Interactive Linked Micromap Plots for the Display of Geographically Referenced Statistical Data

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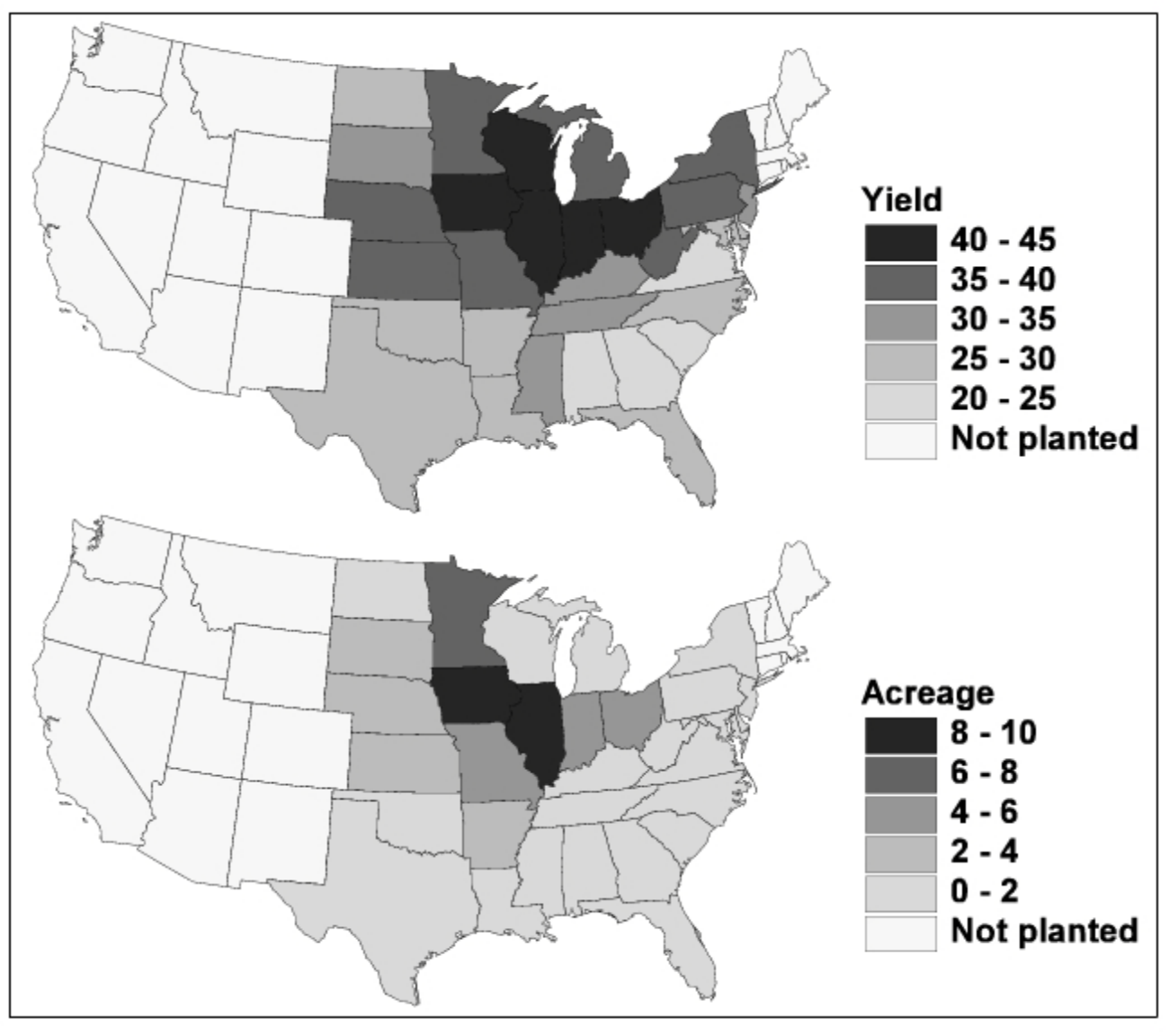
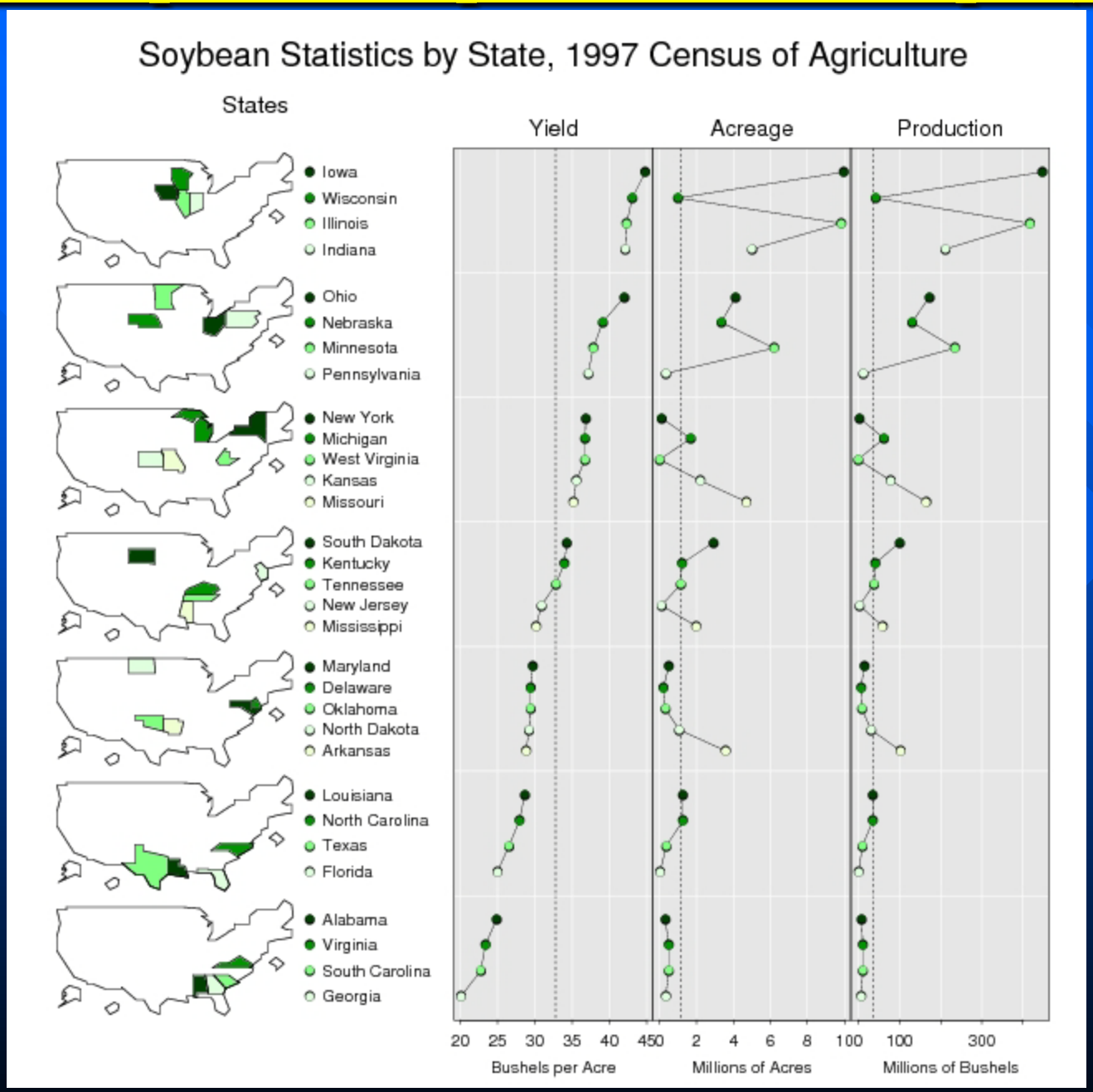
- Micromaps for the West Nile Virus (2003-…)
- French Micromaps (2005-…)

Choropleth Maps vs Micromaps (1)



Choropleth Maps vs Micromaps (2)



Micromaps

- Link of row-labeled univariate (or multivariate) statistical summaries to corresponding geographical region
- Focus on statistical display and not on maps
- Useful for
  - environmental data
  - agricultural data
  - medical data
  - economical data

History of Micromaps

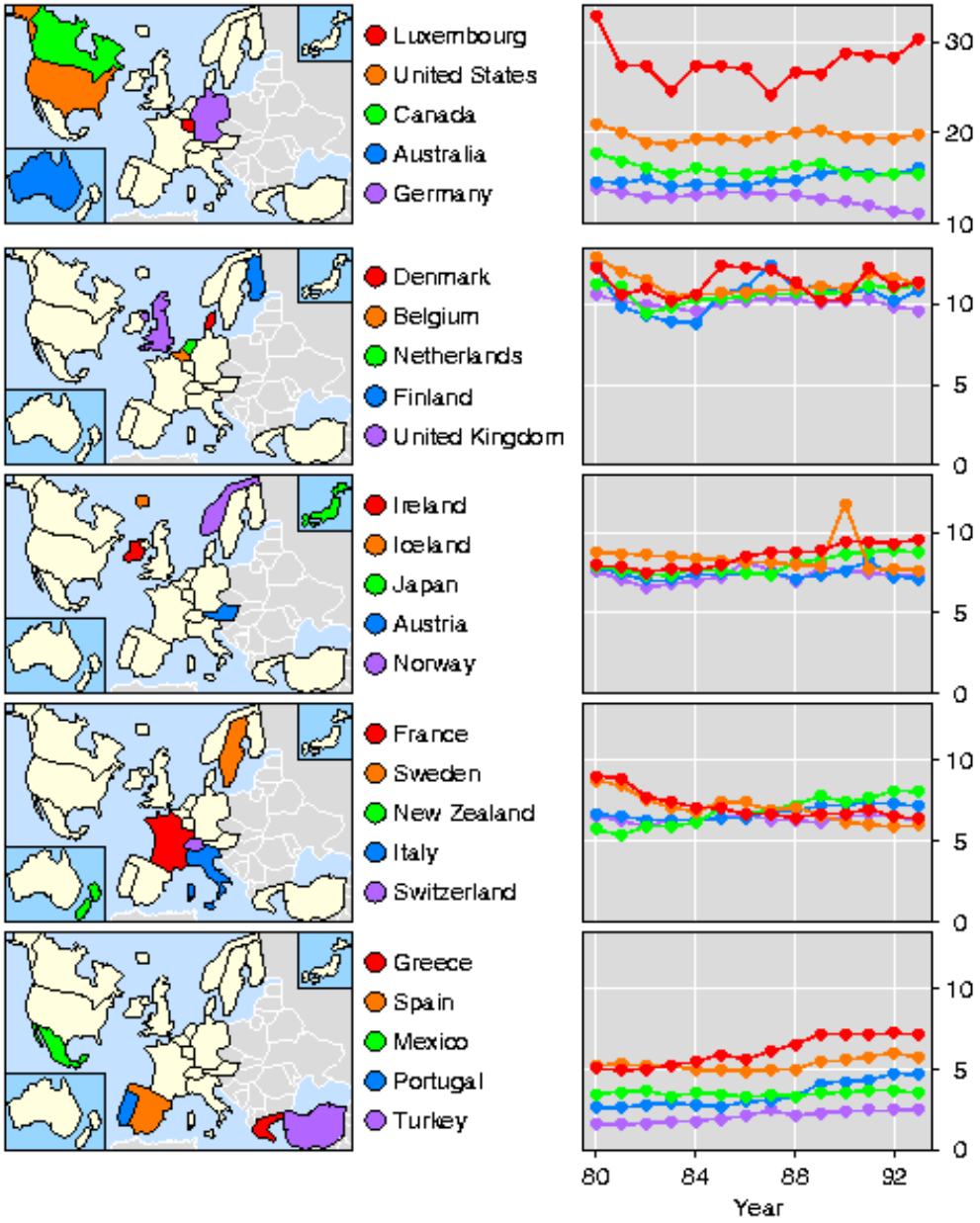
- First presented at 1995 American Statistical Association's annual meeting (Olsen, Carr, Courbois, Pierson)
- First references:
  - Carr, Pierson (1996) Emphasizing Statistical Summaries … with Micromaps, Stat. Computing & Stat. Graphics Newsletter, 7(3)
  - Carr, Olsen, Courbois, Pierson, Carr (1998) Linked Micromap Plots …, Stat. Computing & Stat. Graphics Newsletter, 9(1)

Micromap Examples

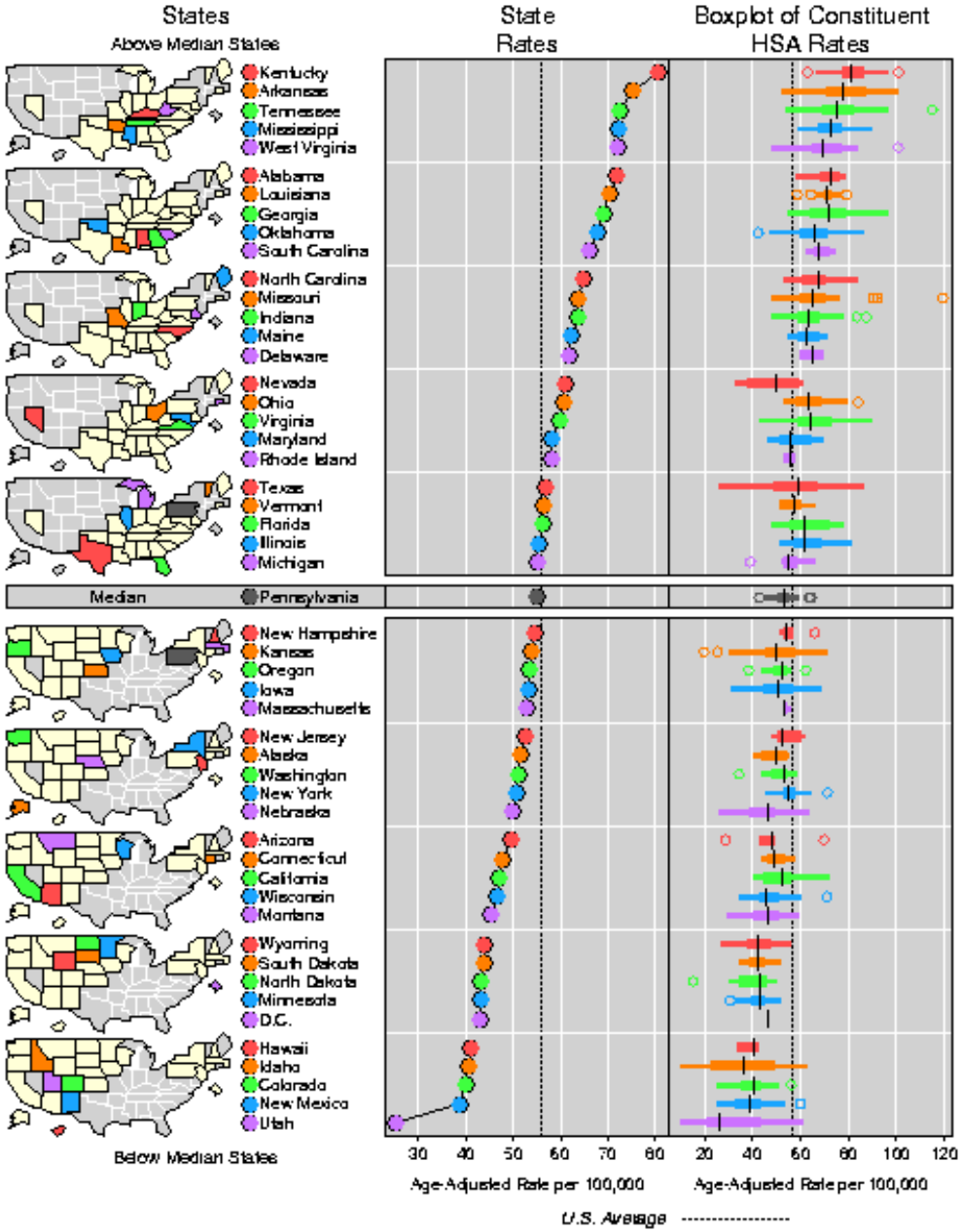
- Dan Carr's S-Plus functions available at
  - ftp://galaxy.gmu.edu/pub/dcarr/newsletter/micromap/
  - ftp://galaxy.gmu.edu/pub/dcarr/newsletter/lmplots/
- Next two examples borrowed from Dan Carr's Web page

Annual CO2 Emissions From Energy Use

Units = Tons Per Person



Lung Cancer Mortality Rates By State
White Males, 1988-1992



EPA's Cumulative Exposure Project (CEP)

- Conducted by the U.S. Environmental Protection Agency (EPA) Office of Policy
- Collection of analyses, addressing multiple pollutants from multiple sites (1998/1999)
- National analyses of
  - Air Toxics (Outdoor Concentrations)
  - Food Contaminants (Exposures)
  - Drinking Water Contaminants (Exposures)

Scope of Modeling

- 188 Hazardous Air Pollutants (HAPs) in Clean Air Act
- 148 HAPs modeled for 1990
- Modeled concentrations for each census tract in continental US (> 60,000)
- Includes stationary and mobile sources of air toxics emissions
- Uncertainty bounds derived from model-monitor comparisons

Web-based Access of HAP Data

- Goals:
  - Concise display
  - Easy access
  - Understandable to non-statistical audience
- Solution via:
  - Web
  - Graphics Production Library (GPL)
  - Micromaps

Symanzik, Carr, Axelrad, Wang, Wong, Woodruff (1999): Interactive Tables and Maps - A Glance at EPA's Cumulative Exposure Project Web Page, Proceedings of the Section on Statistical Graphics, ASA, 94-99.

File Edit View Go Communicator Help

Back Forward Reload Home Search Guide Print Security Stop

Internet Lookup New&Cool

Bookmarks Go To: http://www.epa.gov/CumulativeExposure

HOME
AIR
FOOD
DRINKING WATER
ABOUT THE PROJECT
WHAT'S NEW
RESOURCES
COMMUNITY-SPECIFIC STUDY
GREENPOINT/WILLIAMSBURG

EPA United States Environmental Protection Agency

CUMULATIVE EXPOSURE

P R O J E C T

EPA's Cumulative Exposure Project (CEP) is examining how much toxic contamination Americans are exposed to cumulatively through air, food,and drinking water. The study will estimate exposure levels for different communities and demographic groups nationwide, and identify which types of communities and demographic groups appear to have the highest exposures. The Cumulative Exposure Project is being conducted by EPA's Office of Policy.

About the Project

W H A T ' S N E W ?

Modeled 1990 air toxics concentrations are now available.

[Cumulative Exposure Project Home | EPA Home | Search | What's new]

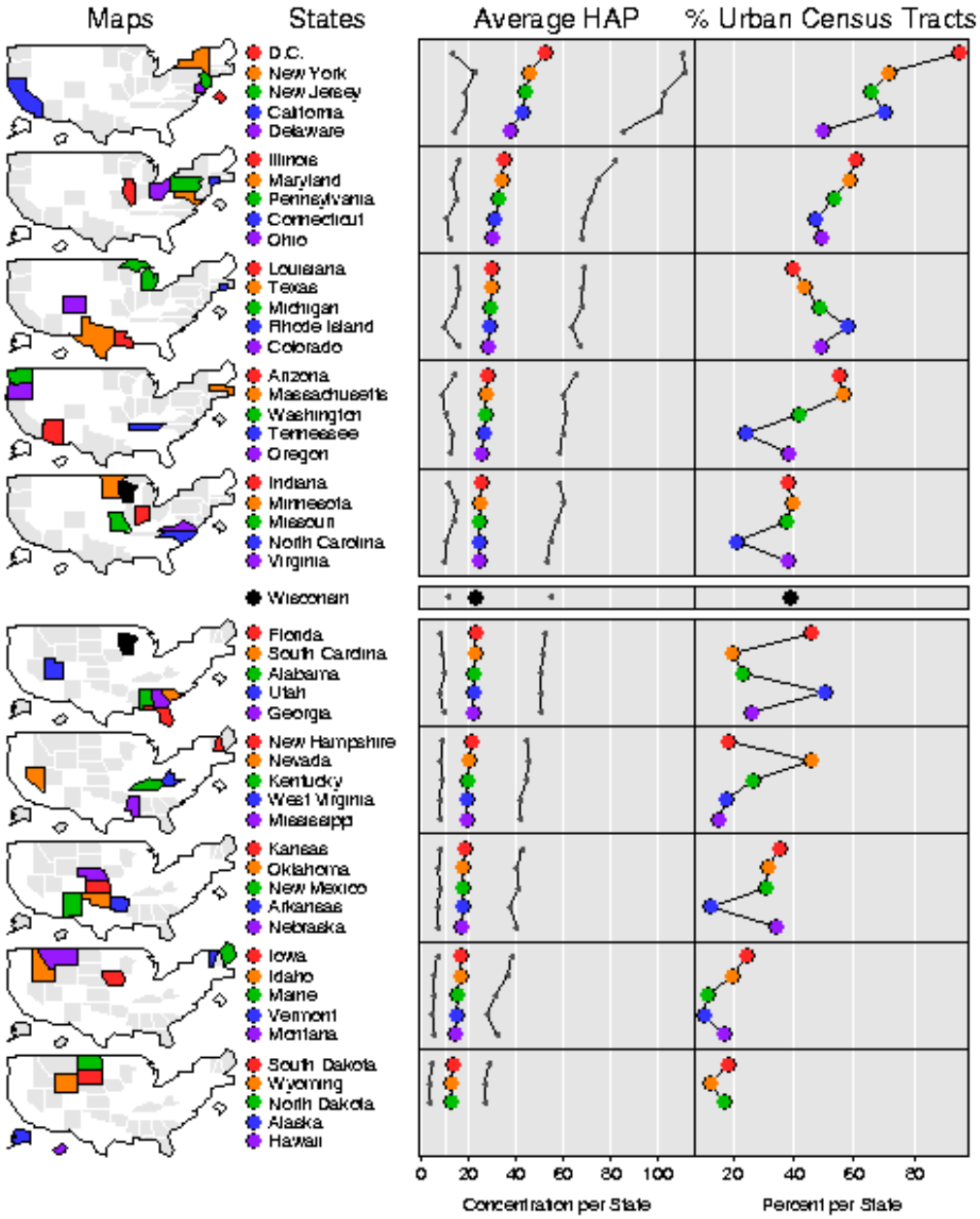
http://www.epa.gov/CumulativeExposure/index.htm

last updated 12/3/98

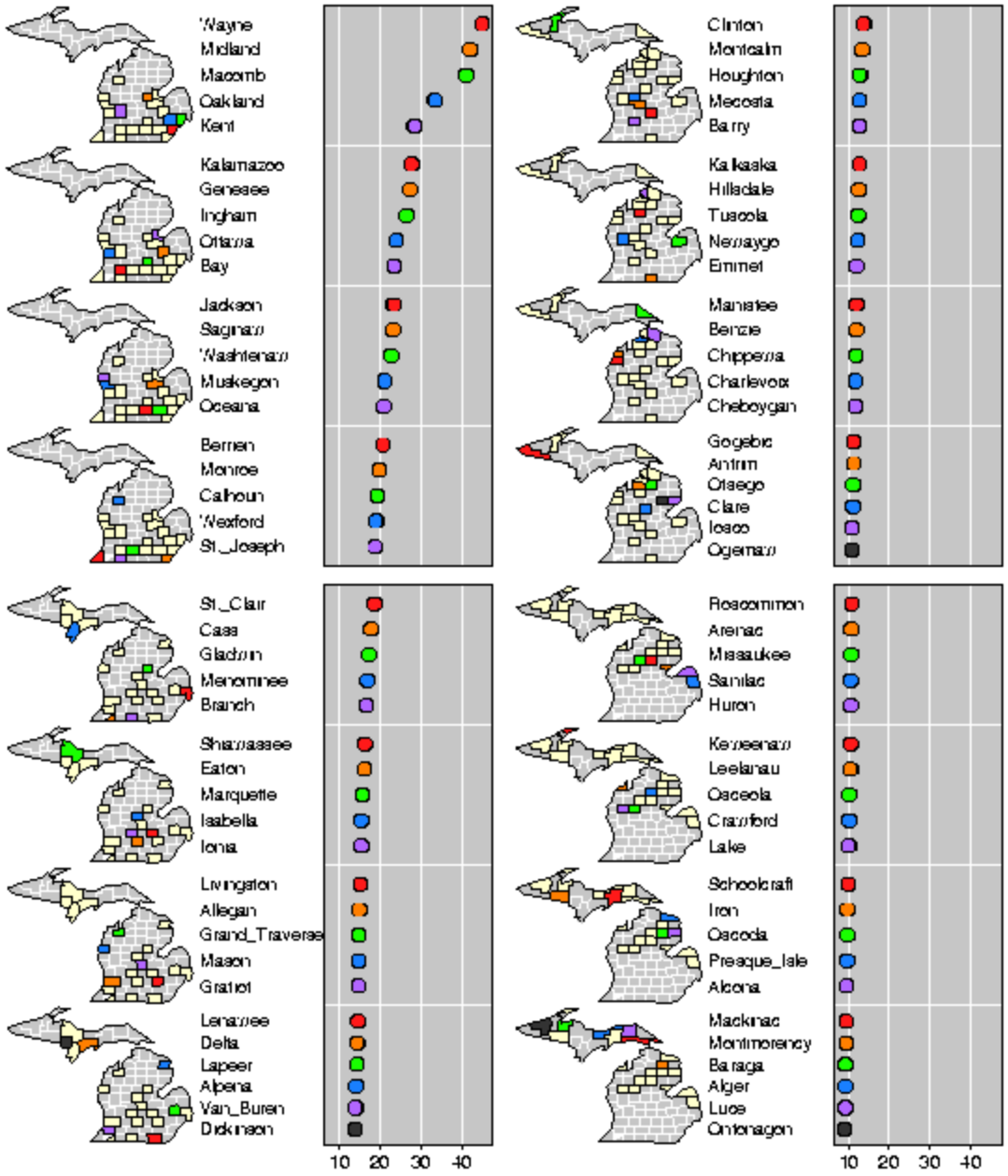
Please send comments about this page to axelrad.daniel@epa.gov

http://www.epa.gov/CumulativeExposure (no longer active)

Hazardous Air Pollutants (HAPs)
1990 Annual Average Per State



Michigan - Modeled 1990 Air Toxics Concentrations



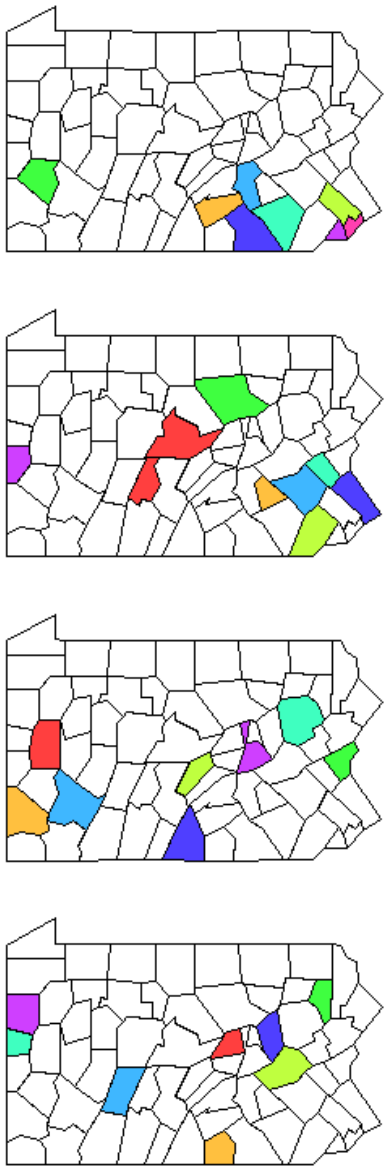
nViZn

- Follow-up to the GPL
- JAVA-based software development kit (SDK) for the creation and modification of interactive statistical graphics applications (tables, charts, micromaps, ...)
- *http://www.spss.com/nvizn*
- Related book “The Grammar of Graphics” by Leland Wilkinson

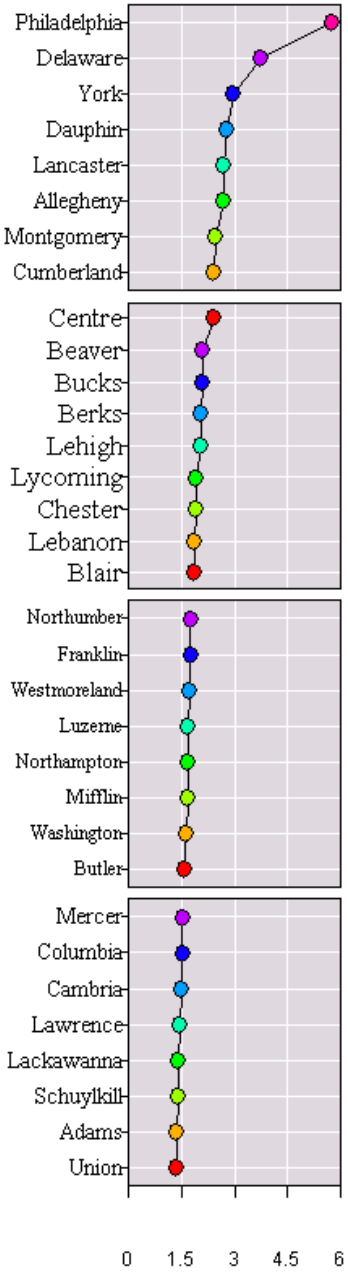
Micromaps with nViZn

- Hierarchical clickable micromaps and tables for the display of Federal statistical data
  - Micromaps and tables under nViZn
  - Clickable maps and tables
  - Hierarchy of maps and tables
  - Selection of variables
  - Use of EPA HAP data for demo purposes

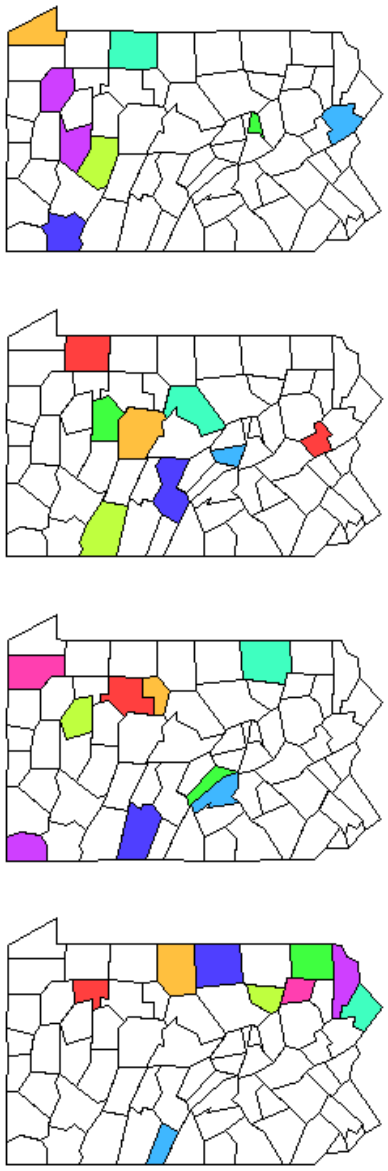
Pennsylvania: Upper Half



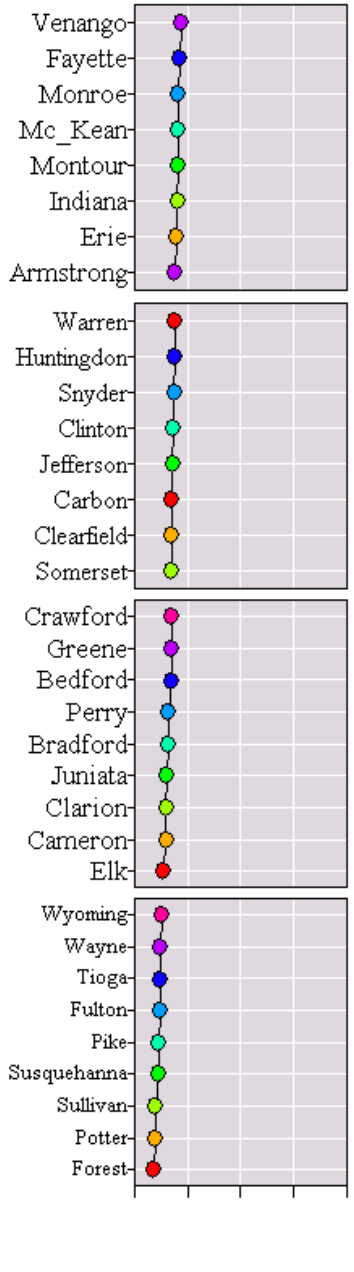
1990 Modeled Benzene Concentrations



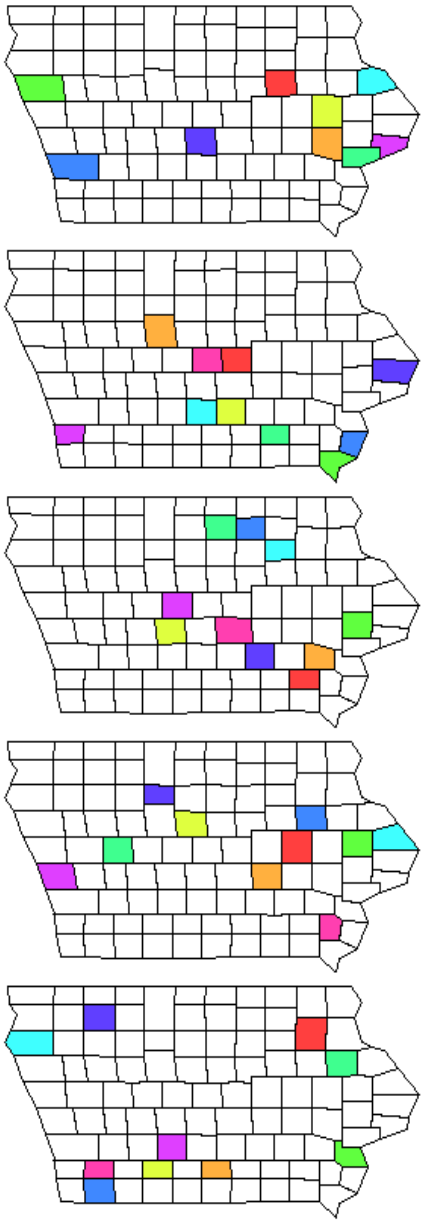
Pennsylvania: Lower Half



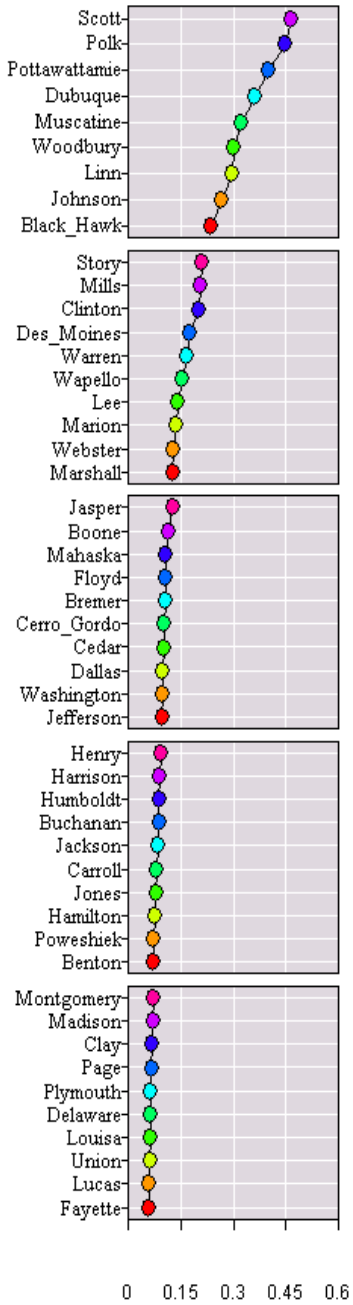
1990 Modeled Benzene Concentrations



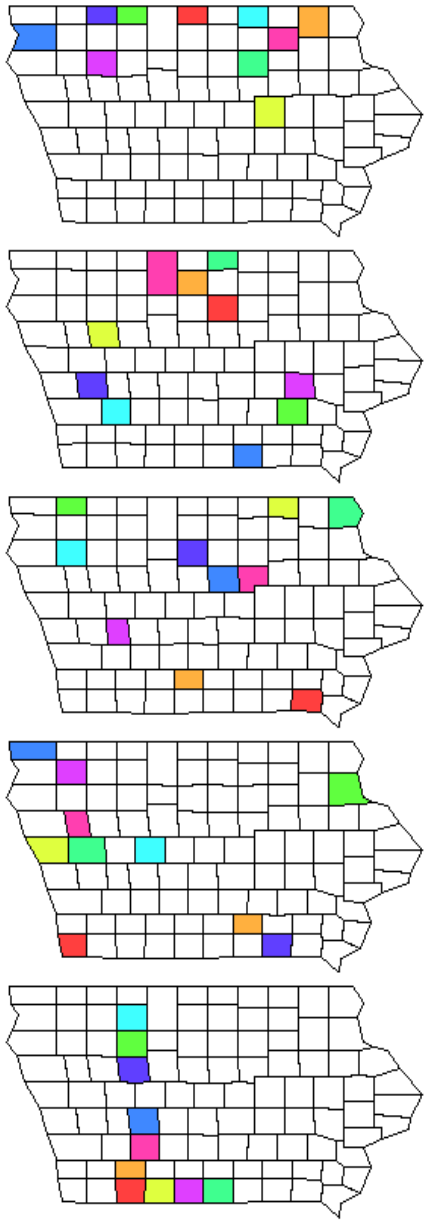
Iowa: Upper Half



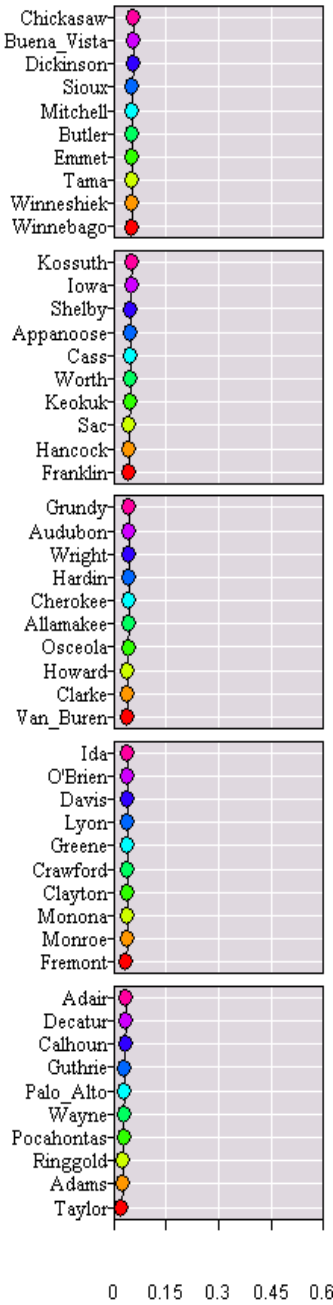
1990 Modeled Lead Concentrations



Iowa: Lower Half



1990 Modeled Lead Concentrations



Disdvantages of nViZn

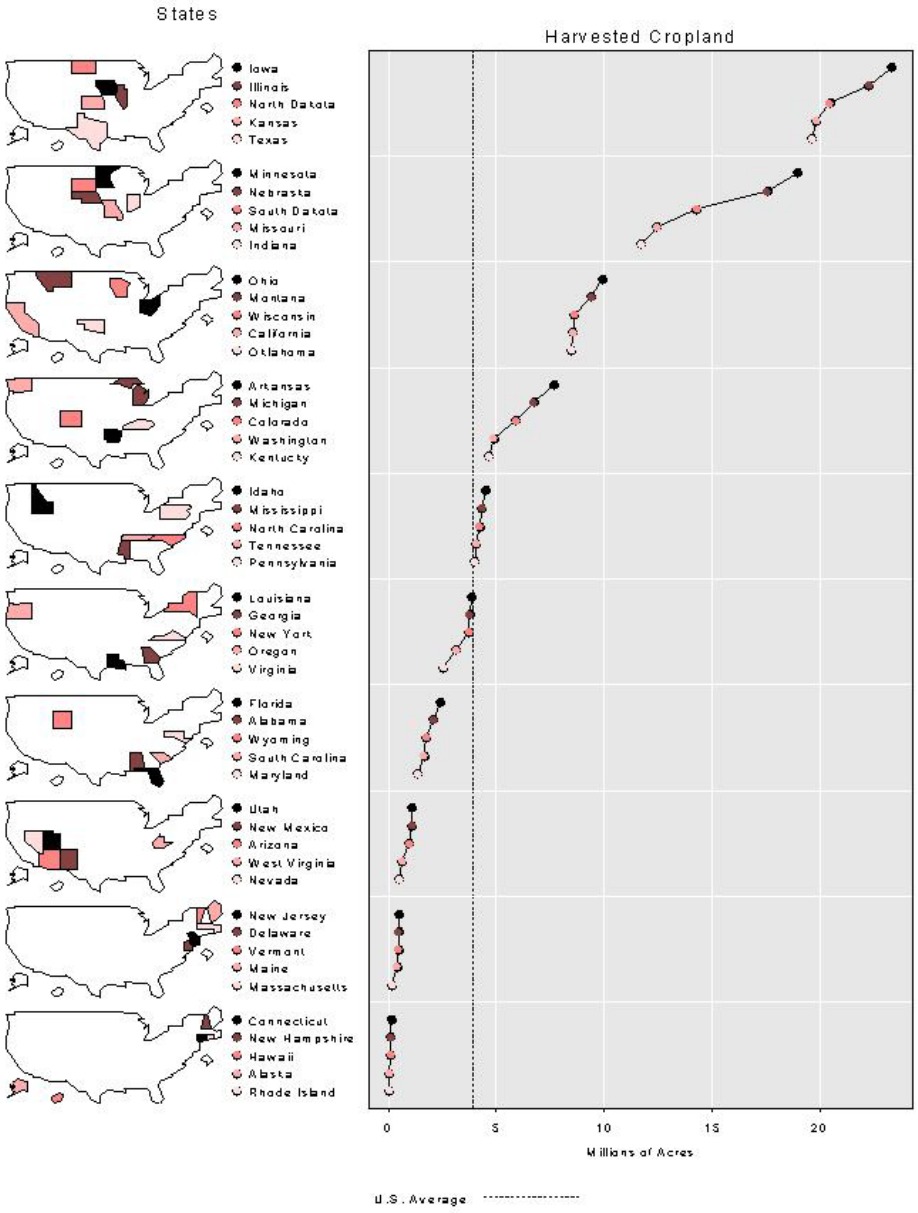
- Little documentation available
- Good JAVA knowledge required
- Sensitive to browsers and plugins
- High cost
- Huge overhead of Java code when only micromaps are needed

- **Meanwhile . . .**

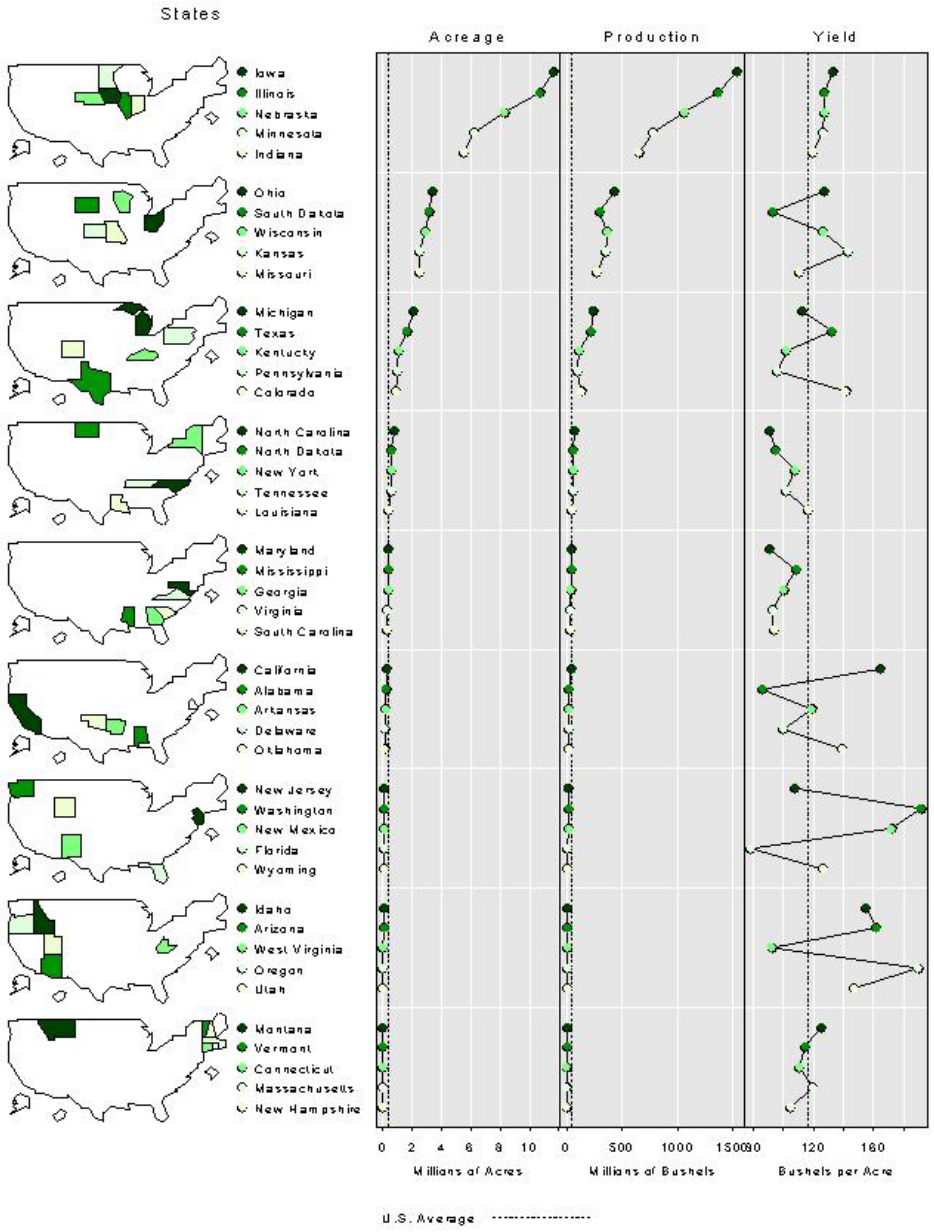
Micromaps at USDA-NASS

- U.S. Department of Agriculture - National Agricultural Statistics Service (USDA-NASS)
- *http://www.nass.usda.gov/research/sumpant.htm*
- Released in September 1999
- 1997 Census of Agriculture:
  - Acreage, production, yield
  - Corn, soybeans, wheat, hay, cotton
- Pre-calculated micromaps

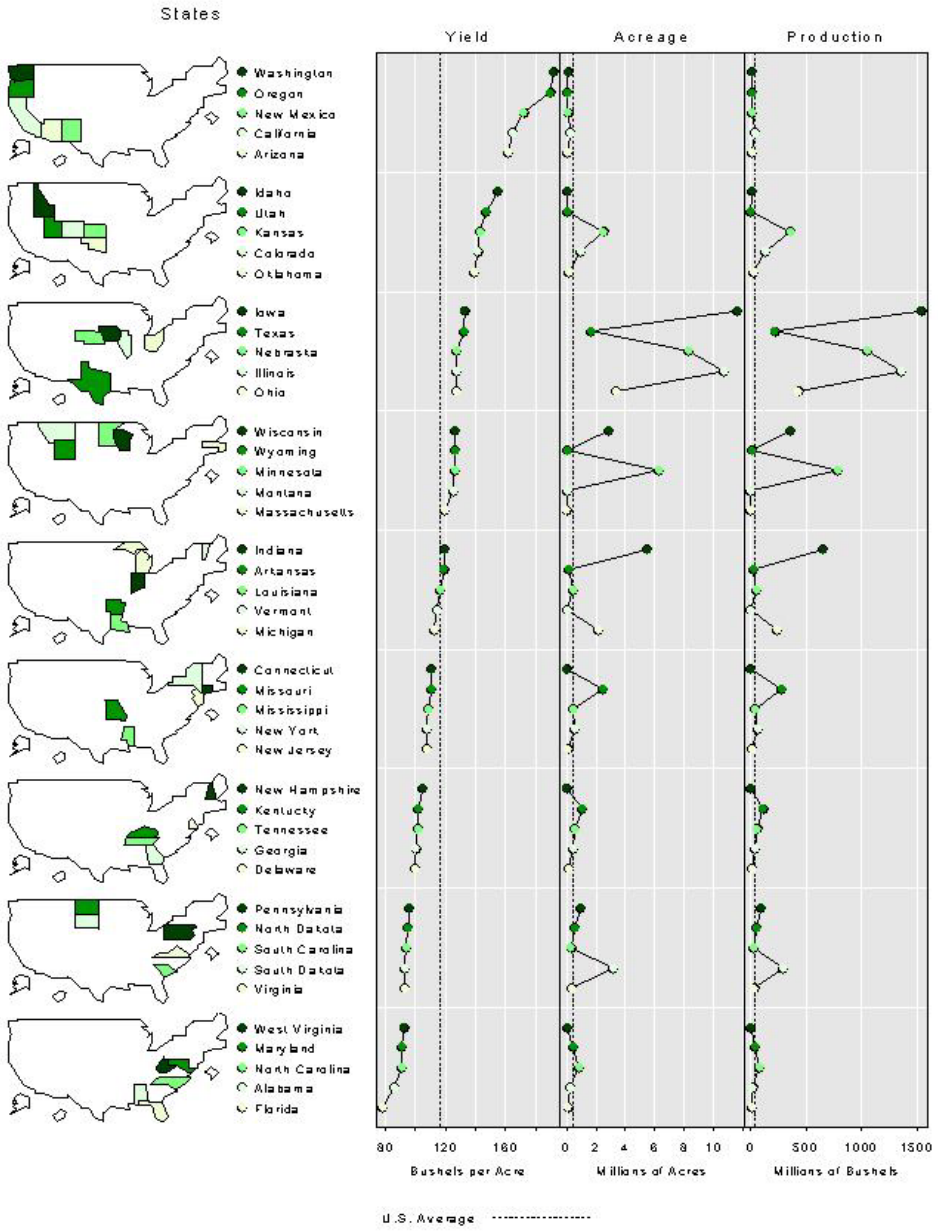
Harvested Cropland by State, 1997 Census of Agriculture



Corn Statistics by State, 1997 Census of Agriculture



Corn Statistics by State, 1997 Census of Agriculture



Micromaps at NCI

- National Cancer Institute (NCI)
- *http://www.statecancerprofiles.cancer.gov/micromaps*
- Released in April 2003
- Cancer statistics:
  - Mortality and incidence counts and rates
  - Trends by sex and race/ethnicity
- Fully interactive
- Extensive usability testing

Wang, Chen, Carr, Bell, Pickle (2002): Geographic Statistics Visualization: Web-based Linked Micromap Plots, Computing in Science & Engineering 4(3):90-94.

cancer.gov

NATIONAL CANCER INSTITUTE

State Cancer Profiles

Dynamic views of cancer statistics for prioritizing cancer control efforts in the nation, states, and counties

Help us improve! Contact us with feedback.

CDC

Left Column Data

Area: US - state level
Data Group: Cancer Statistics
Cancer: Lung & Bronchus
Statistic: Incidence Rate
Race: All Races
Sex: Female
Age: All Ages

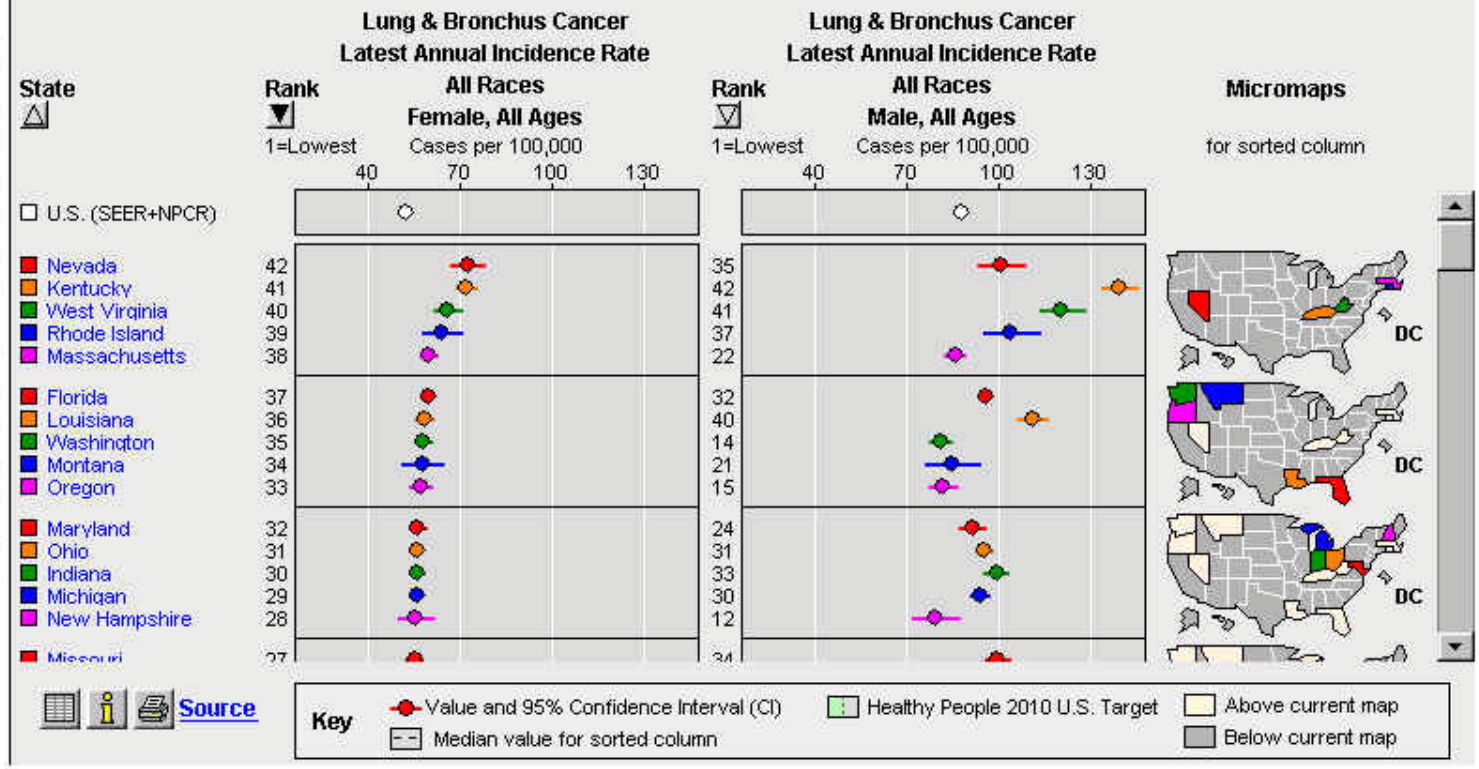
Right Column Data (optional)

Data Group: Cancer Statistics
Cancer: Lung & Bronchus
Statistic: Incidence Rate
Race: All Races
Sex: Male
Age: All Ages

Draw Clear

Overview

Options



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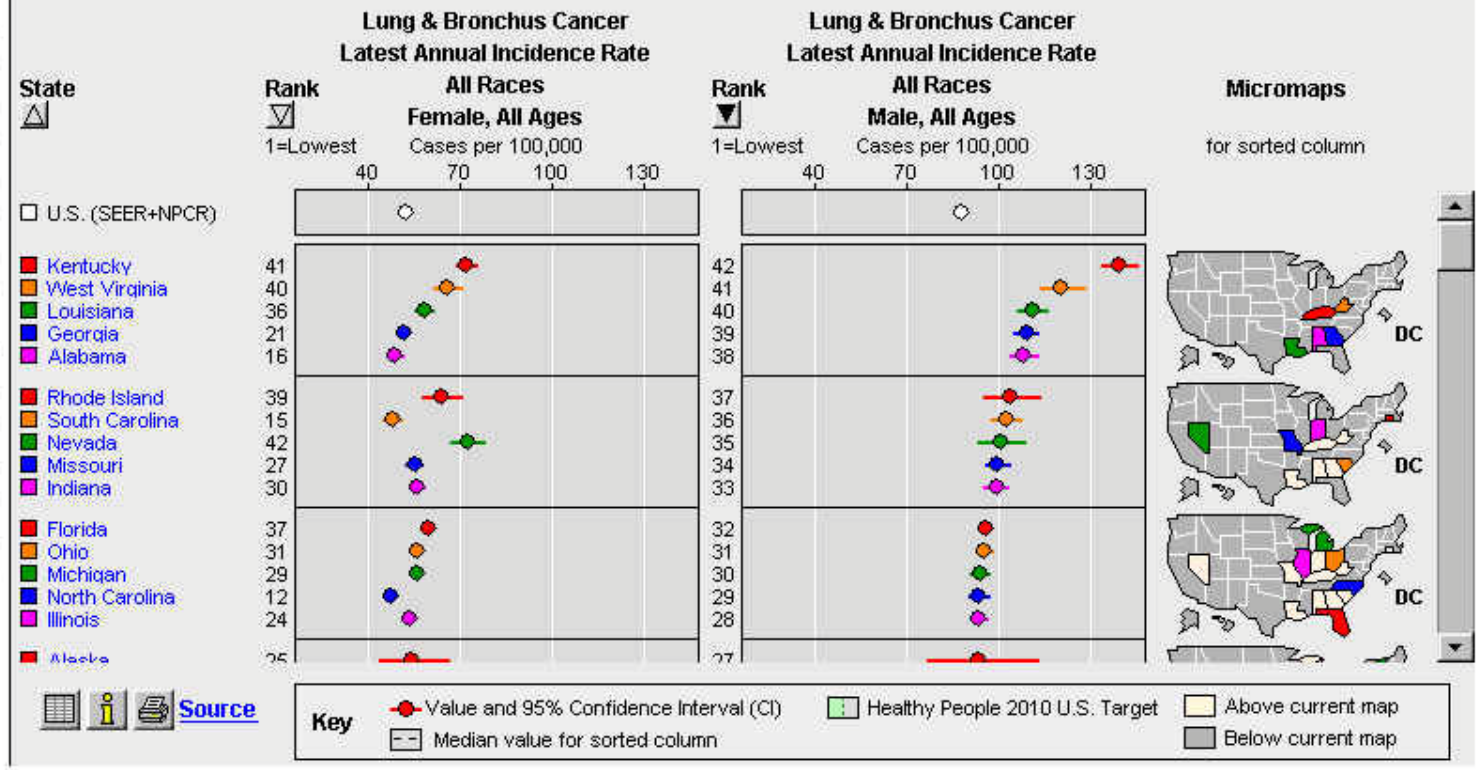
Right Column Data (optional)

Data Group: Cancer Statistics
Cancer: Lung & Bronchus
Statistic: Incidence Rate
Race: All Races
Sex: Male
Age: All Ages

Draw Clear

Overview

Options



statecancerprofiles.cancer.gov - Microsoft Internet Explorer provided by America Online

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Links Address http://statecancerprofiles.cancer.gov/micromaps/ Go

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Left Column Data

Area: US - state level
Data Group: Cancer Statistics
Cancer: Lung & Bronchus
Statistic: Incidence Rate
Race: White
Sex: Both Sexes
Age: All Ages

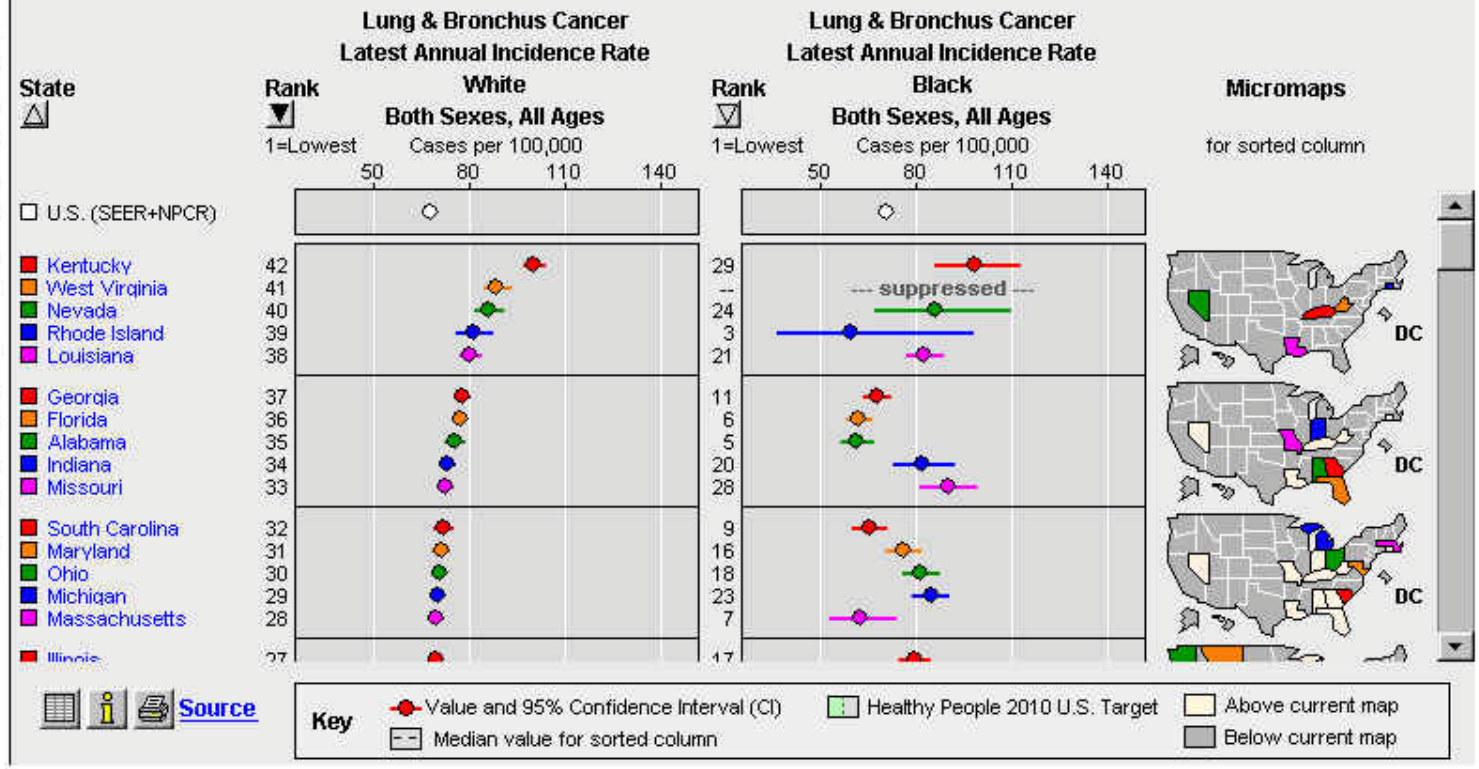
Right Column Data (optional)

Data Group: Cancer Statistics
Cancer: Lung & Bronchus
Statistic: Incidence Rate
Race: Black
Sex: Both Sexes
Age: All Ages

Draw Clear

Overview

Options



Applet Micromaps started

Internet

cancer.gov

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State Cancer Profiles

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Race: White
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Age: All Ages

Right Column Data (optional)

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Cancer: Lung & Bronchus
Statistic: Incidence Rate
Race: Black
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Age: All Ages

Draw Clear

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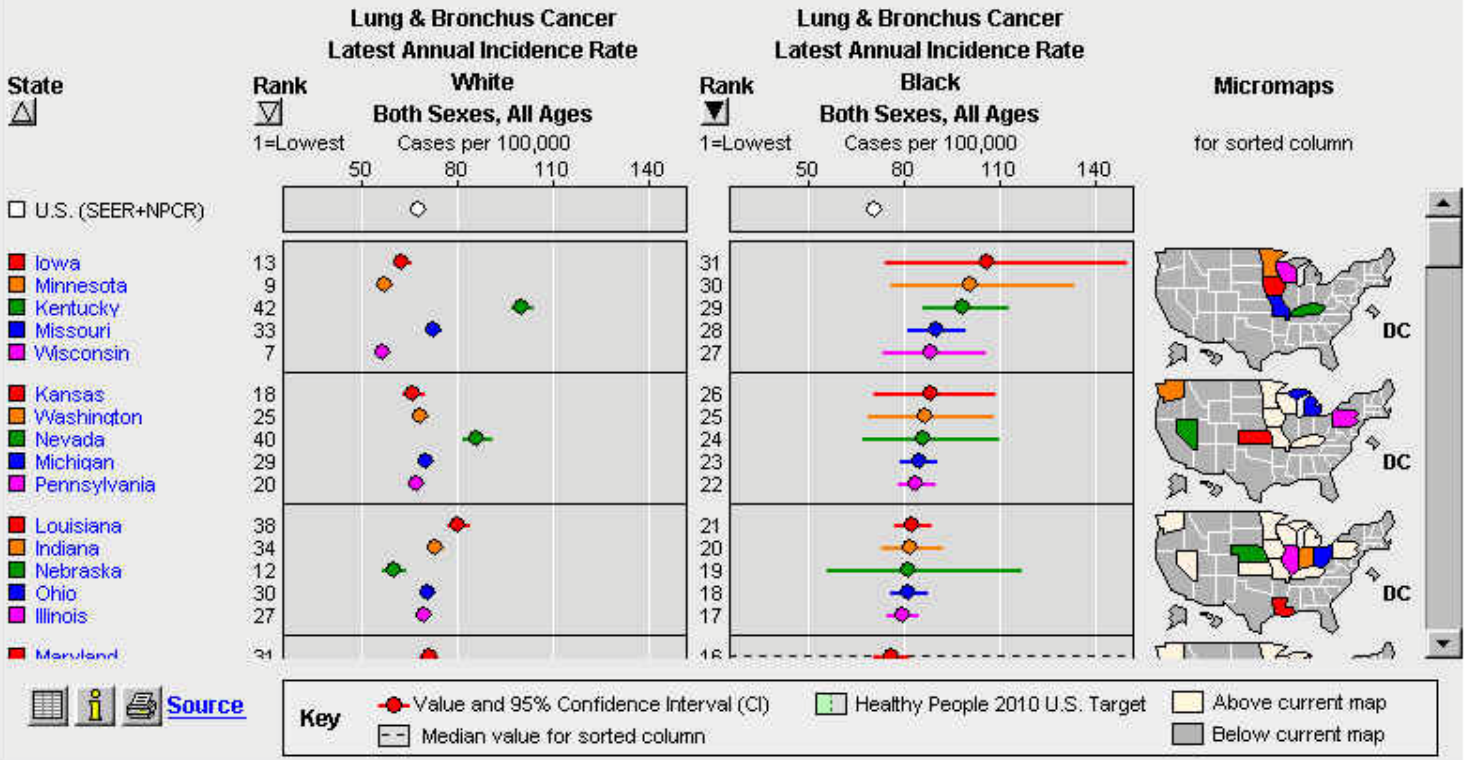
Options

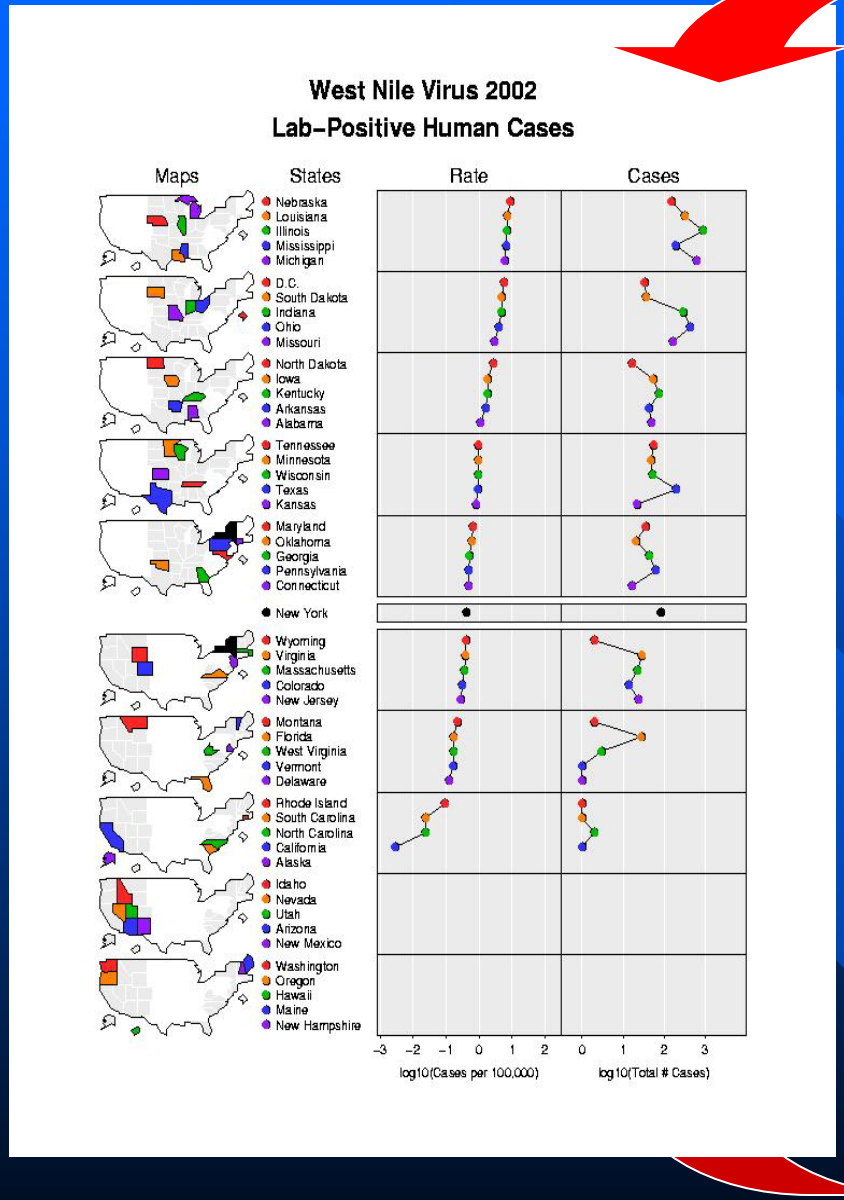


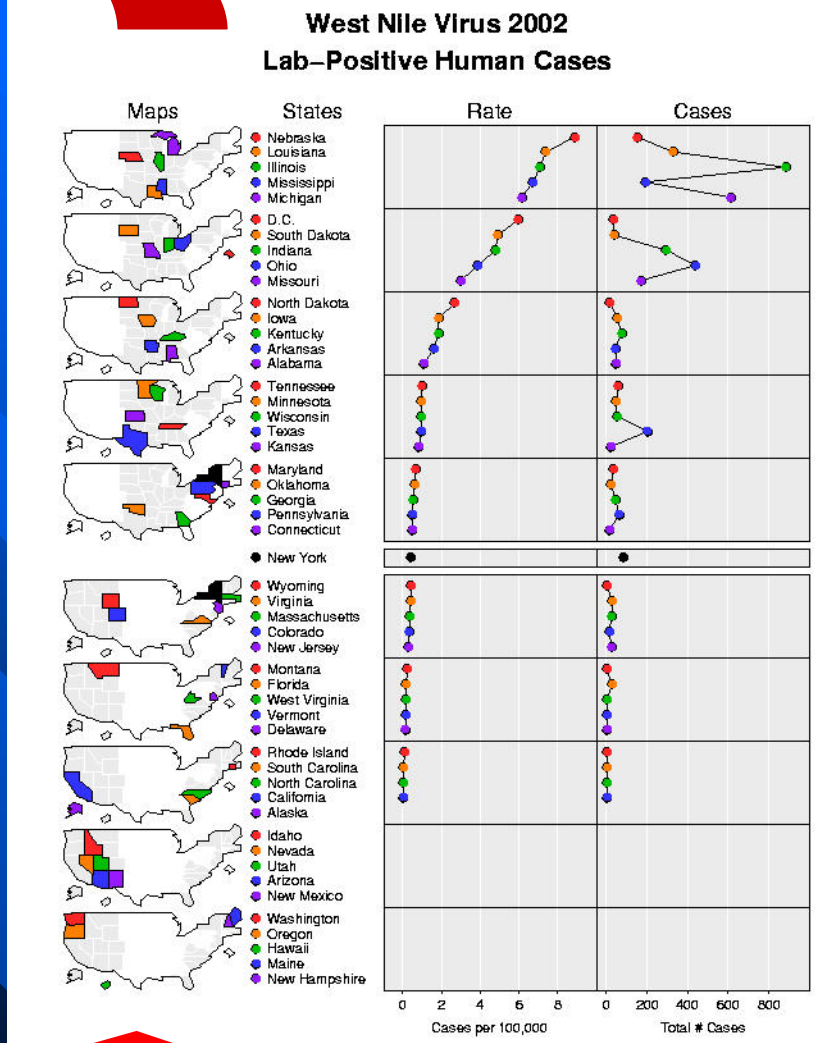
Micromaps for the Display of West Nile Virus (WNV) Data

West Nile Virus (WNV) ???

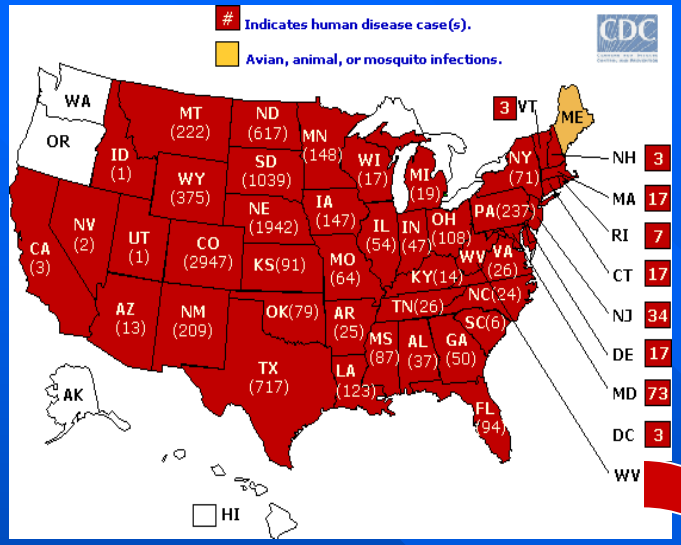
- Introduced to the US in 1999
- Spread across North America in 5 years
- Initial event - Culex mosquito transmits virus within avian populations
- Bridging Aedes albopictus transmits virus from birds to animals and humans

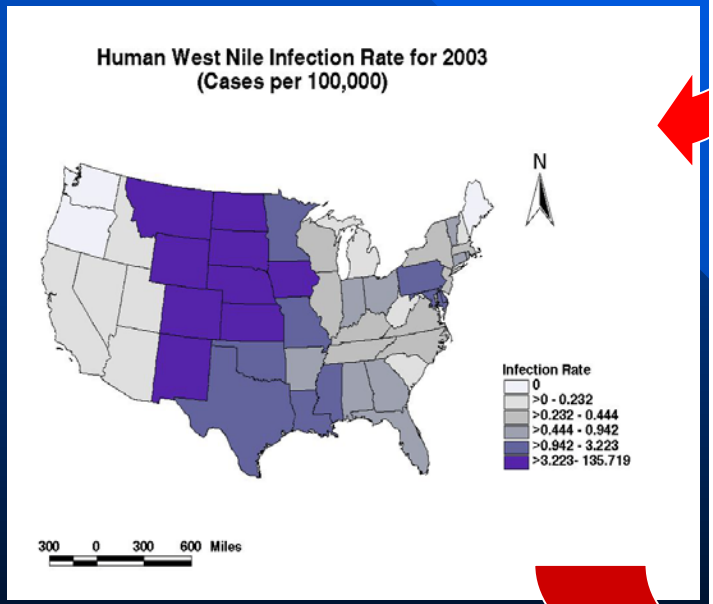
From 2002 CDC Web Page to Micromaps

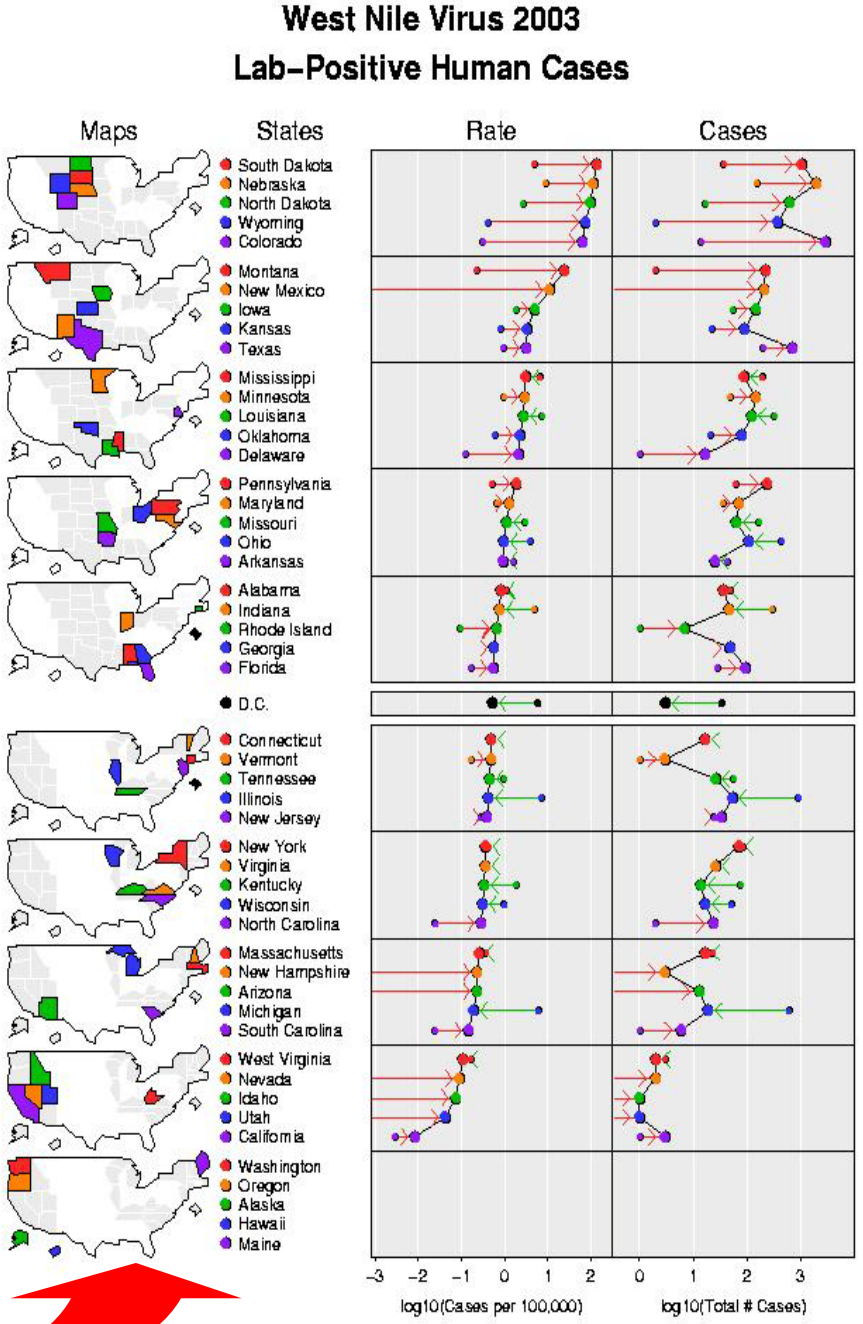




From 2003 CDC

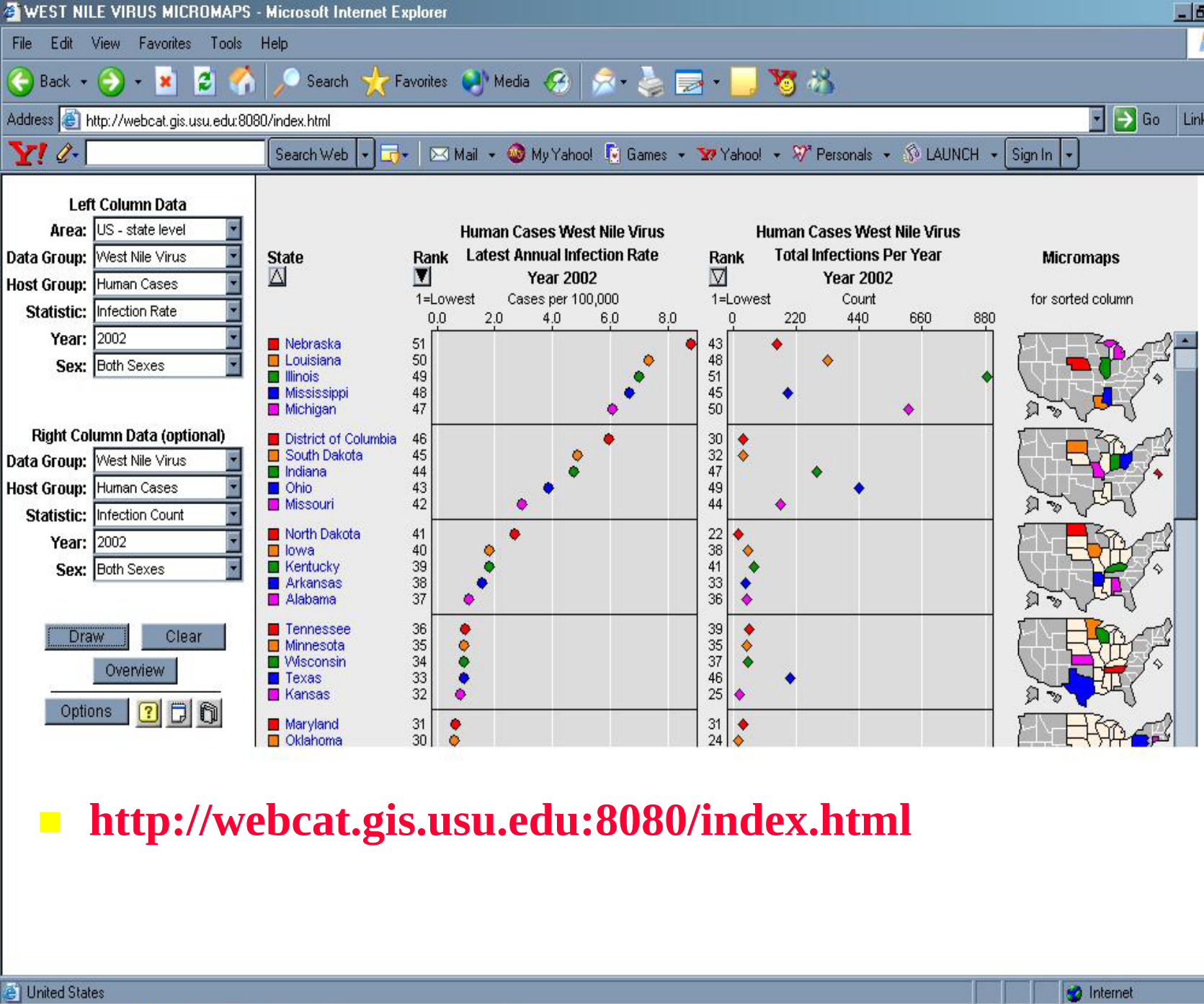






Web-Based Access to WNV Data

- Decision at Utah State University (USU):
  - Obtain NCI Java code for Web-based WNV micromaps
  - Upgrades for the display of WNV data
  - Reference: Symanzik, Gebreab, Gillies, Wilson (2003): Visualizing the Spread of West Nile Virus, Proceedings, ASA, CD.



- **http://webcat.gis.usu.edu:8080/index.html**

WEST NILE VIRUS MICROMAPS - Microsoft Internet Explorer

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Back Search Favorites Media

Address http://webcat.gis.usu.edu:8080/index.html Go Links

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Left Column Data

Area: US - state level
Data Group: West Nile Virus
Host Group: Human Cases
Statistic: Infection Rate
Year: 2003
Sex: Both Sexes

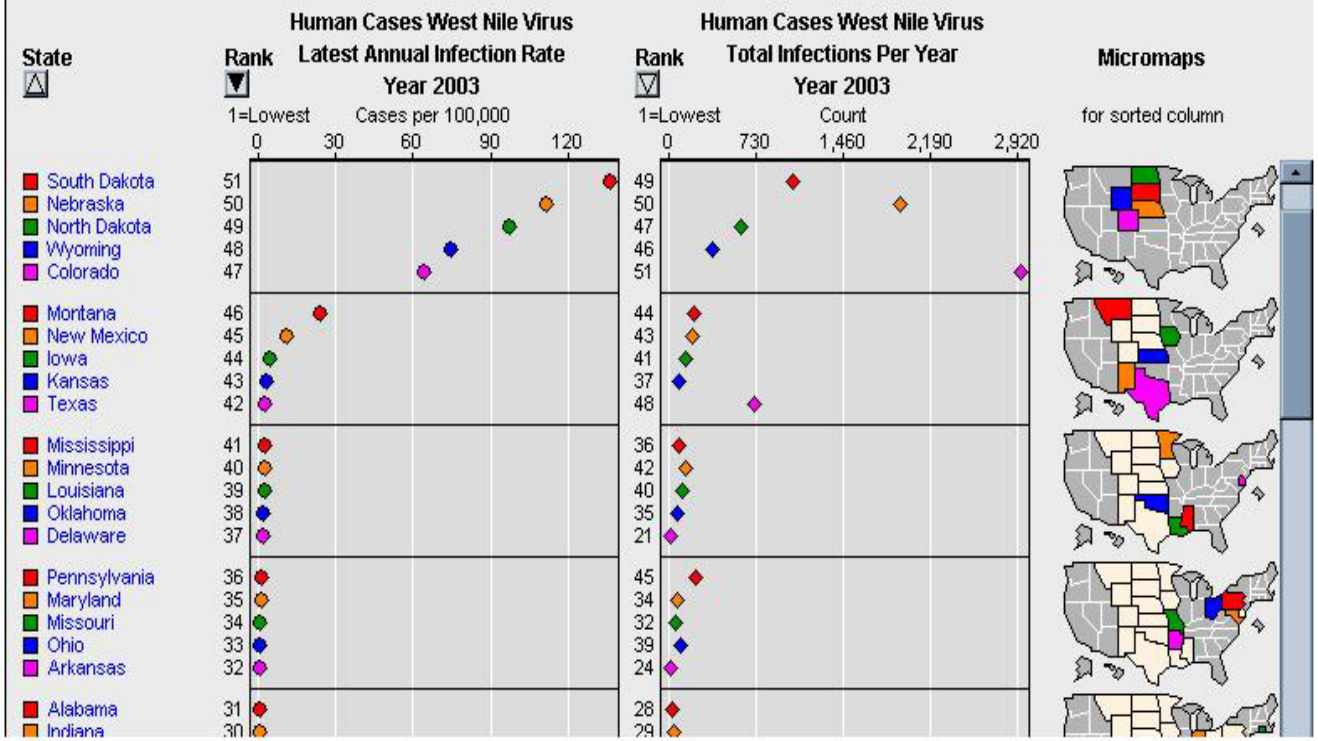
Right Column Data (optional)

Data Group: West Nile Virus
Host Group: Human Cases
Statistic: Infection Count
Year: 2003
Sex: Both Sexes

Draw Clear

Overview

Options



United States Internet

Start WEST NILE VIRUS ... Document1 - Microsoft W... Micromaps2002.jpeg - Paint 11:50 AM

WEST NILE VIRUS MICROMAPS - Microsoft Internet Explorer

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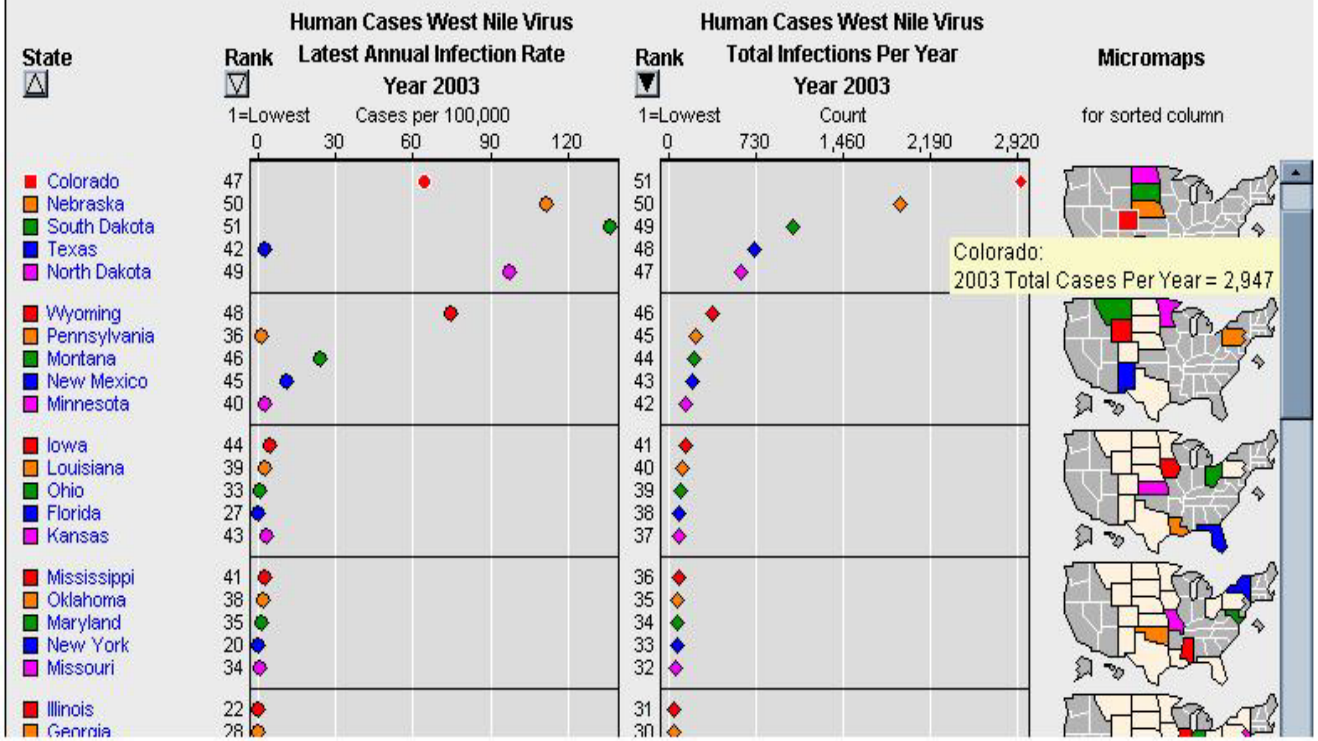

United States Internet

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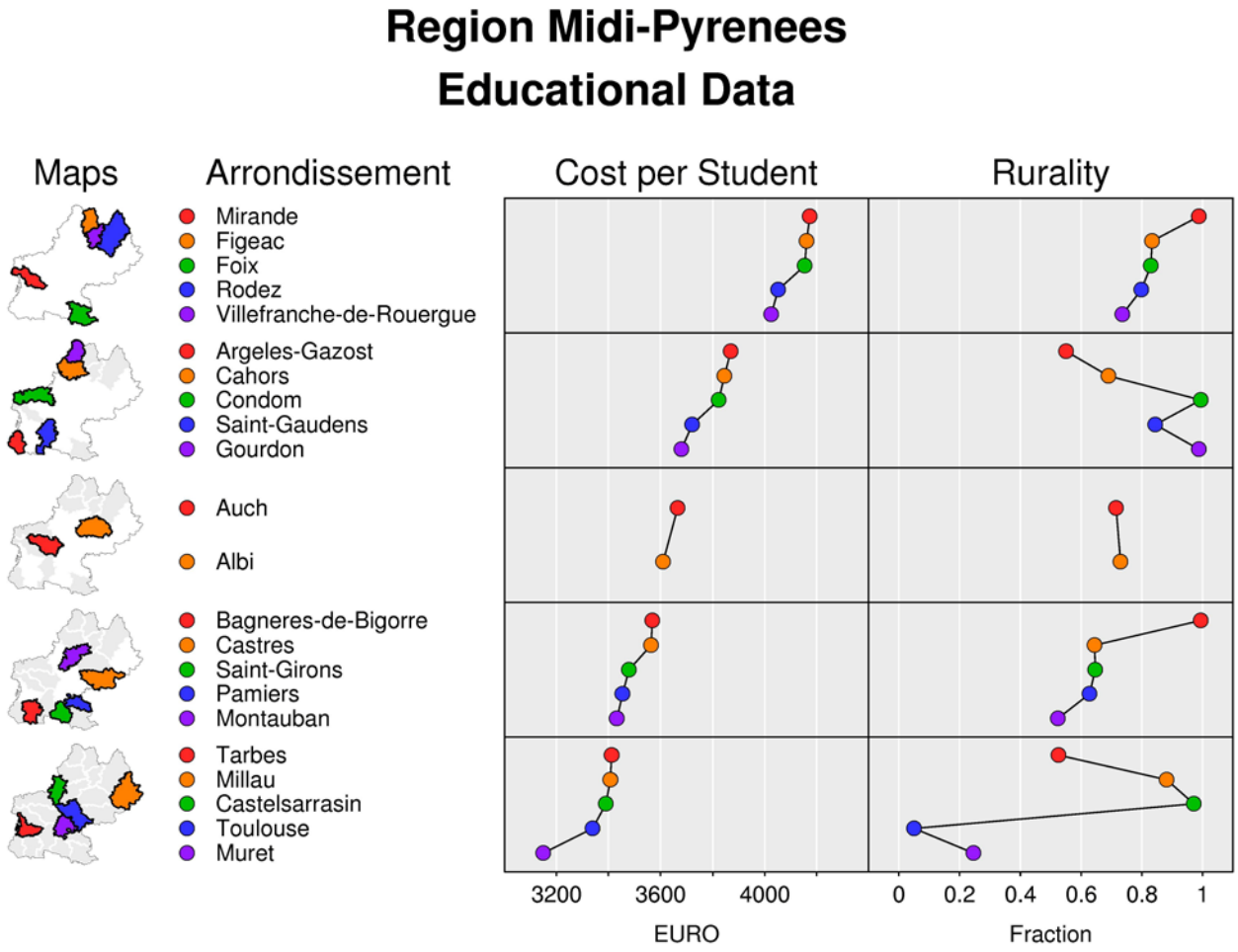
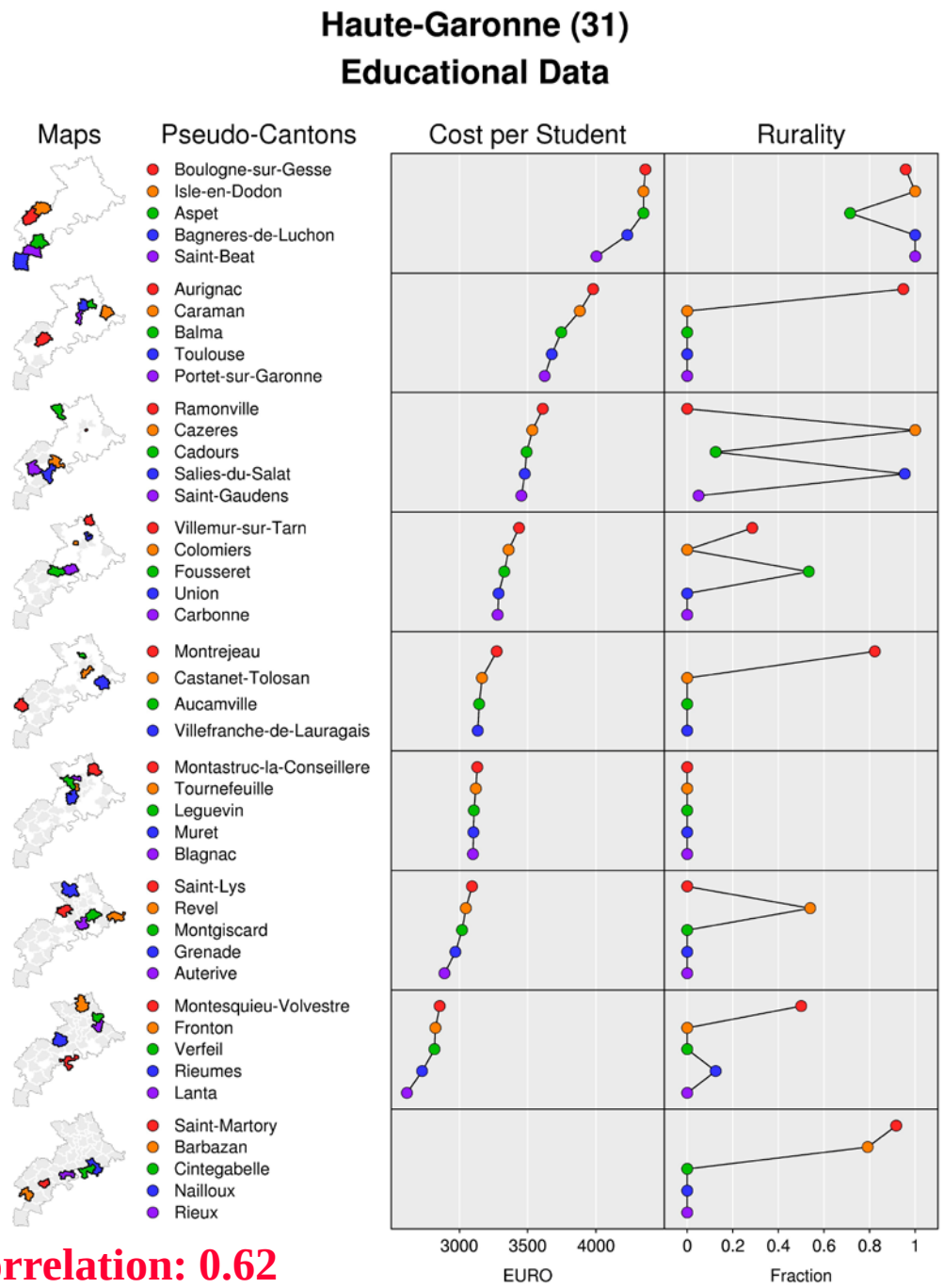
French Micromaps



Correlation: 0.50



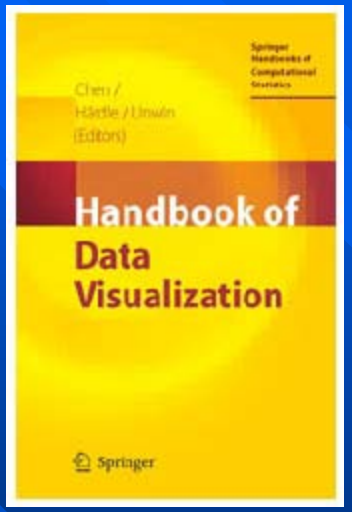
Correlation: 0.62

Concluding Remarks

- Interactive micromaps useful to display spatially complex data from environmental, agricultural, medical, economical sources, etc.
- Regional similarities quickly observed
- Easily understood by general audiences, such as “everyday” Web users and employees in government agencies and medical fields

Ongoing Work

- Upcoming micromap chapter in Springer "Handbook of Data Visualization" (2006)



- Article on French micromaps in preparation
- Linking of USU West Nile Micromap Server with USU Climate Data Base

Questions ???