

# **Linked Micromap Plots in R & Map Overlays via RgoogleMaps – With a Focus on Chinese Religions**

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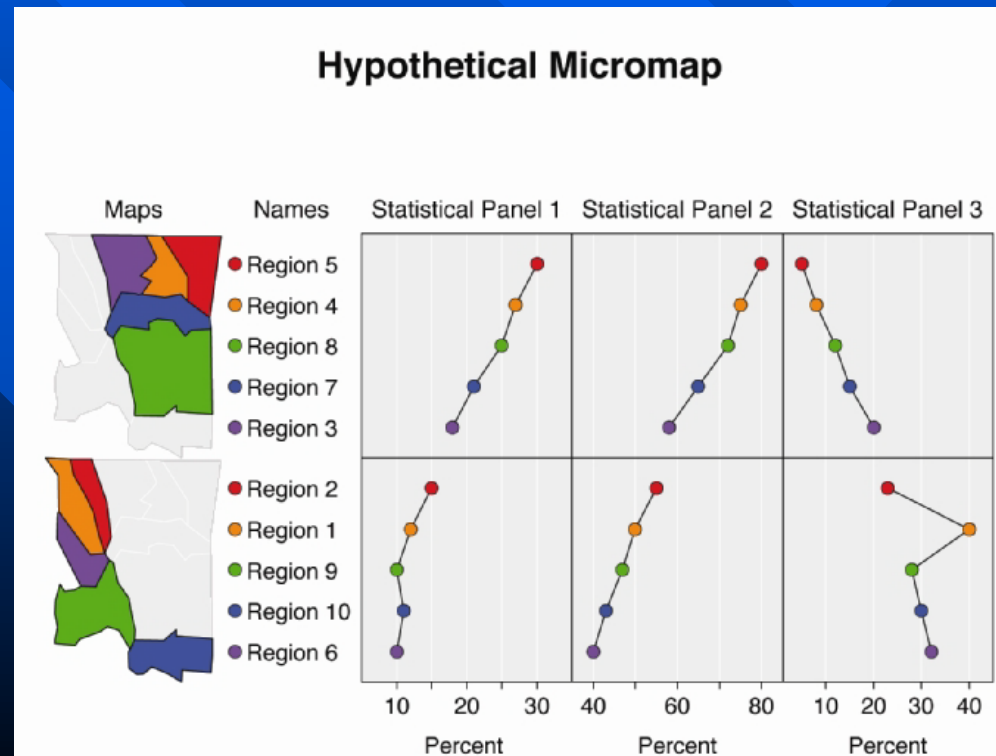
February 4, 2014

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# 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

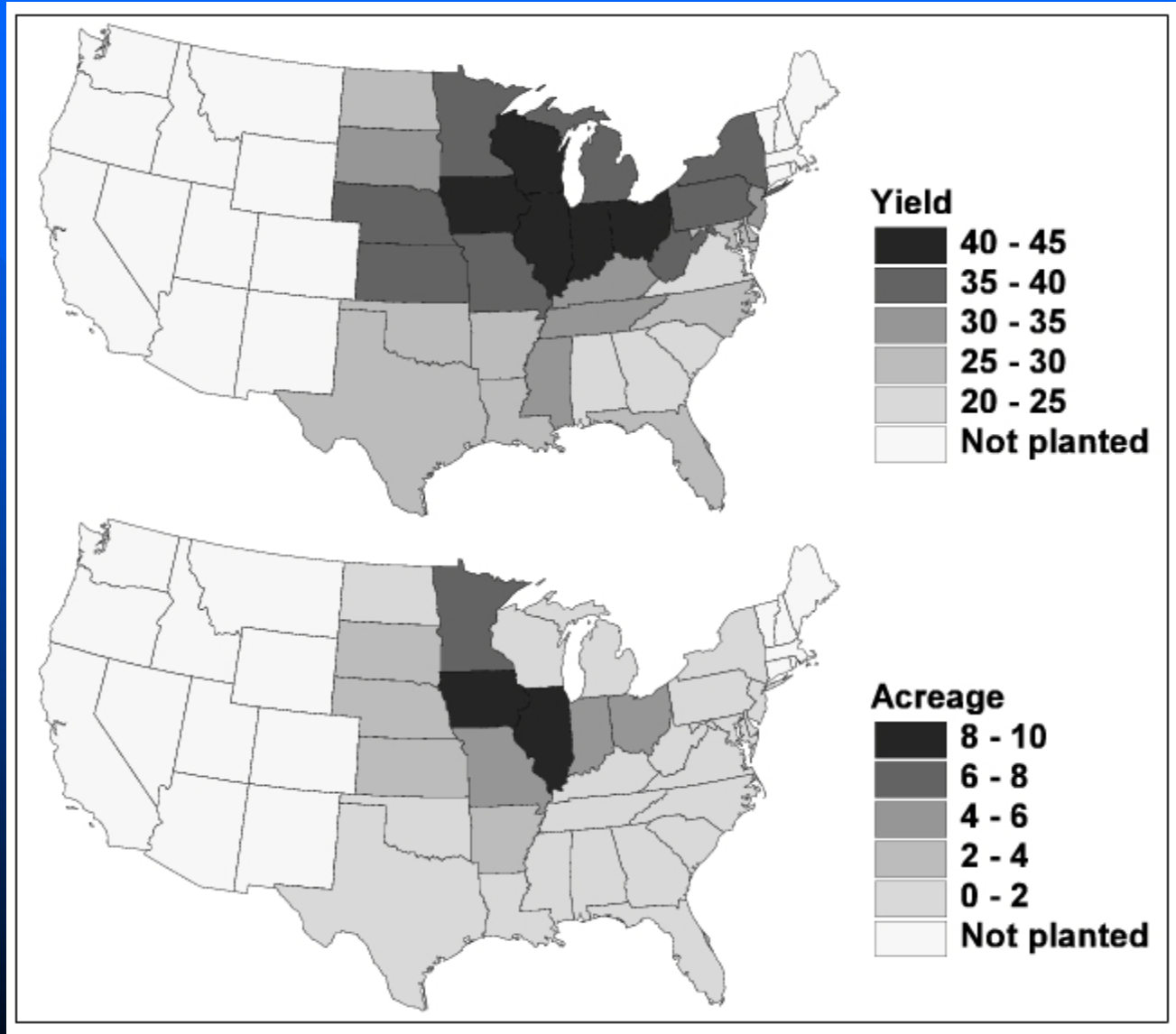
- First presented at 1995 American Statistical Association's annual meeting (Olsen, Carr, Courbois, Pierson)
- Initial references:
  - Carr, Pierson (1996) Emphasizing Statistical Summaries ...with Micromaps, SCSG\*, Vol.7, No.3
  - Carr, Olsen, Courbois, Pierson, Carr (1998) Linked Micromap Plots ..., SCSG, Vol. 9, No.1

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\*Statistical Computing & Statistical Graphics Newsletter:

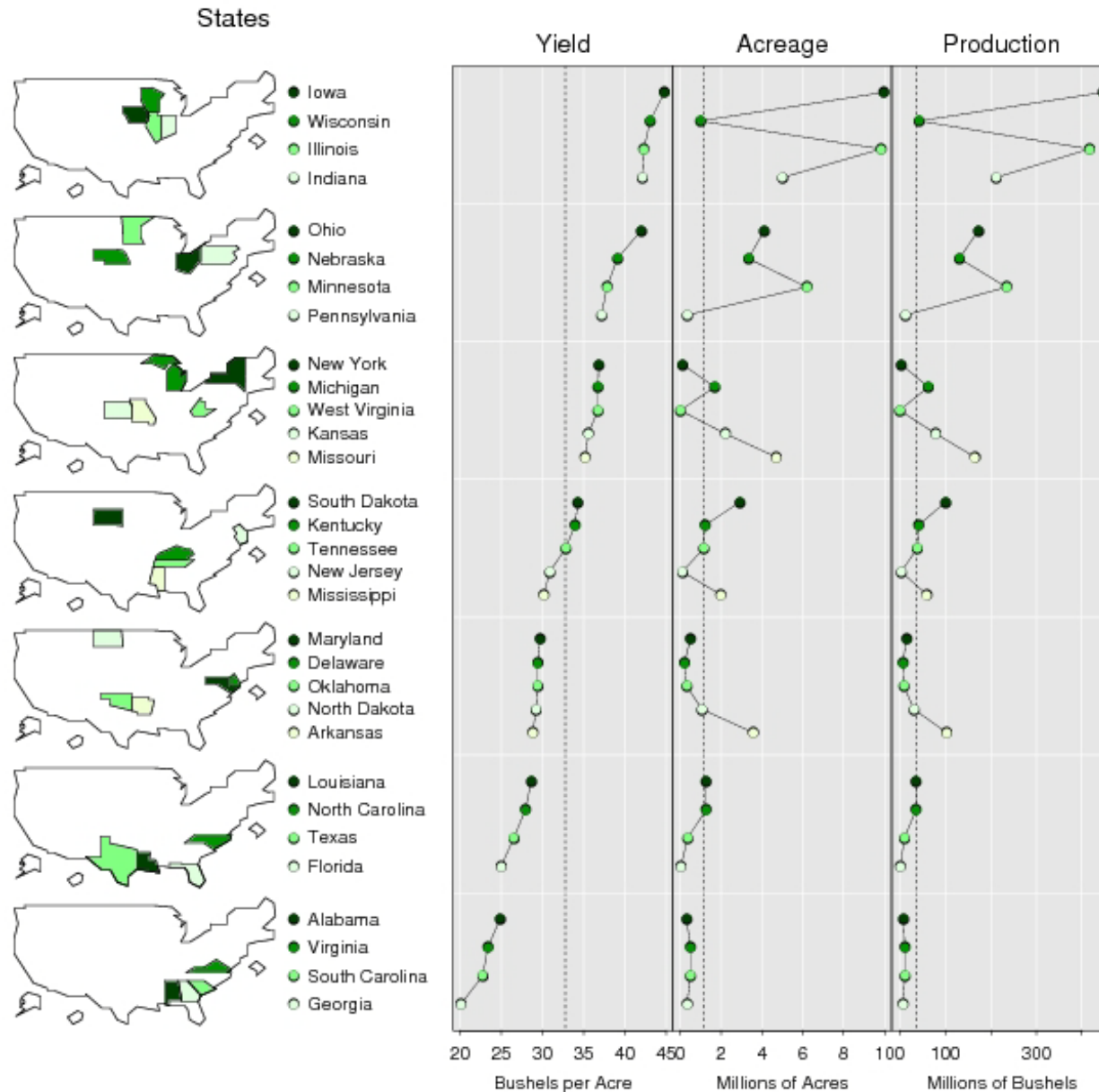
<http://stat-computing.org/newsletter/archive.html>

# Choropleth Maps vs Micromaps (1)



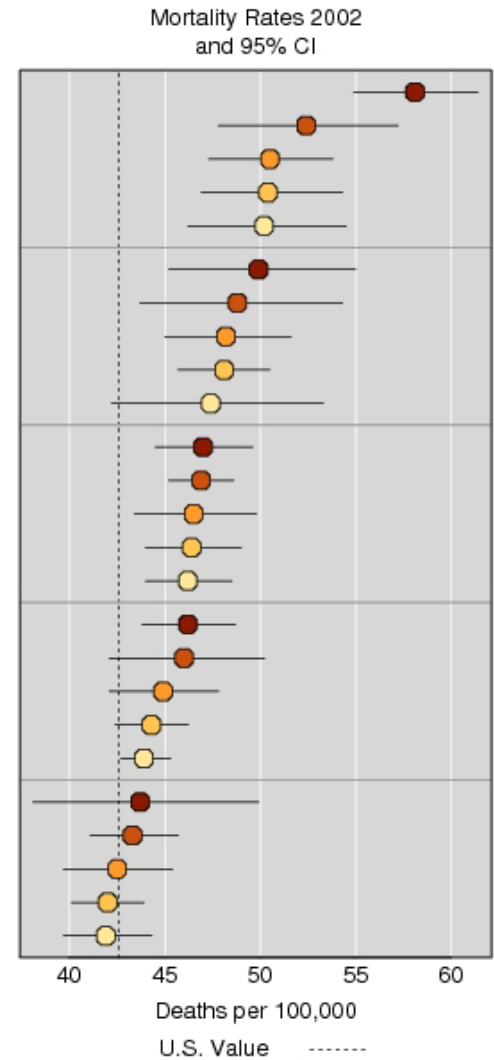
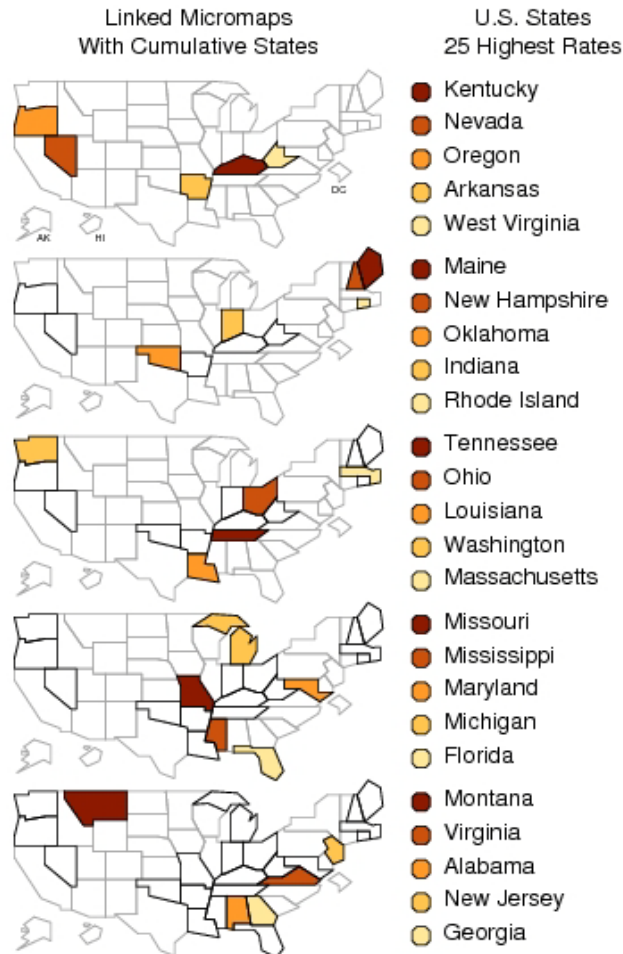
# Choropleth Maps vs Micromaps (2)

Soybean Statistics by State, 1997 Census of Agriculture



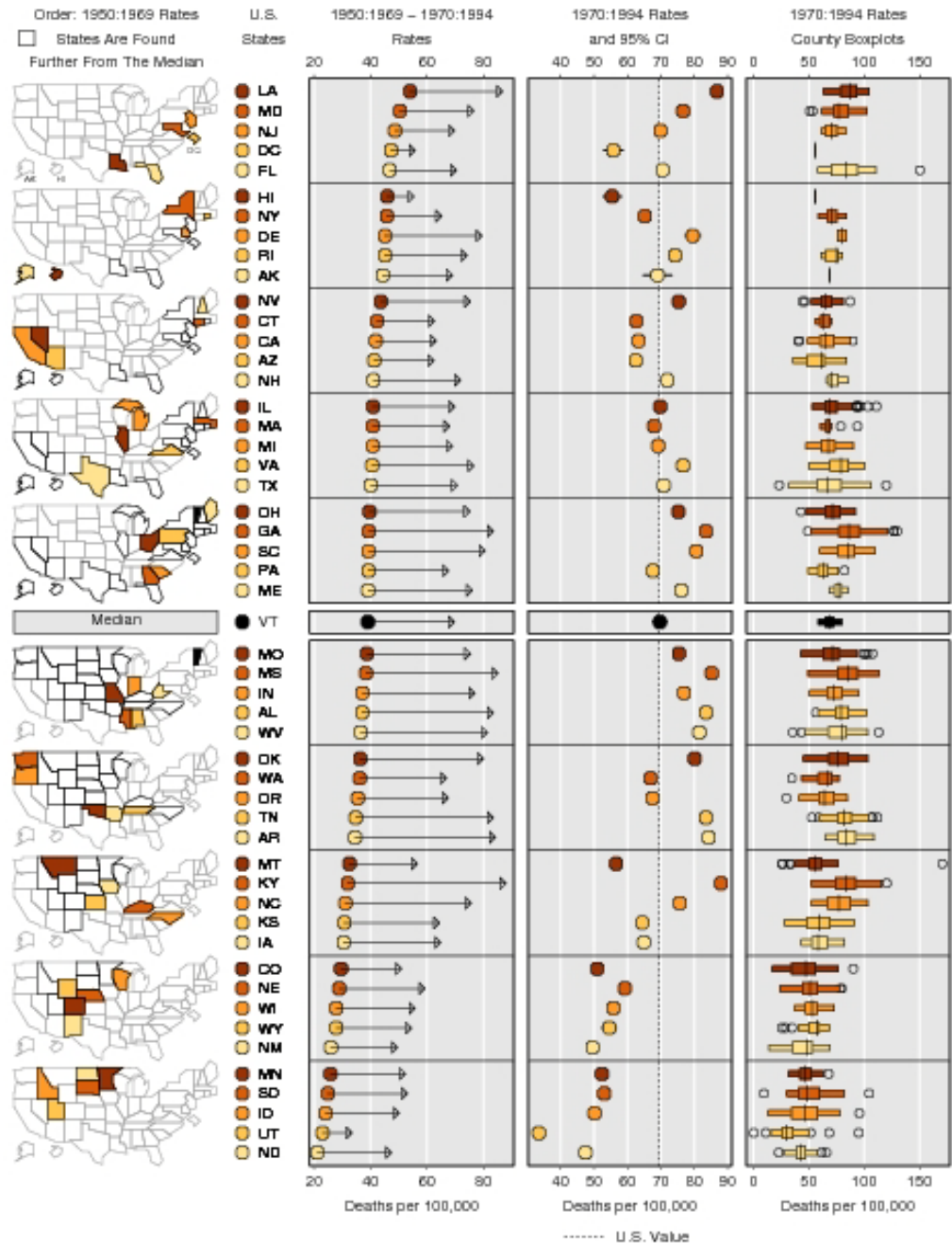
# Some Nice Examples (1)

## Lung and Bronchus Cancer: White Female Mortality 2002

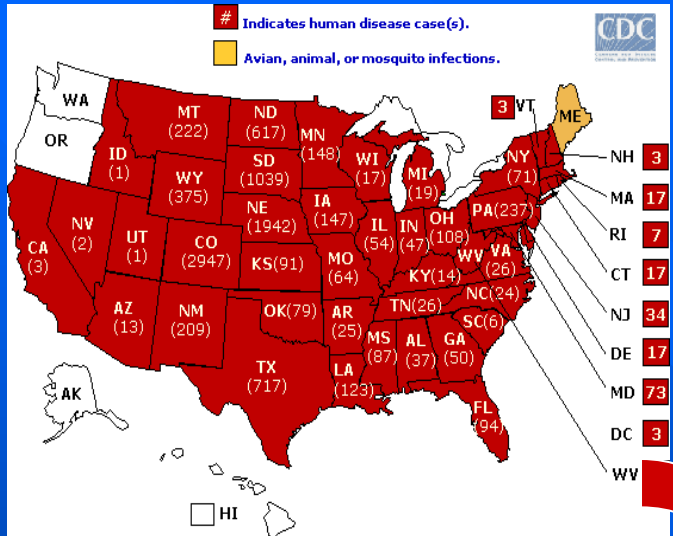


# Some Nice Examples (2)

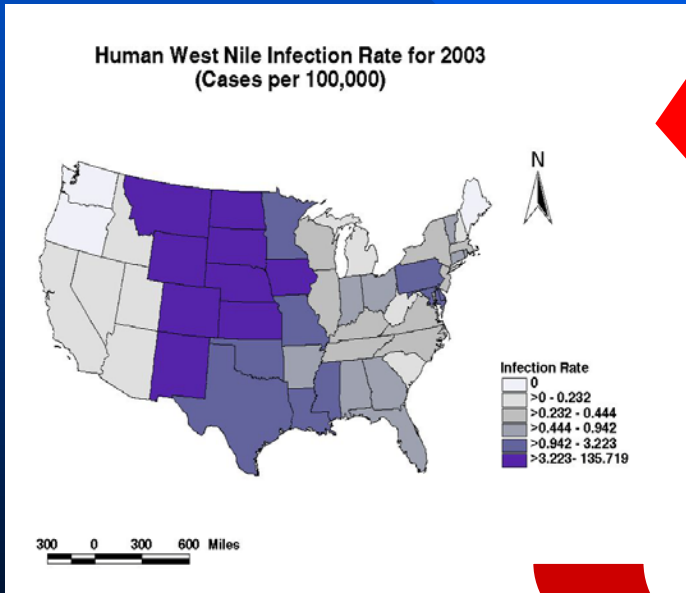
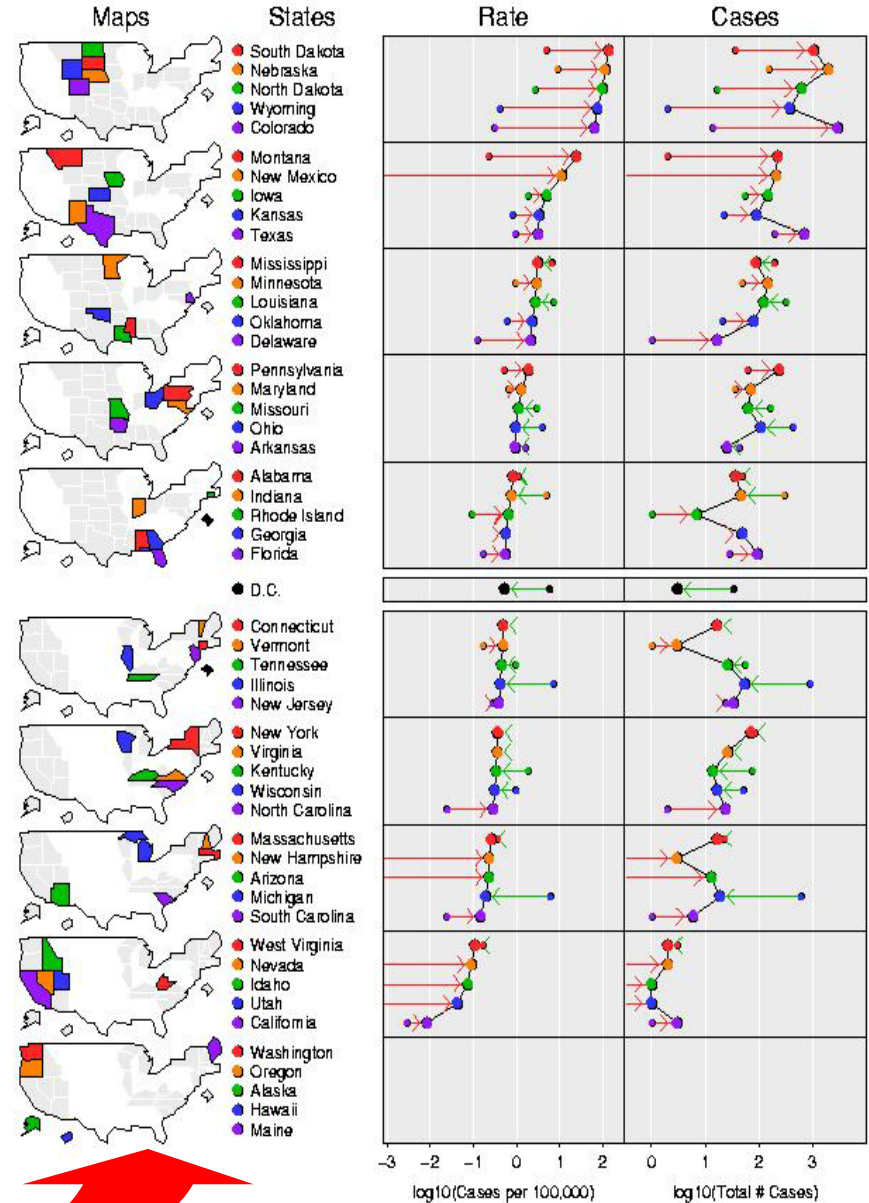
## White Male Lung Cancer Mortality Rates



# Example (3)

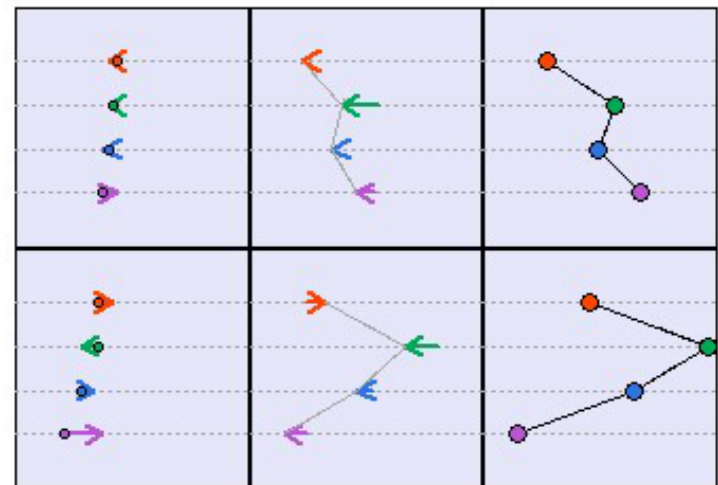
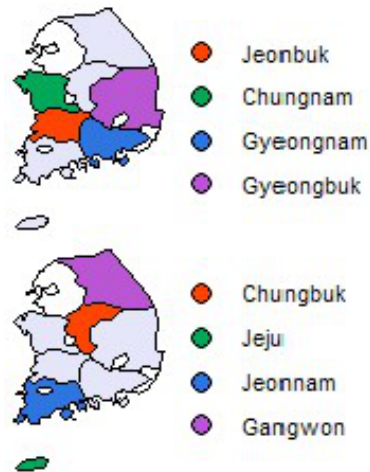
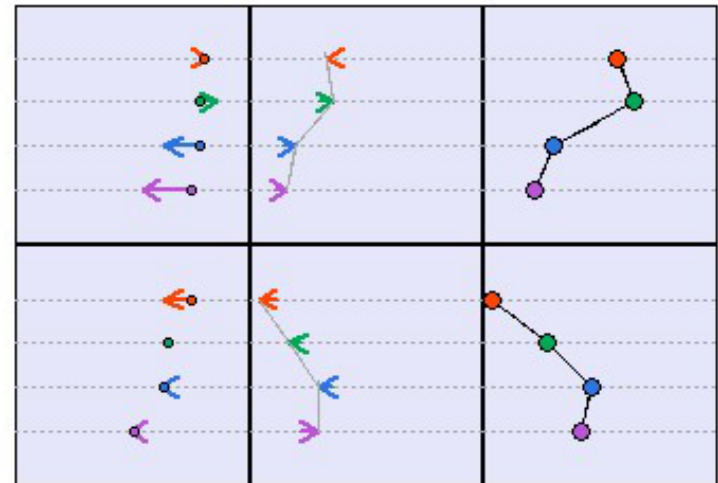
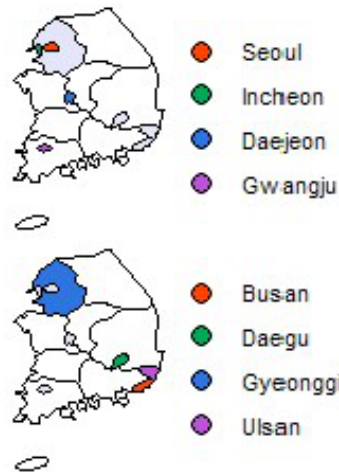


## West Nile Virus 2003 Lab-Positive Human Cases



# Regional Micromap Example: Korea (Ahn, 2013)

## Employment (Compared with 2006)



1 2 3 4 5 55 60 65 70 56 60 64  
 unemployment rate(%) employment rate(%) activity rate(%)

# Regional Micromap Example: China (1)

**Data  
taken  
from:**

## **Spatial Studies of Chinese Religions and Society**

**Xinyan Zhu**

*The State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University*

**Changzhen Wang**

*The State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University*

**Shuming Bao**

*China Data Center, University of Michigan*

**Bing She**

*The State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University*

# Regional Micromap Example: China (2)

Table shows number of officially registered religious organizations in each province

**Table 1** The number of Administration, Buddhism, Daoism, Islam, Christianity, 2004

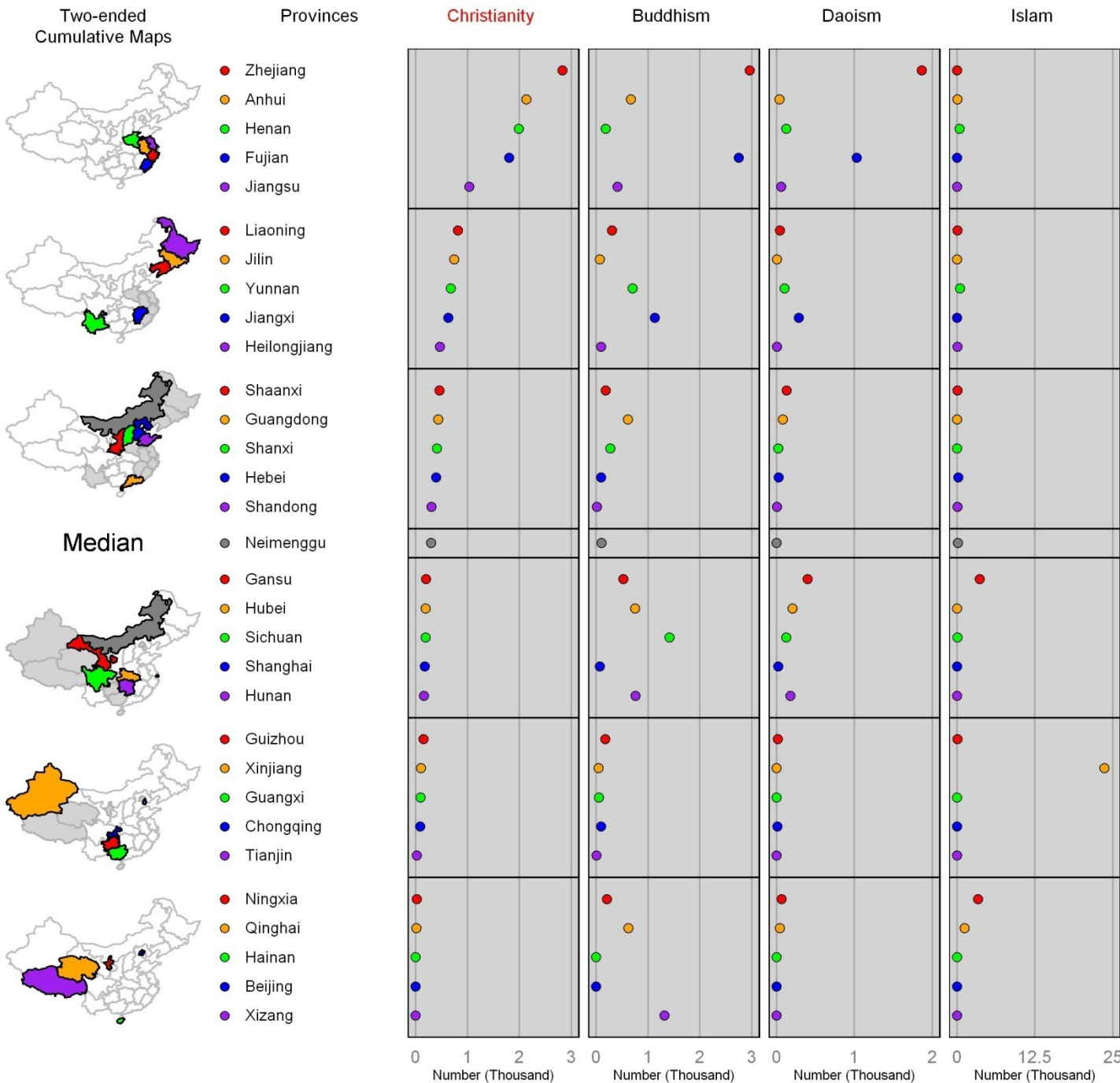
<u>gbprov</u>	<u>ename</u>	<u>st0</u>	<u>st1</u>	<u>st3</u>	<u>st4</u>	<u>st5</u>	<u>sttotal</u>
11	Beijing	0	2	0	22	5	29
12	Tianjin	1	6	0	30	25	62
13	Hebei	0	98	31	246	399	774
14	Shanxi	3	280	25	29	411	748
15	Neimenggu	4	109	2	126	304	545
21	Liaoning	2	312	47	89	821	1271
22	Jilin	0	71	8	56	745	880
23	Heilongjiang	1	100	9	64	473	647
31	Shanghai	1	73	21	7	175	277
32	Jiangsu	7	415	62	35	1039	1558
33	Zhejiang	2	2956	1868	10	2830	7666
34	Anhui	3	675	40	98	2132	2948
35	Fujian	10	2745	1030	6	1804	5595
36	Jiangxi	9	1133	288	5	633	2068
37	Shandong	5	14	7	122	306	454
41	Henan	10	187	128	444	1988	2757
42	Hubei	9	756	205	31	198	1199
43	Hunan	5	763	178	36	160	1142
44	Guangdong	10	617	81	3	440	1151
45	Guangxi	1	61	0	14	101	177
46	Hainan	0	2	0	0	5	7
50	Chongqing	1	102	11	3	88	205
51	Sichuan	9	1412	124	116	196	1857
52	Guizhou	1	178	15	80	158	432
53	Yunnan	1	701	102	525	682	2011
54	Xizang	7	1320	0	2	1	1330
61	Shaanxi	2	186	131	69	464	852
62	Gansu	6	530	400	3680	202	4818
63	Qinghai	1	627	42	1266	16	1952
64	Ningxia	0	211	68	3416	22	3717
65	Xinjiang	8	47	1	23678	105	23839

# Regional Micromap Example: China (3)

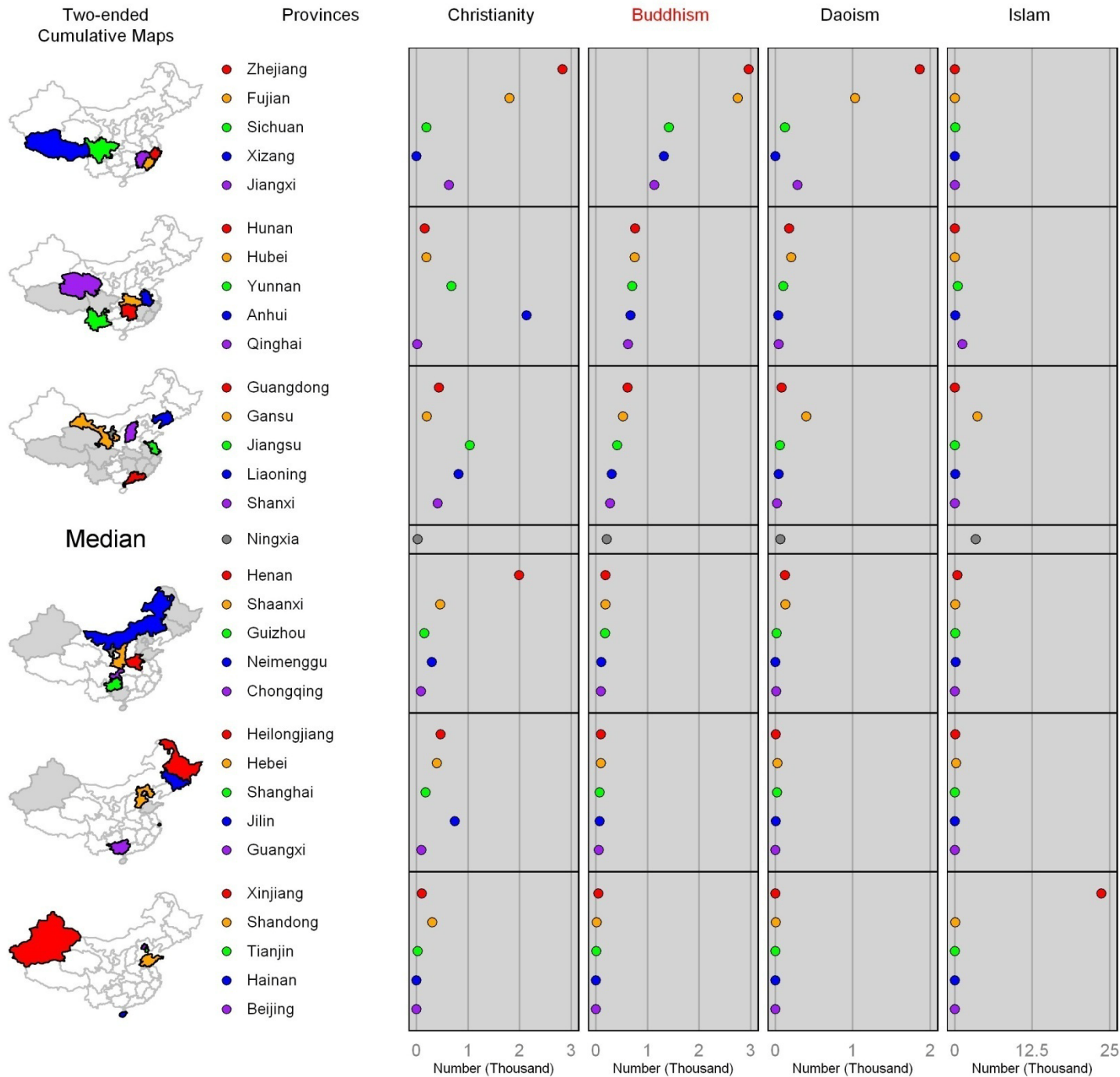
## Questions:

1. What is the single biggest outlier? And is this also a spatial outlier?
2. Is there any association between Buddhism and Daoism? If so, is this positive or negative? Are there regional differences?
3. For the four provinces with the highest count of Christianity, how is Buddhism represented in those provinces?

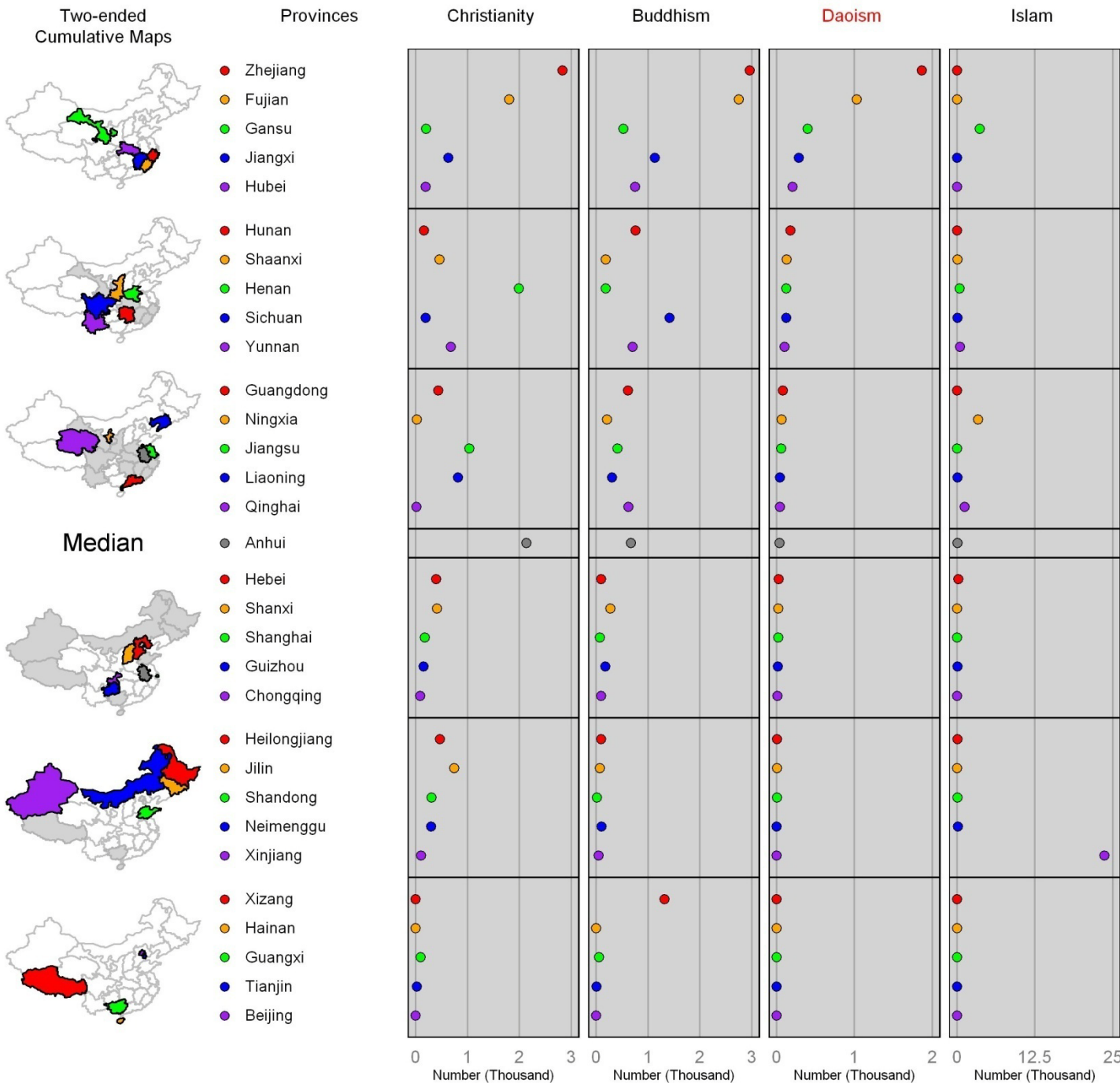
# Regional Micromap Example: China (4)



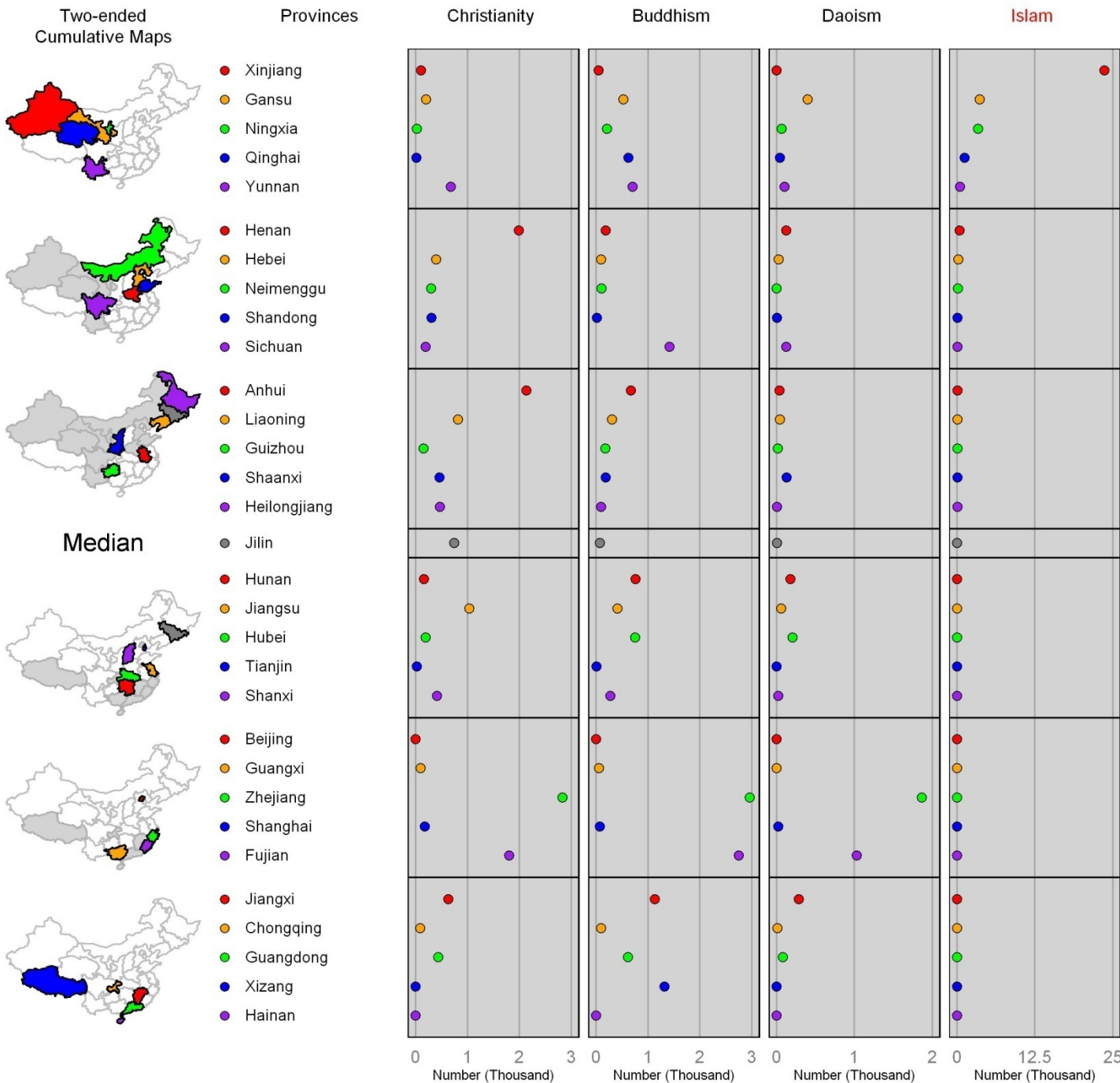
# Regional Micromap Example: China (5)



# Regional Micromap Example: China (6)

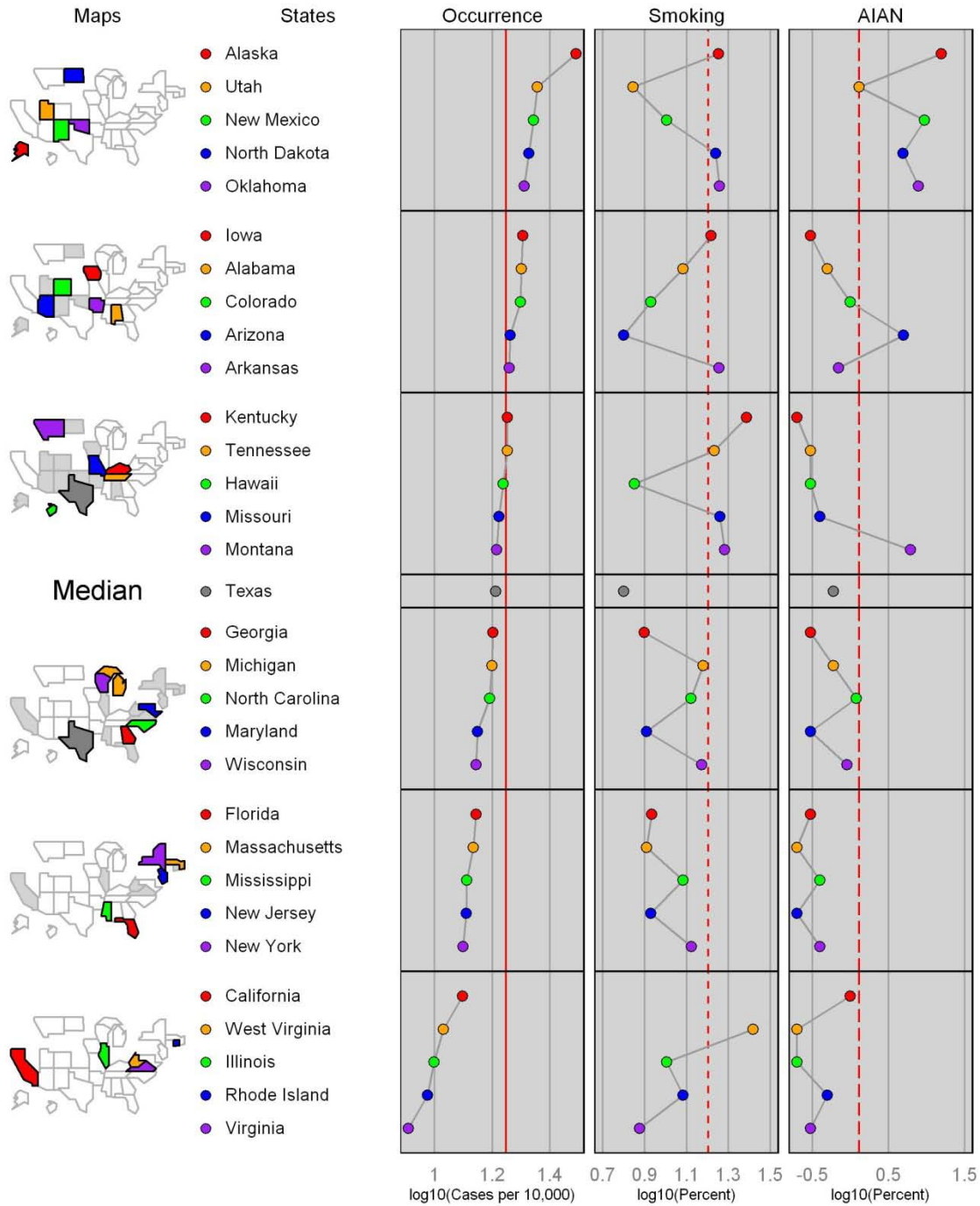


# Regional Micromap Example: China (7)



# Micromaps in R

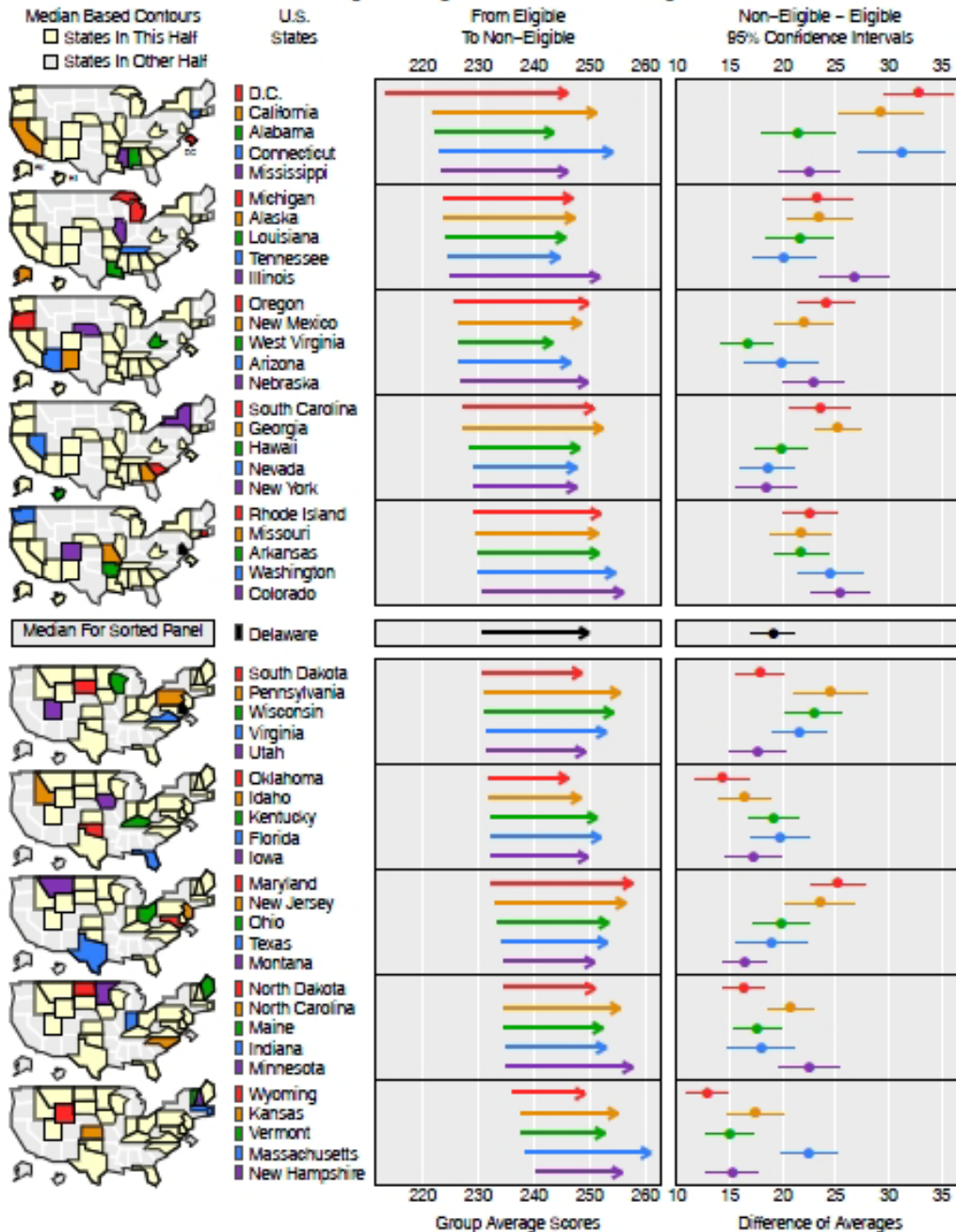
- Two recently developed R Packages:
  - “micromap”: general purpose
  - “micromapST”: focus on the 50 U.S. states



via "micromap"  
R Package

# NAEP Average Mathematics Scores: 4th Grade 2011

## School Lunch Program Eligible Versus Non-Eligible Students



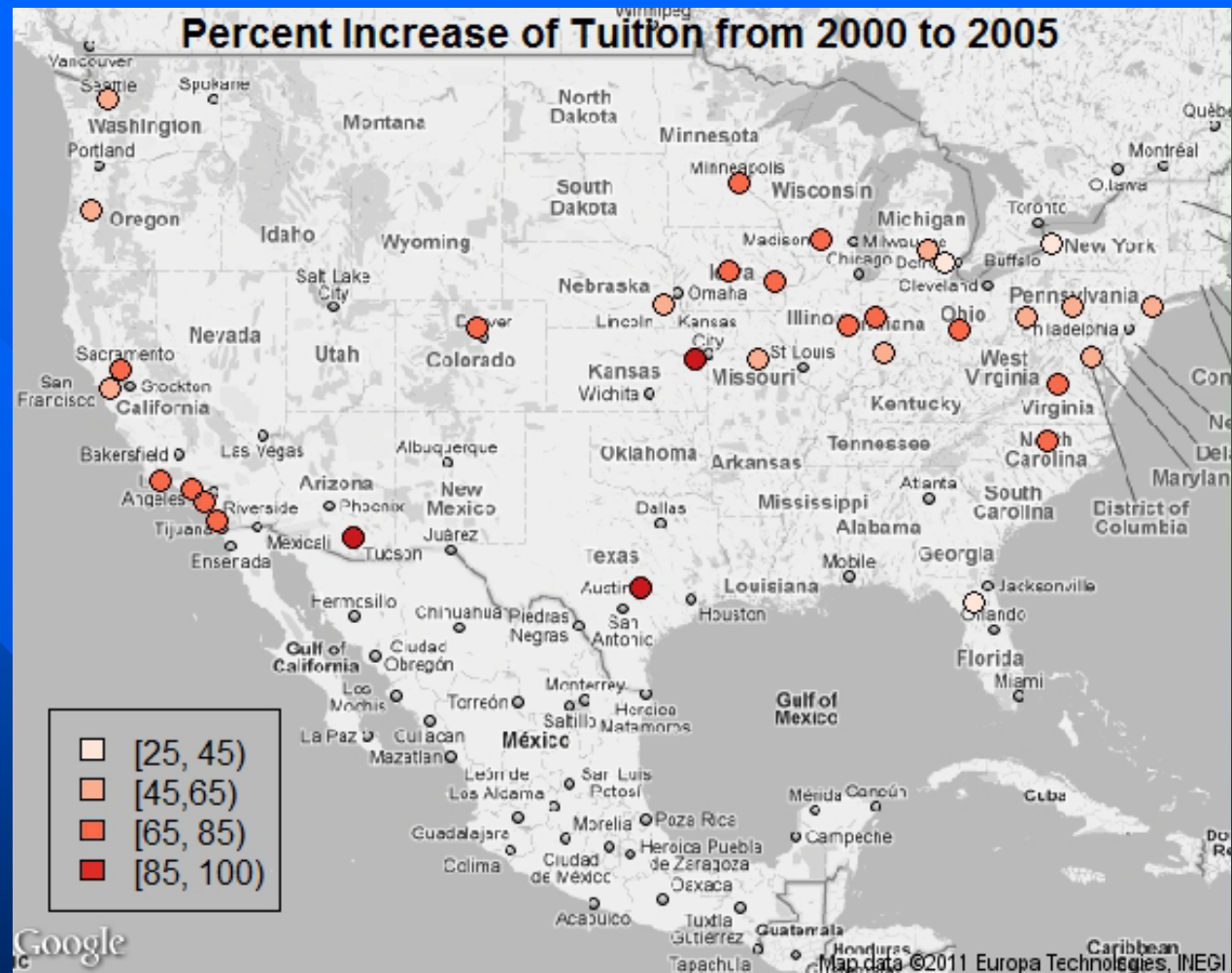
via "micromapST"  
 R package

# RgoogleMaps

- R package ``RgoogleMaps``:
- Two main purposes:
  - Provide a comfortable R interface to query the Google server for static maps
  - Use the map as a background image to overlay plots within R

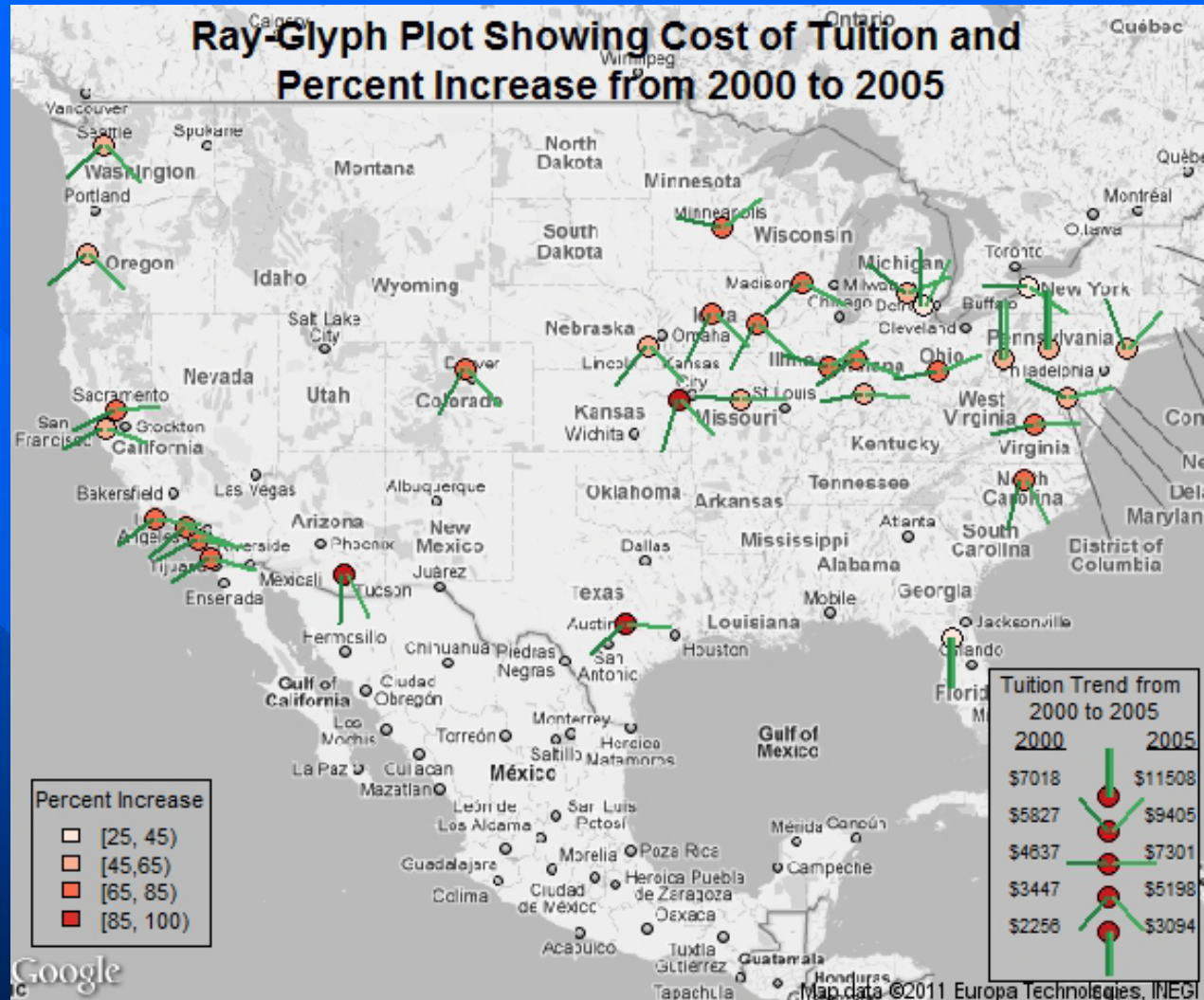
# Google Map - Tuition

- Data with latitude and longitude points can be represented on a Google Map
- Able to see grouping
- We can identify outliers



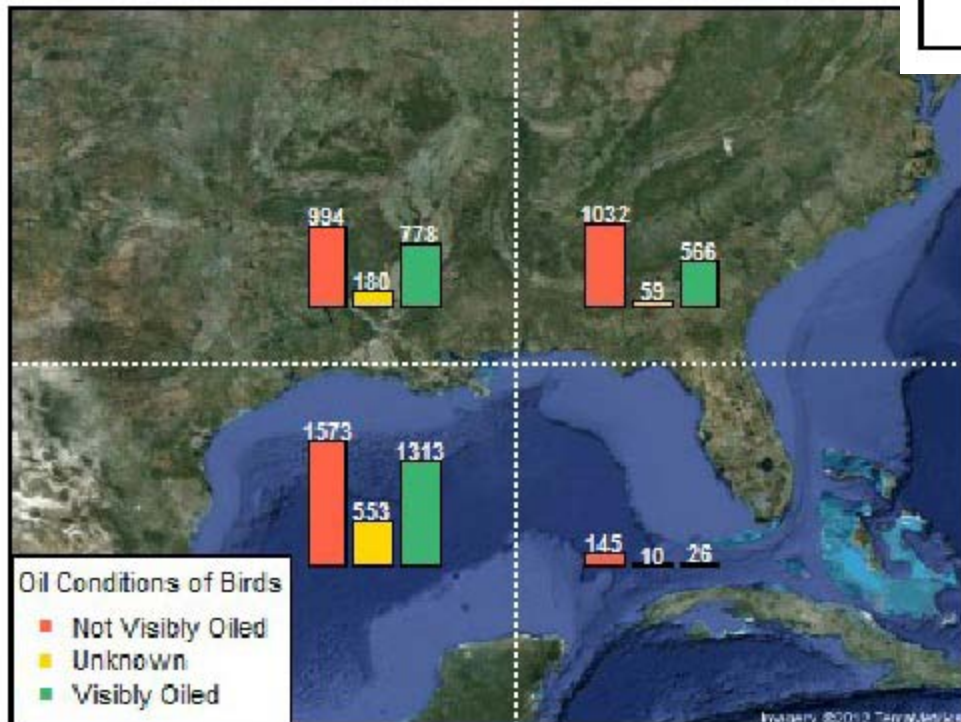
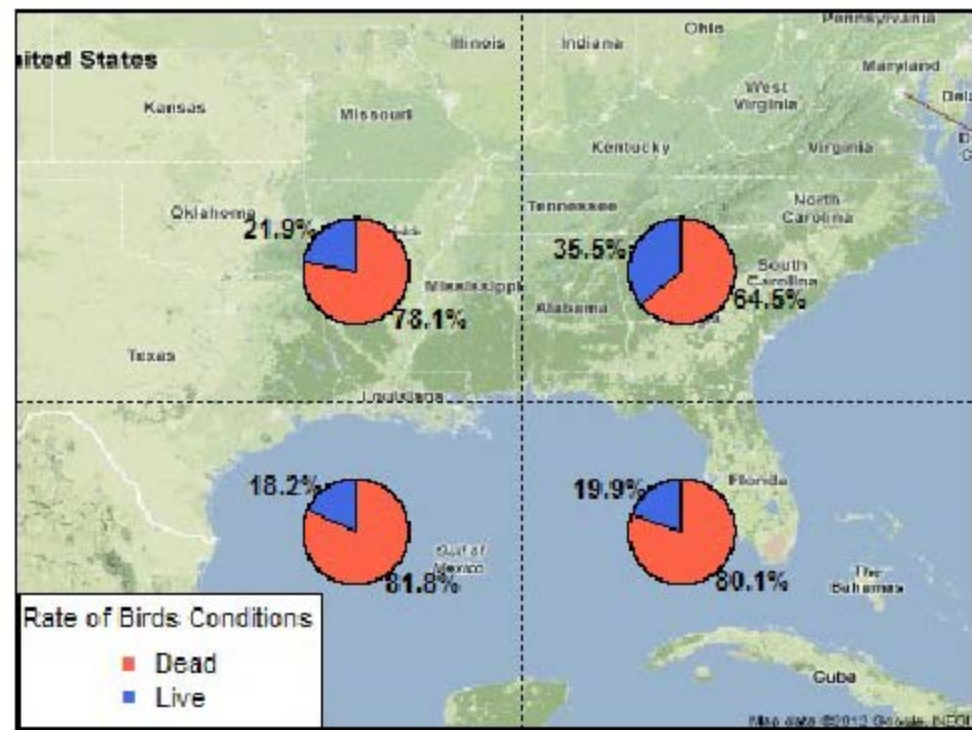
# Google Map - Tuition

- If we add a Ray-Glyph plot we can look at multiple variables on one map
- The green lines represent the tuition for 2000 and 2005 respectively with a line pointing down as the lowest and up as the highest tuition in that year
- Makes it easy to see outliers and identify trends



# Google Map – Oil Spill

Simple plots related to the 2010 Deepwater Horizon oil spill



# Religion in China – Relative Spatial Distribution



**Religion in  
China –  
Relative  
Spatial  
Distribution  
(with GPS-  
based  
boundaries)**



# Current Work

- Fine-tune micromaps
  - Enhance & relocate small areas (Beijing & Shanghai)
- Adjust micromaps with respect to population and/or area of the provinces
- Fine-tune plot locations for RgoogleMaps
  - Find better projection
  - Avoid overplotting
  - Replace midpoints where needed (instead of using geographic median)

# Outlook

- Sabbatical in 2014
- Collaborate with researchers at the China Data Center (CDC) in Ann Arbor, MI
- Specific Goals:
  - Extend micromaps for applications in China
  - Further advance micromaps concepts
  - Enhance China Geo-Explorer with micromaps
  - Enhance RgoogleMaps with new plot types
- **Specific Needs:**
  - Data
  - Specific Research Questions

# References

- Mun, G. S., Park, S. J., Symanzik, J., Ahn, J. Y. (2013): Visualizing Statistical Information Using Google Static Maps and R, ICIC Express Letters, Vol. 7, No. 3(A), 729-734.
- Symanzik, J., Carr, D. B. (2008): Interactive Linked Micromap Plots for the Display of Geographically Referenced Statistical Data, In: Chen, C., Haerdle, W., Unwin, A. (Eds.), Handbook of Data Visualization, Springer, Berlin/Heidelberg, 267-294 & 2 Color Plates.
- Symanzik, J., Carr, D. B. (2013): Linked Micromap Plots in R, Proceedings of the 2013 IASC Satellite for the ISI WSC and the 8<sup>th</sup> IASC-ARS Conference,  
[http://hbutton.com/IASC/iascproceedings/proceeding\\_pdf/Proceedings.pdf](http://hbutton.com/IASC/iascproceedings/proceeding_pdf/Proceedings.pdf).
- Voge, N. D., Symanzik, J. (2011): Ignoring the Spatial Context in Intro Stats Classes - And Some Simple Graphical Remedies, 2011 JSM Proceedings, American Statistical Association, Alexandria, Virginia, CD.

*Questions ???*

*– or –*

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