West Nile Virus Activity in the United States

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Outline

- Descriptive epidemiology

- Temporal and geographic trends

- West Nile fever reporting

- Bird and mosquito surveillance

- Changes to ArboNET in 2008

Data Reported to ArboNET

- Ecologic
  - Mosquitoes, birds, other animals

- Human cases
  - West Nile neuroinvasive disease (WNND)
    - Encephalitis, meningitis, acute flaccid paralysis
  - West Nile fever (WNF)
  - Other clinical illnesses

- Data presented current as of February 5, 2008

Reported WNV Disease Cases
US, 1999-2007

- 27,337 cases from 1,824 counties in 47 states and DC

  - 11,020 (40%) WNND

  - 15,685 (58%) WNF

  - 632 (2%) other clinical illness

- 1,060 (4%) fatal cases

Demographics of Reported WNV Disease Cases by Clinical Syndrome, US, 2002-2007

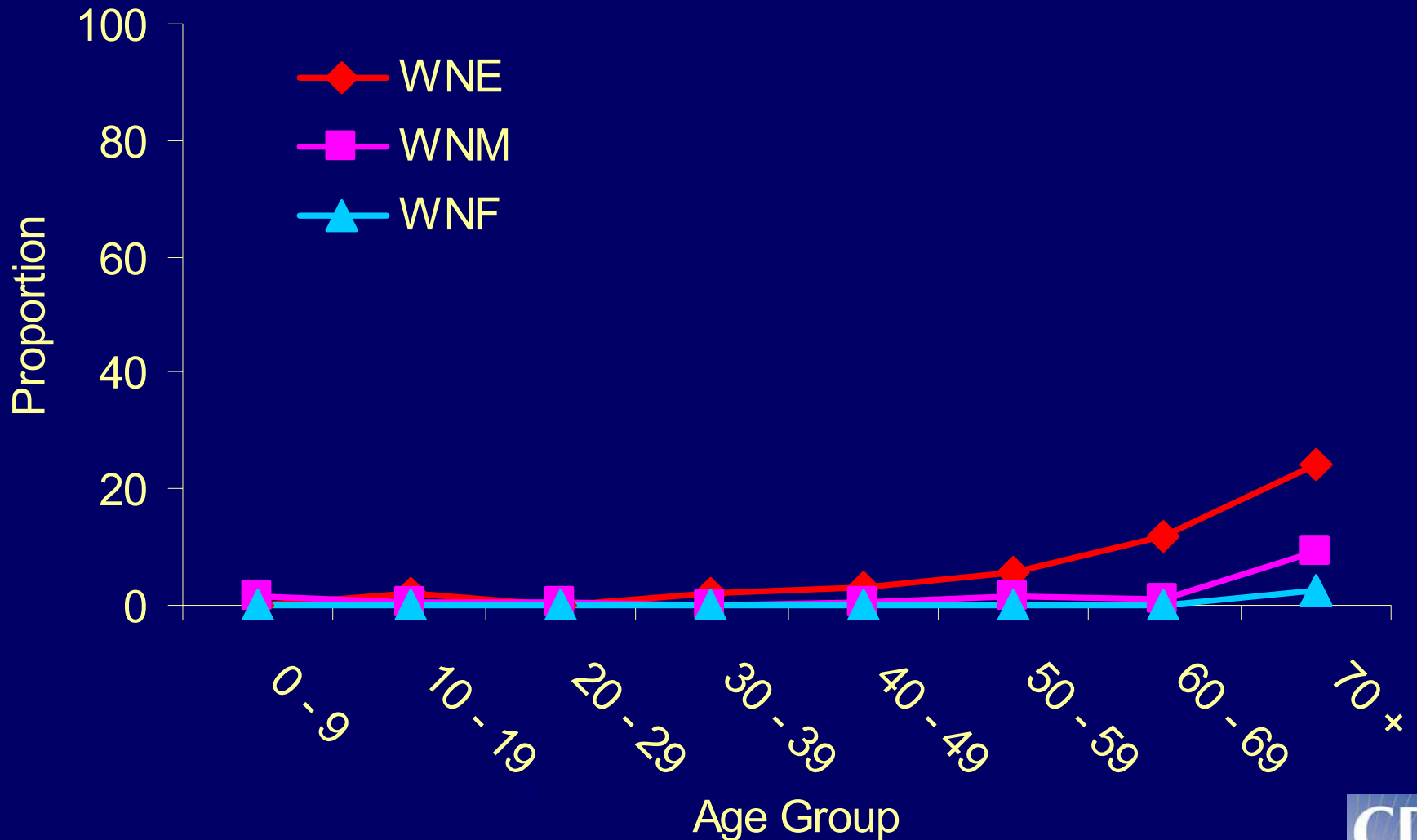|	Encephalitis	Meningitis	Fever
N	5,454	3,682	15,678
Median Age	65 yr	47 yr	47 yr
Males	60%	55%	52%
Hospitalization	88%	80%	20%
Case fatality	13%	2%	0.3%

WNV Disease Incidence, by Age Group and Syndrome, US, 2002-2007
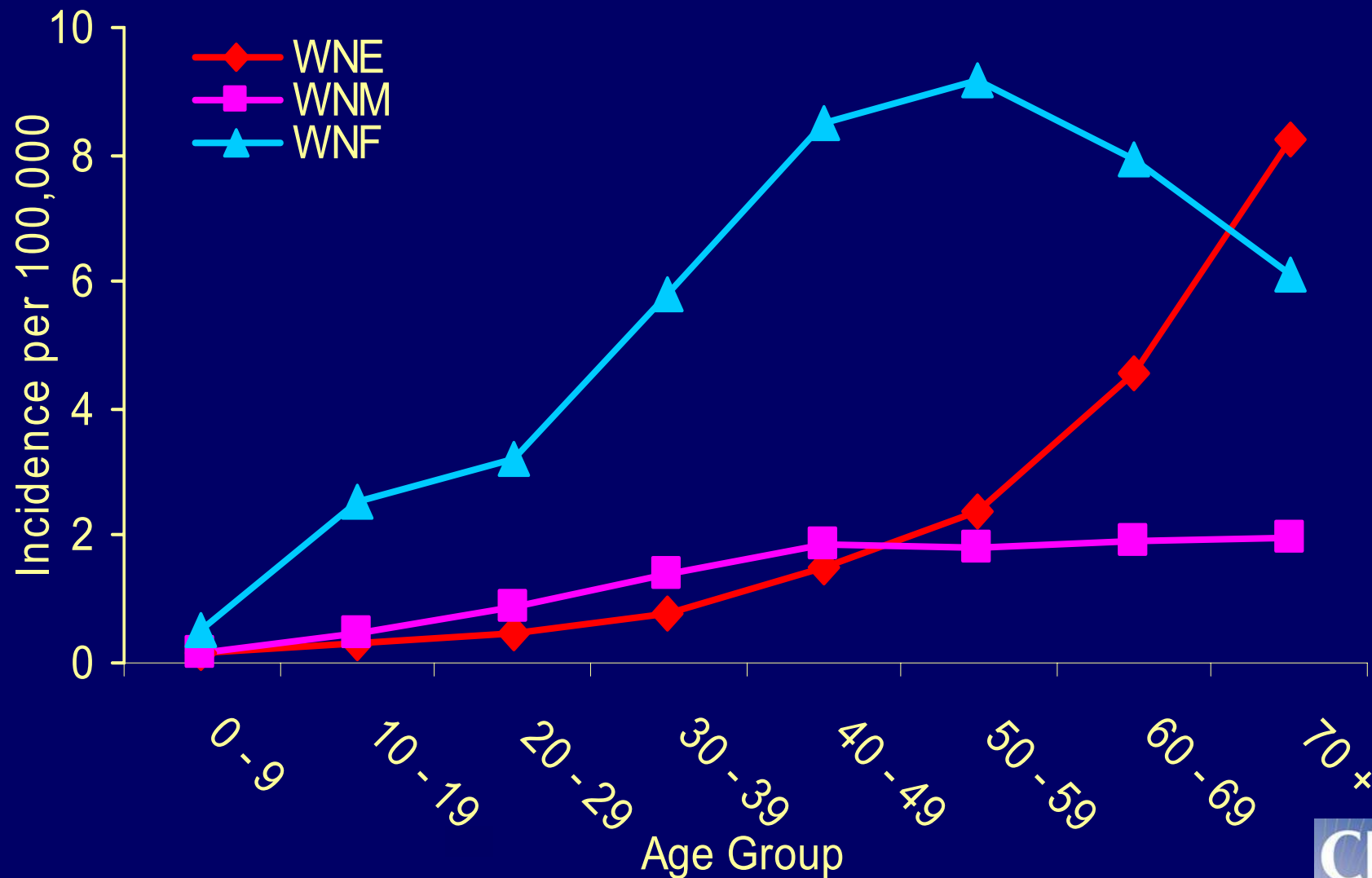
Proportion of Cases Hospitalized by Age Group and Syndrome, US, 2002-2007
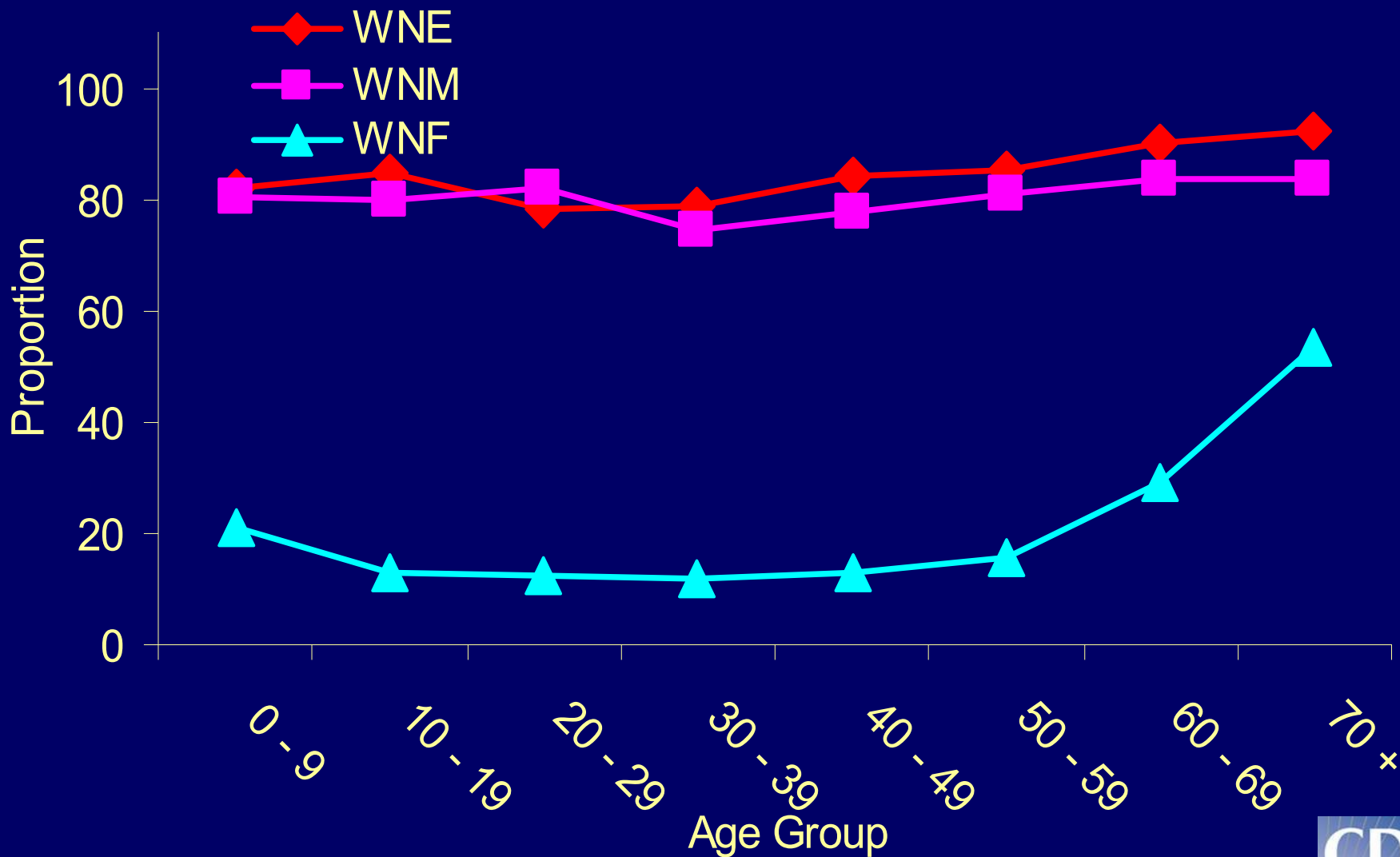
Proportion of Cases Resulting in Death by Age Group and Syndrome, US, 2002-2007
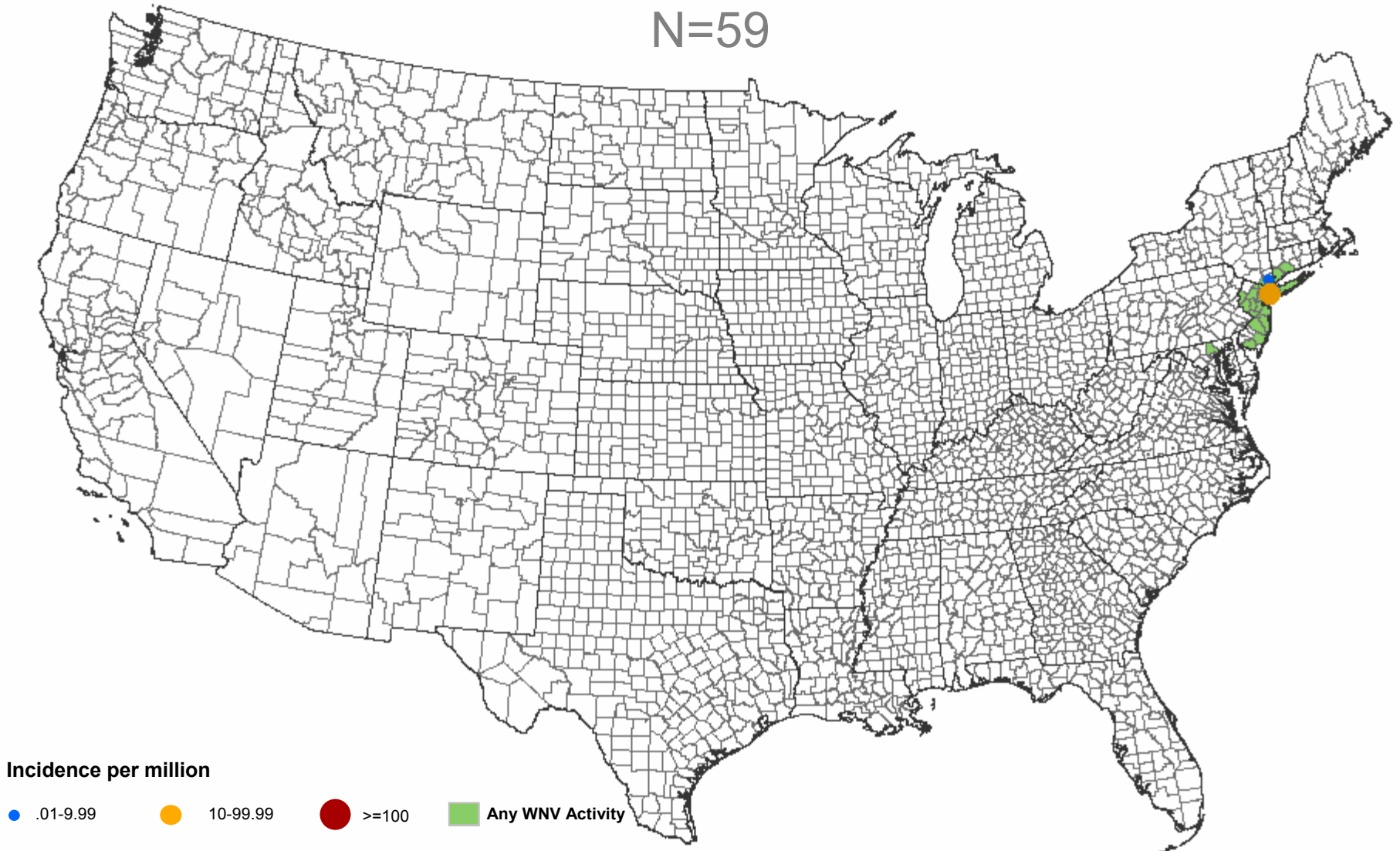
Limitations of West Nile Fever Data

- Representativeness of fever cases reported to ArboNET is unknown

  - Reported cases may be more severe

- Reporting has varied by jurisdiction and over time.

  - Use neuroinvasive disease cases to describe geographic and temporal patterns

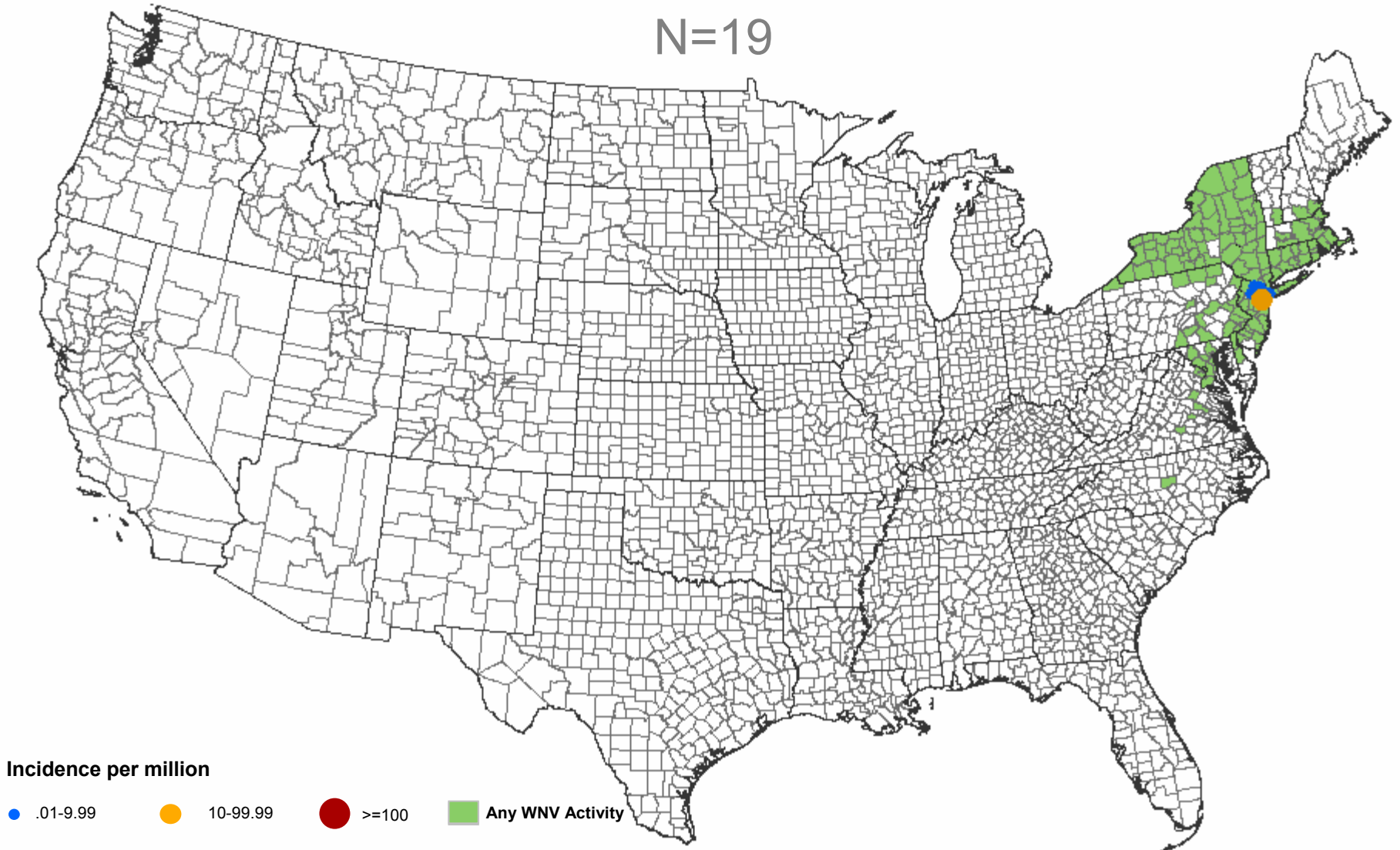CDC

WNV Neuroinvasive Disease Cases and Deaths, US, 1999-2007
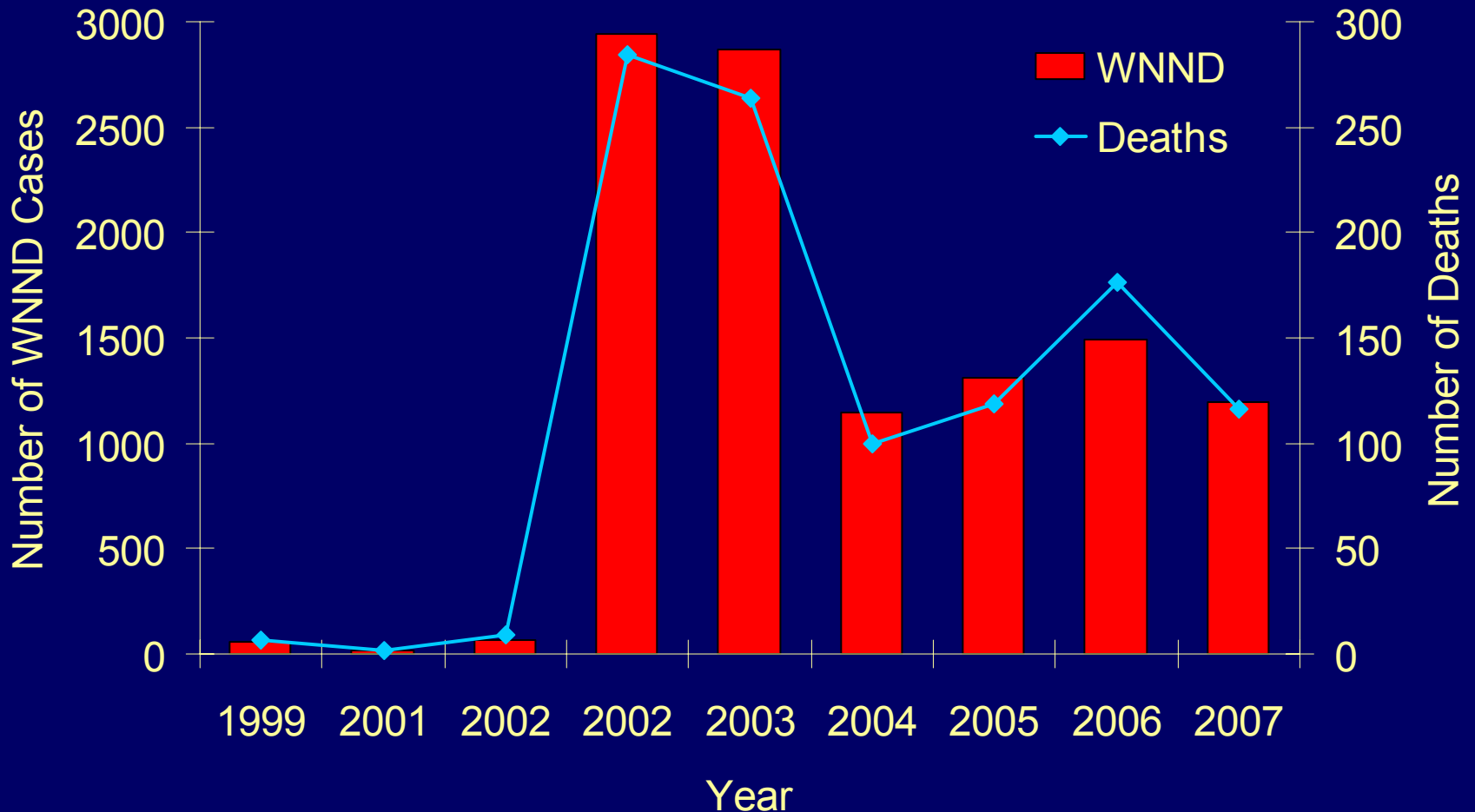
WNV Neuroinvasive Disease Incidence, by County, US, 1999

N=59

Incidence per million

● .01-9.99   ● 10-99.99   ● >=100   ▮ **Any WNV Activity**

WNV Neuroinvasive Disease Incidence, by County, US, 2000

N=19

Incidence per million

● .01-9.99 ● 10-99.99 ● >=100 ▣ **Any WNV Activity**

WNV Neuroinvasive Disease Incidence, by County, US, 2001

N=64

Incidence per million

- .01-9.99
- 10-99.99
- >=100
- Any WNV Activity
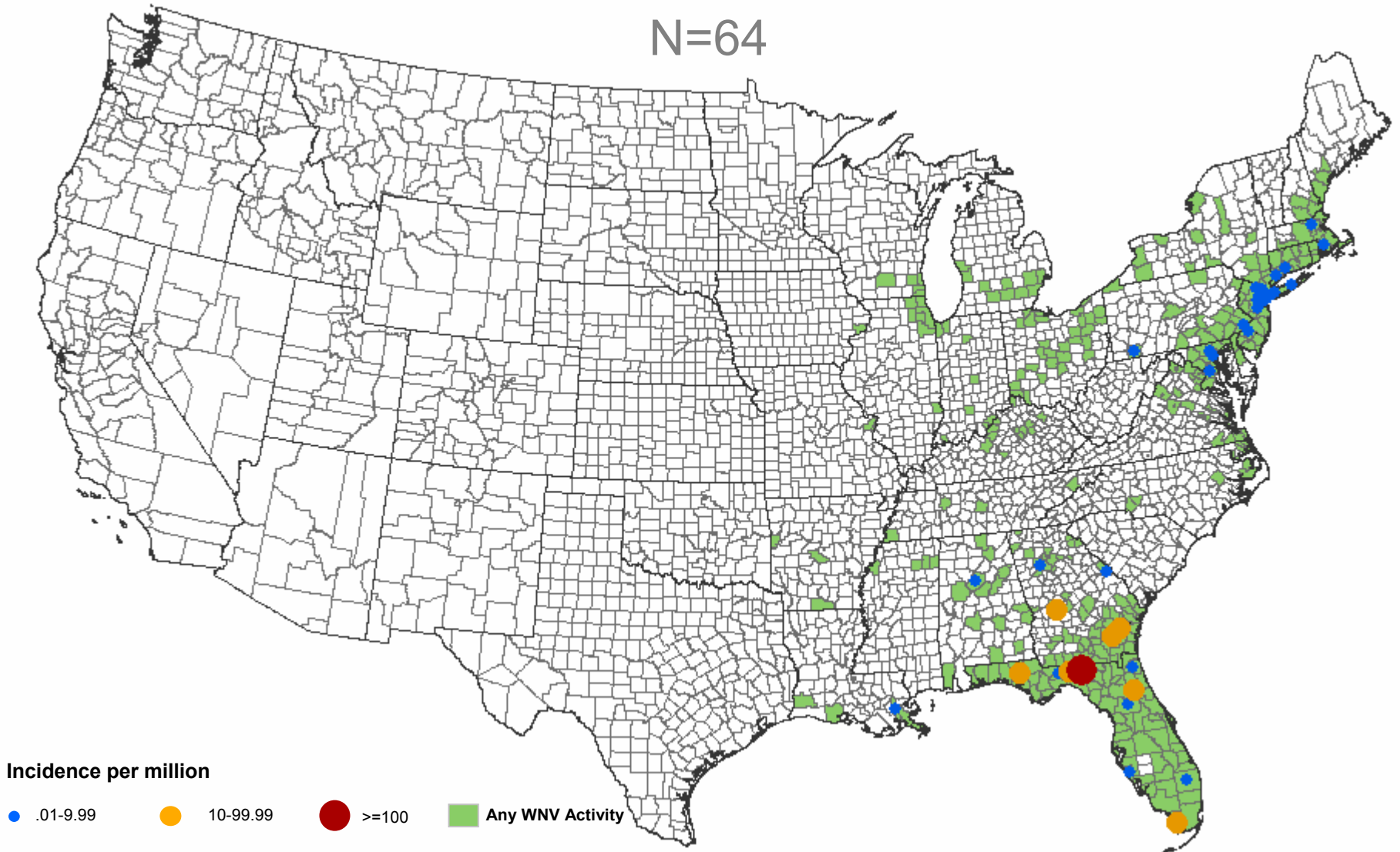
WNV Neuroinvasive Disease Incidence, by County, US, 2002

N=2,946

Incidence per million

● .01-9.99 ● 10-99.99 ● >=100 ▰ Any WNV Activity
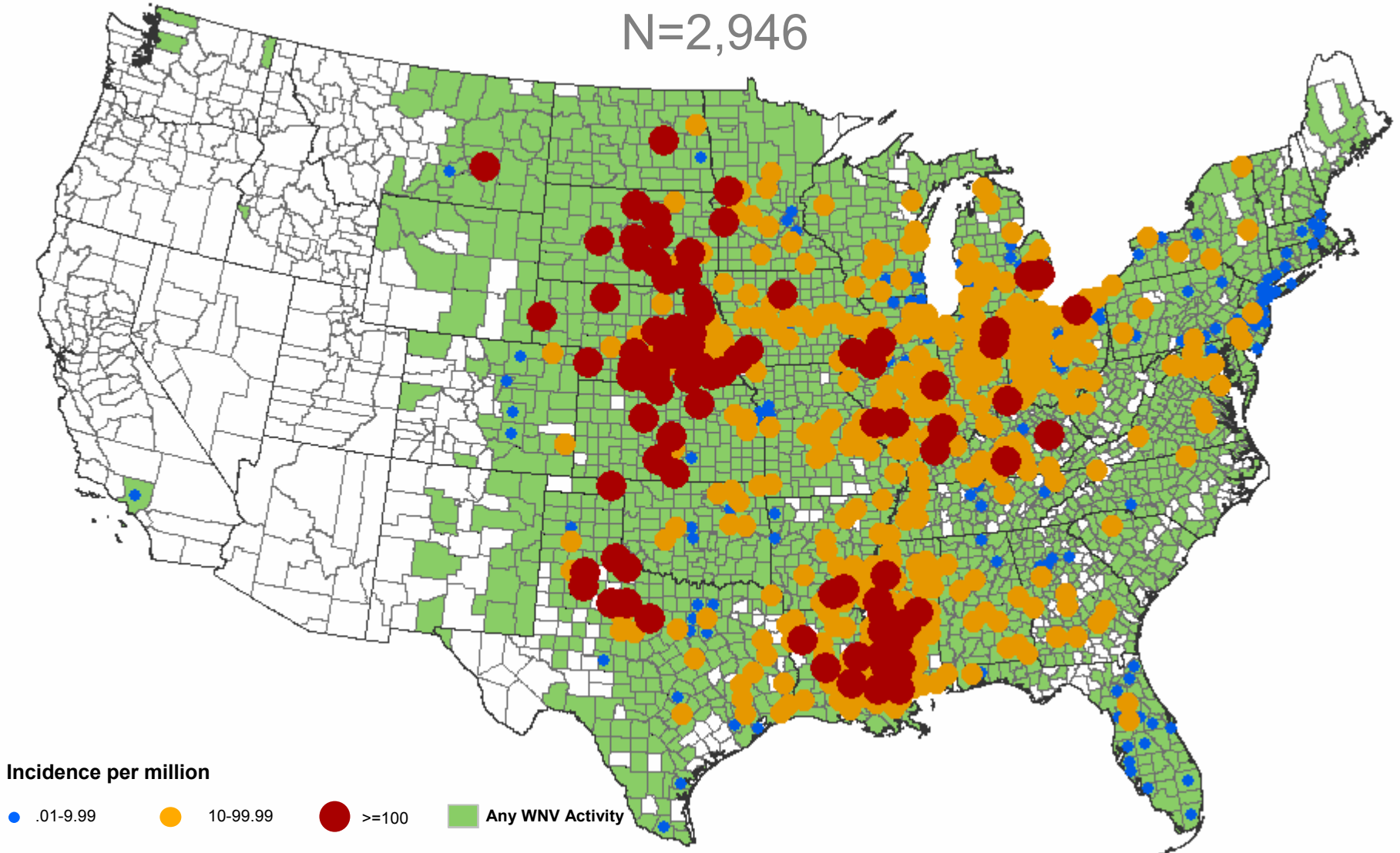
WNV Neuroinvasive Disease Incidence, by County, US, 2003

N=2,866

Incidence per million

- • .01-9.99
- • 10-99.99
- • >=100
- ▮ Any WNV Activity
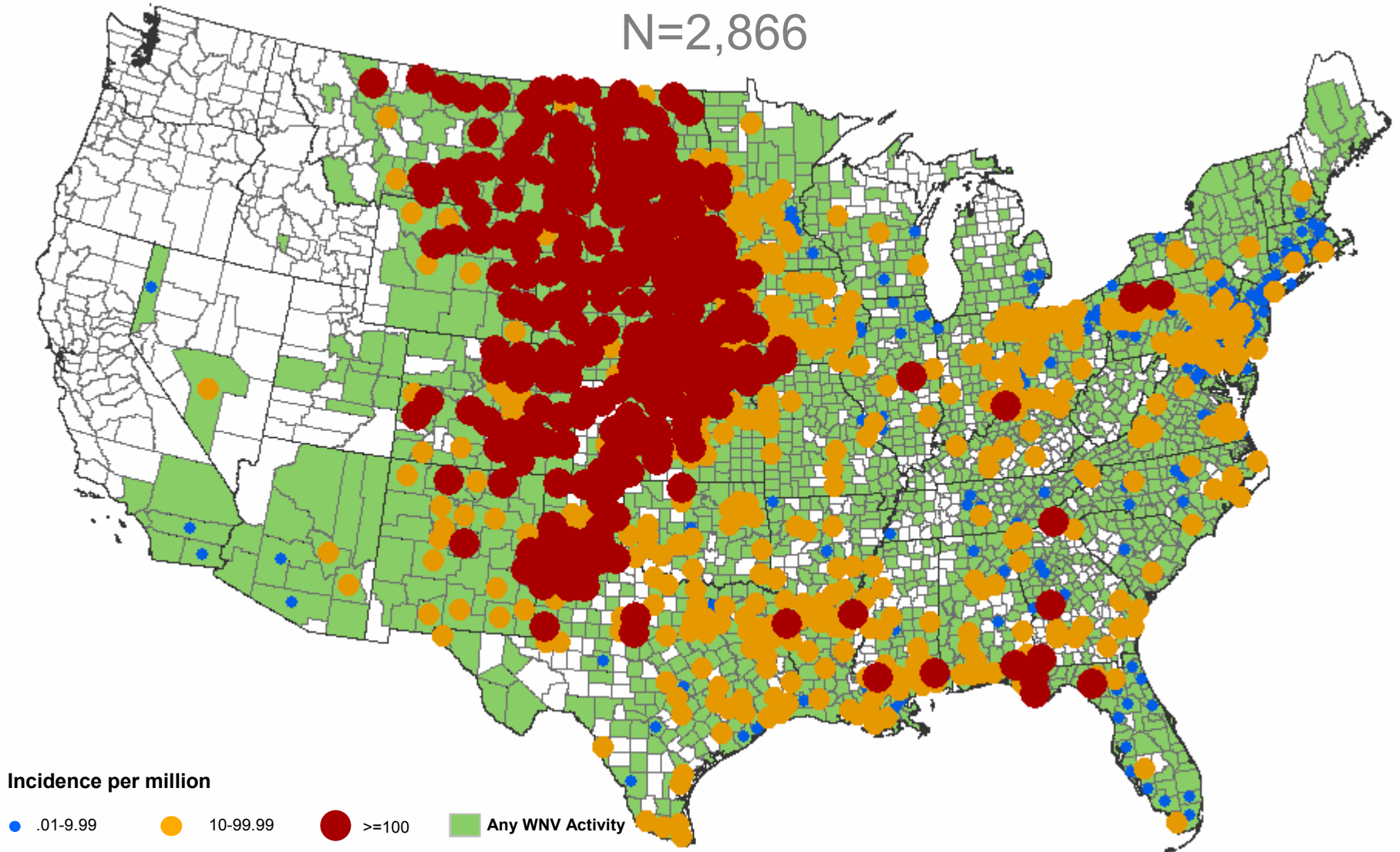
WNV Neuroinvasive Disease Incidence, by County, US, 2004

N=1,148

Incidence per million

- ● .01-9.99
- ● 10-99.99
- ● >=100
- ■ Any WNV Activity
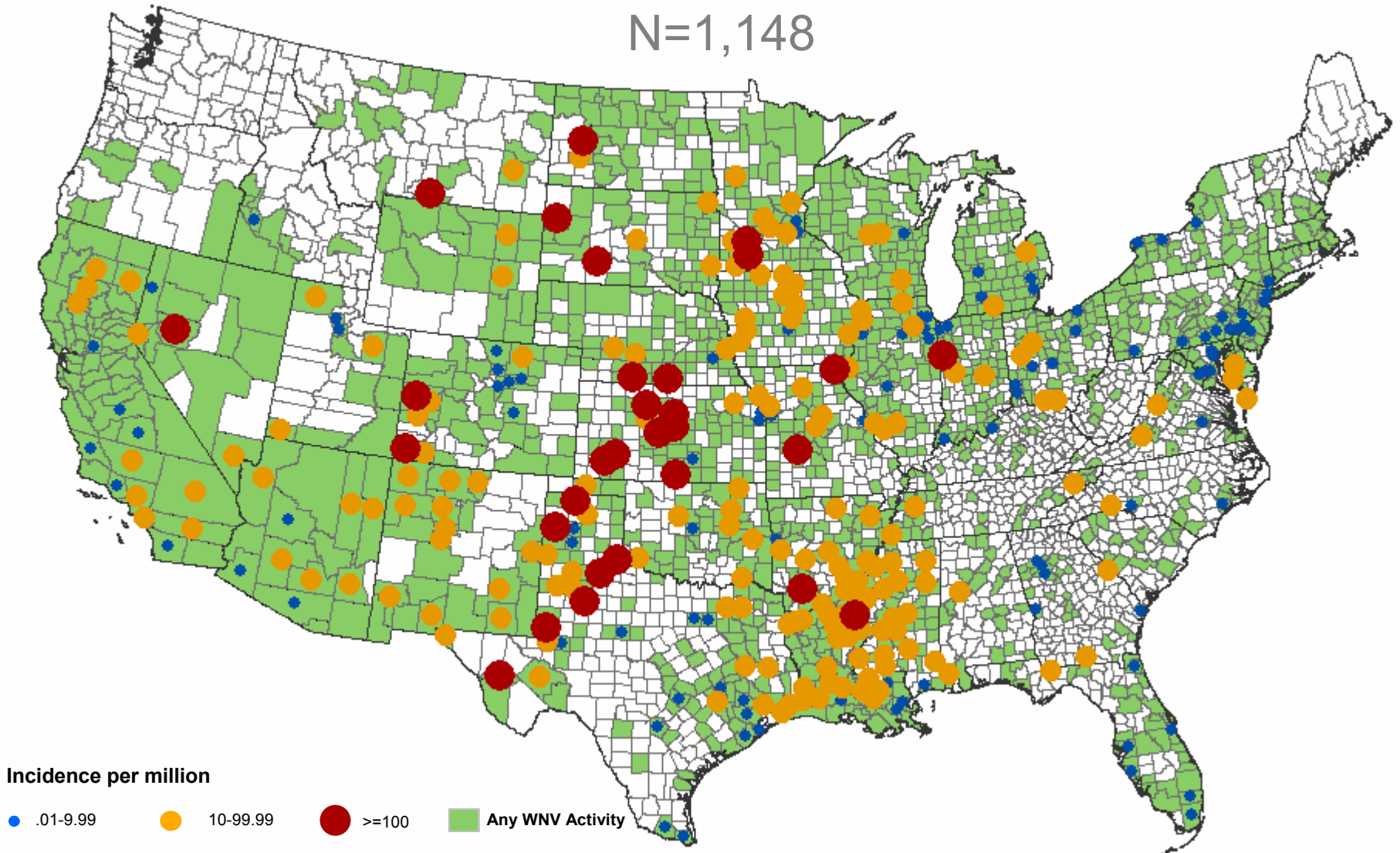
WNV Neuroinvasive Disease Incidence, by County, US, 2005

N=1,309

Incidence per million

- ● .01-9.99
- ● 10-99.99
- ● >=100
- ▇ **Any WNV Activity**
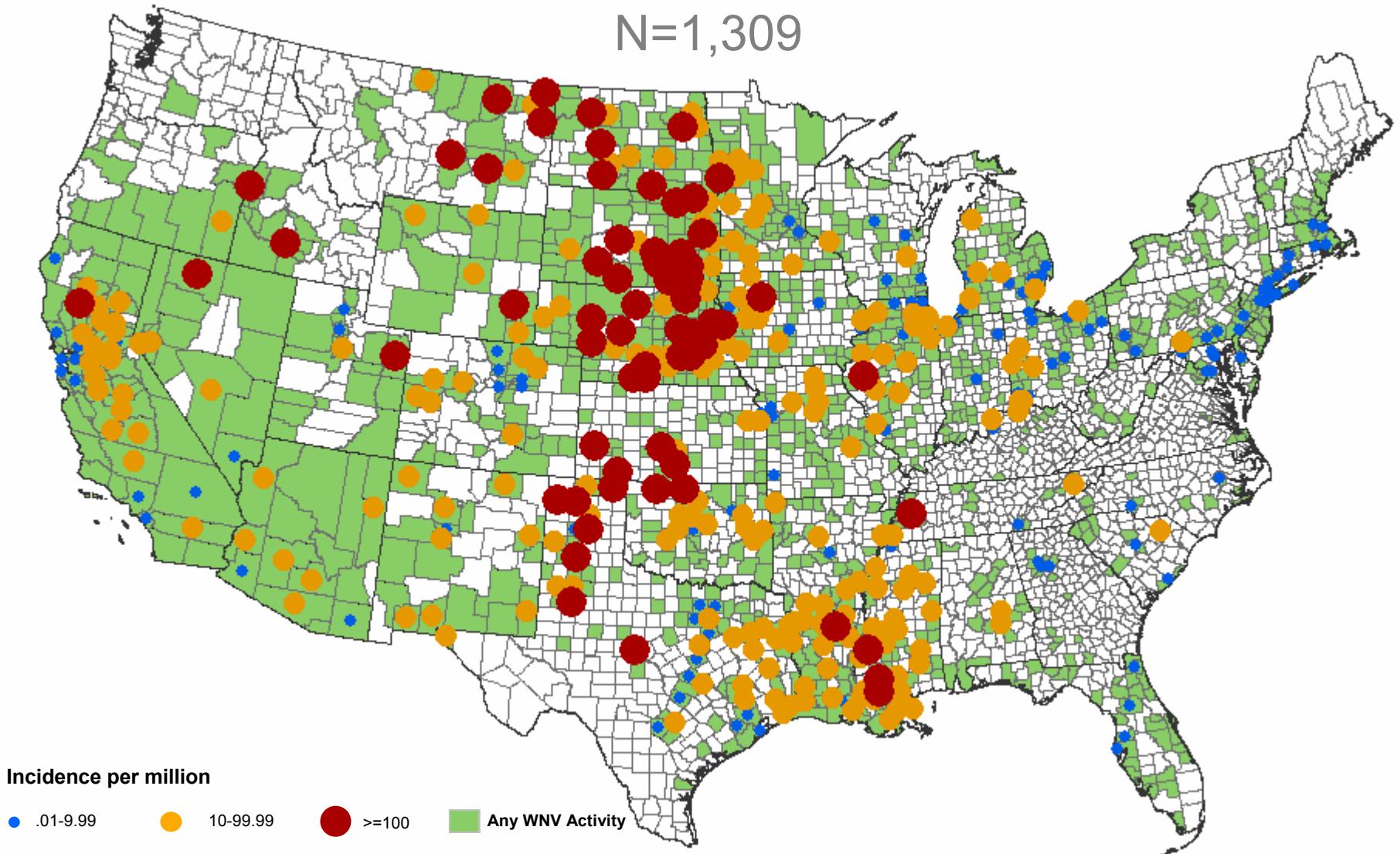
WNV Neuroinvasive Disease Incidence, by County, US, 2006

N=1,459

Incidence per million

● .01-9.99 ● 10-99.99 ● >=100 ▇ Any WNV Activity

WNV Neuroinvasive Disease Incidence, by County, US, 2007

N=1,195

Incidence per million

- ● .01-9.99
- ● 10-99.99
- ● >=100
- ▮ Any WNV Activity
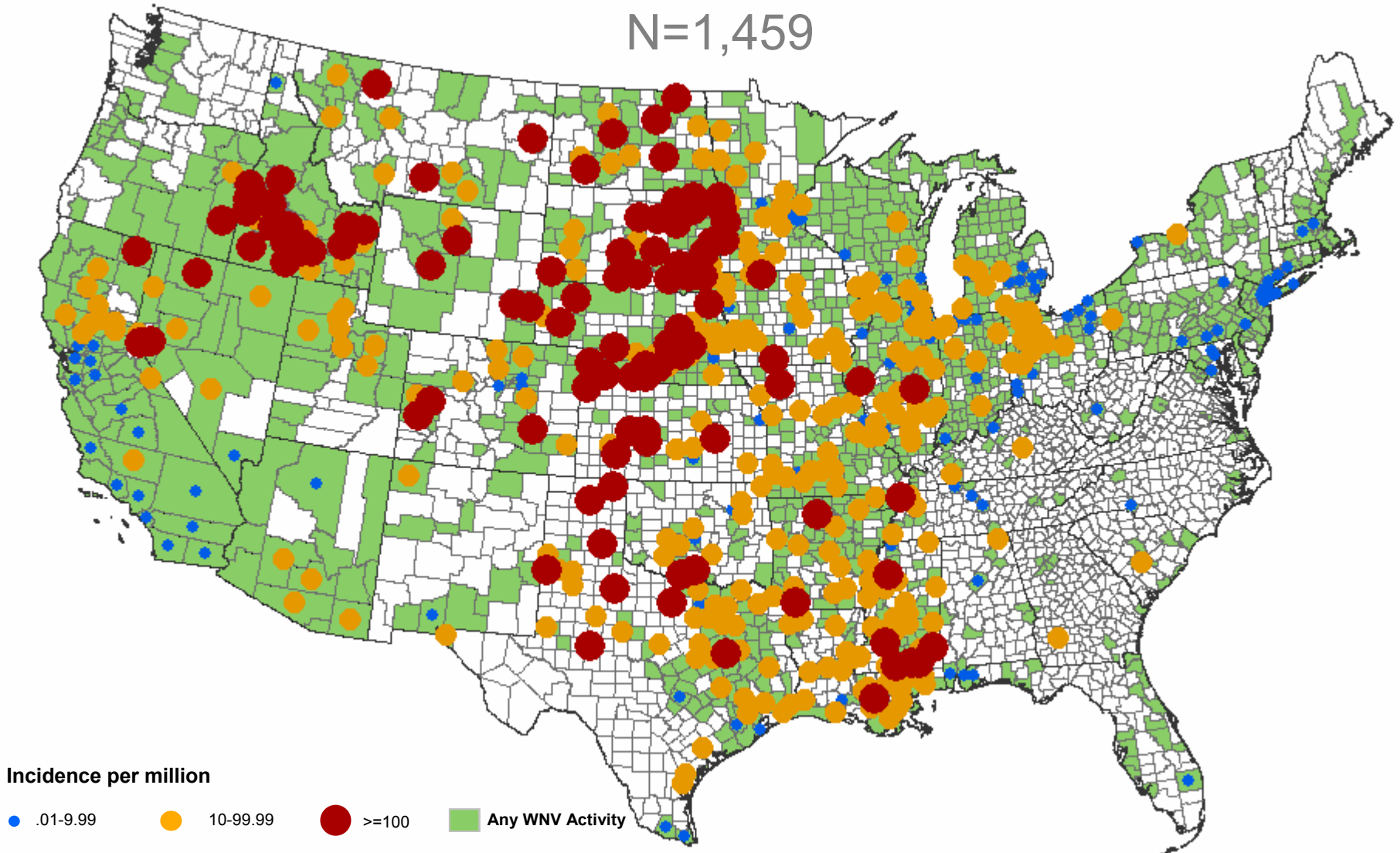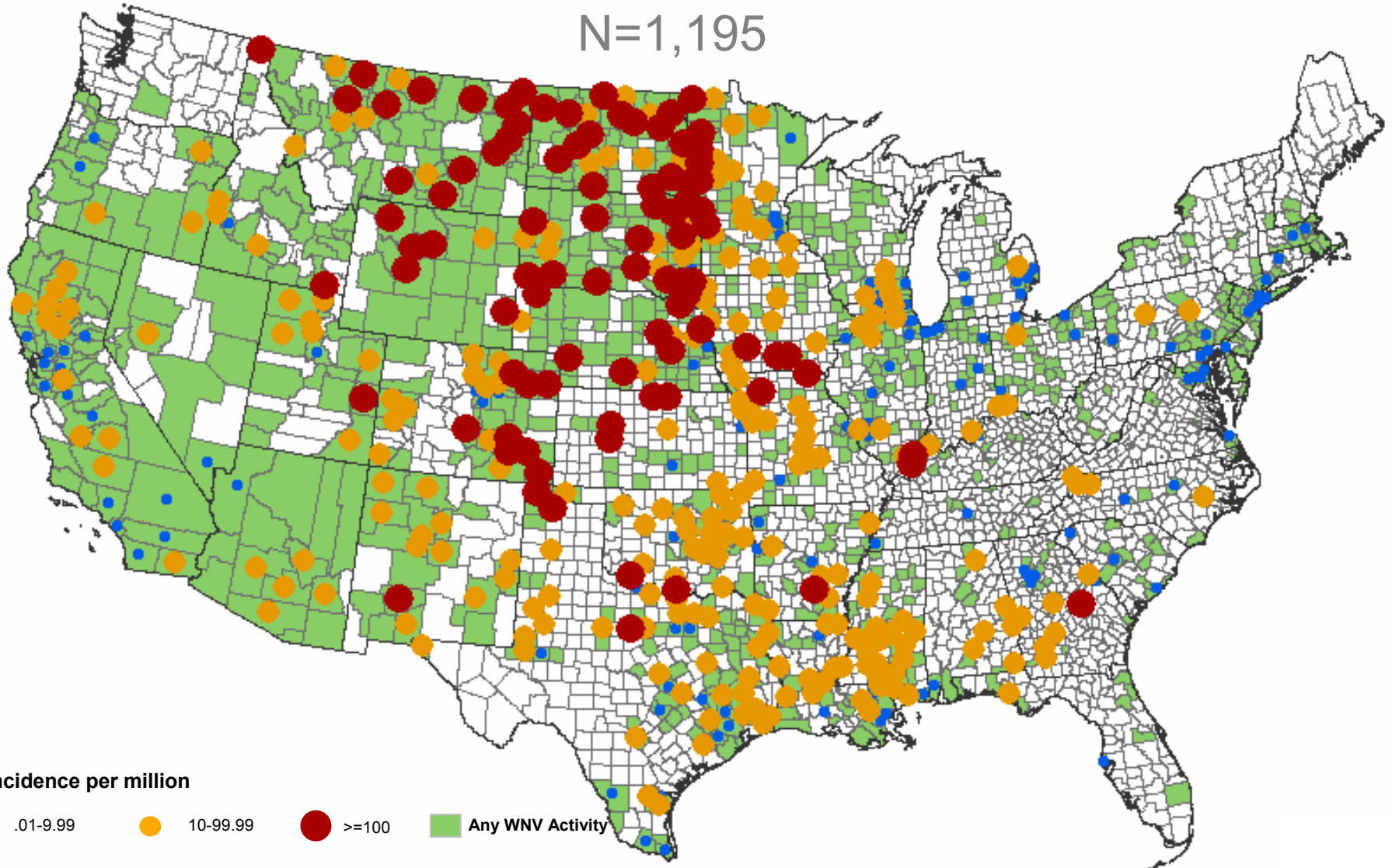
Cumulative WNV Neuroinvasive Disease Incidence, by County, US, 1999-2007

Cumulative Incidence per 100,000 population

- 0.1 - 9.9
- 10.0 - 24.9
- 25.0 - 49.9
- 50.0 - 99.9
- 100.0 - 309.6
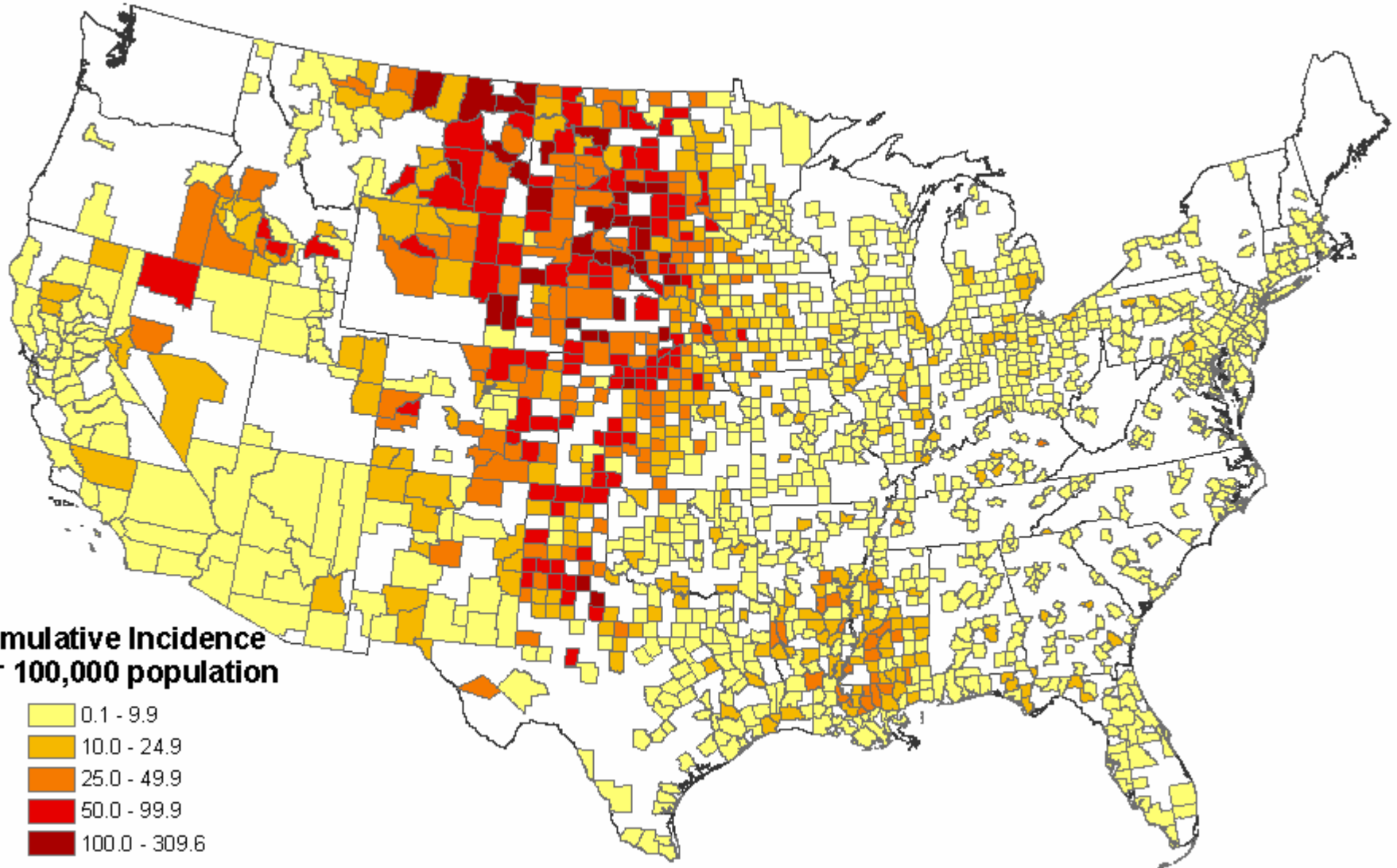
WNV Acute Flaccid Paralysis (AFP), US, 2004-2007

	AFP with encephalitis	AFP without encephalitis
N (%)	149 (56)	118 (44)
Median age (range)	59 (7-94 yr)	50 (1-87 yr)
Deaths (%)	25 (17)	7 (6)

Preliminary Evaluations of ArboNET Data

- How variable is West Nile fever reporting?

- Given the variation, what is the utility of fever data?

- What is the predictive value of bird and mosquito data reported to ArboNET?

CDC

Preliminary Evaluations of ArboNET Data

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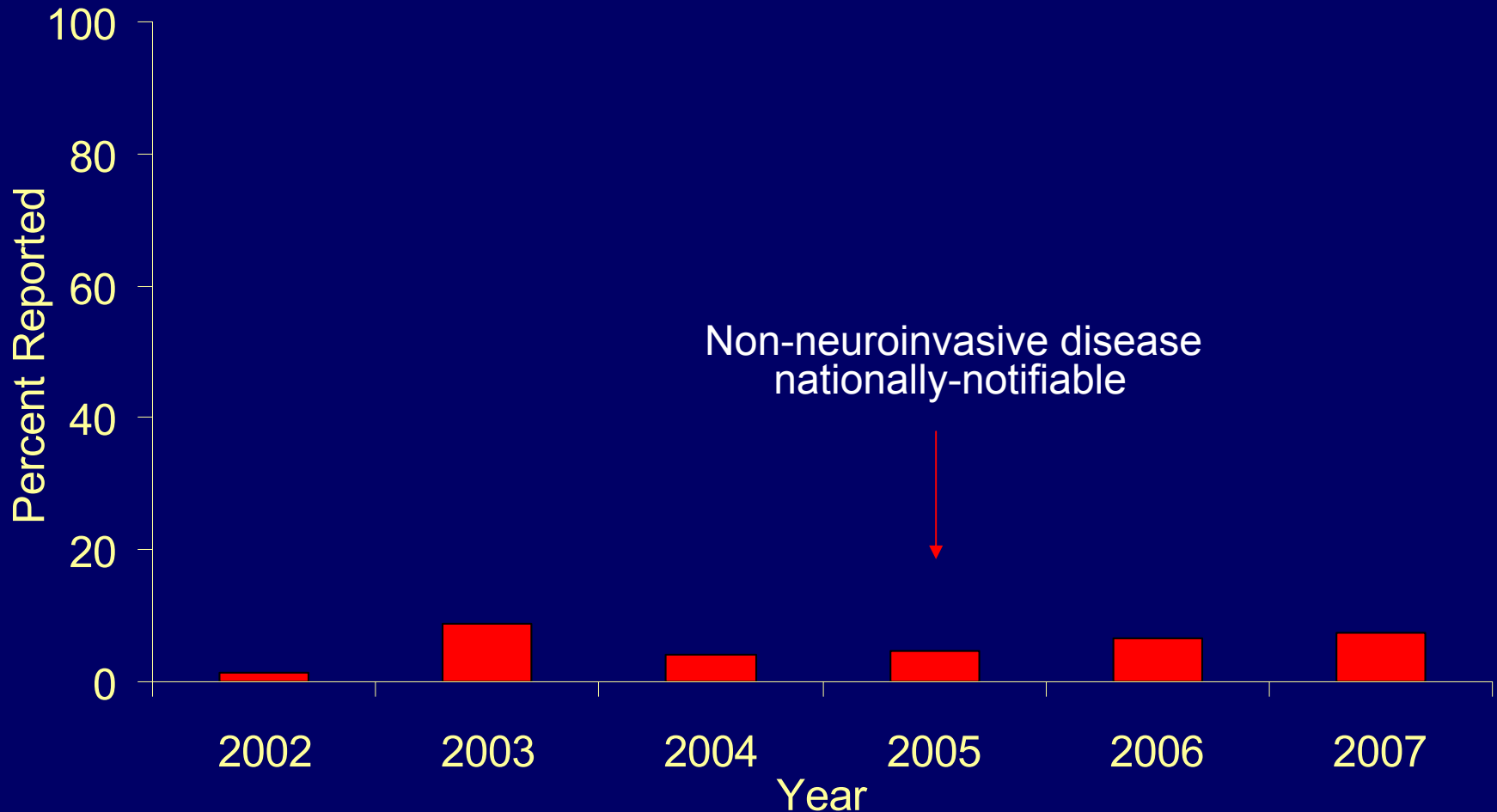
CDC

Assessing Variations in Reporting of West Nile Fever, US, 2002-2007

- Determined proportion of estimated WNF cases that were reported by year and by state

- Serosurvey conducted in 1999 estimated 28 fever cases occur for every diagnosed neuroinvasive case.

- Estimate of WNF cases that occurred
  - 10,878 WNND x 28 = 304,584 estimated WNF

- 15,678 WNF cases reported
  - 15,678/ 304,584 = **~ 5%**

Proportion of Estimated West Nile Fever Cases Reported by Year, US, 2002-2007

Percent of Estimated West Nile Fever Cases Reported by State, US, 2002-2007

Proportion of Estimated WNF Cases That Were Reported

- <3 %
- 3 - 5 %
- 6 - 10 %
- >10 %
- No estimate of WNF cases

Preliminary Evaluations of ArboNET Data

- How variable is West Nile fever reporting?

- **Given the variation, what is the utility of fever data?**

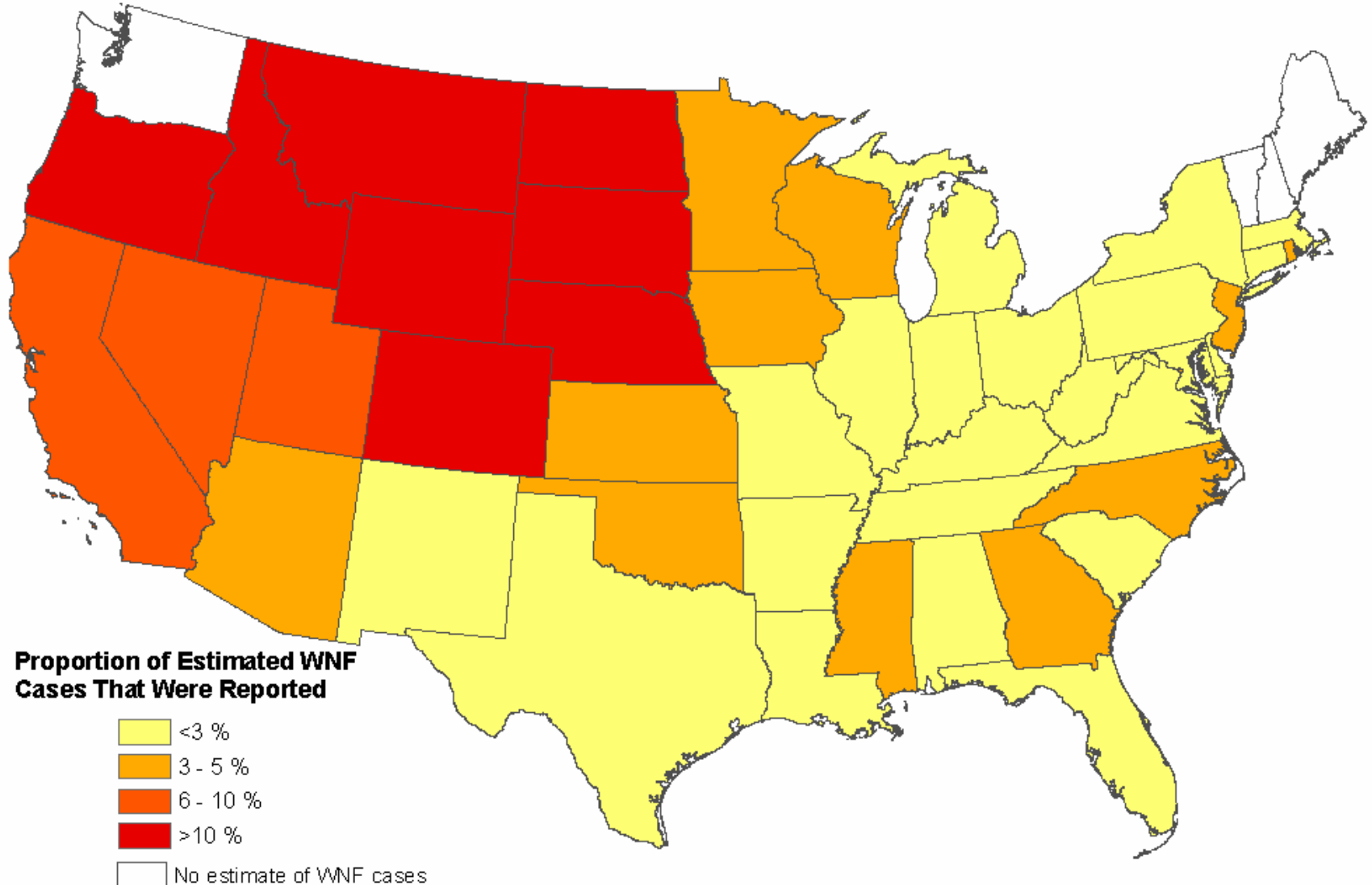- What is the predictive value of bird and mosquito data reported to ArboNET?

CDC

Assessing Utility of Reported West Nile Fever Data, US, 2002-2007

- Does WNF reporting give us a more complete representation of the geographic range of WNV disease in humans?

- How many counties reported any case of human WNV each year?

- How many of those reported only West Nile fever cases?

CDC

Counties Reporting Only West Nile Fever Cases by Year, US, 2002-2007

	Counties reporting any human WNV	Percent reporting only fever cases
2002	737	20%
2003	1077	26%
2004	520	40%
2005	625	35%
2006	722	31%
2007	725	39%
Average	**734**	**32%**

Counties Reporting West Nile Neuroinvasive Disease, US, 2007

West Nile Neuroinvasive Disease Cases
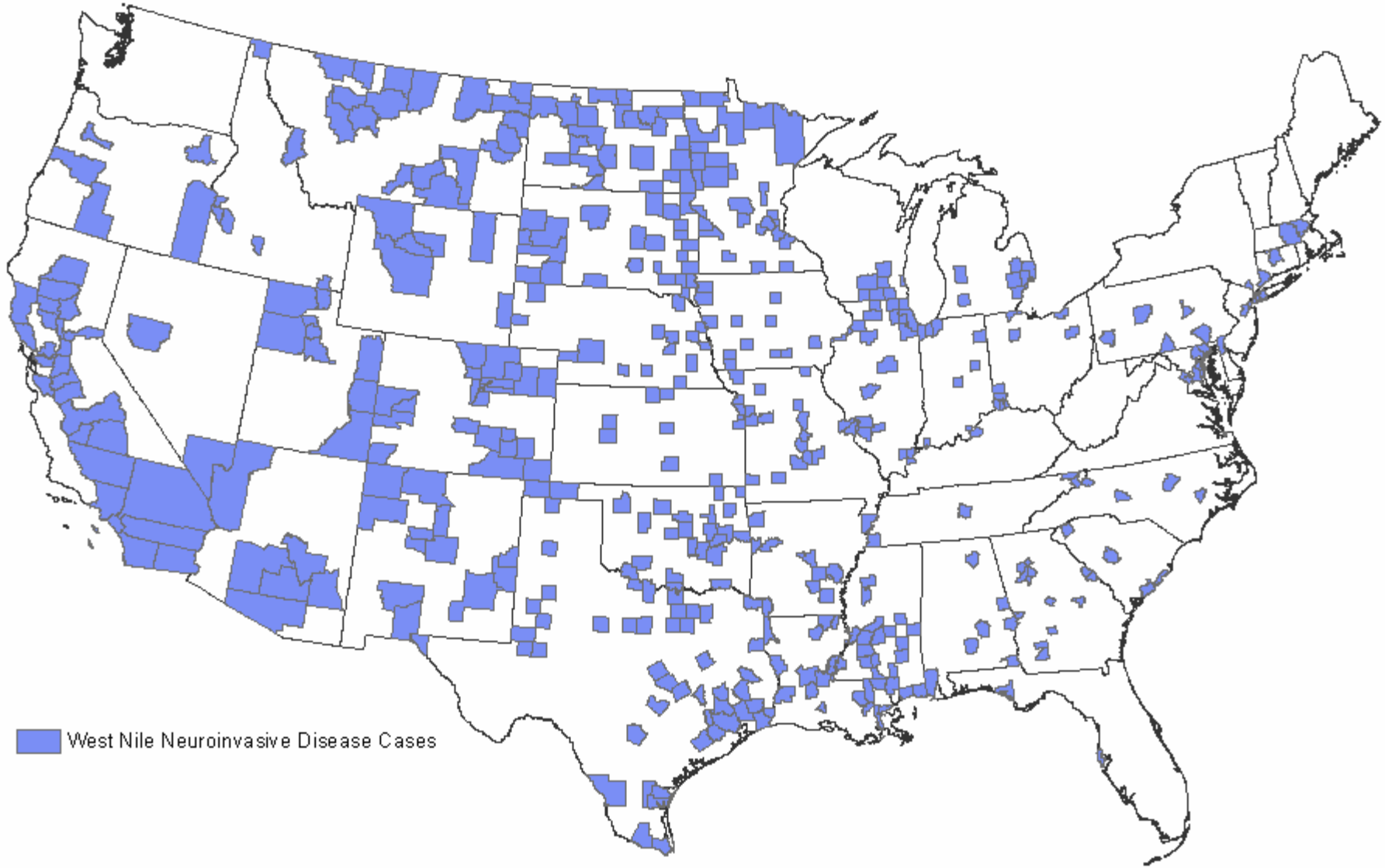
Counties Reporting Any Human West Nile Disease, US, 2007
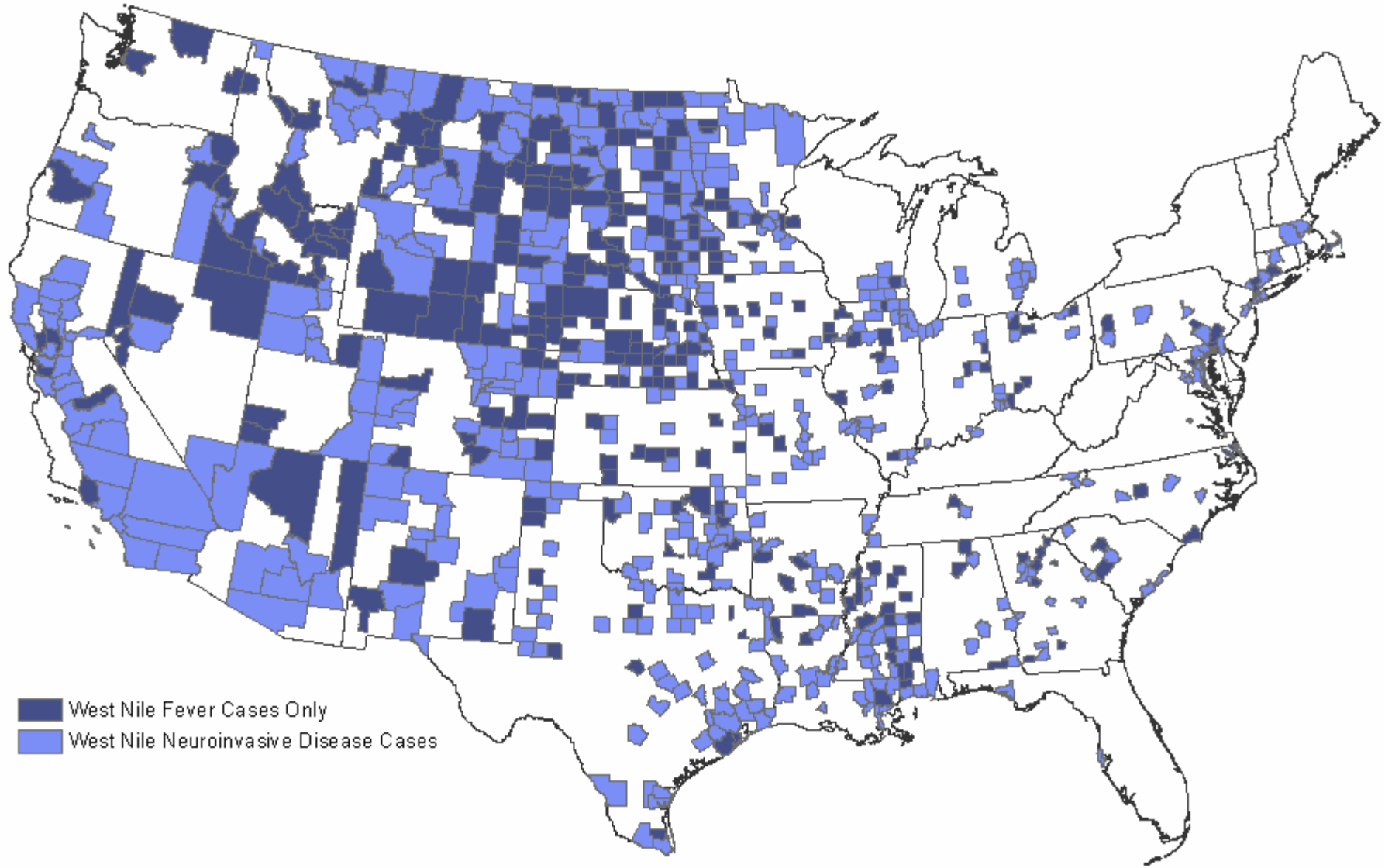
West Nile Fever Cases Only
West Nile Neuroinvasive Disease Cases

Preliminary Evaluations of ArboNET Data

- How variable is West Nile fever reporting?

- Given the variation, what is the utility of fever data?

- **What is the predictive value of bird and mosquito data reported to ArboNET?**

Trends in Reporting of Bird and Mosquito Data to ArboNET, 2002-2007

- Determined the number and proportion of all counties reporting bird and mosquito surveillance each year

  - Denominator data

  - Numerator data

Proportion of Counties Reporting Any Bird or Mosquito Data to ArboNET, 2002-2007
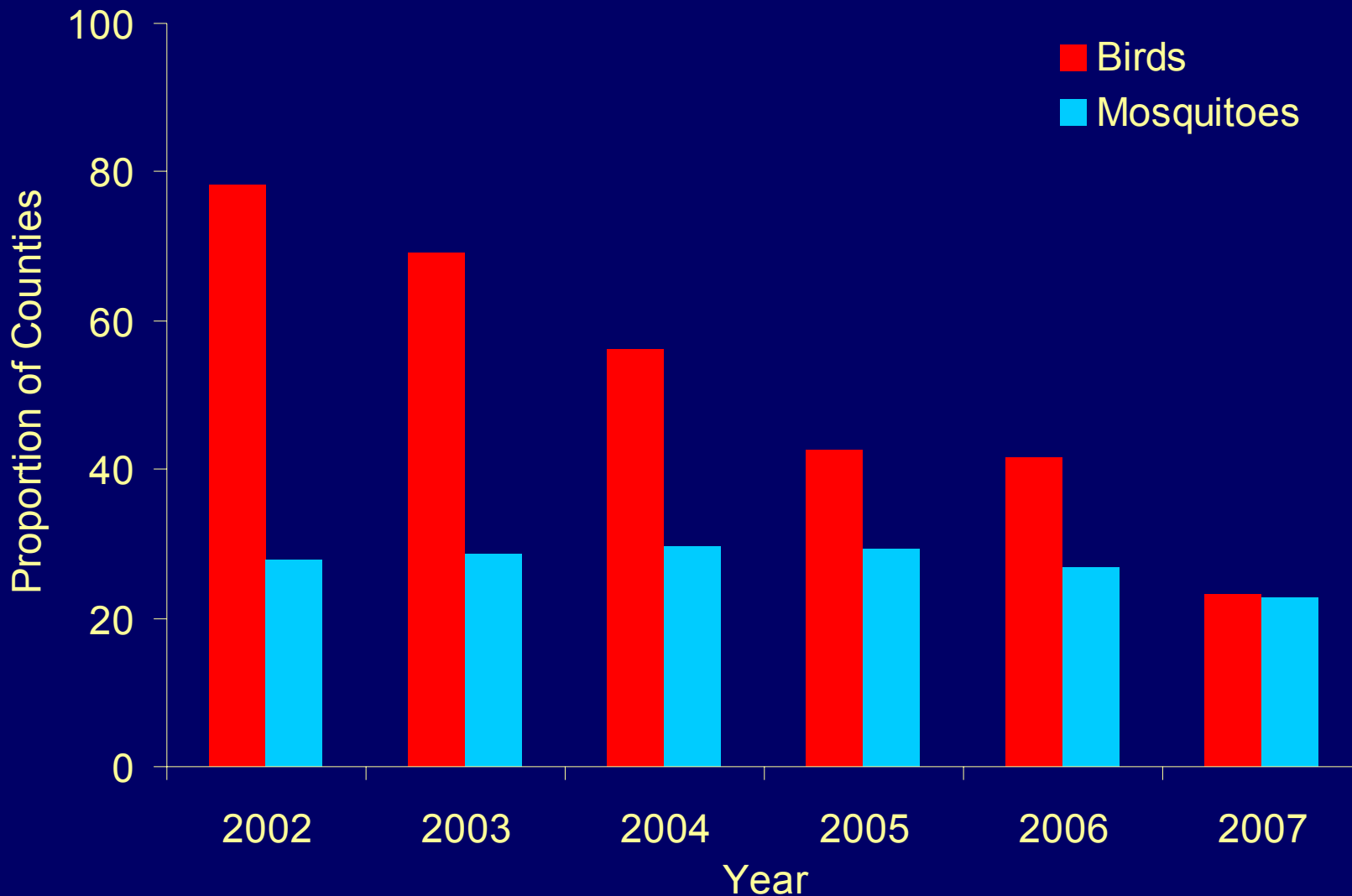
Assessing Predictive Value of Bird and Mosquito Surveillance Data, 2002-2007

- Are positives detected in time to implement control measures to possibly prevent human cases?

- How many counties reported any bird or mosquito data and human cases each year?

- How many of those counties reported a bird or mosquito positive collected ≥ 14 days before the first human case?

    - 14 day lag time included to account for shipping, testing, reporting of results, and incubation period

Predictive Value of Bird Data Reported to ArboNET, US, 2002-2007

| Year	Counties reporting any bird data and human case	Percent reporting collection of bird positive before human
2002	699	66%
2003	829	51%
2004	364	44%
2005	381	39%
2006	388	37%
2007	206	33%

Proportion of Counties with Bird Positive Collected Before Human Case by Population Density
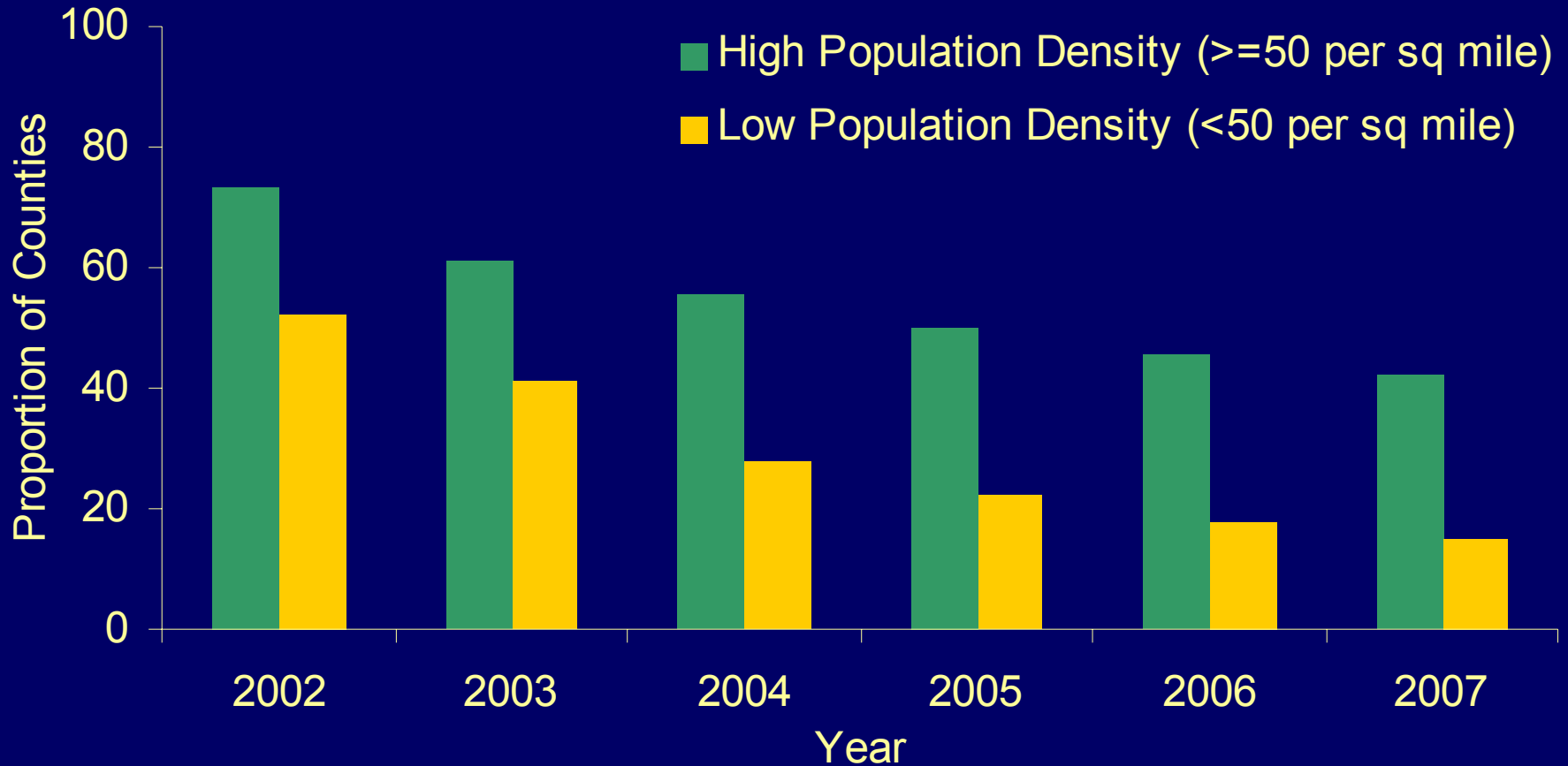
Predictive Value of Mosquito Data Reported to ArboNET, US, 2002-2007

Year	Counties reporting any mosquito data and human case	Percent reporting collection of mosquito positive before human
2002	313	41%
2003	430	36%
2004	243	36%
2005	283	48%
2006	295	47%
2007	246	39%

Proportion of Counties Reporting Collection of Positives ≥14 Days Before Human Illness
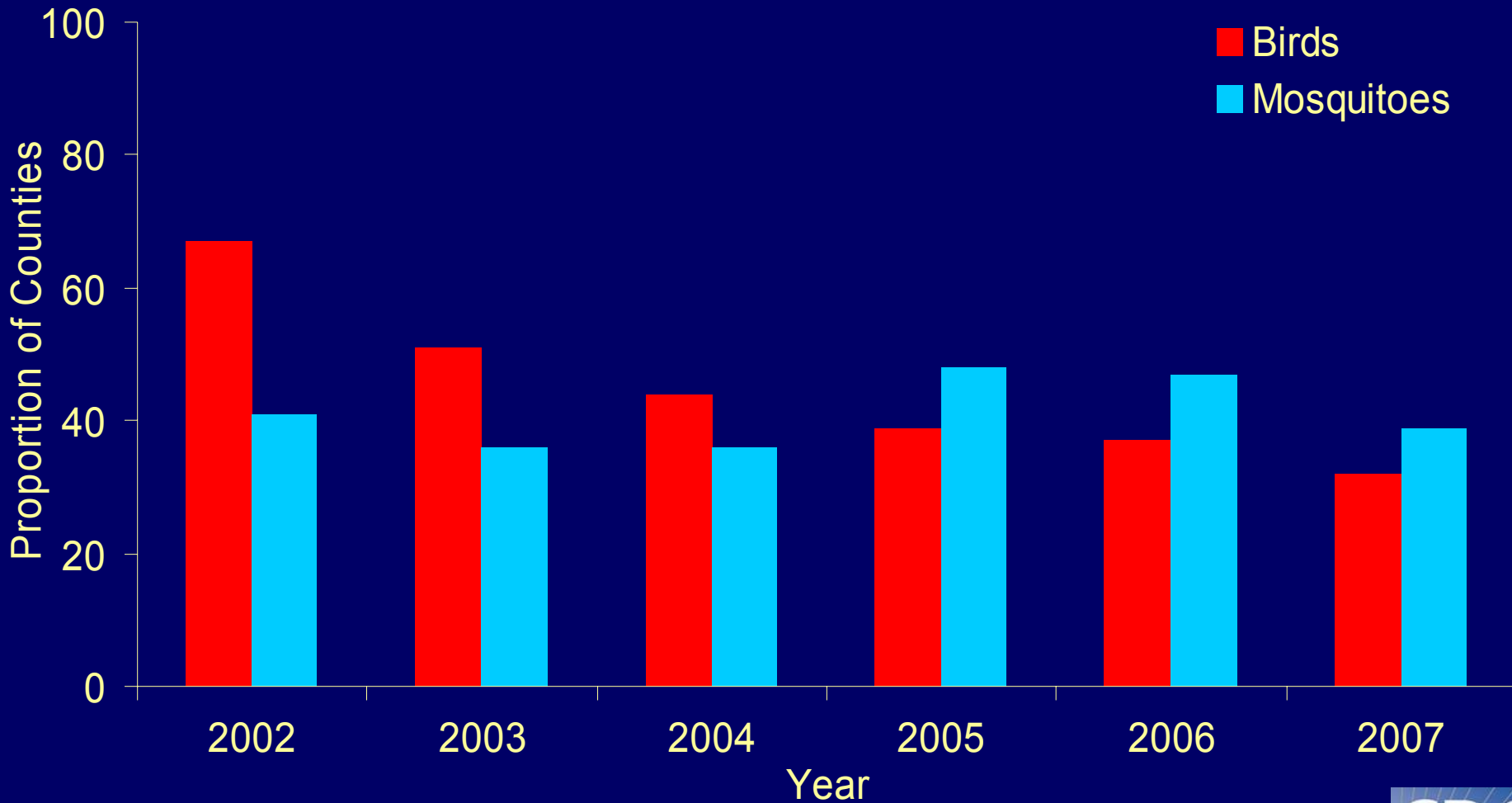
Limitations

- Lag time (from collection to report) unknown and likely influenced by multiple factors

- Different counties included in each year of the analysis; predictive values likely to differ by county

Changes to ArboNET for 2008 Season

- Addition of an optional module to collect information on medical risk factors for WNV cases

    - Pre-existing medical conditions
    - Use of immunosuppressive medications

- Addition of a new field to report who conducted the diagnostic testing for each case

    - Public Health Lab (CDC and/or state lab)
    - Commercial Lab
    - Both

CDC

Changes to ArboNET for 2008 Season (cont)

- Chikungunya and Colorado tick fever are being added to the list of arboviral diseases in the system.

Cache Valley	Non-LaCrosse California serogroup
Chikungunya	Powassan
Colorado tick fever	St Louis encephalitis
Dengue	Venezuelan equine encephalitis
Eastern equine encephalitis	Western equine encephalitis
Japanese encephalitis	West Nile
LaCrosse	Yellow fever

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CDC