



**TOWERS
PERRIN**

PM-6: Handling High-Dimensional Variables: Territory Analysis

CAS Ratemaking and Product Management Seminar

Klayton N. Southwood, FCAS, MAAA
March 11, 2009





ANTITRUST Notice

The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.

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It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

Basis to Group Areas

County

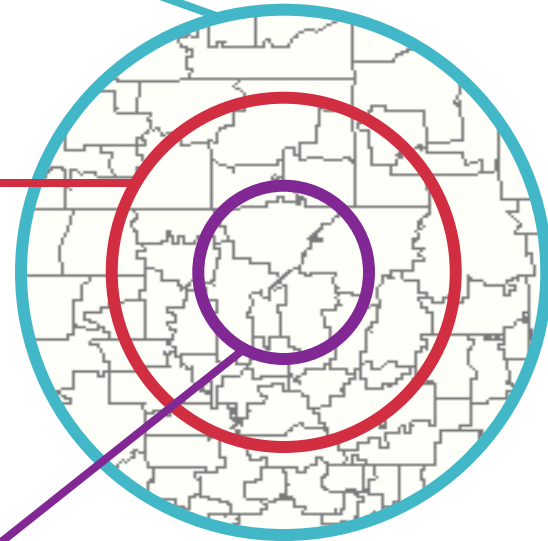
- Largely stable over time
- Broad area

ZIP Code

- Narrowly defined — may be beneficial to define territories
- Useful for online rating
- Main disadvantage is need to deal with change over time

Geo-Coding

- Finest detail
- Static over time
- No predefined grouping



Loss Index Normalized Pure Premium

Normalized Zip Code Pure Premium

=

Actual Zip Code Pure Premium

X

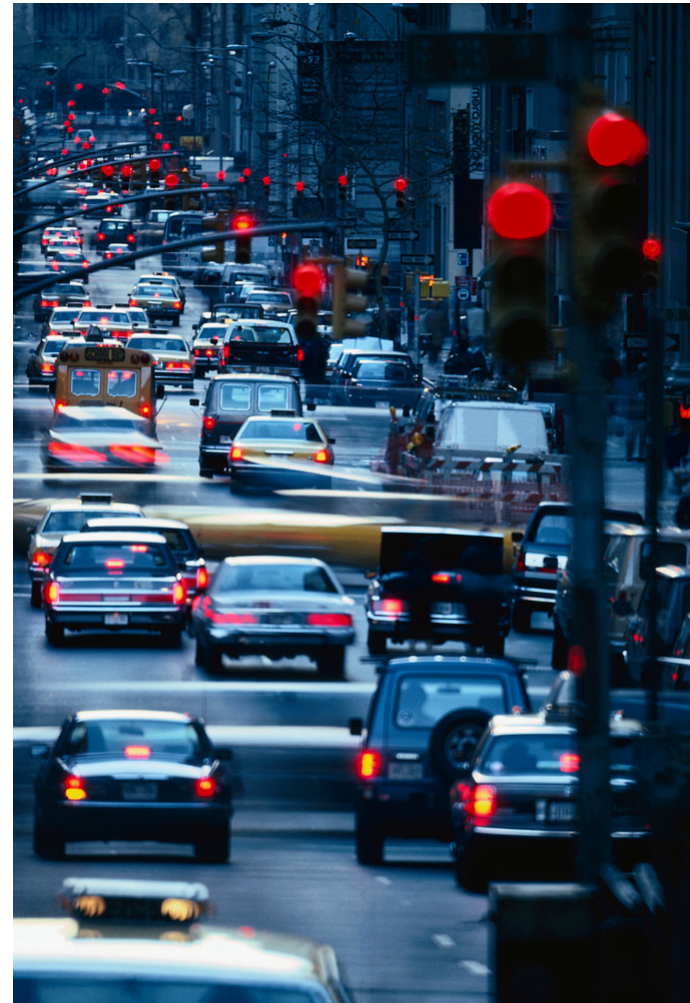
State Avg. Prem.
State Avg. Base

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Zip Avg. Prem.
Zip Base

Loss Index Econometric Model — Private Passenger Auto

- Population Density →
- Vehicle Density →
- Accidents per Vehicle →
- Injuries per Accident →
- Thefts per Vehicle →



Loss Index Econometric Model — Business Owners Liability

- Departure from Normal Temperature →
- Number of Days Maximum Temperature is Below Freezing →
- Total Precipitation →
- Population Density →
- Population Growth →
- Percent of Population Using Public Transportation →

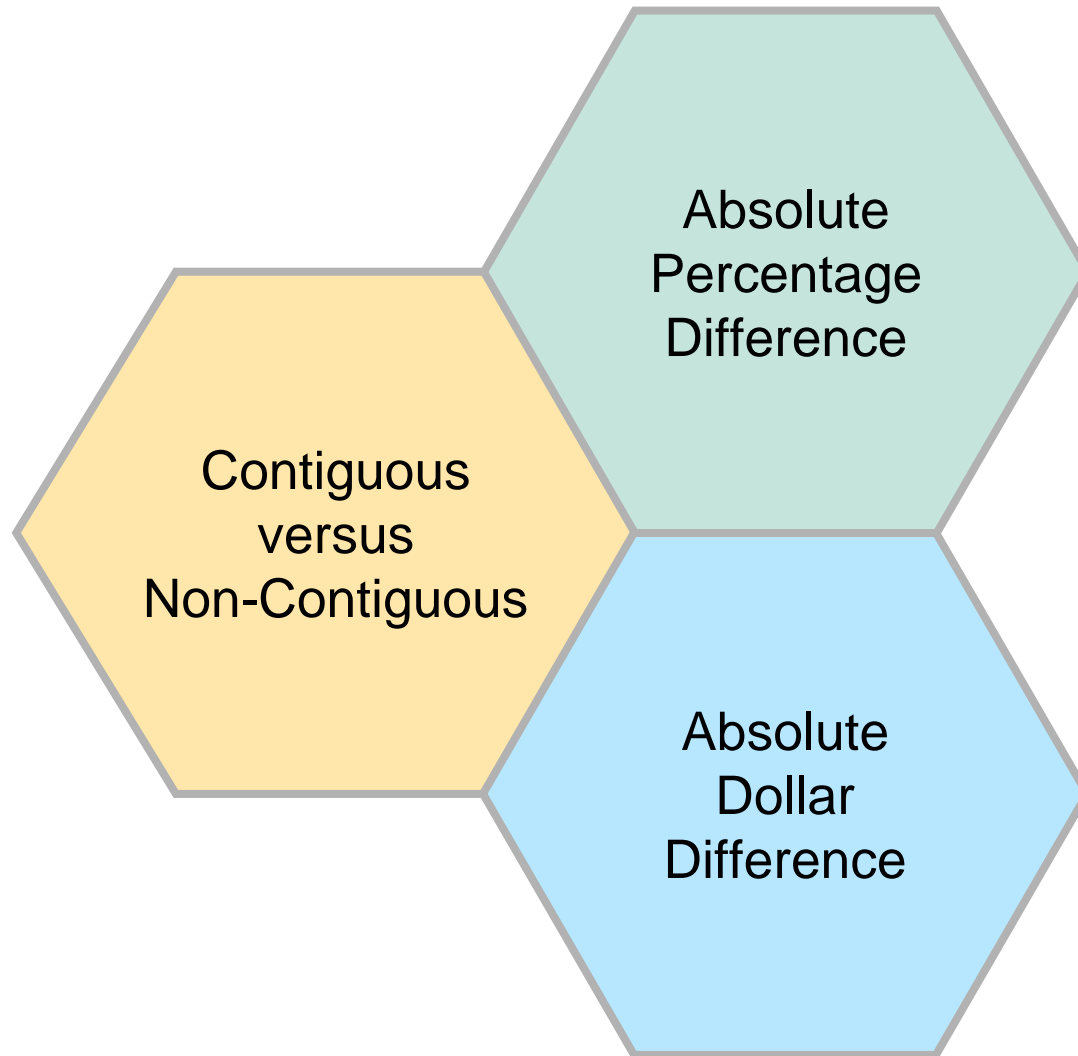


Credibility

- No “right” answer
- We commonly use:
 - 3,000 Claims
 - With complement applied to:
 - Neighborhood Pure Premium
 - Within Two Miles
 - One Mile Extensions



Clustering

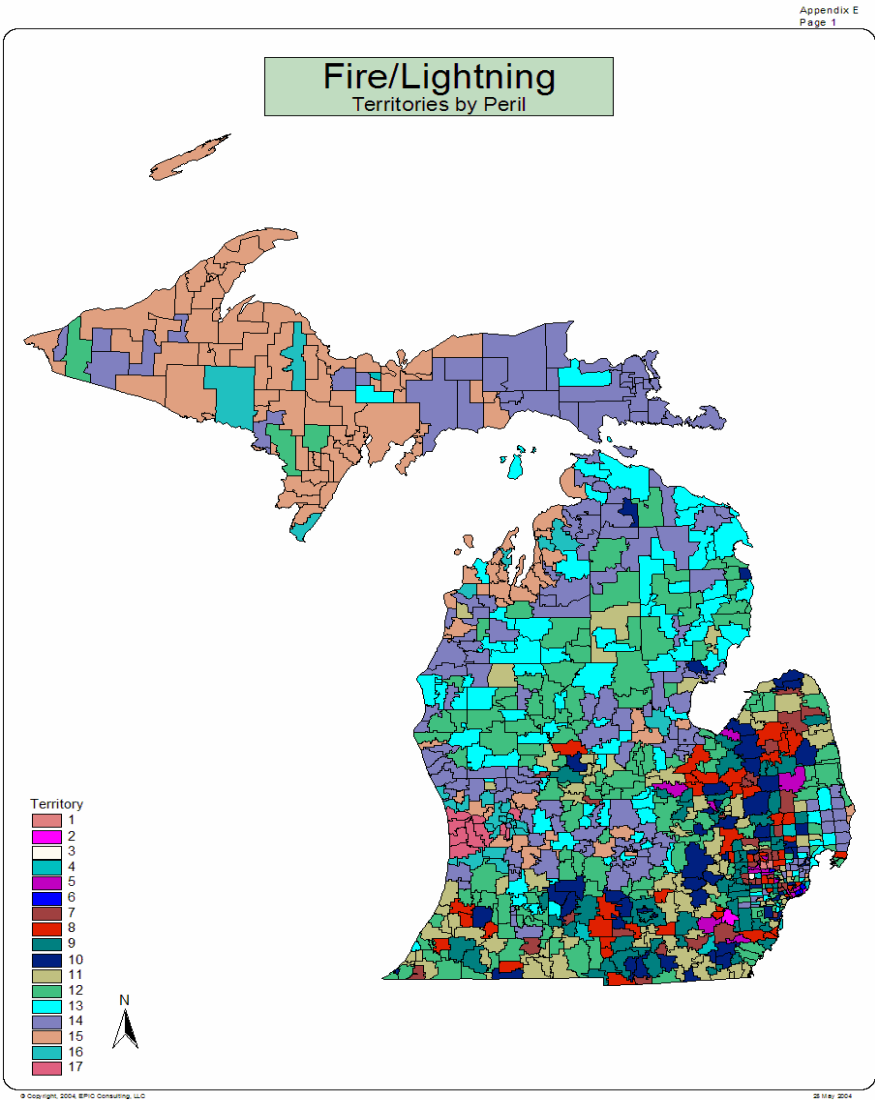


Michigan Industry Homeowners



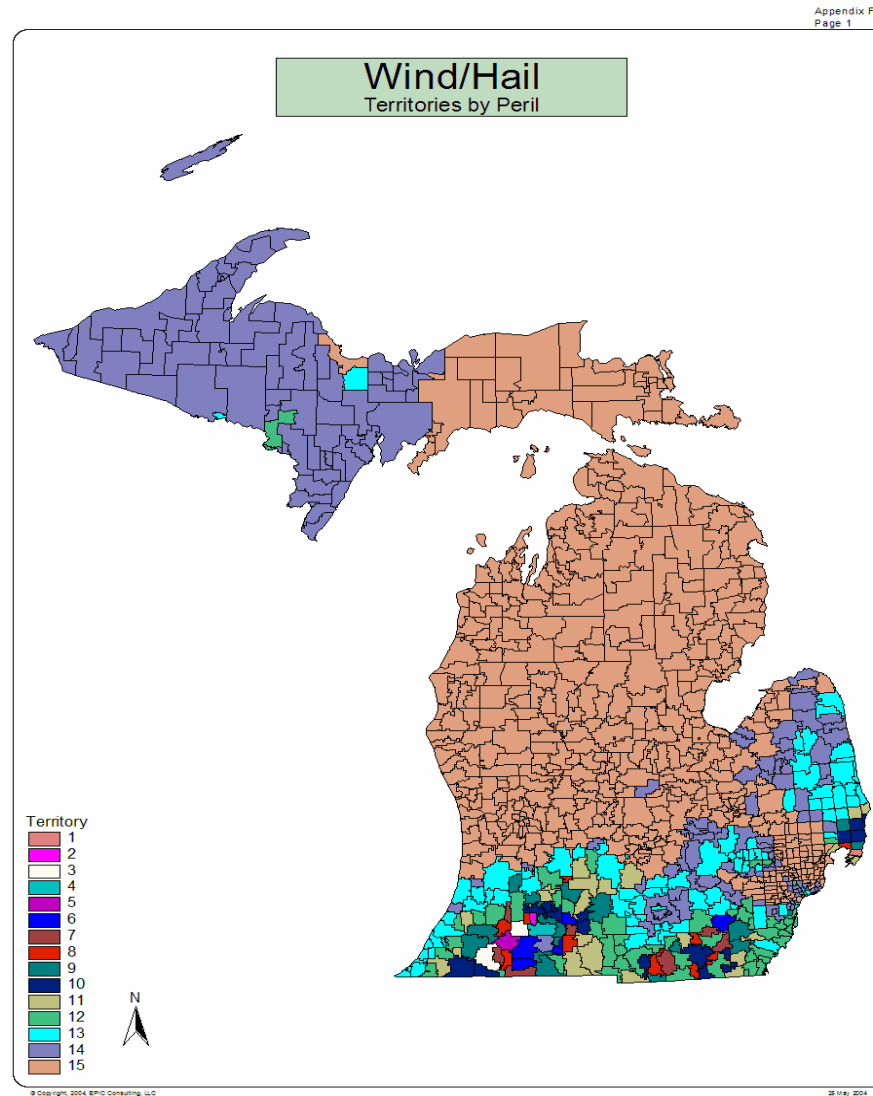
Industry Homeowners— Fire (Non-Contiguous)

Michigan



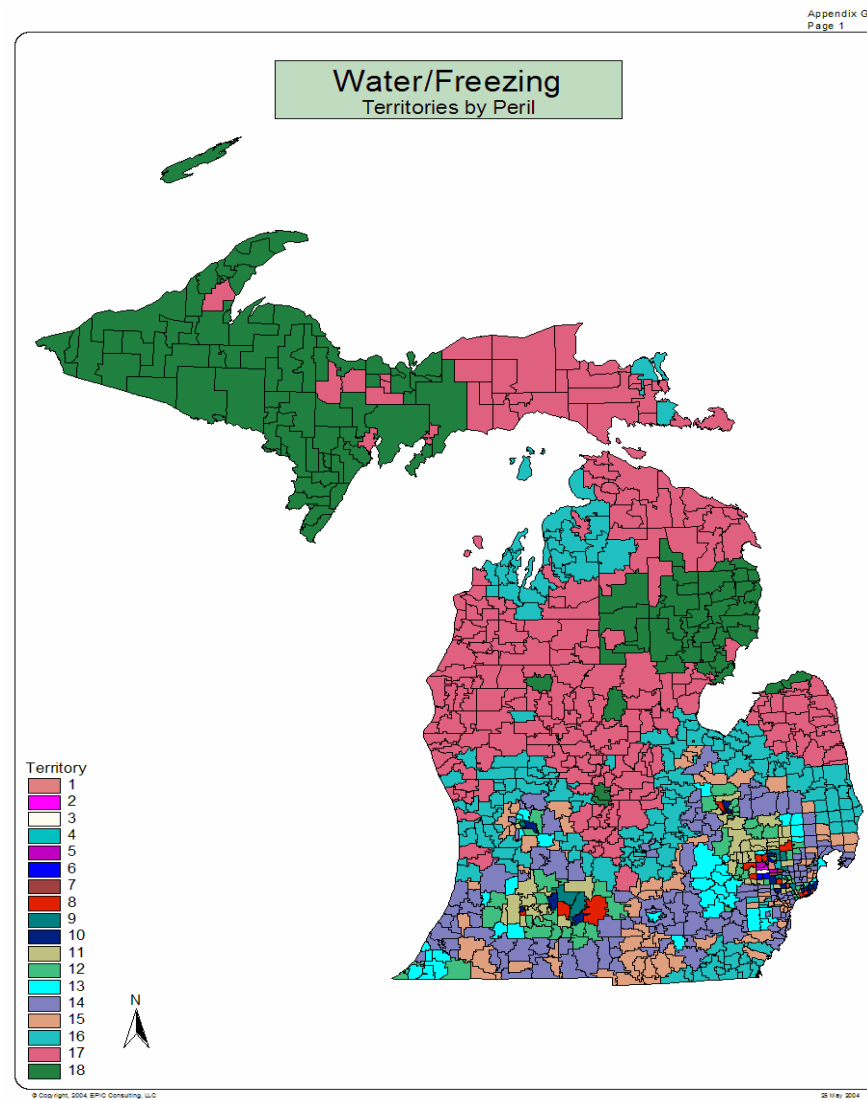
Industry Homeowners— Wind/Hail (Non-Contiguous)

Michigan



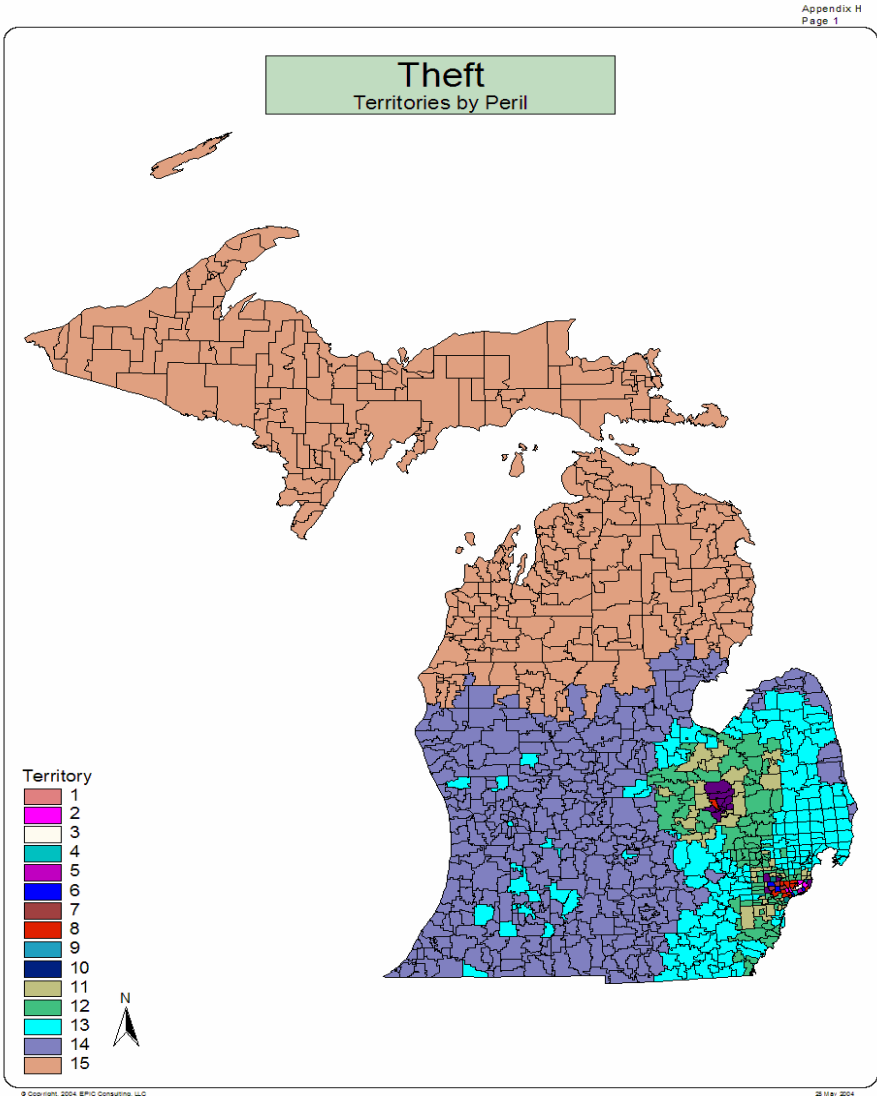
Industry Homeowners — Water/Freezing (Non-Contiguous)

Michigan



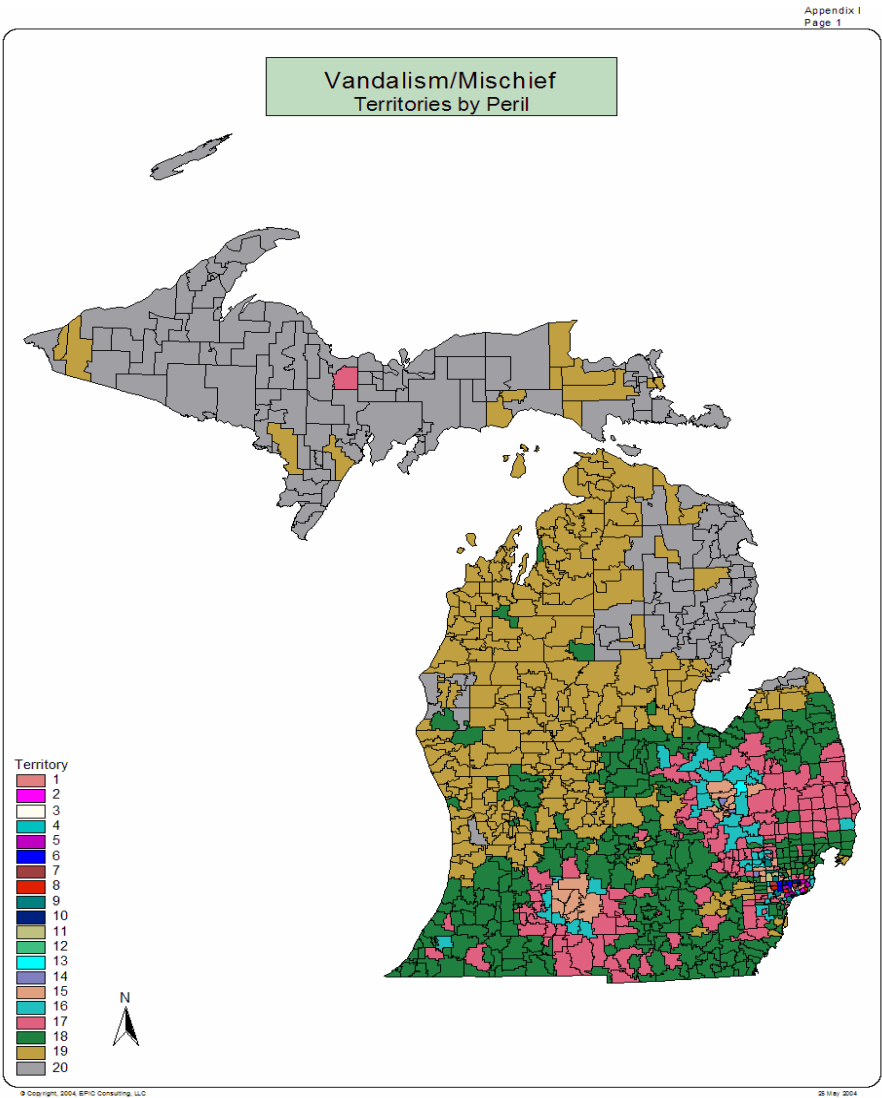
Industry Homeowners — Theft (Non-Contiguous)

Michigan



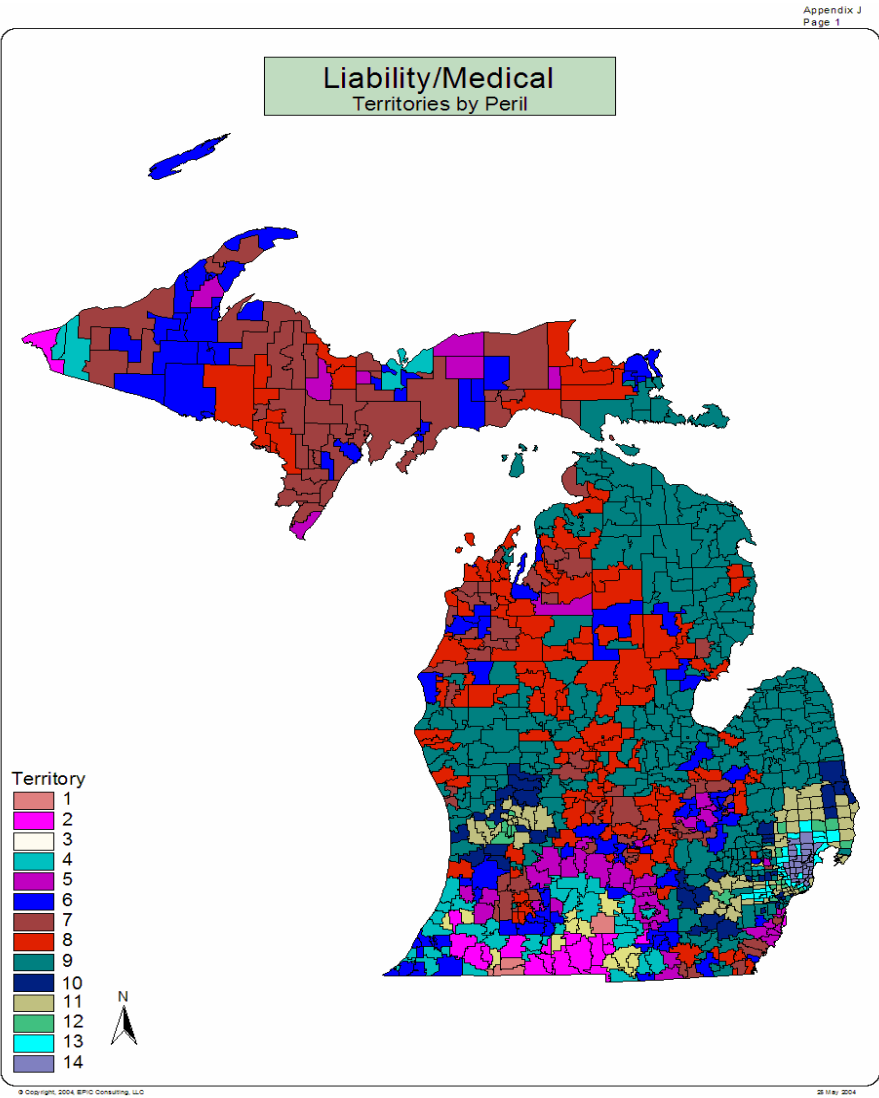
Industry Homeowners — Vandalism (Non-Contiguous)

Michigan



Industry Homeowners — Liability (Non-Contiguous)

Michigan

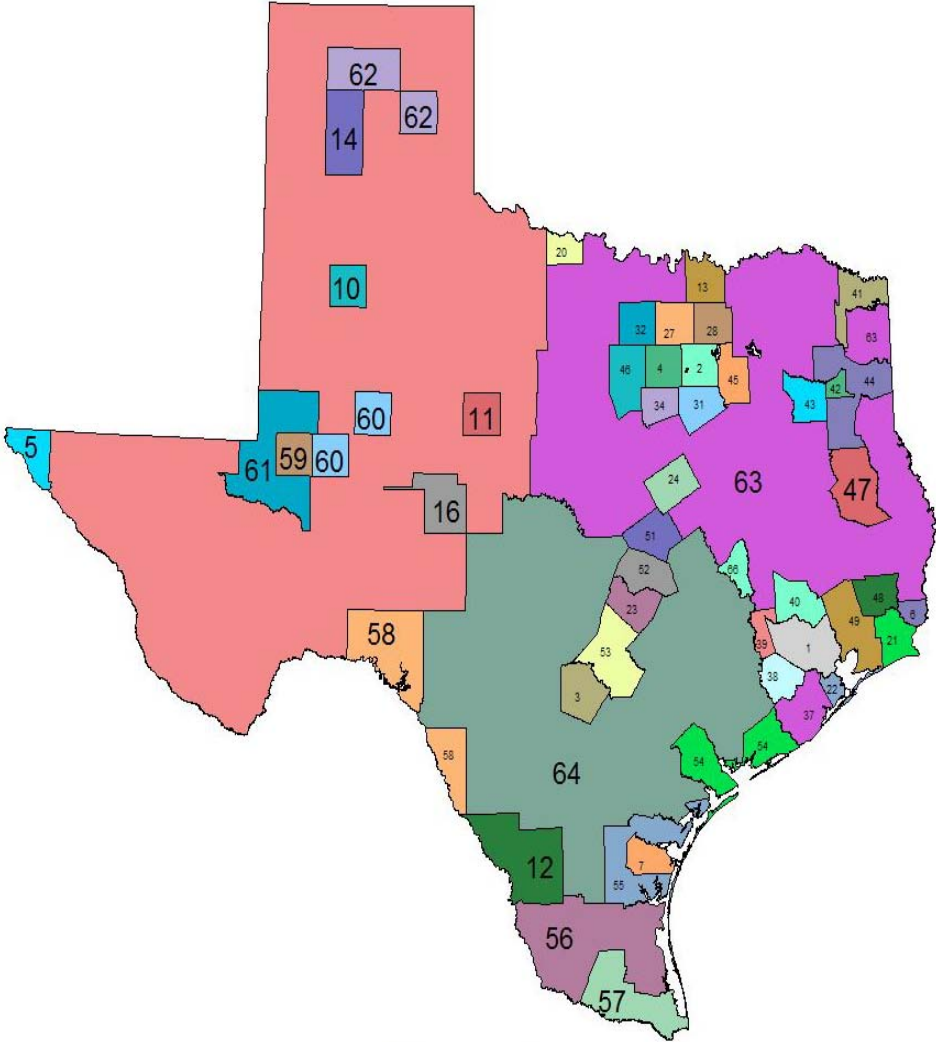
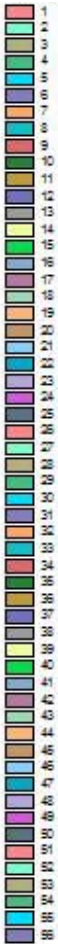


Texas Auto Benchmark



Texas Auto Benchmark

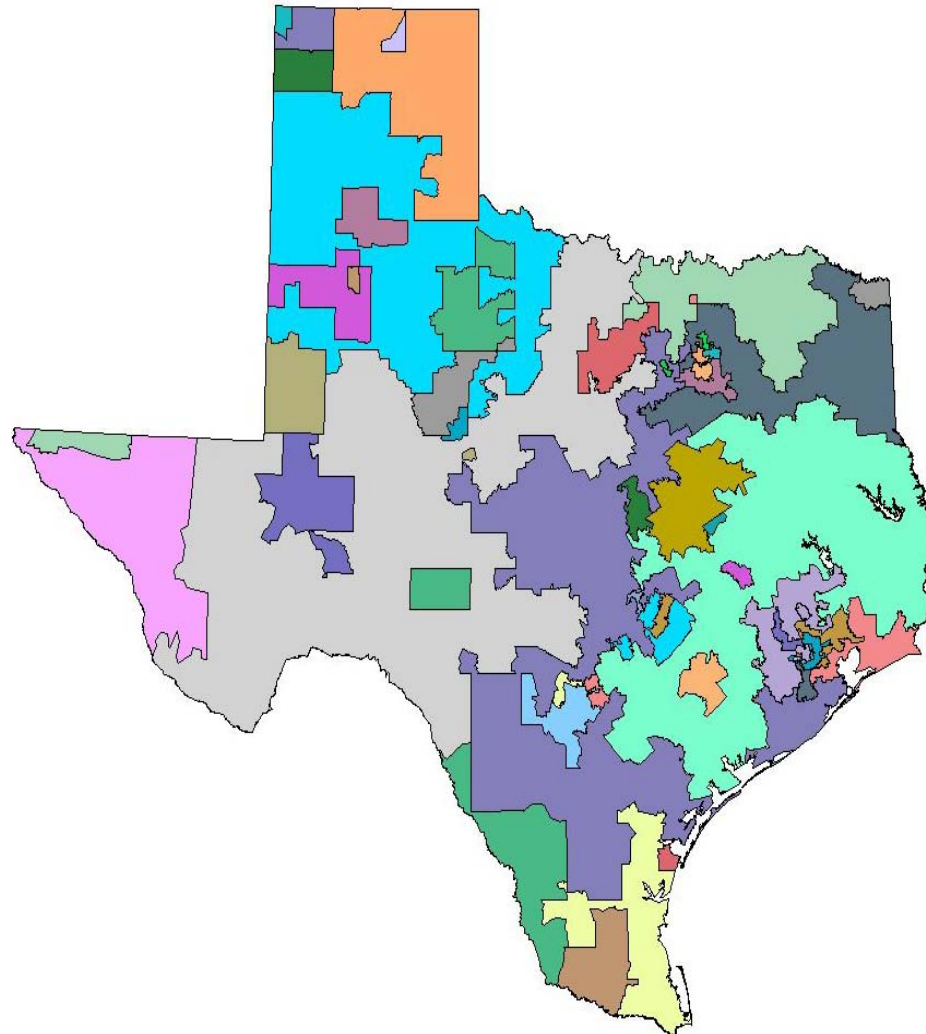
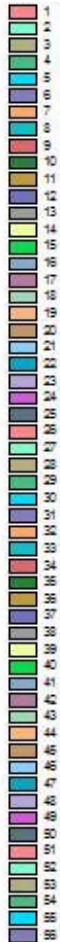
AUTO BENCHMARK



Indicated Auto Territories — All Coverages (Contiguous)

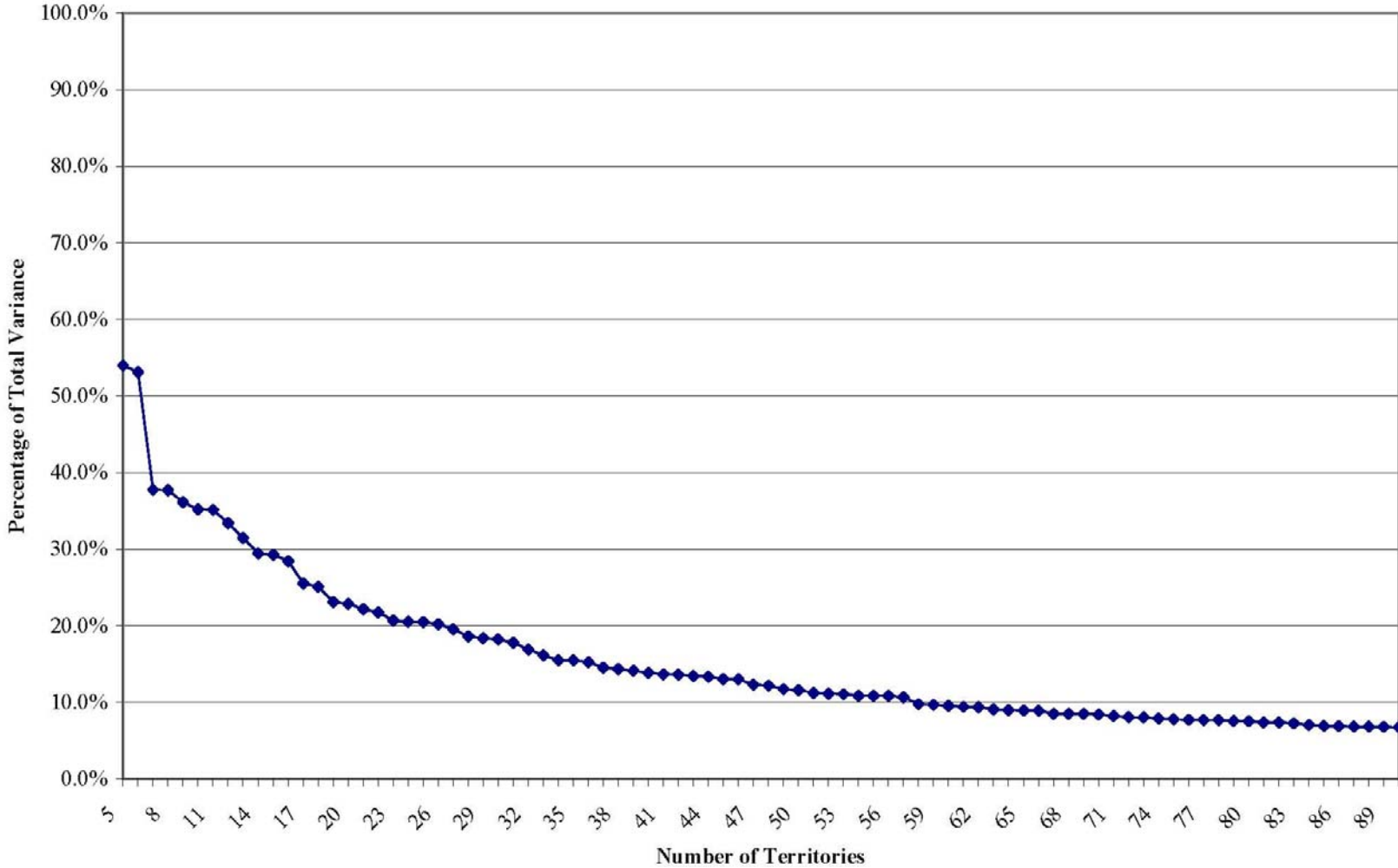
Texas

ALL COVERAGES



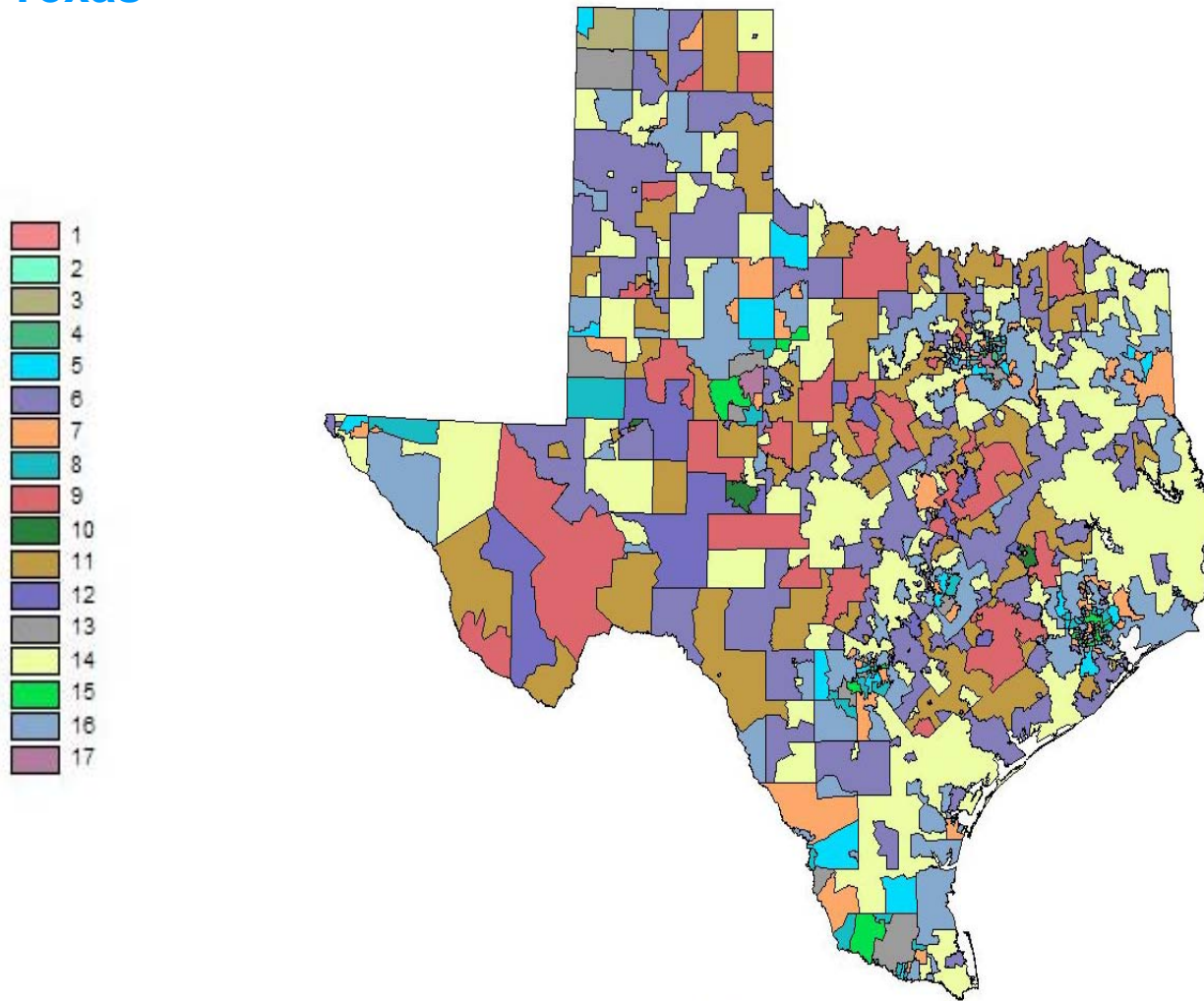
Within Territory Variance as a Percentage of Total Variance — All Coverages (Contiguous)

Texas



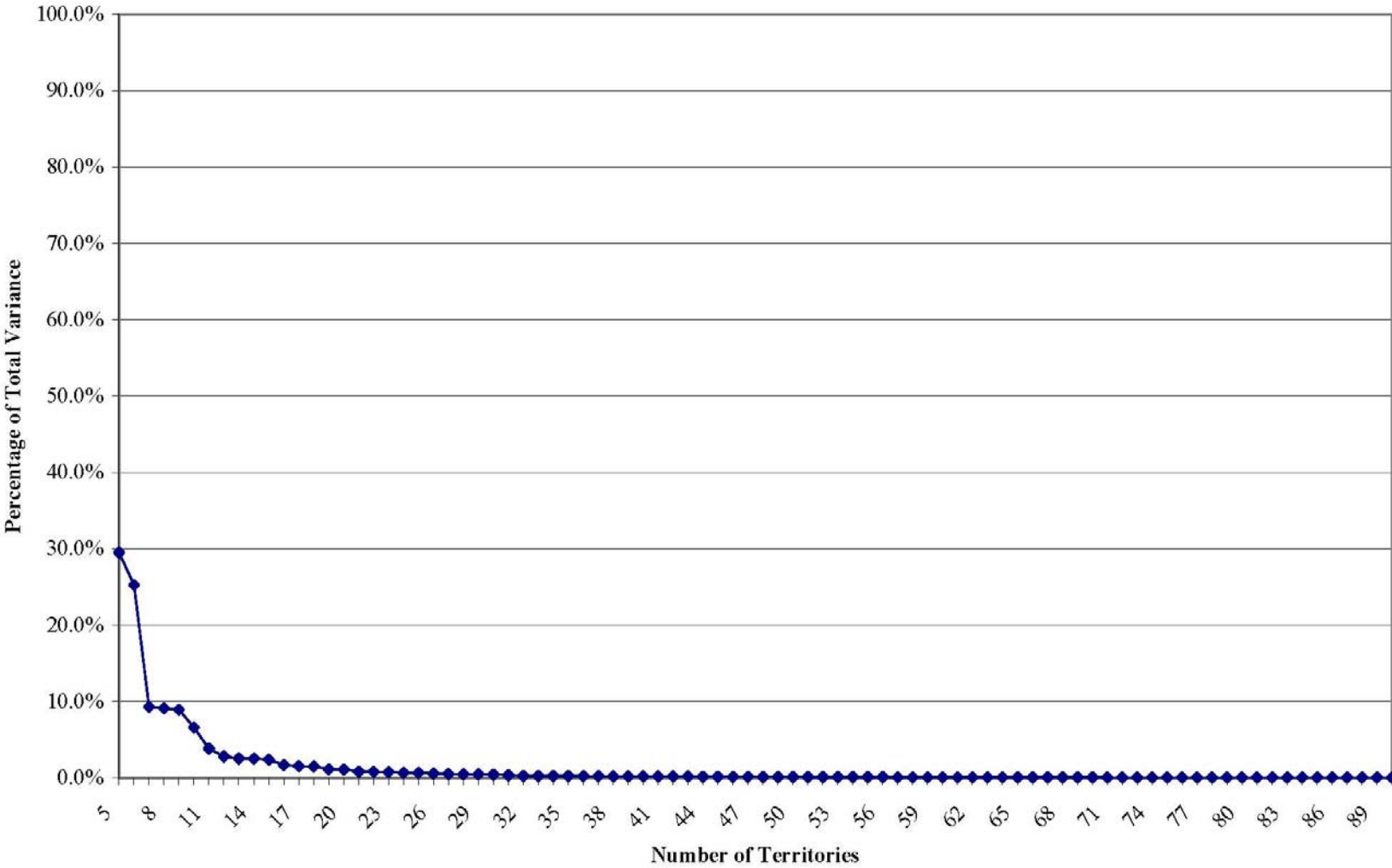
Indicated Auto Territories — All Coverages (Non-Contiguous)

Texas



Within Territory Variance as a Percentage of Total Variance — All Coverages (Non-Contiguous)

Texas

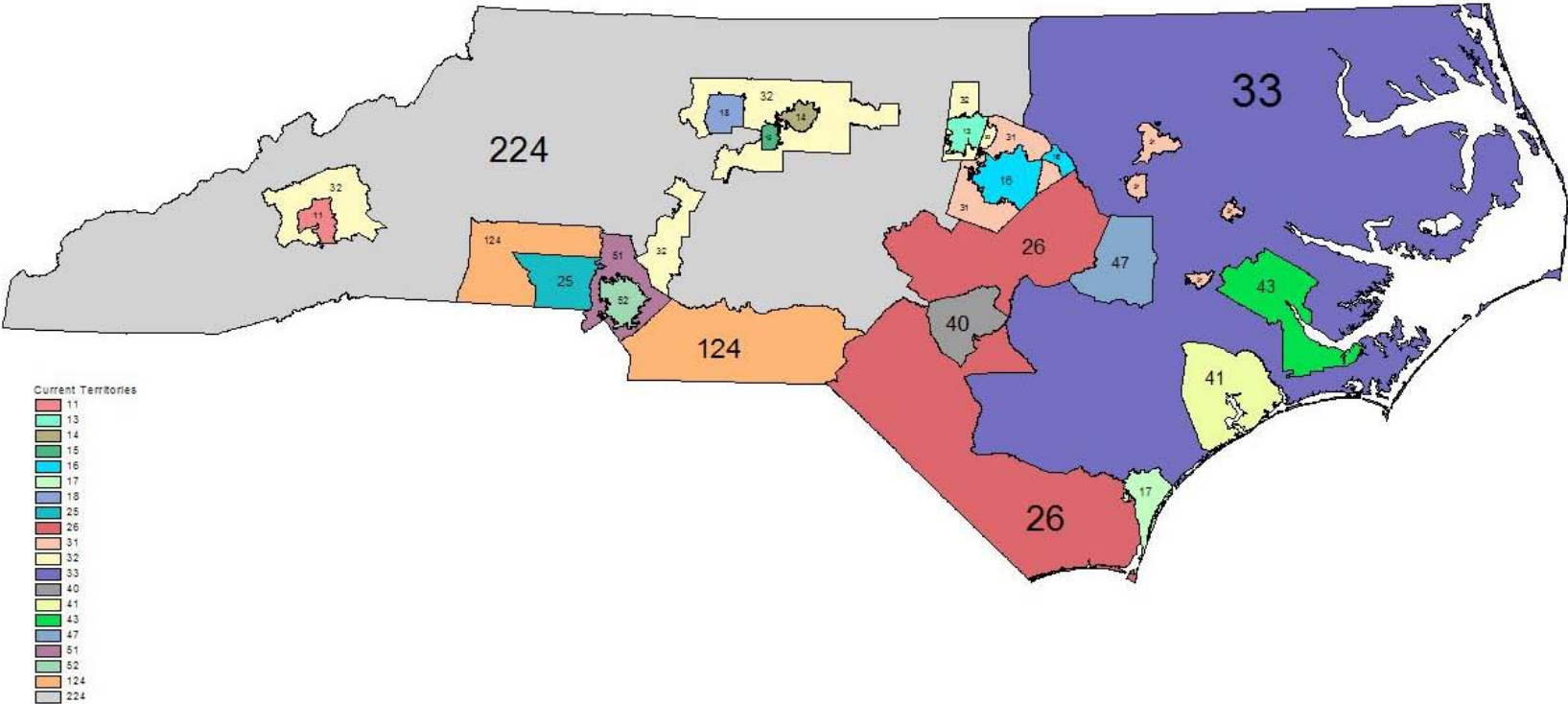


North Carolina



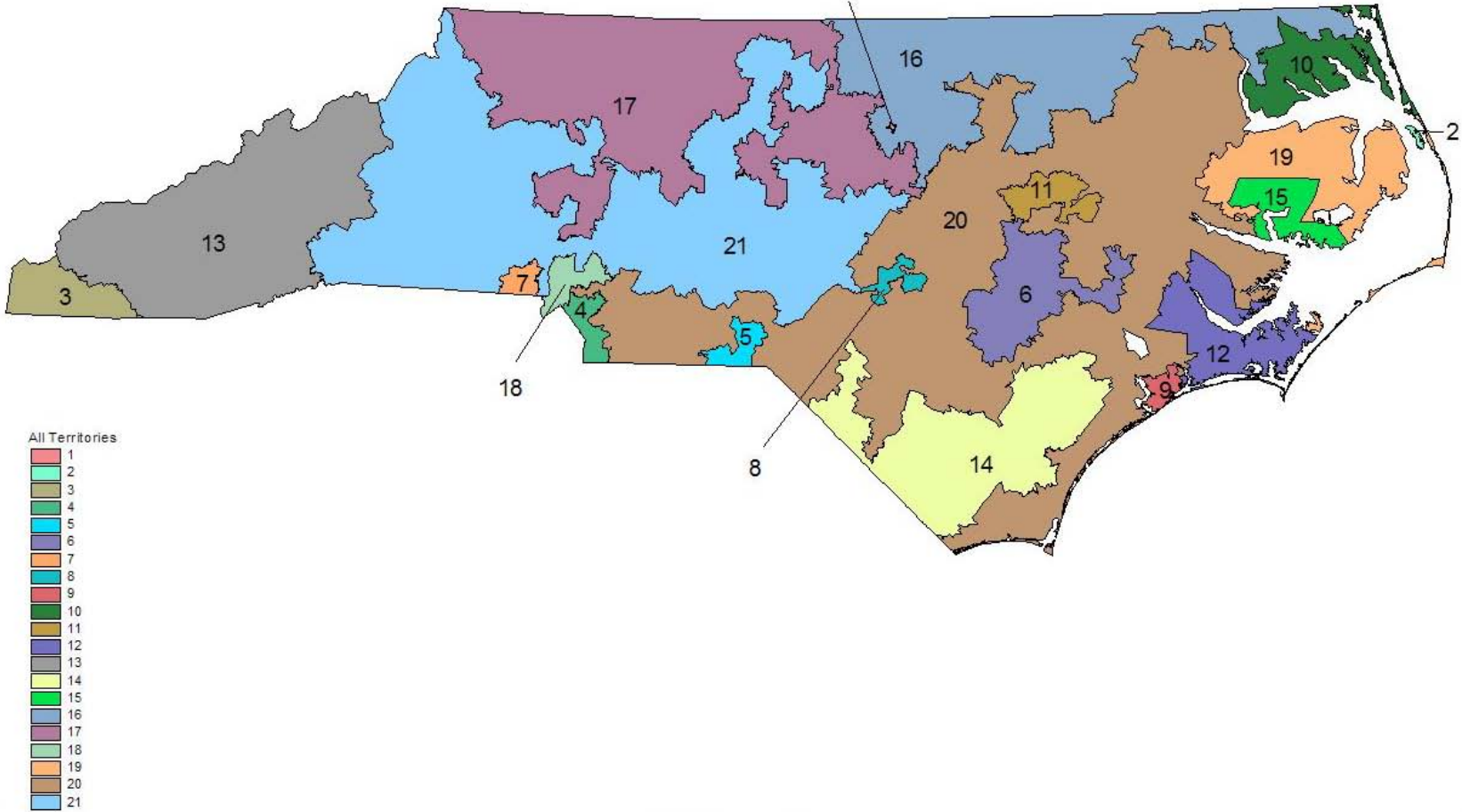
Current Auto Territories — All Coverages

North Carolina



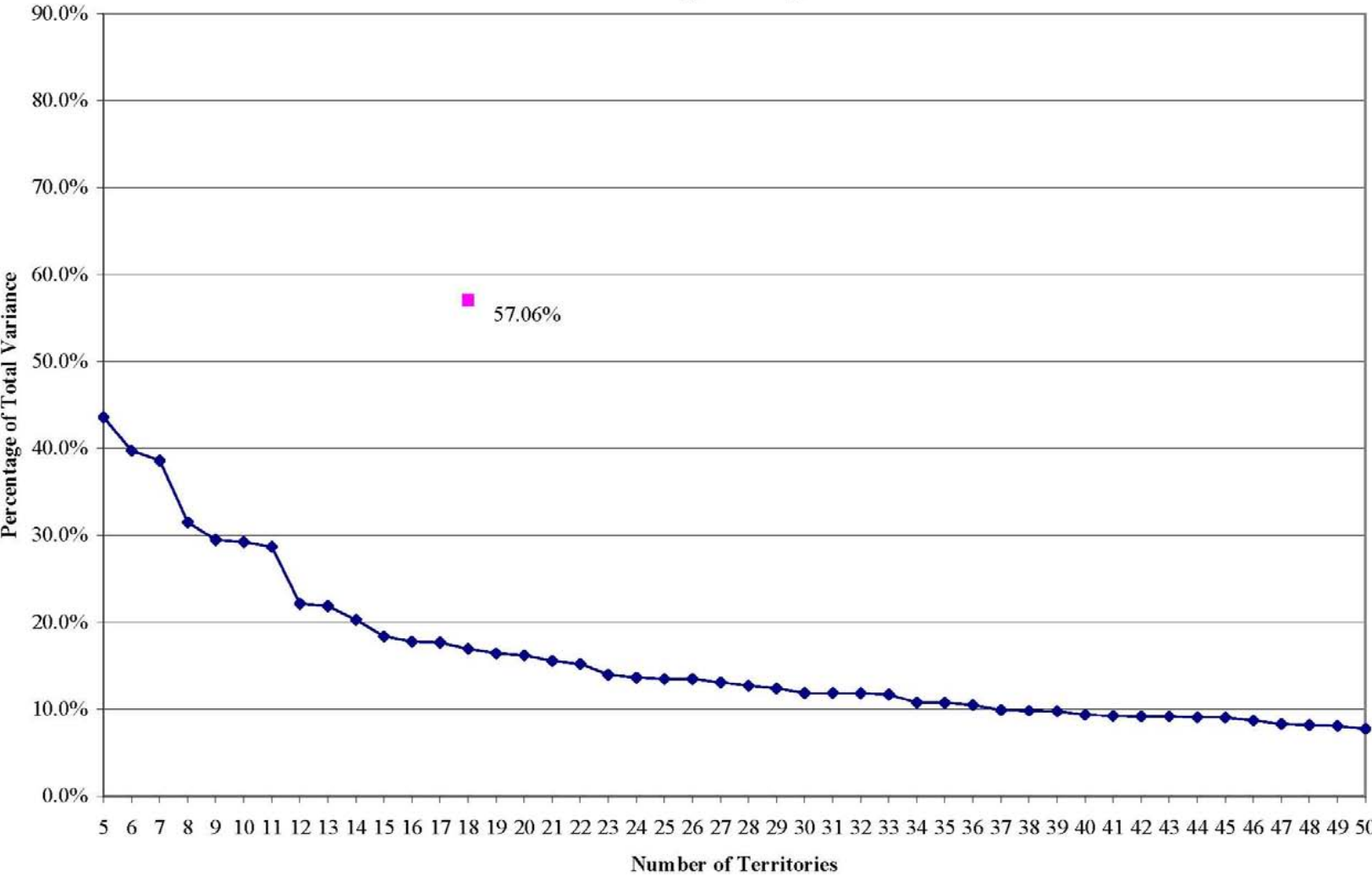
Indicated Auto Territories — All Coverages (Contiguous)

North Carolina



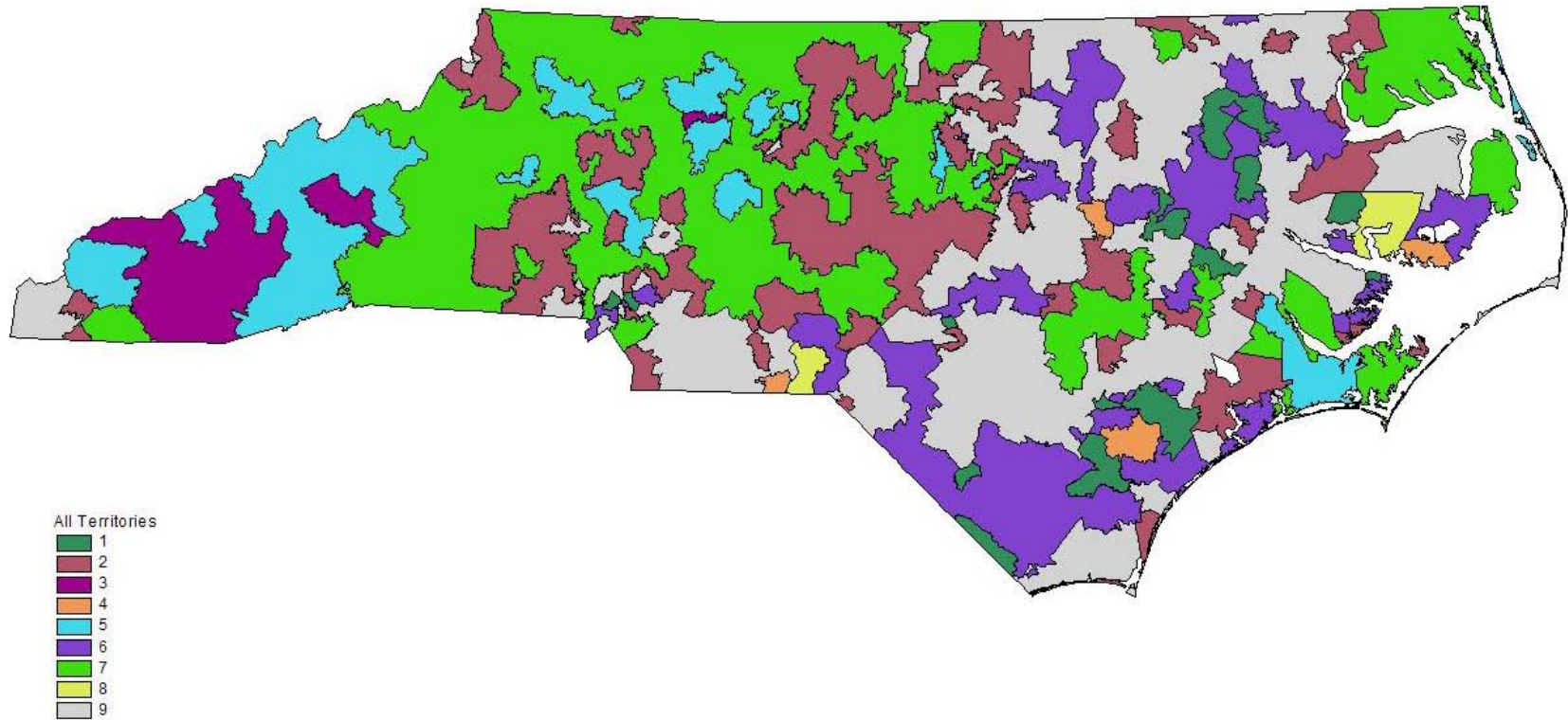
Within Territory Variance as a Percentage of Total Variance — All Coverages (Contiguous)

North Carolina



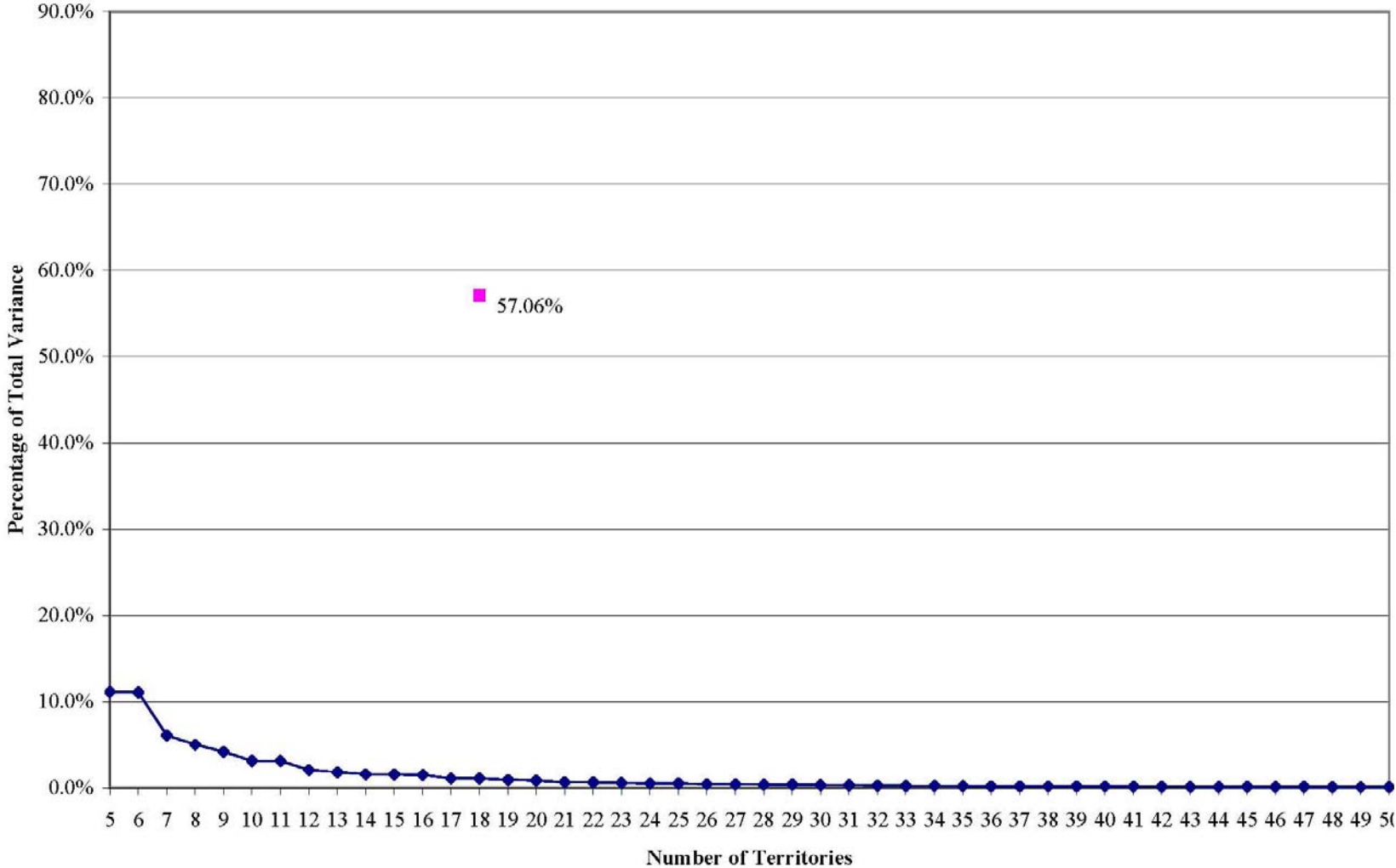
Indicated Auto Territories — All Coverages (Non-Contiguous)

North Carolina



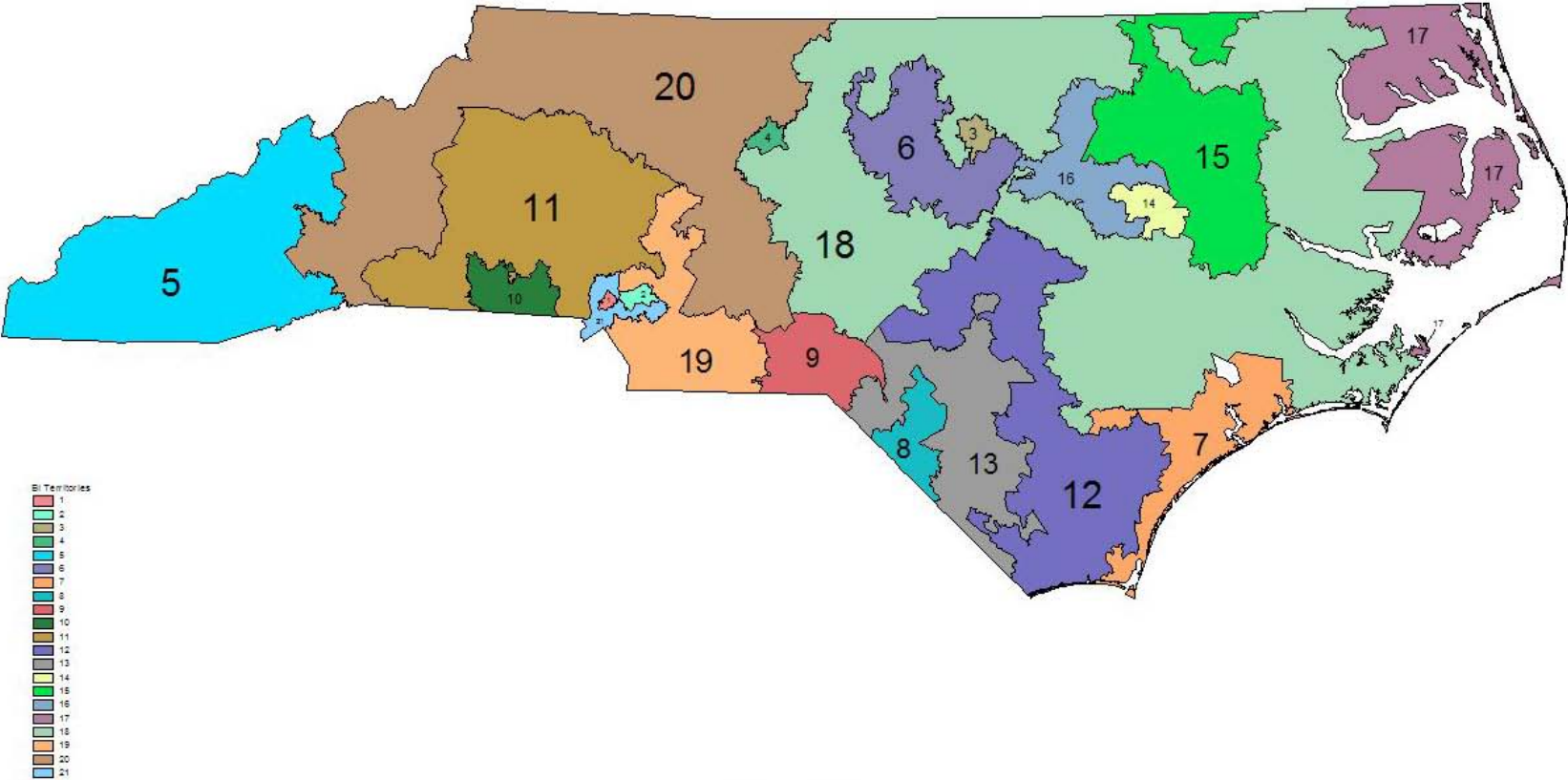
Within Territory Variance as a Percentage of Total Variance — All Coverages (Non-Contiguous)

North Carolina



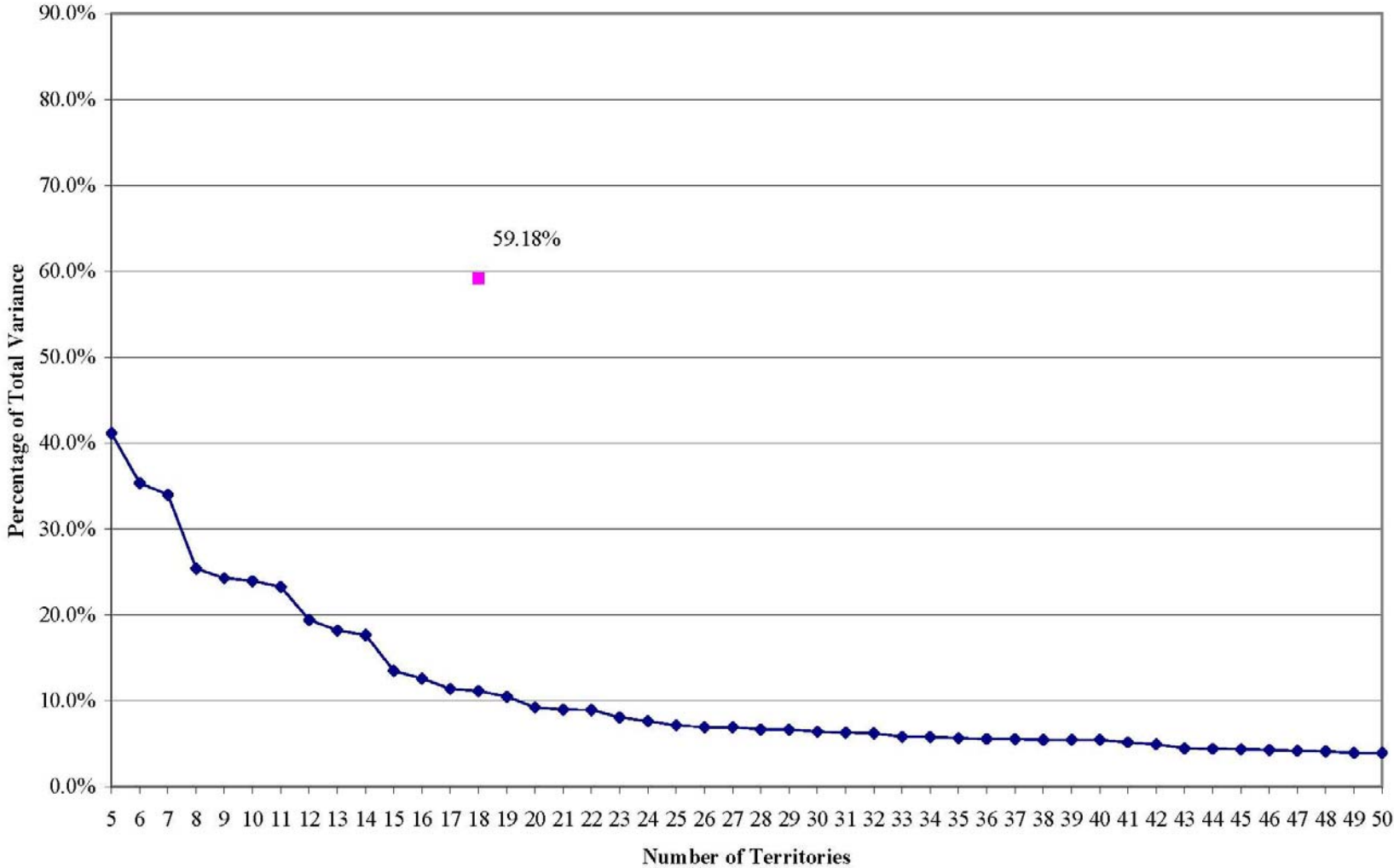
Indicated Auto Territories — Bodily Injury (Contiguous)

North Carolina



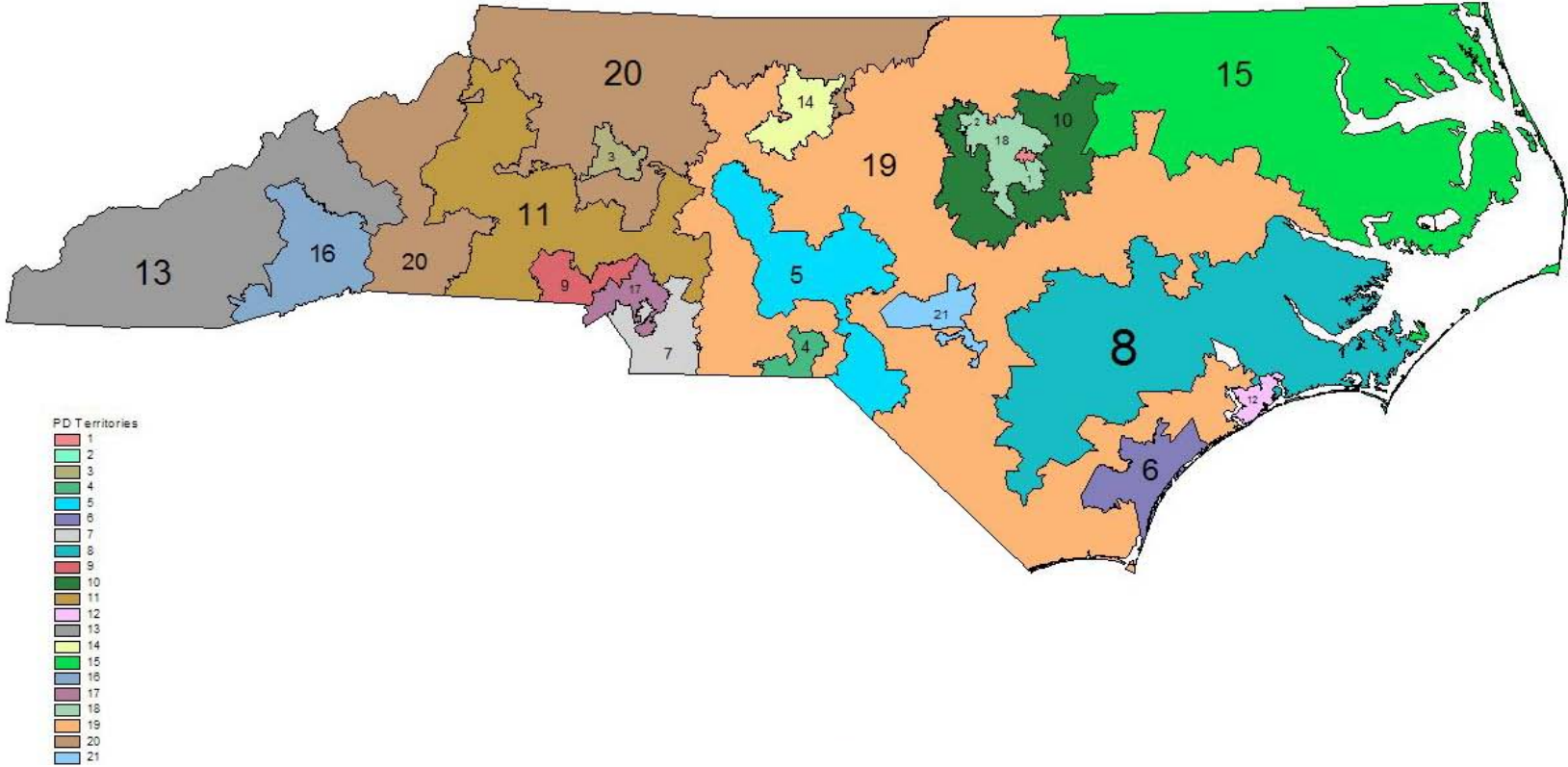
Within Territory Variance as a Percentage of Total Variance — Bodily Injury (Contiguous)

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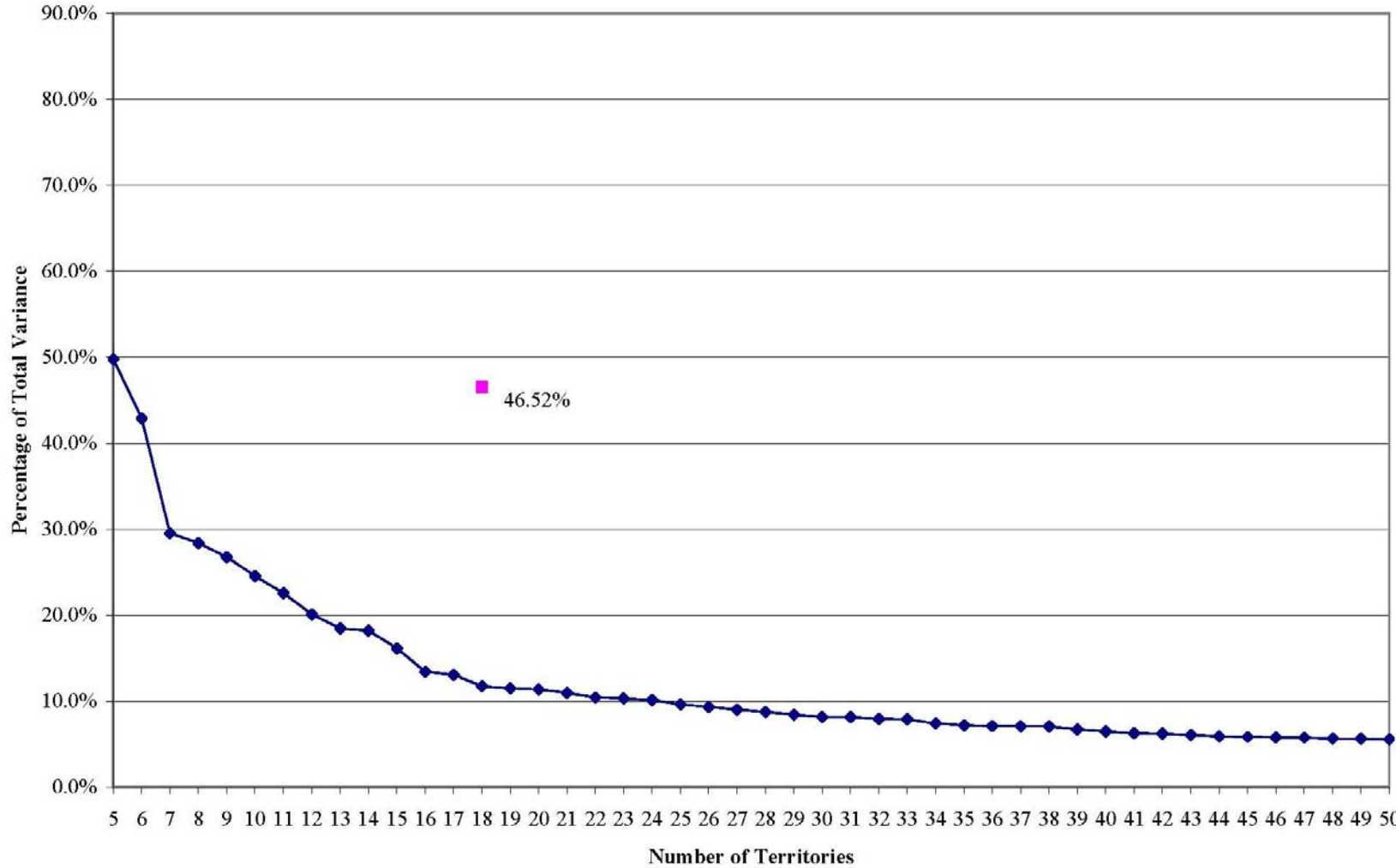
Indicated Auto Territories — Property Damage (Contiguous)

North Carolina



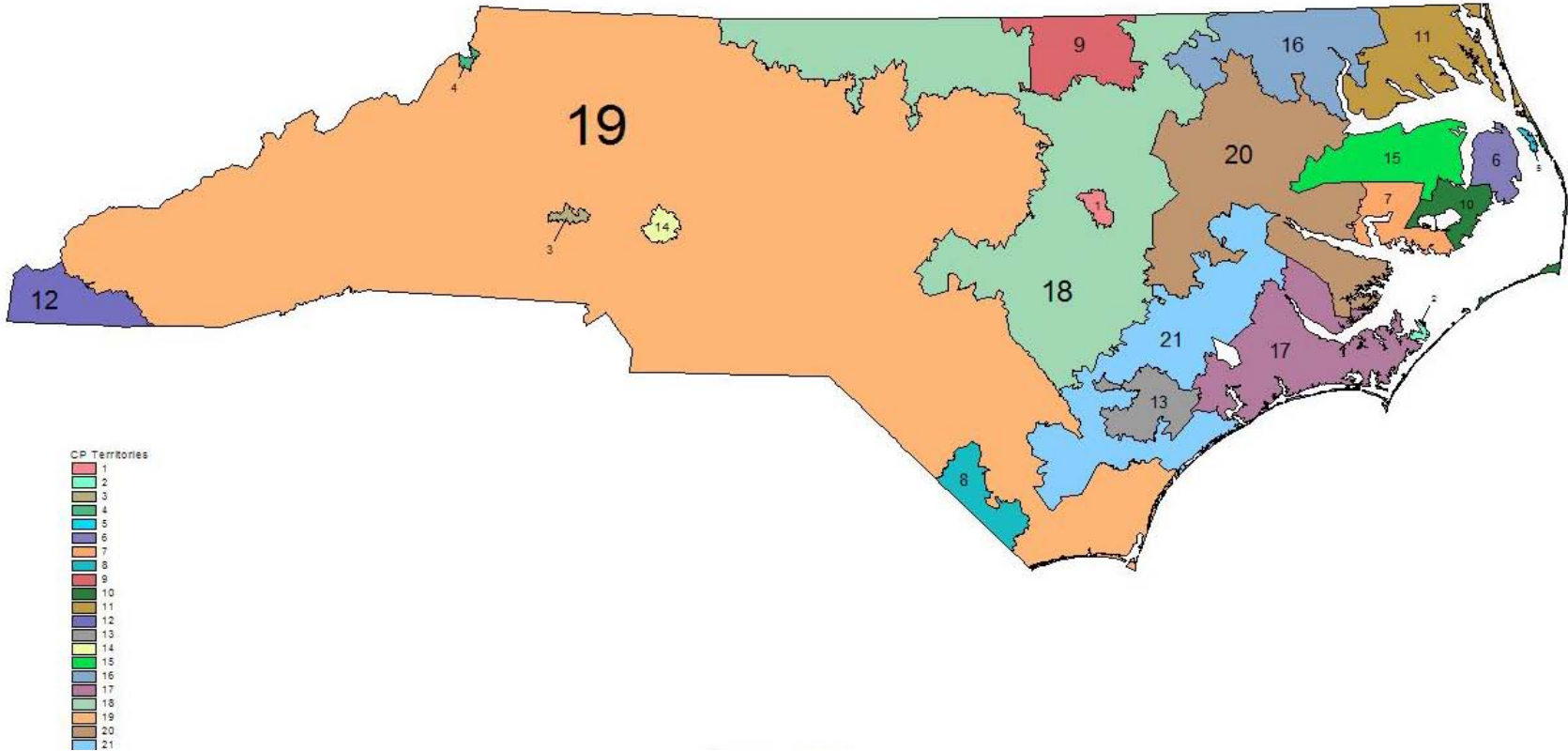
Within Territory Variance as a Percentage of Total Variance — Property Damage (Contiguous)

North Carolina



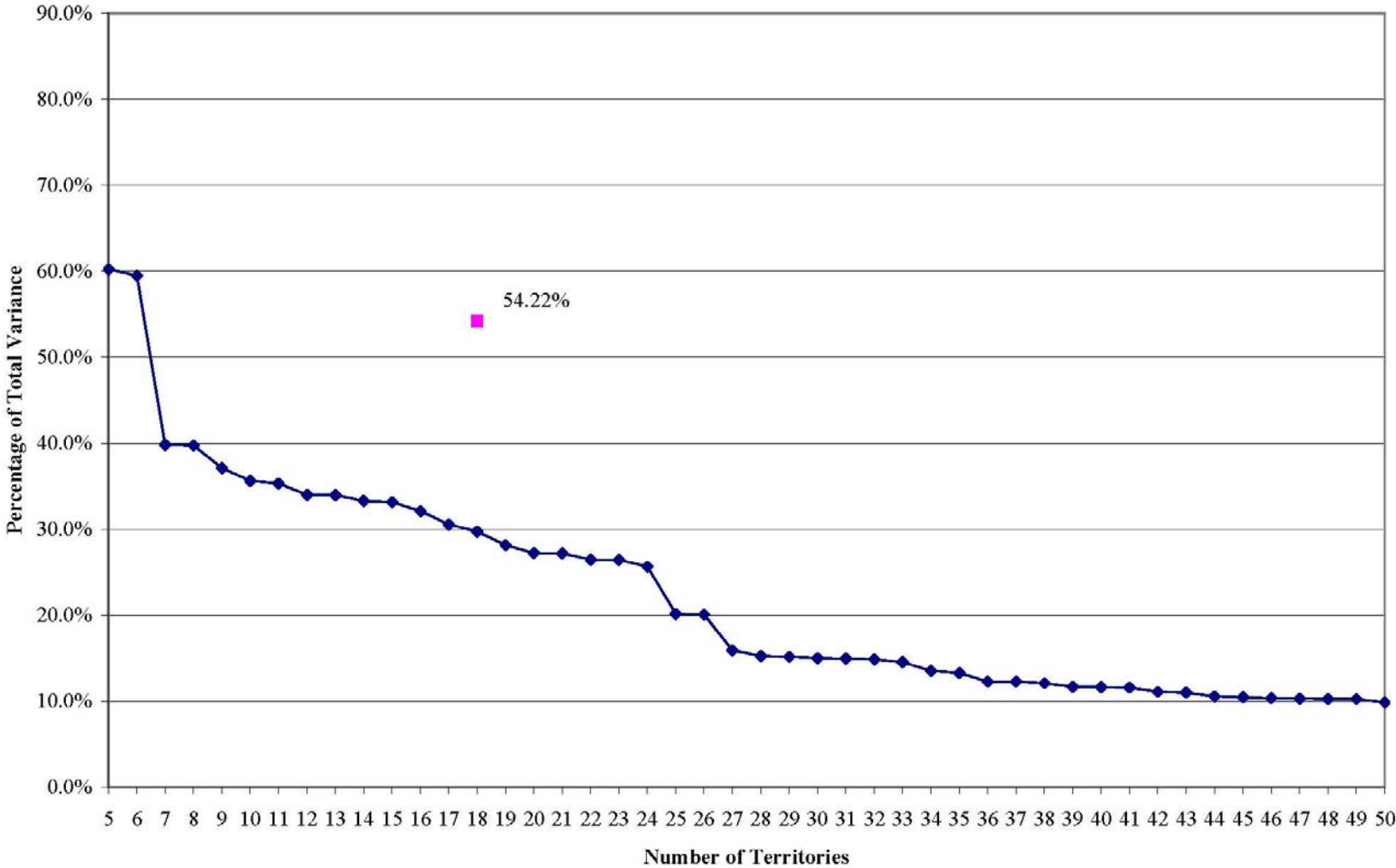
Indicated Auto Territories — Comprehensive (Contiguous)

North Carolina



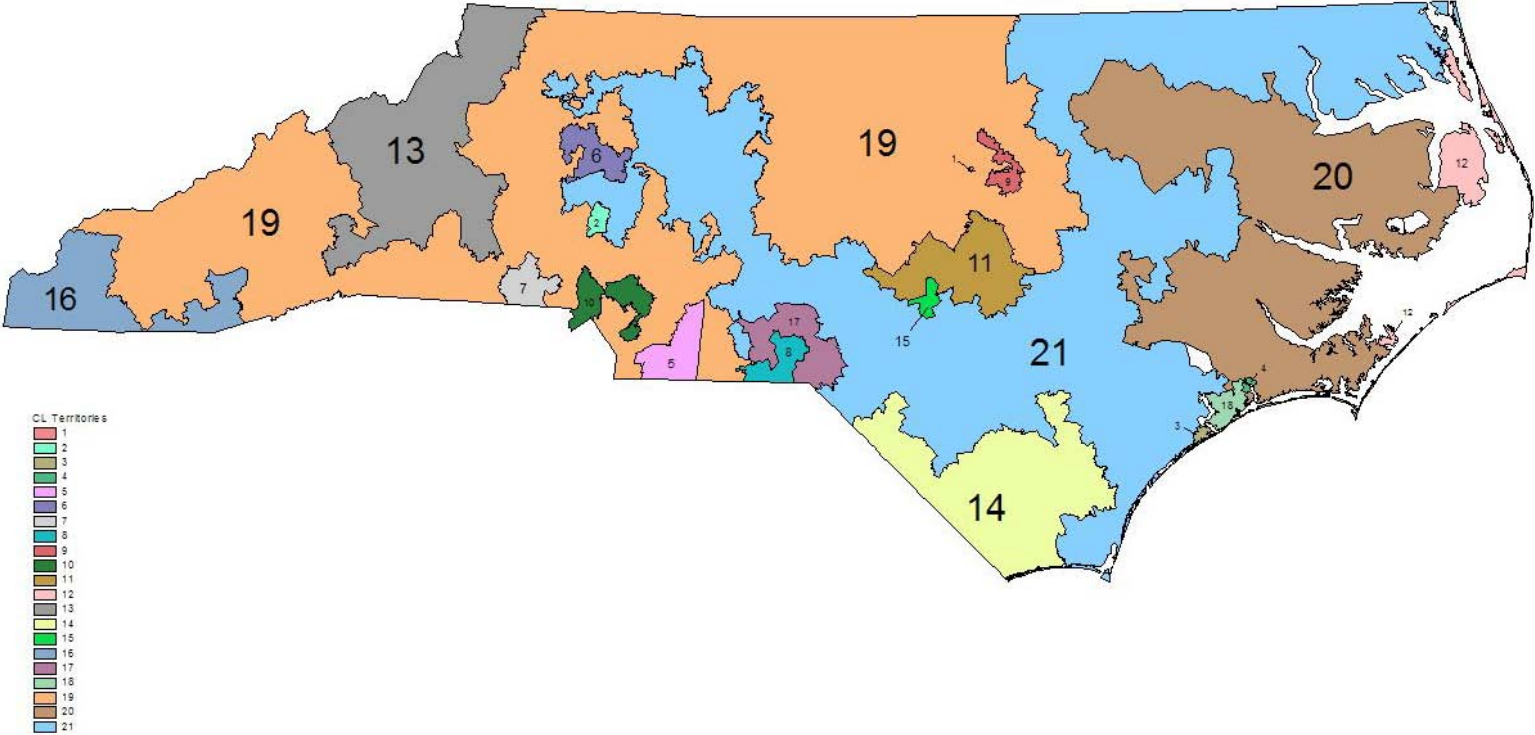
Within Territory Variance as a Percentage of Total Variance — Comprehensive (Contiguous)

North Carolina



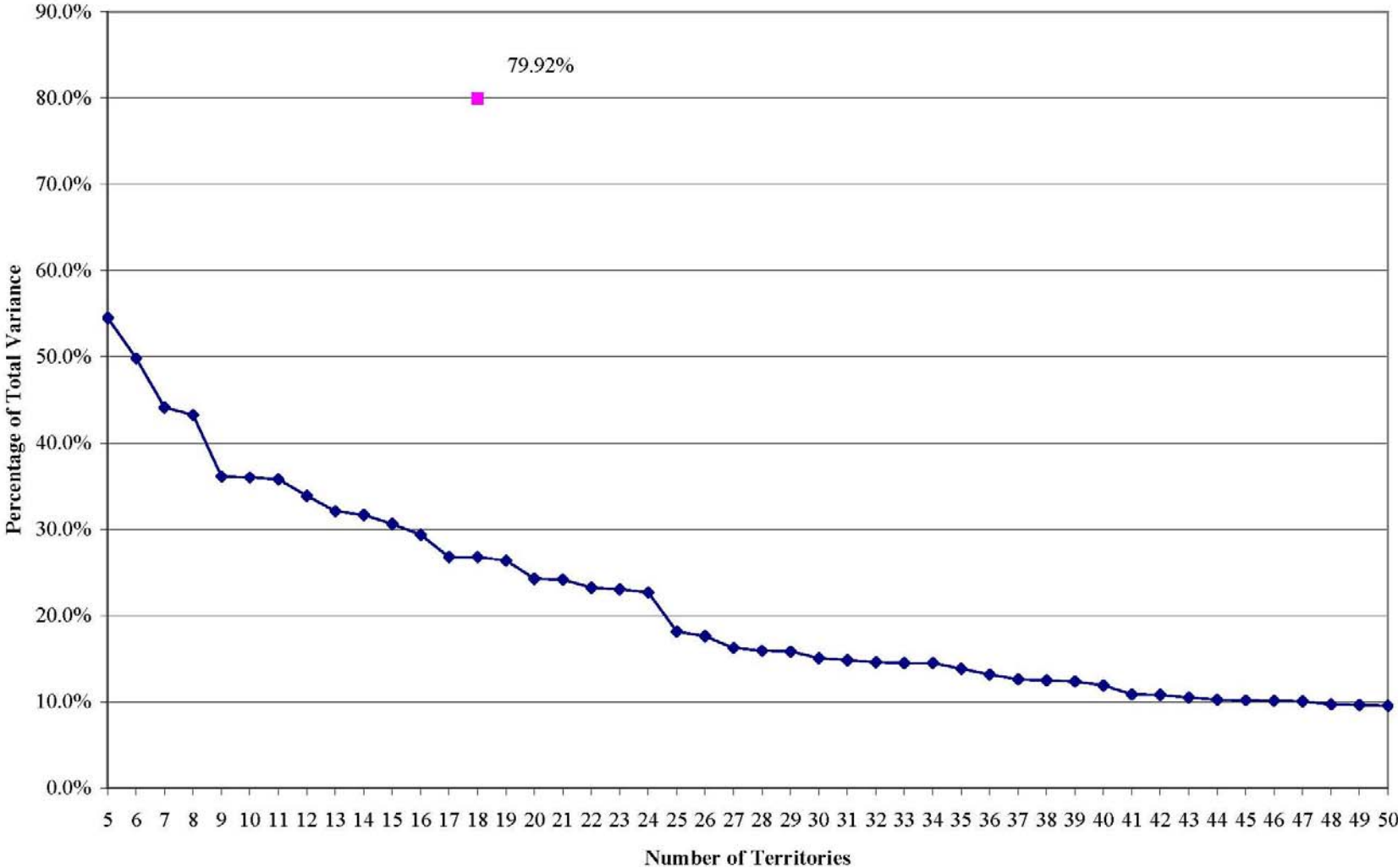
Indicated Auto Territories — Collision (Contiguous)

North Carolina



Within Territory Variance as a Percentage of Total Variance — Collision (Contiguous)

North Carolina



Stability and Implementation Considerations

Predictive Stability

- Choice of perils included in data
- Number of years of data

Implementation Considerations/Rating Stability

- Limit movement between zones
- Use of capping
- Use of confidence intervals to help analyze changes

Predictive Power and Stability

Predictive Power — Test #1

- 1993 – 1994 versus 1995 – 1996
- Correlation Coefficient
- Tested Boundaries Based on 1994 – 1996
- Non-Contiguous Better



Predictive Power — Test #2

- 1993 – 1995 versus 1994 – 1996
- Tested Boundaries Based on 1994 – 1996
- Within Variance Only Marginally Better for 1994 – 1996 Data

Stability

- 1993 – 1995 Clusters versus 1994 – 1996 Clusters
- Compared Indicated Boundaries and Relativities
- Little Dislocation