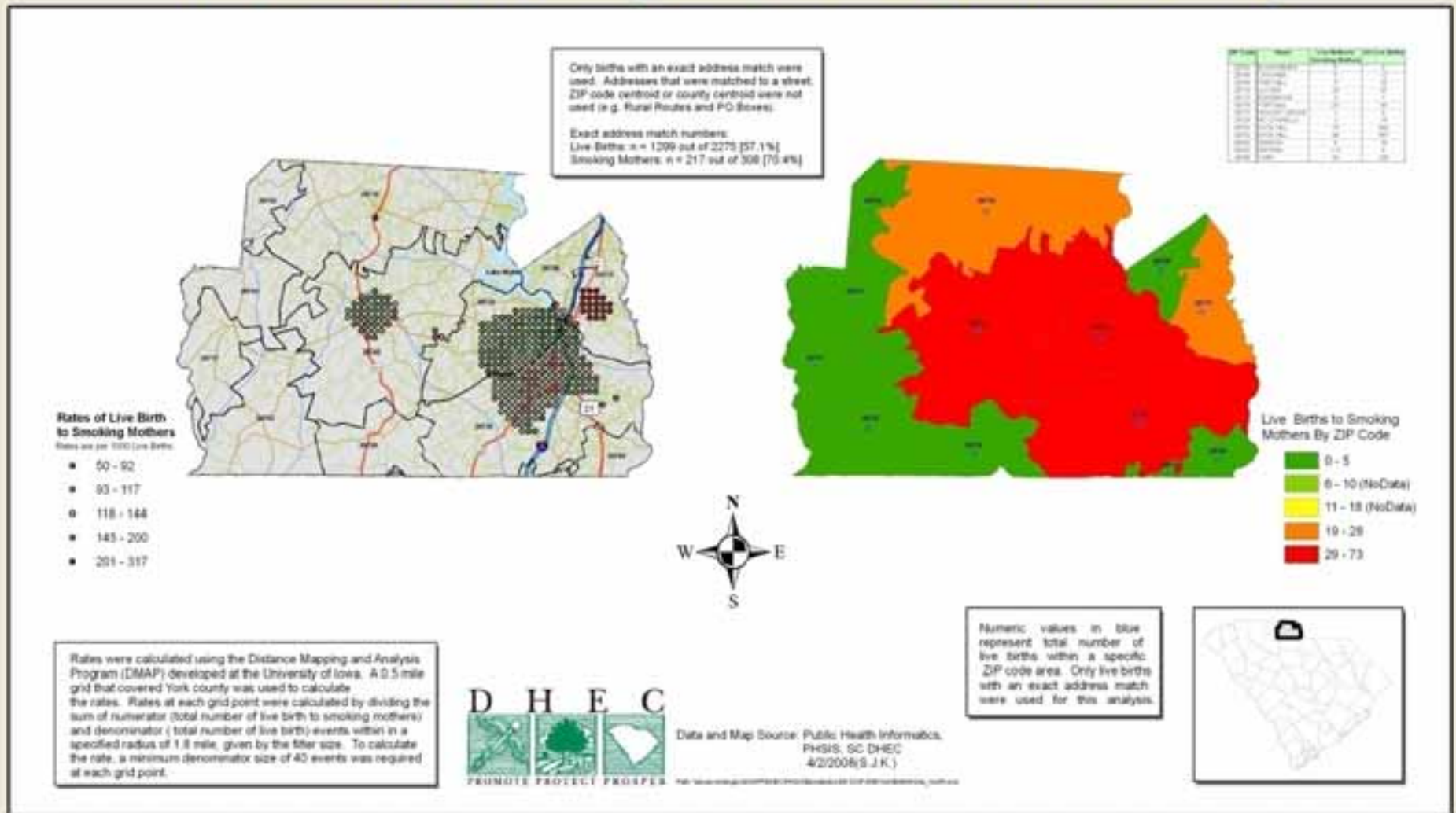
2004



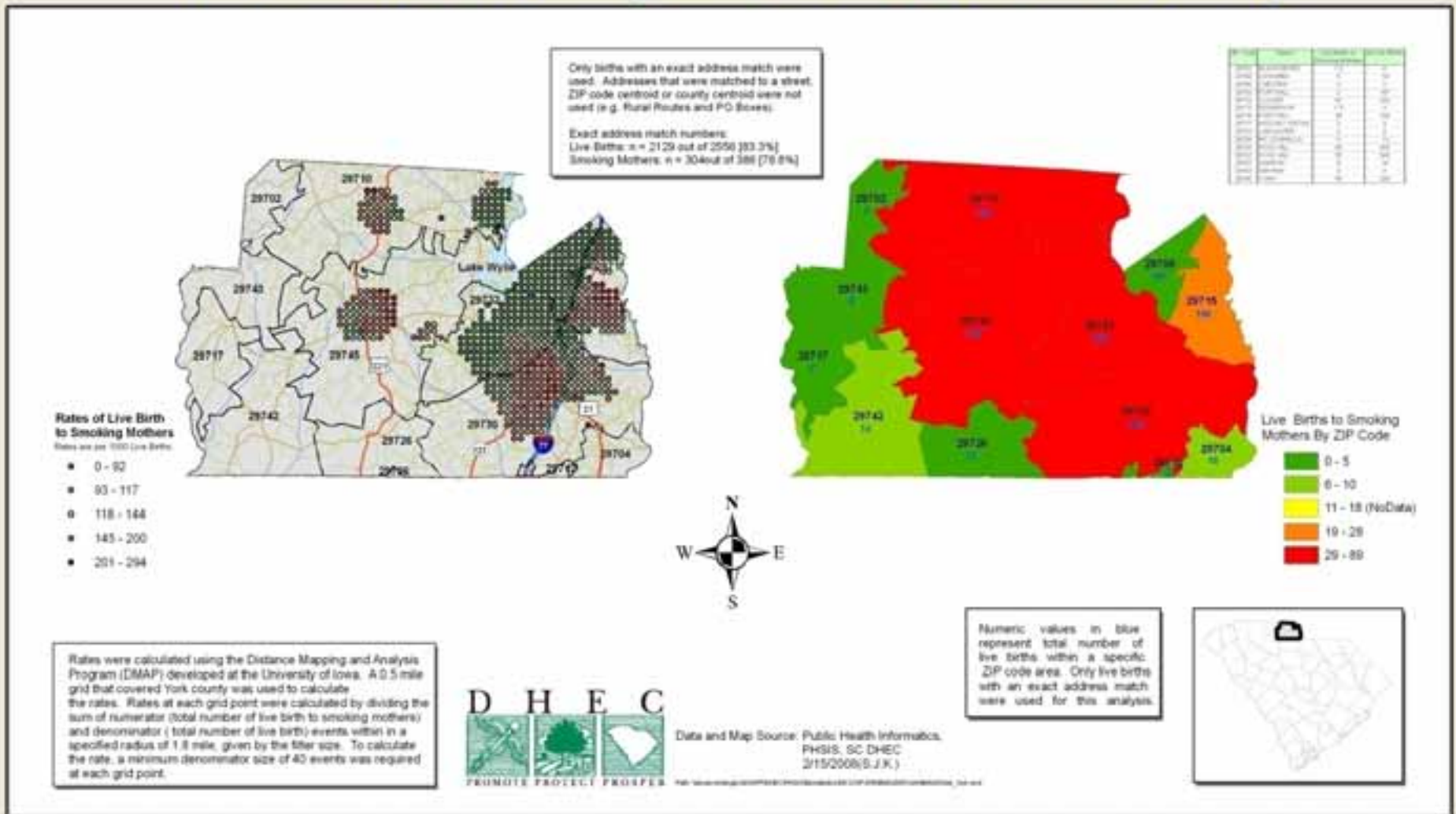
2005



Live Births to Mothers Who Reported Smoking During Pregnancy for 2004 and Who Resided in York County, South Carolina at the Time of Delivery



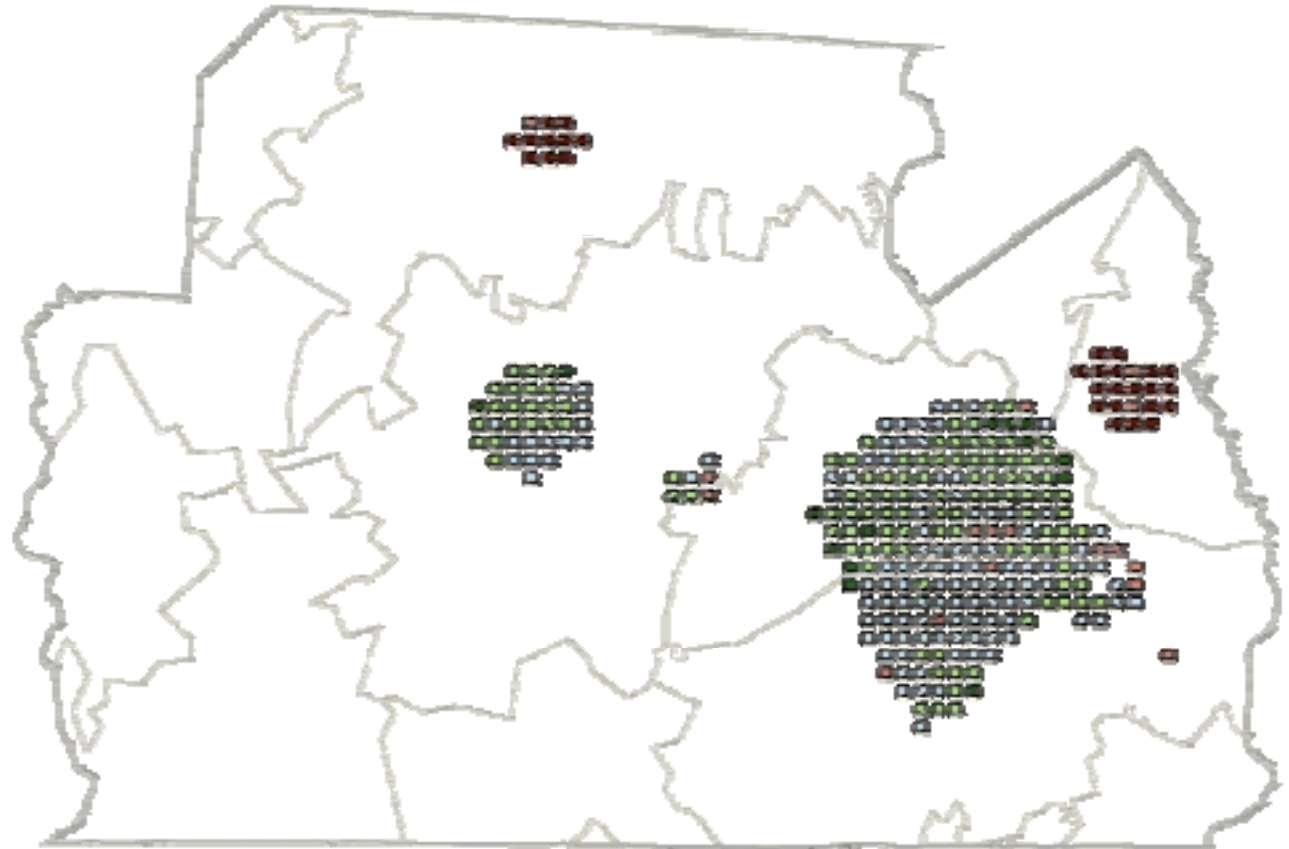
Live Births to Mothers Who Reported Smoking During Pregnancy for 2005 and Who Resided in York County, South Carolina at the Time of Delivery



2004 Rates of Live Births to Mothers who Reported Smoking York County, SC

Rates

- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 235
- 236 - 364

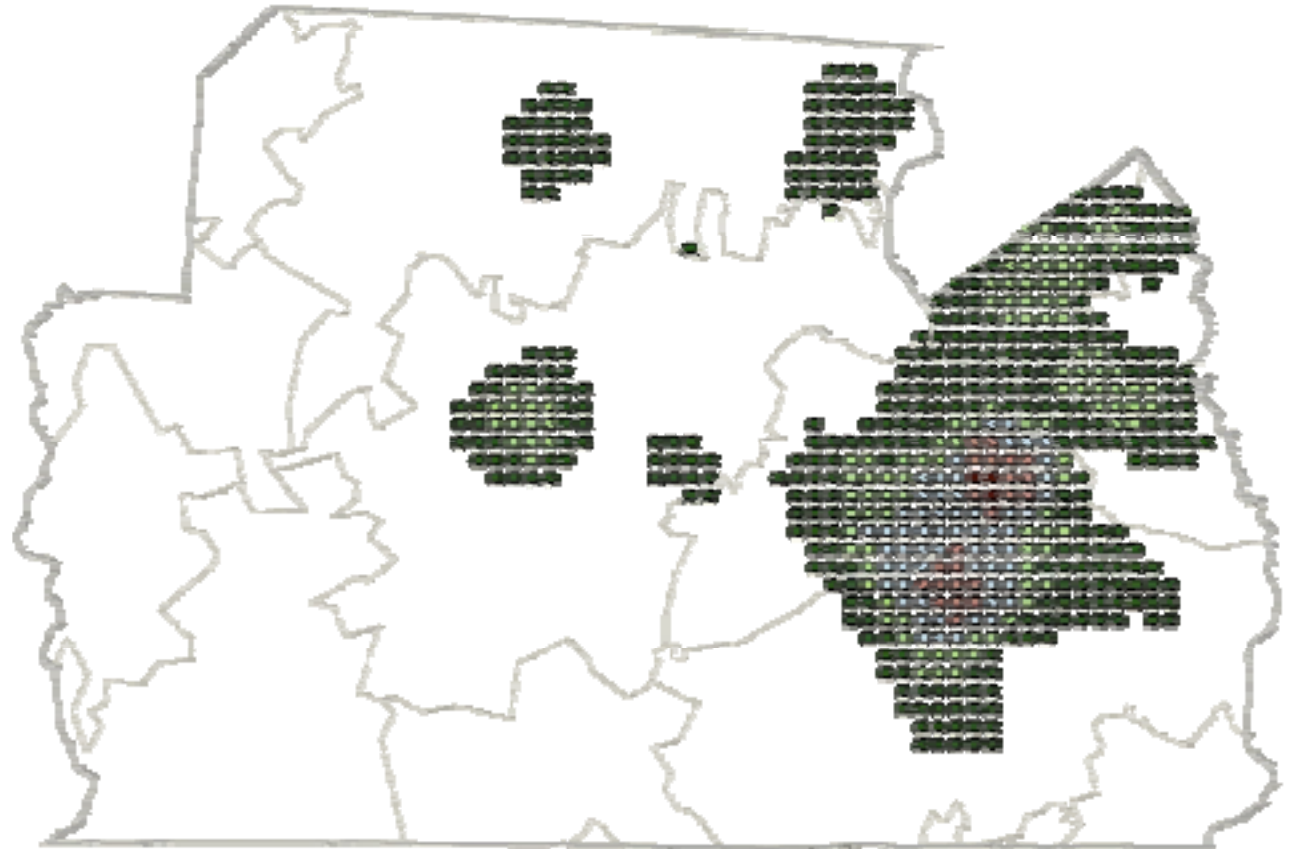


Rates are per 1000 live births

2005 Rates of Live Births to Mothers who Reported Smoking York County, SC

Rates

- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 235
- 236 - 261

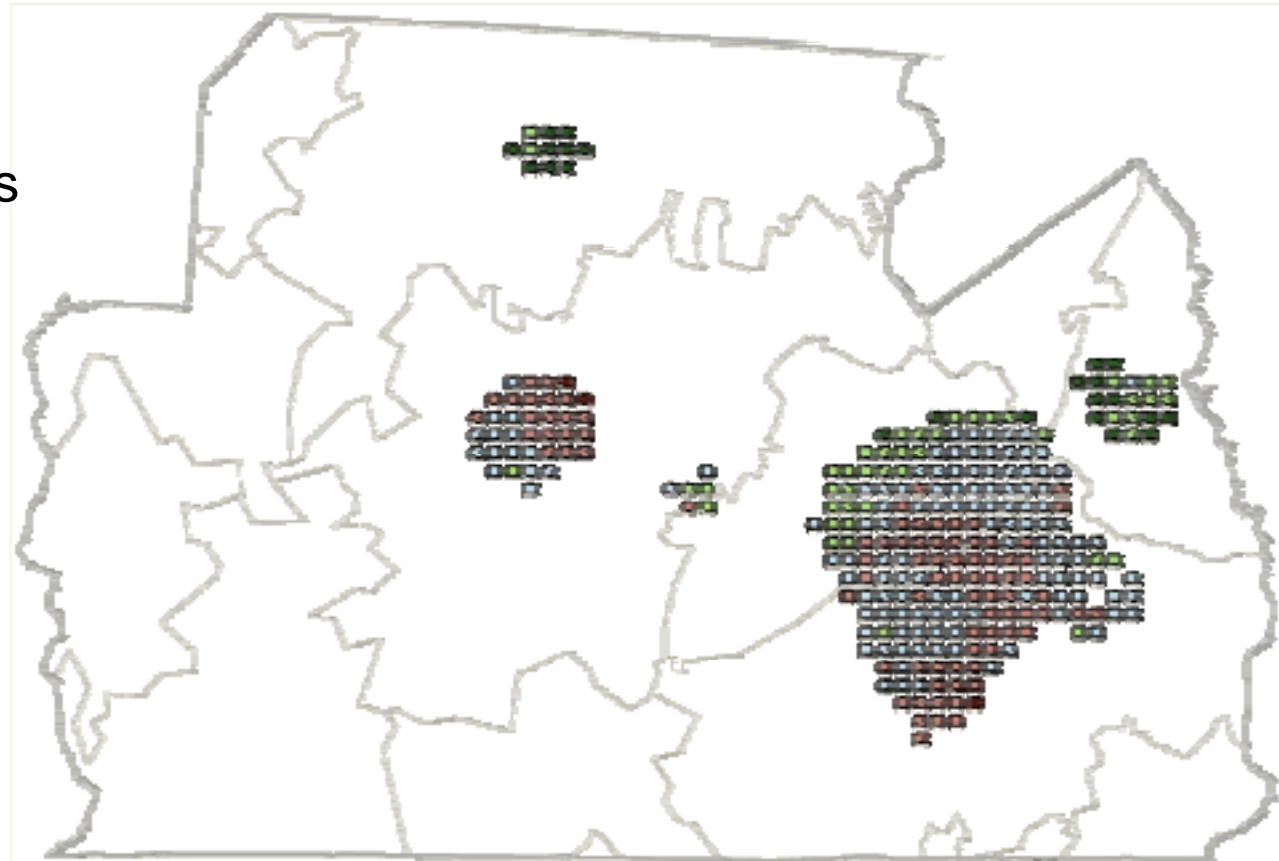


Rates are per 1000 live births

Rate Changes between 2005 and 2004 York County, SC

Rate Changes

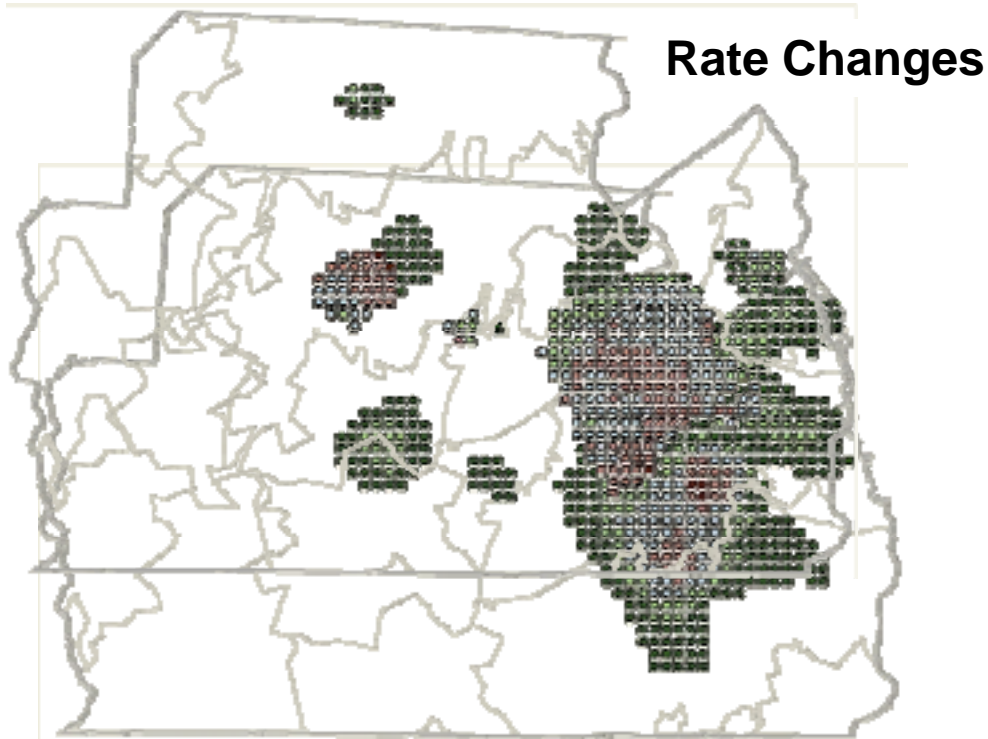
- -184 - -100
- -99 - -30
- -29 - 30
- 31 - 99
- 100 - 141



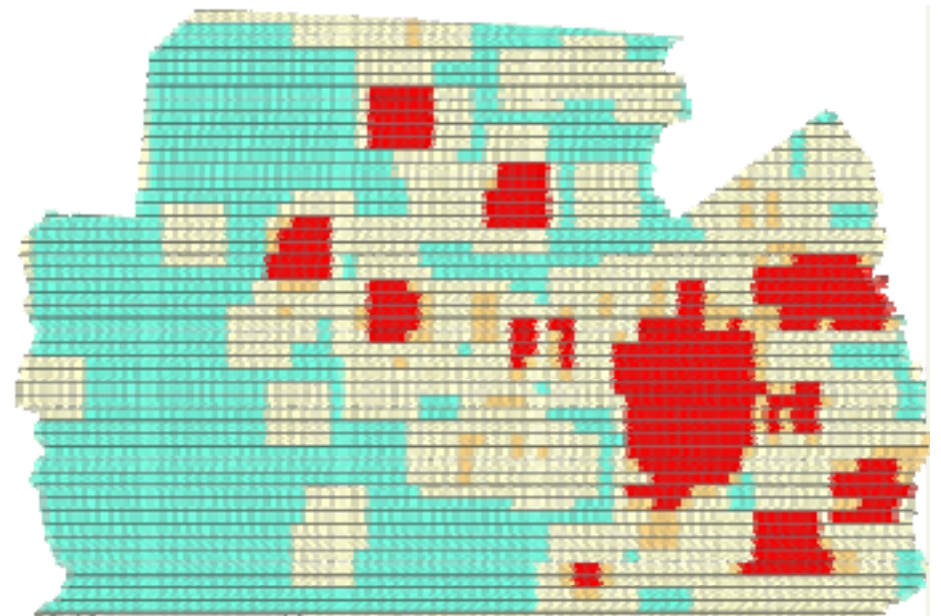
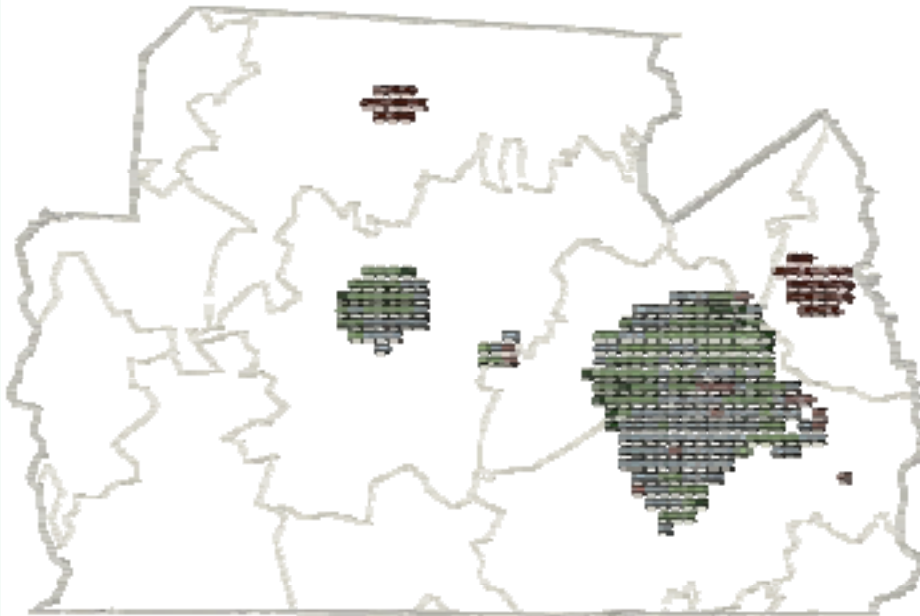
Rate changes are calculated by subtracting 2004 rates from 2005 rates

2005 Rates of Live Births to Mothers who Reported Smoking York County, SC

- 0 - 72
- 73 - 117
- 2004**
- 118 - 165
- 166 - 235
- 236 - 261



2004 Rates and Hot Spot of Live Births to Mothers who Reported Smoking York County, SC



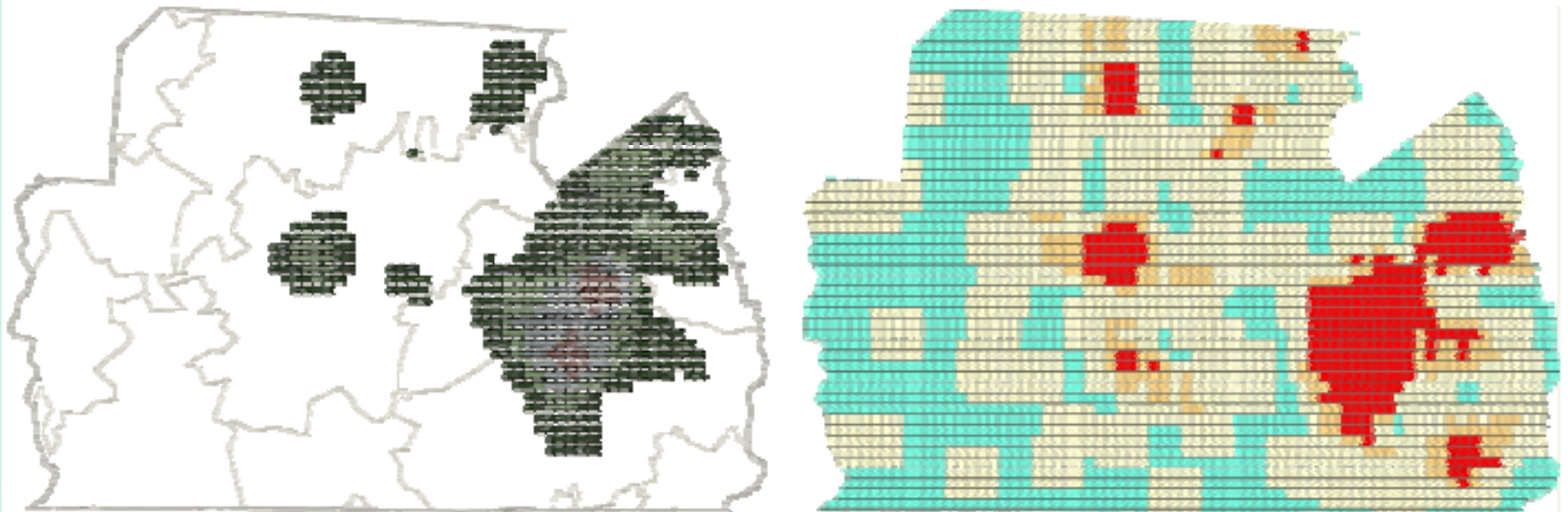
Rates

- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 235
- 236 - 364

Z Scores

- -2 - -1
- -1 - 1
- 1 - 2
- > 2

2005 Rates and Hot Spot of Live Births to Mothers who Reported Smoking York County, SC



Rates

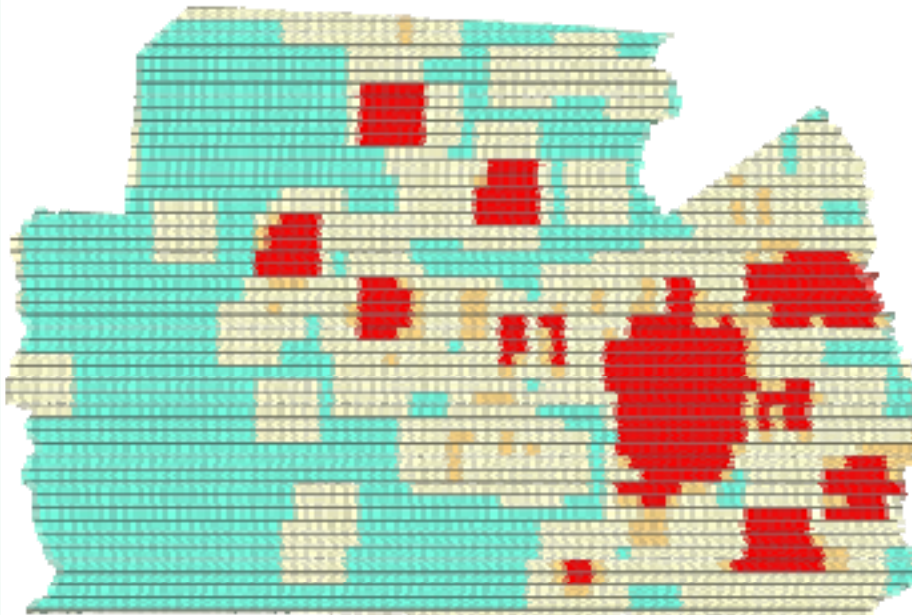
- 0 - 72
- 73 - 117
- 118 - 165
- 166 - 235
- 236 - 261

Z Scores

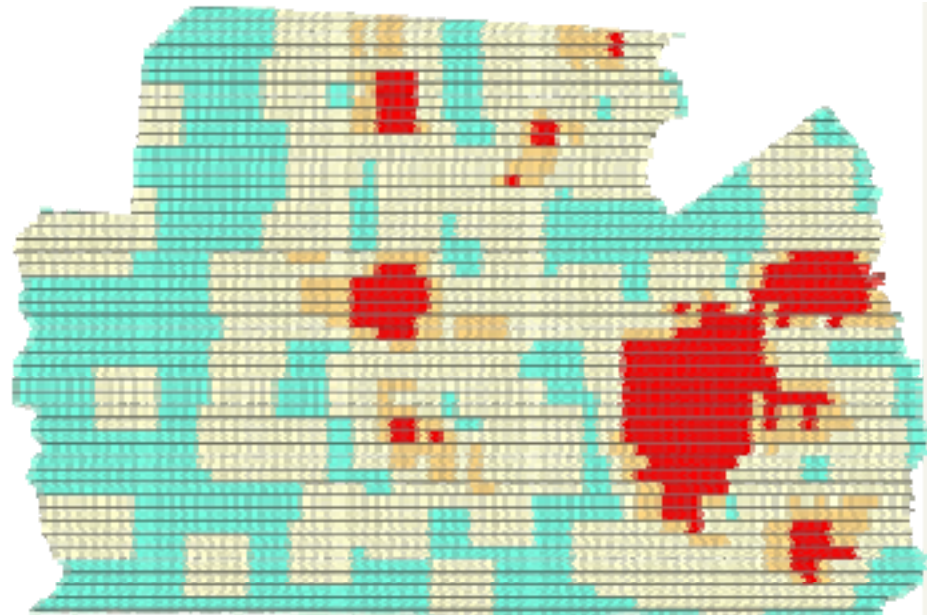
- -2 - -1
- -1 - 1
- 1 - 2
- > 2

Hot Spot of Live Births to Mothers who Reported Smoking York County, SC

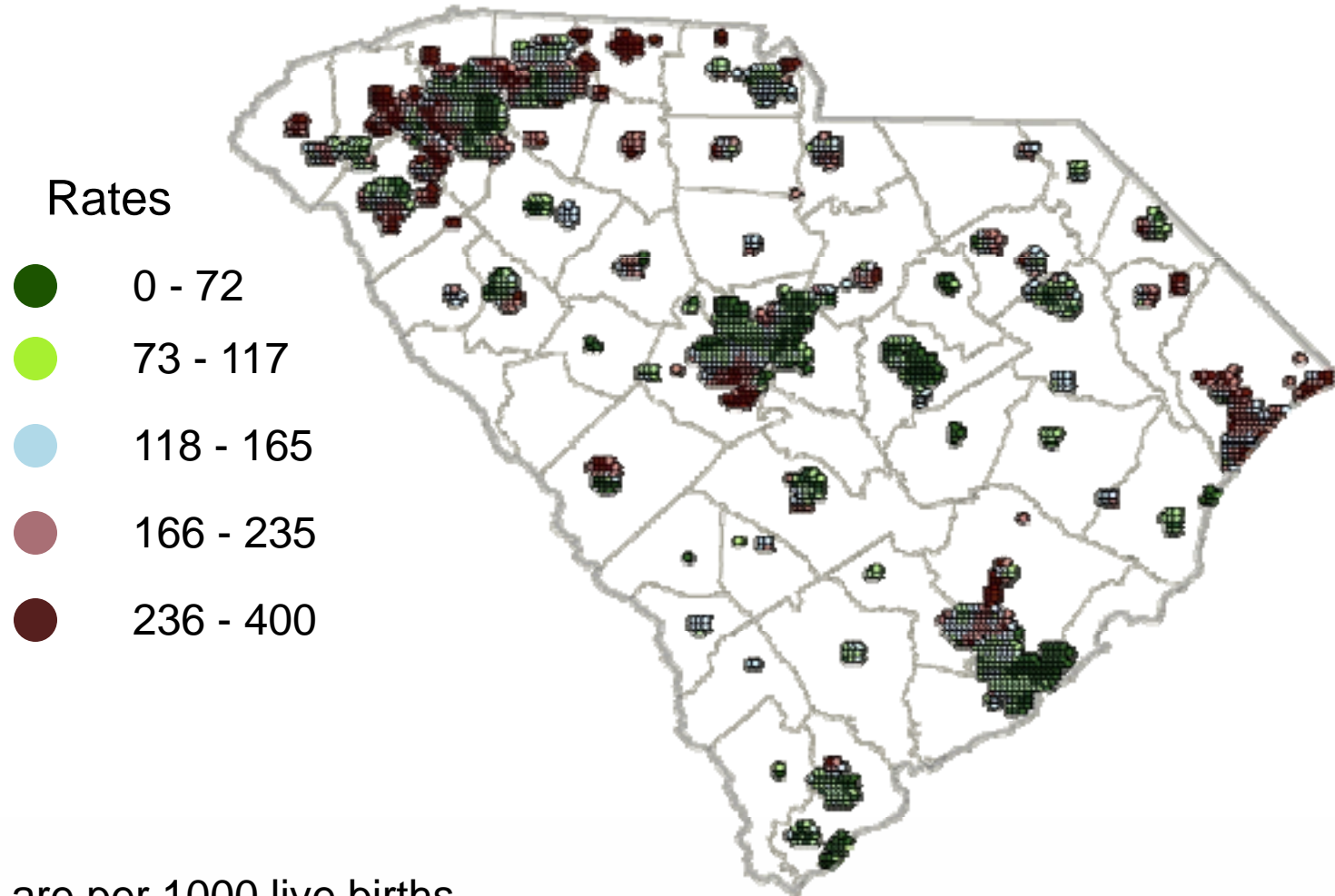
2004



2005

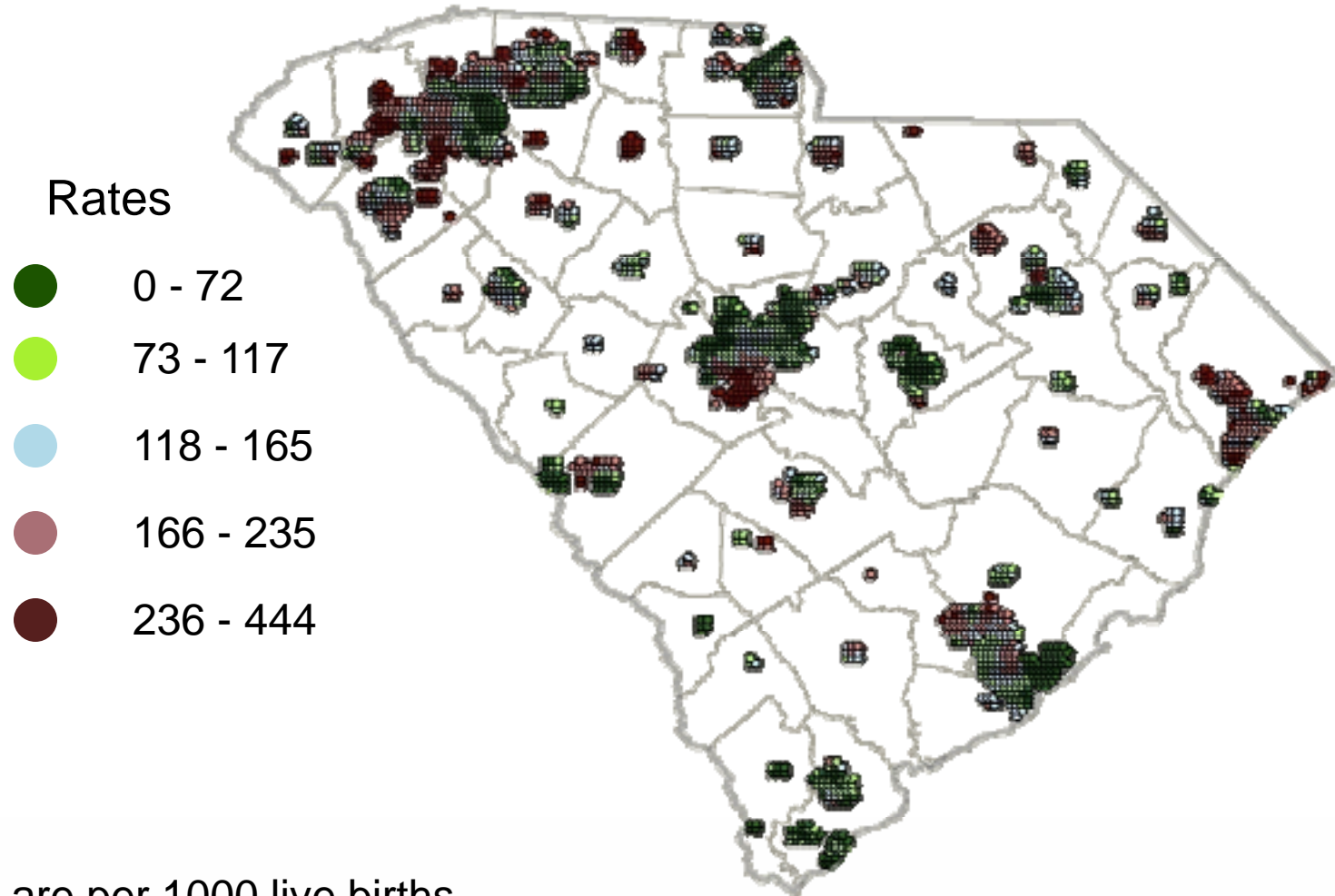


2004 Rates of Live Births to Mothers who Reported Smoking South Carolina



Rates are per 1000 live births

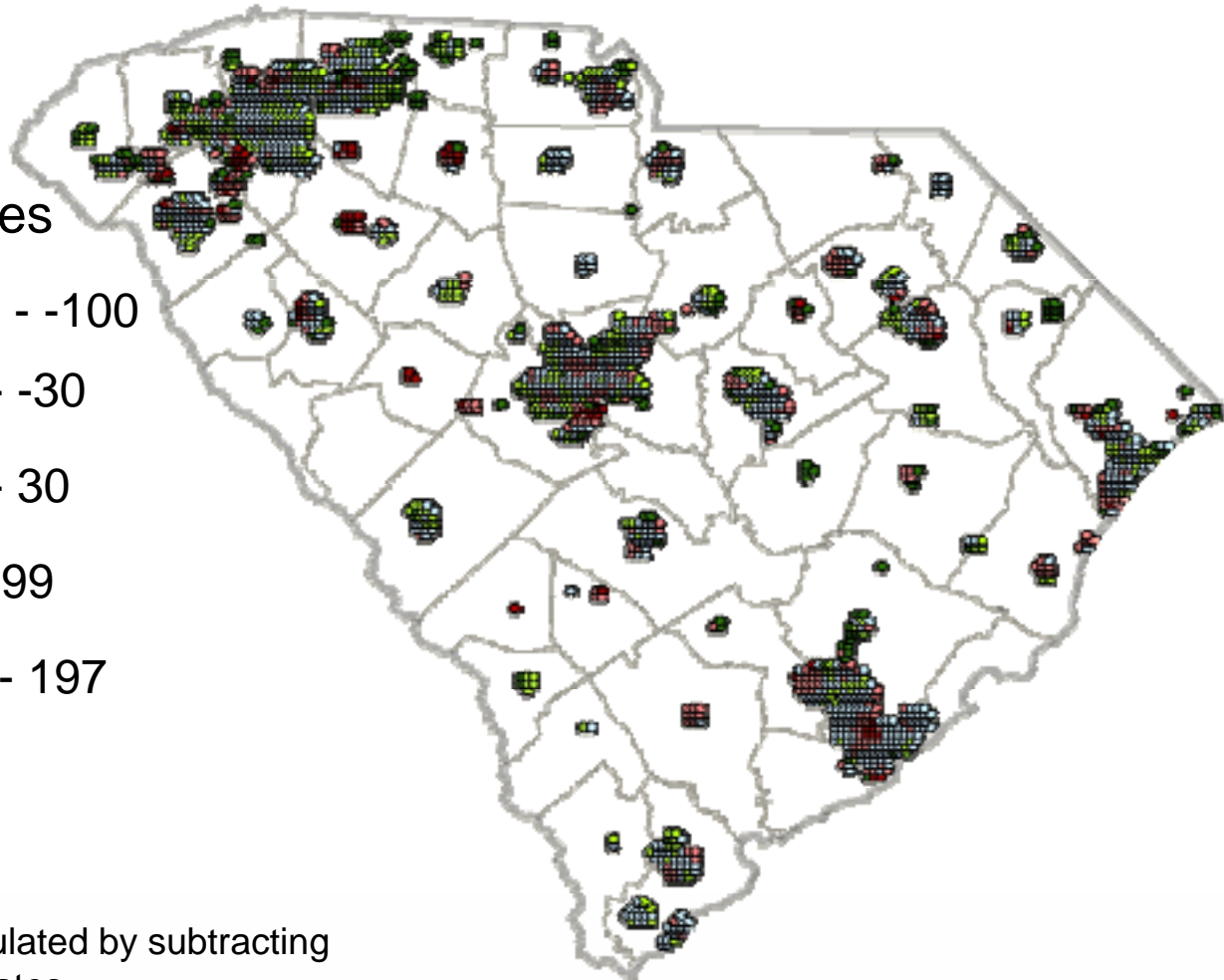
2005 Rates of Live Births to Mothers who Reported Smoking South Carolina



Rates are per 1000 live births

Rate Changes between 2005 and 2004 South Carolina

Rate Changes

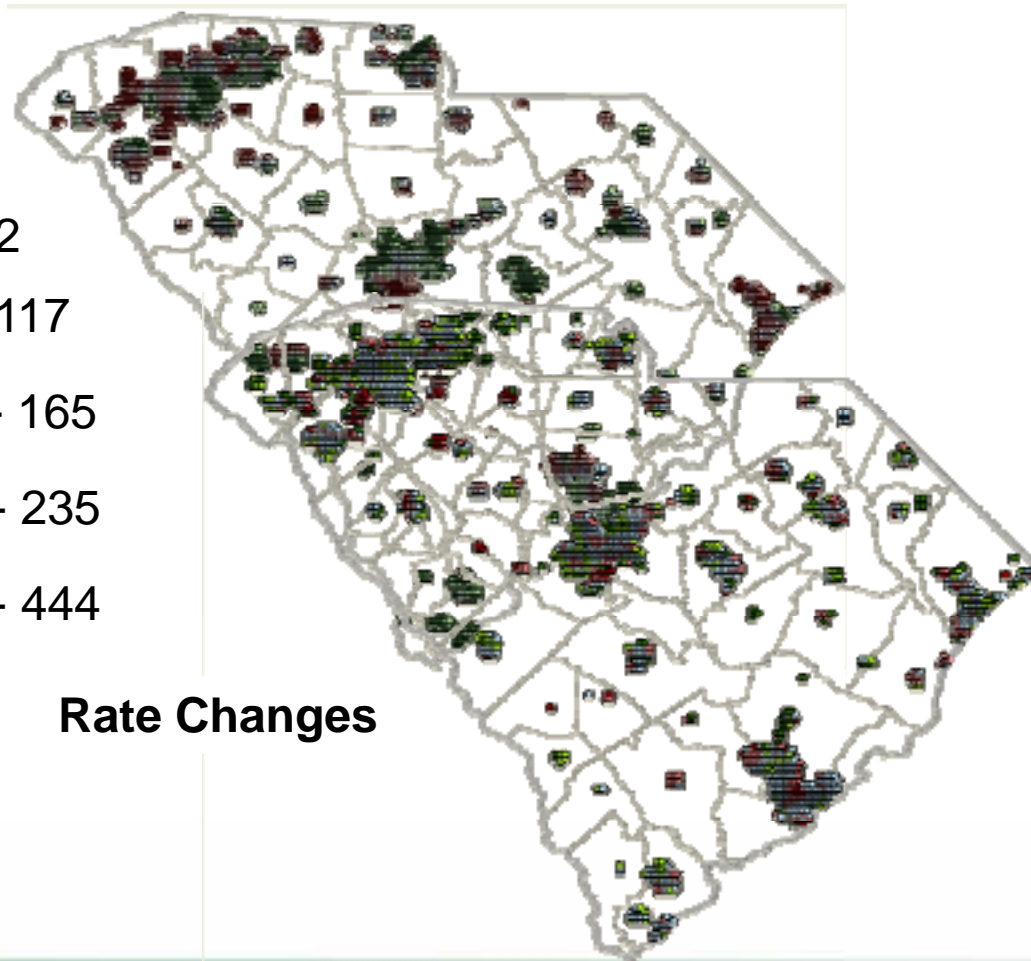


Rate changes are calculated by subtracting 2004 rates from 2005 rates

Rates of Live Births to Mothers who Reported Smoking South Carolina

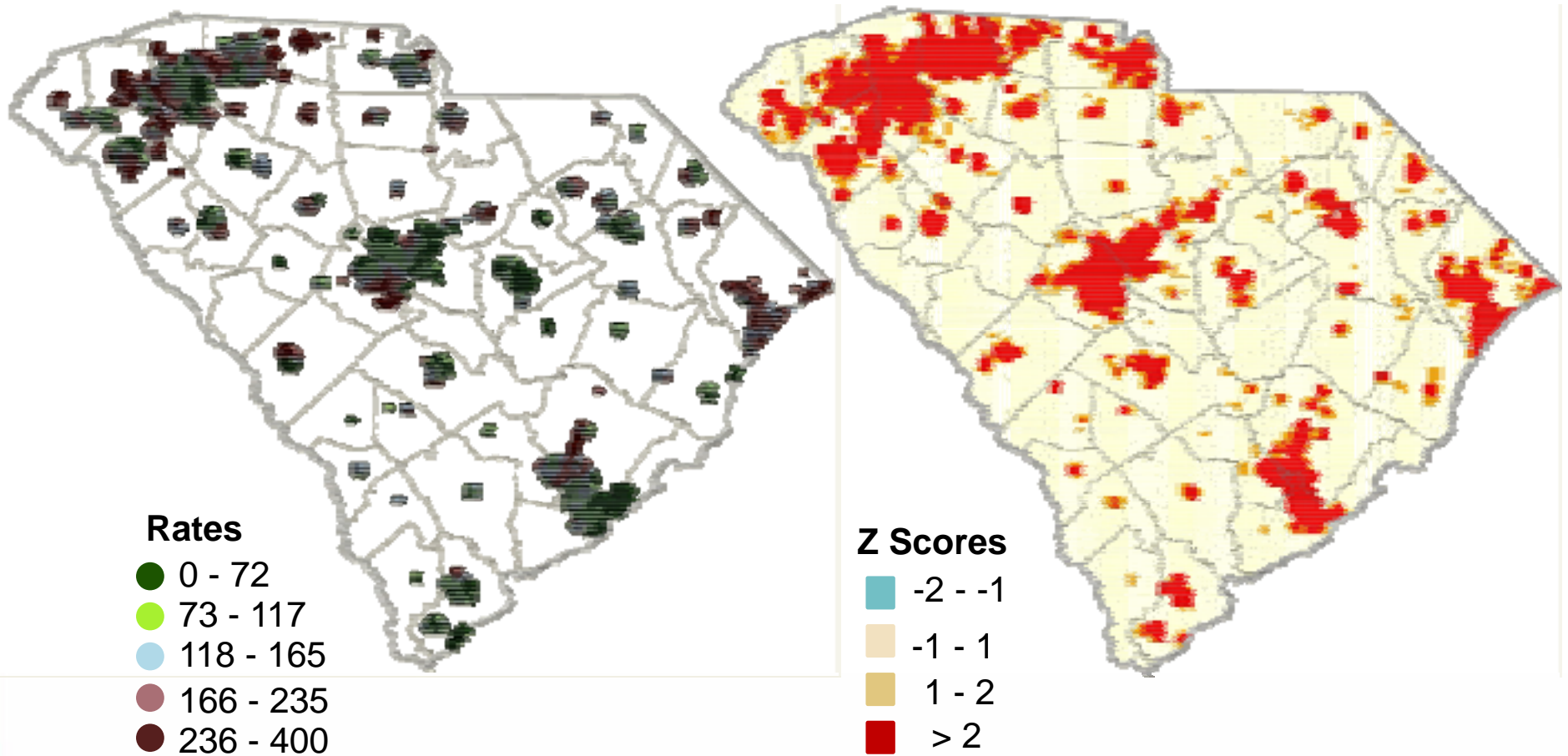
2004

2005

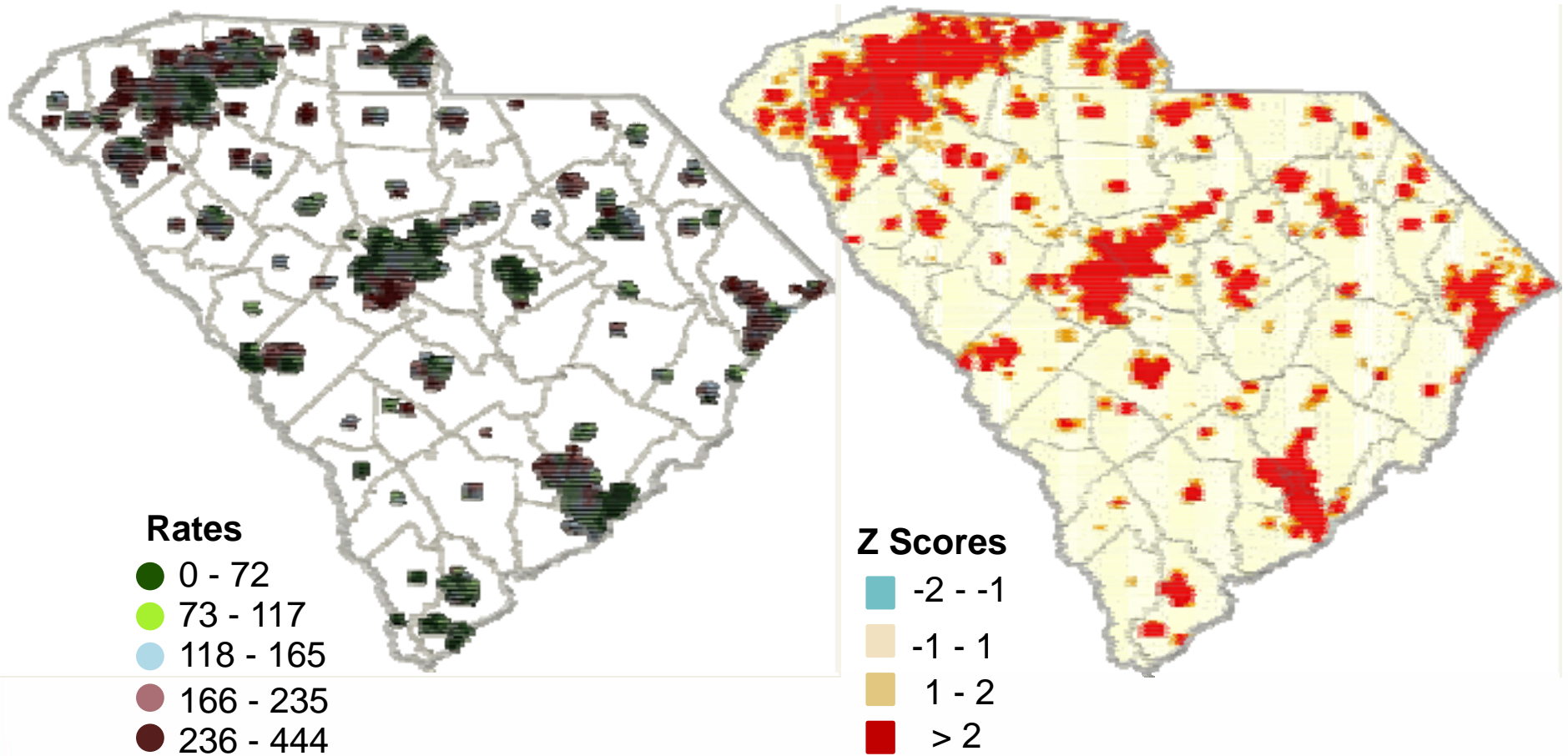


Rate Changes

2004 Rates and Hot Spot of Live Births to Mothers who Reported Smoking South Carolina



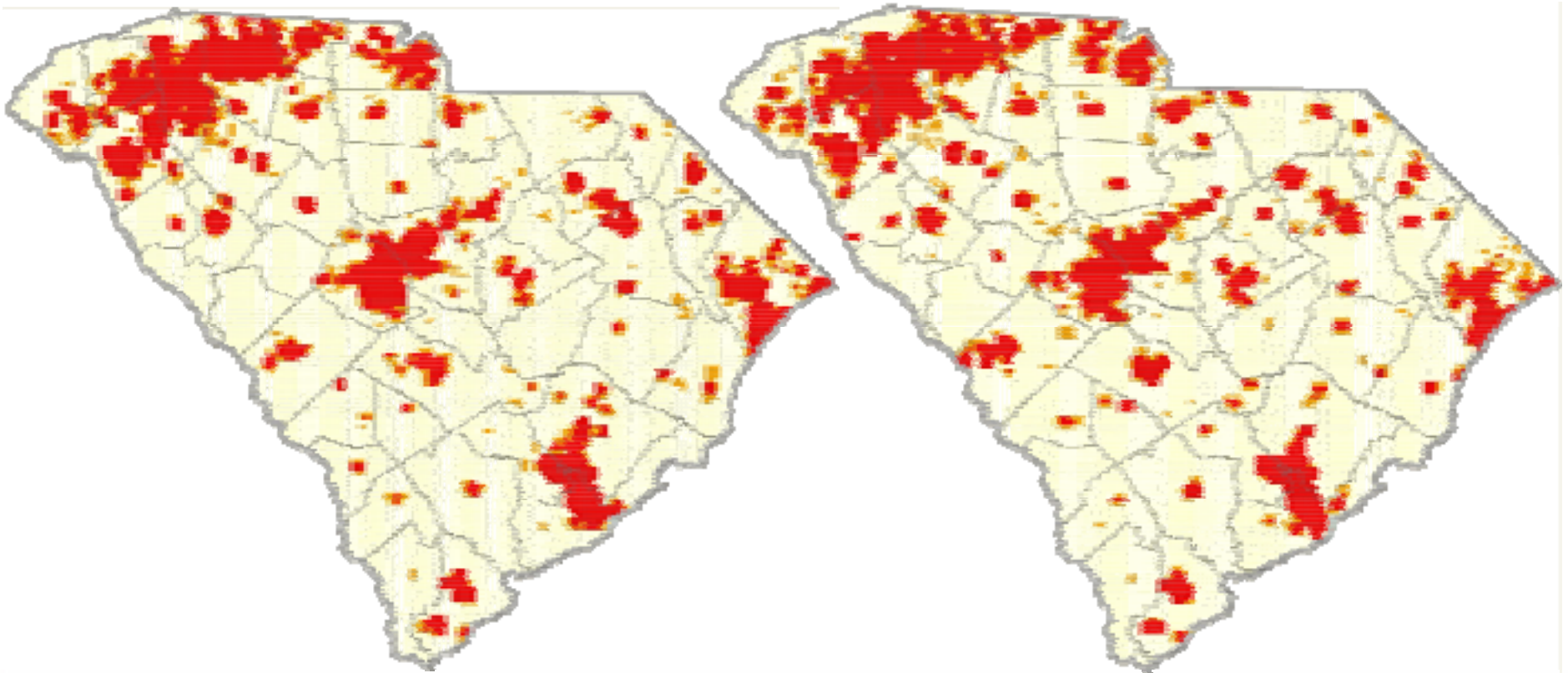
2005 Rates and Hot Spot of Live Births to Mothers who Reported Smoking South Carolina



Hot Spot of Live Births to Mothers who Reported Smoking South Carolina

2004

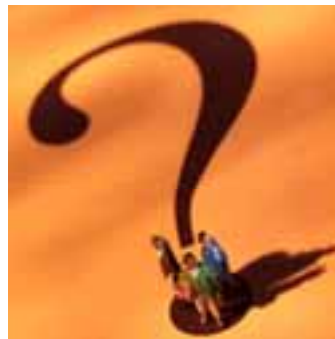
2005



Conclusion

- Great opportunity to put important state-wide public health data to work at the community level
- Community health care providers much better able to understand map presentations and thus get more actively involved and committed to local public health intervention strategies
- Explore available spatial statistical analysis tools (DMAP, SatScan, CrimeStat, Hot Spot...)
- Improvements are needed for reference and birth data to raise address matching results.

Questions



Thank you for your time and attention

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Email: kims@dhec.sc.gov