MAPPING UNCERTAINTY: ACS ESTIMATES AND MOE

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INTRODUCTION

- Prior to the 2010 Census the decennial censuses used what was known as the “short form” and the “long form.”
- The short form contains the basic 10 questions you all filled out last year.
- By contrast, the long form covered about 16.7% of the population, but it had the “good stuff”—income, education, work force, family arrangements, poverty
- The “long form” has been replaced by the American Community Survey (ACS).

INTRODUCTION

- The American Community Survey (ACS) is a small sample compared to the 100% coverage of the US Population in the decennial censuses.
- Being a relatively small sample, sampling variability is present and can result in consequential uncertainty of estimation of things like the “true value” of
  - median household income,
  - unemployment rate,
  - work force characteristics
  - commuting patterns
  - education, etc.

INTRODUCTION

- Because of its small size and uncertainty of estimates, it has became evermore important to present the error of estimates as well as the estimates.
- The problem is how to do this.
- So, consider for a moment the nature of the error of estimation.

ERROR OF ESTIMATION

- In Census parlance the error of estimation has been encapsulated with the term Measure of Error (MOE)
- The rest of the world probably knows this as the 90% confidence limits of the estimate.
- Whatever it is called, the general principle is the same: the larger the MOE, the lower the estimate's precision/reliability.
- And areas with smaller population tend to have larger standard errors of estimates (and MOEs)

ESTIMATE OF ERROR

- Ignoring the MOE could easily lead a data user to mistake sampling error for a trend, or to make the wrong interpretation of analysis results like the differences of means between two areas.
- State and local agencies could, for example, underestimate the population in poverty and lose funding for vital government services.
- Companies could misinterpret household income and fail to locate in a profitable area.

ESTIMATE OF ERROR

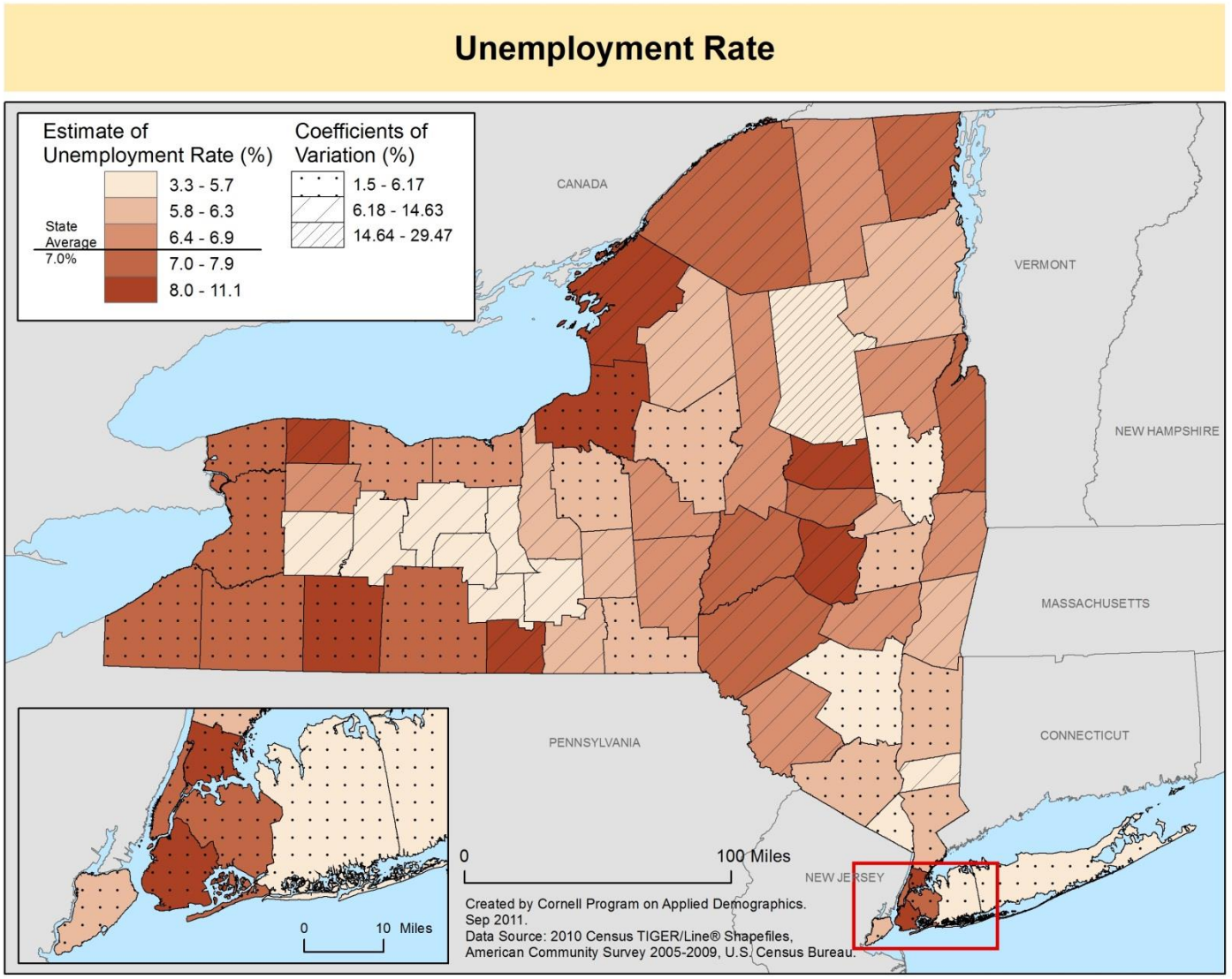
- There are also various choices the spatial analyst/cartographer can make as to how to present this combination of information.
- For static maps a common approach is to cast the error into a "percentage of the estimate," namely the coefficient of variation*100.

$$\left(\frac{\text{standard error of estimate}}{\text{estimates}} \right) \times 100$$

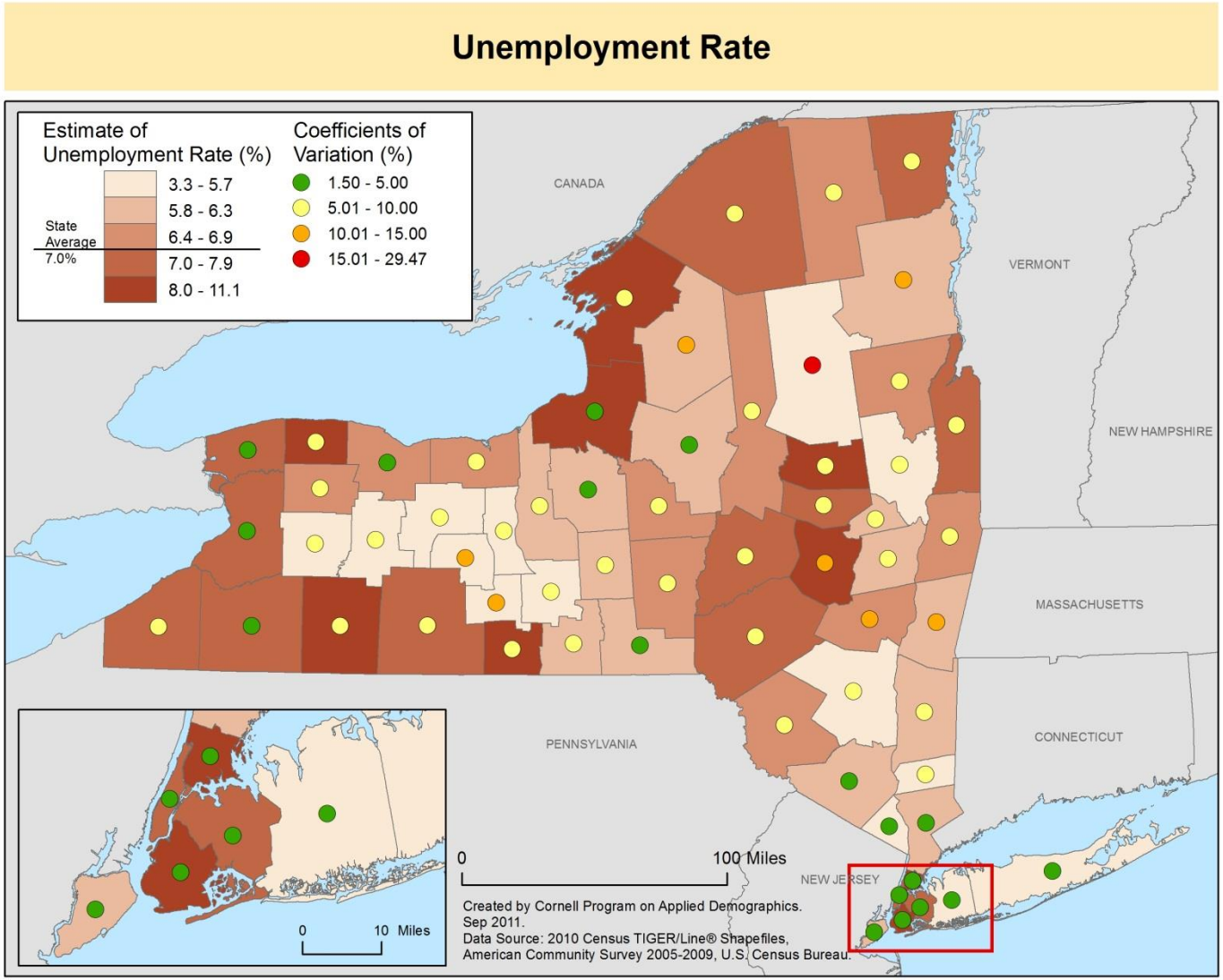
PORTRAYING UNCERTAINTY

- Using this approach, one can create a layer of different symbolic representations for error and then overlay it on a choropleth (thematic) map of estimates.
- On the following maps we show several attempts at visualizing, simultaneously, both an estimate of some variable and the unreliability of that estimate.
- The ideas is that this gives the user more information leading to better decision making.

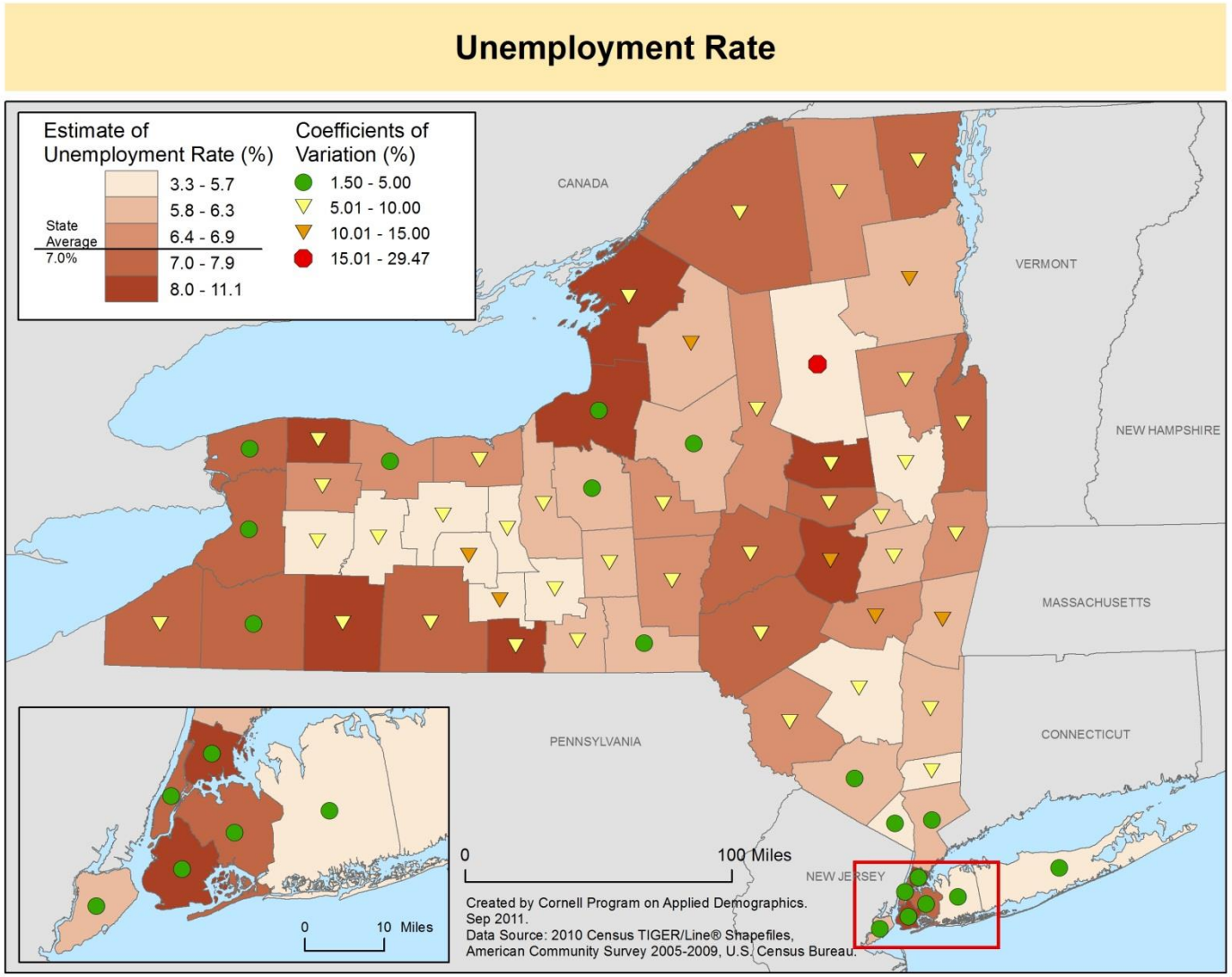
CROSS-HATCH & DOT APPROACH



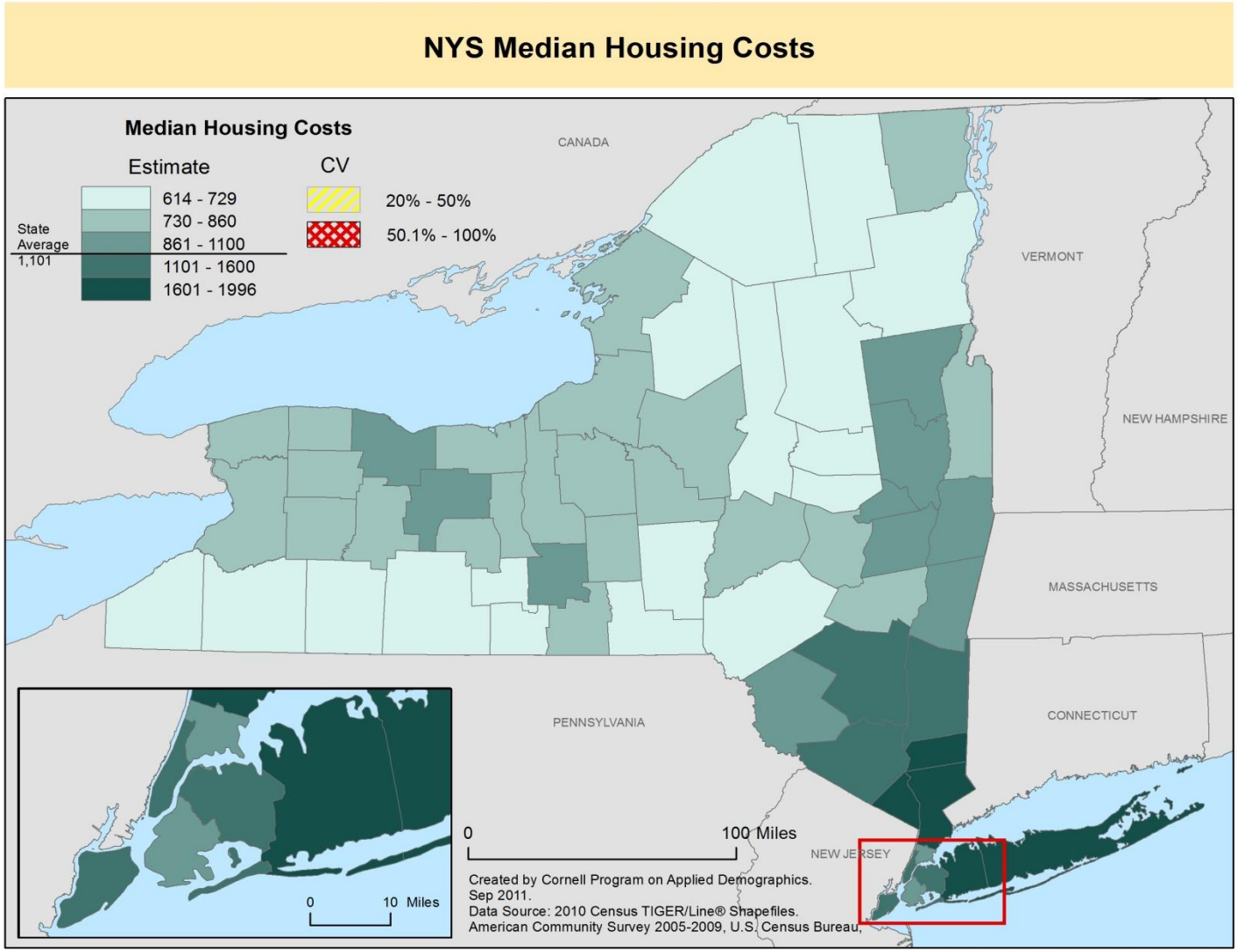
COLORED CIRCLES APPROACH



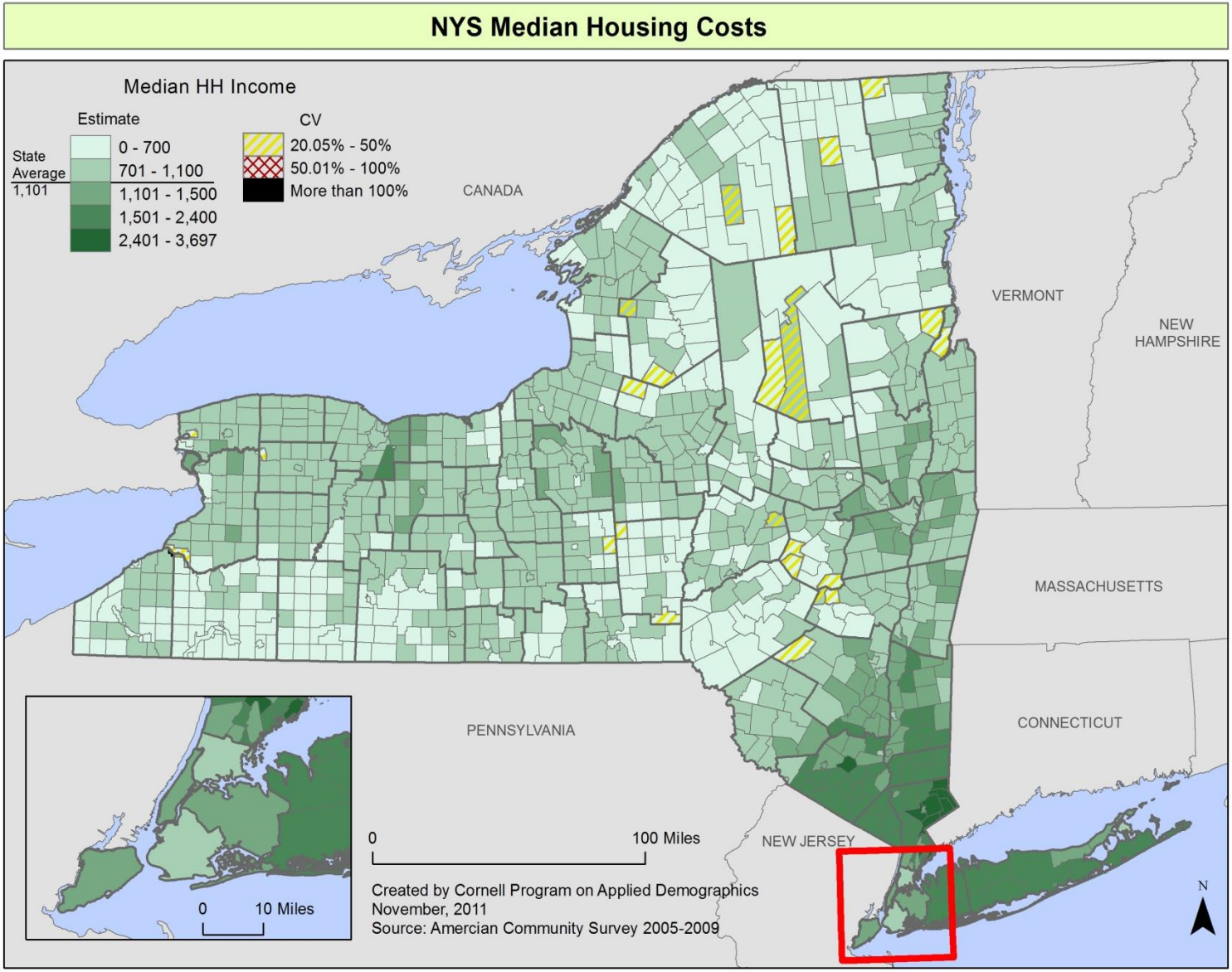
COLORED ICONS APPROACH



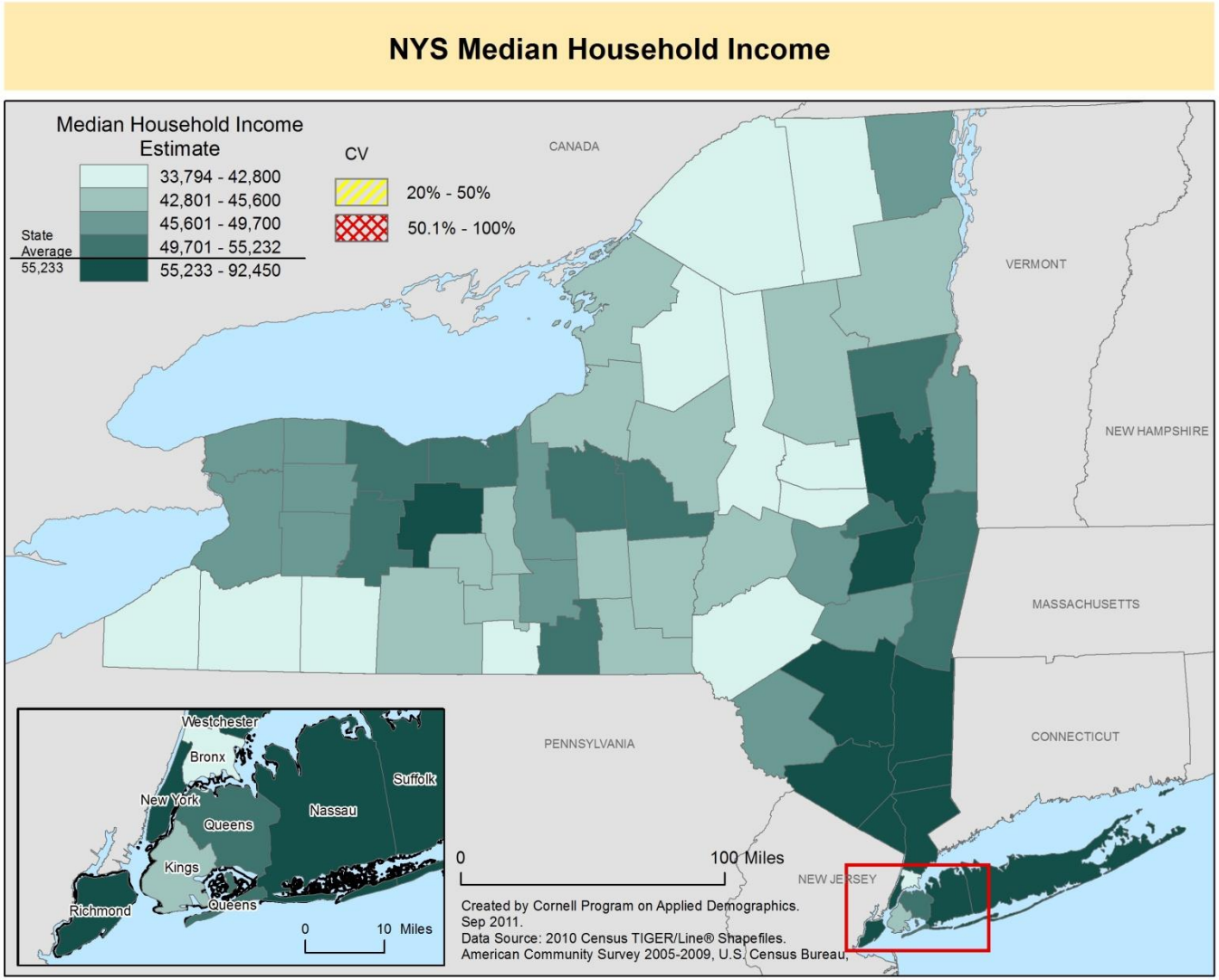
CROSS-HATCHED COUNTY APPROACH



CROSS-HATCHED SUBCOUNTY APPROACH



CROSS-HATCHED SUBCOUNTY APPROACH



CROSS-HATCHED SUBCOUNTY APPROACH