Data Visualization

Susan Stoddard, PhD

InfoUse, VRRTC

- “A picture is worth a thousand words”

But more than that:

- Using data visualization tools, we can “see” patterns and relationships we might miss using tables and numbers alone…

Chartbooks

- From the beginning (1984), InfoUse was about using data tools to understand statistics and information
- InfoUse “Chartbooks” on disability data
- Established a model for using disability data from different sources in graphs, charts, and maps, for a public audience
- Almost all available was national data, except for “work disability” available by state

Now, rich new sources

- Data: American Community Survey, BRFSS. State and sub-state information on disability
- New data visualization tools: mapping, “dashboards”, graphing and charting

Edward Tufte

- A data visualization pioneer
- Using visual display to display, explain

Data Viz learning community

- Summit members: sent a call for current users of mapping and other data visualization techniques in VR
- Examples from Alabama, Alaska
- Collaboration with Alabama on data exploration and this panel
- Toward a user group on data viz tools…

Data Visualization in Vocational Rehabilitation

Jeff Pflueger

Data Communications Consulting

- Data Visualization
- Web
- Database

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Definitions

- **Data visualization**
  - Means of communicating relationships in data visually
  - "Data Viz" is coming of age in Internet age where "visualizations" have become interactive and report from live and changing data sources
- **Business intelligence (BI)**
  - Computer based technologies used to analyze, share and visualize business related information such as sales, market research, etc.
  - "Dashboards" are a common way to present BI
- **Data journalism**
  - Traditional journalists have become sophisticated in data analysis and visualization to seize opportunities for compelling reporting
- **Geospatial**
  - Related to location, as in "geospatial data"
- **Geovisualization ("geographic visualization")**
  - Geospatial data analysis and communication through the use of interactive cartographic visualizations on a computer

Contents

- Examples
- Important Datasets and Data Sources
- Data Visualization Tools

Examples

Data visualization examples which highlight tools, techniques, datasets, and analysis related to VR.

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Overview

- Geovisualization
  - Animations
    - Simple time series animations communicate dramatic stories
  - Dynamic geospatial queries
    - Users explore large, complex datasets with maps
  - Other examples highlight
    - Development tools
    - Datasets
    - Approaches relevant to VR
- Other visualizations
- State case studies: Alabama and Alaska

Map examples include:

- **Platform**
  - The technology used to **display** the visualization
    - **Flash Player -** Adobe's popular multimedia platform for adding interactivity and animation to web pages.
      - SWF files created either byAdobe Flash or Flex
      - Can create animations and web applications
      - Disadvantages include accessibility issues for people with disabilities, cannot view on iPad/iPhone
    - **HTML & Javascript** - The native language of the web.
      - New developments in technologies make rich, interactive websites and animations possible with HTML and Javascript
- **Development**
  - The technology used to **develop** the visualization
    - **Custom programming** - Programmers worked to develop the visualization with various languages and scripting
    - **Other Tools** - Specific tools used (tool are detailed at end of presentation)
- **Application**
  - Applications in visualizing data related to vocational rehabilitation

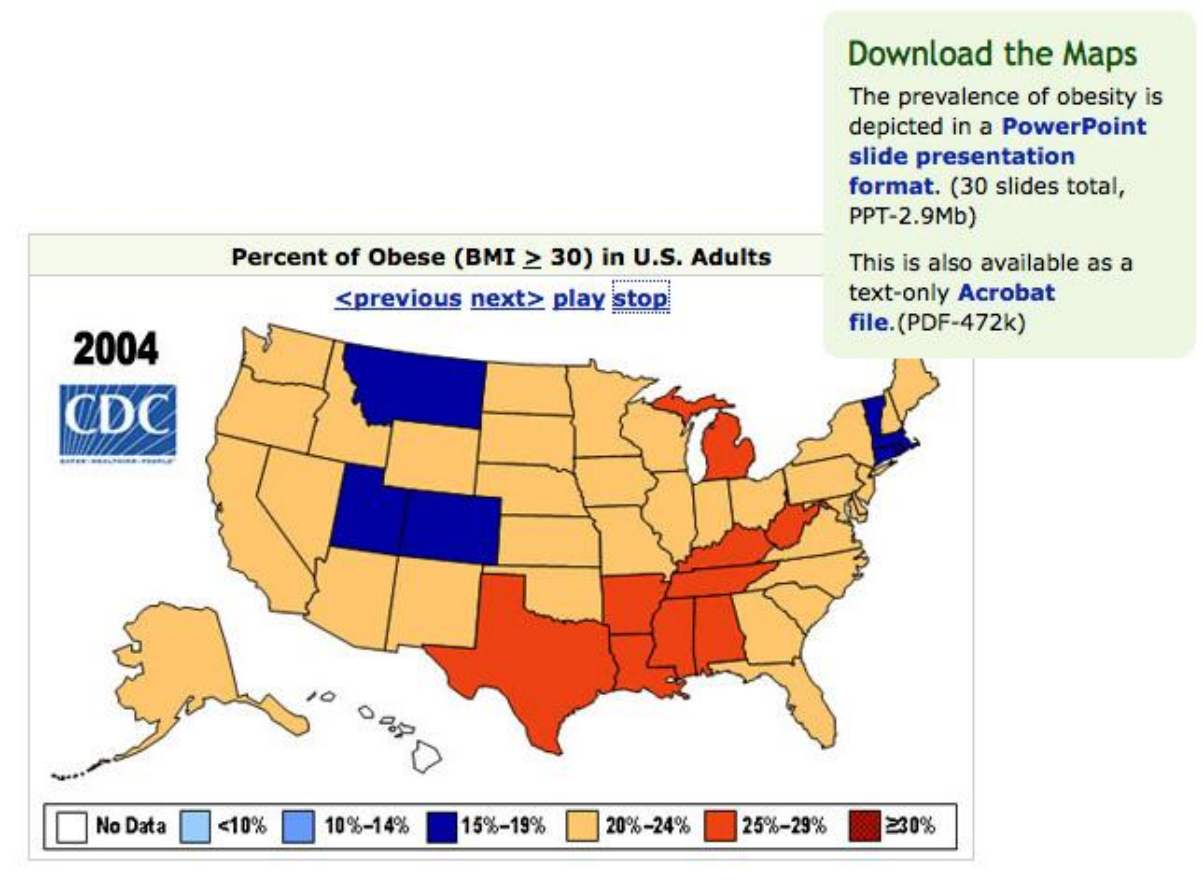
Examples: Geovisualization - Animation to show changes over time

Is there a compelling geospatial story as a trend over time?

Consider using a time series animation:

- Simple
- Powerful
- Engaging

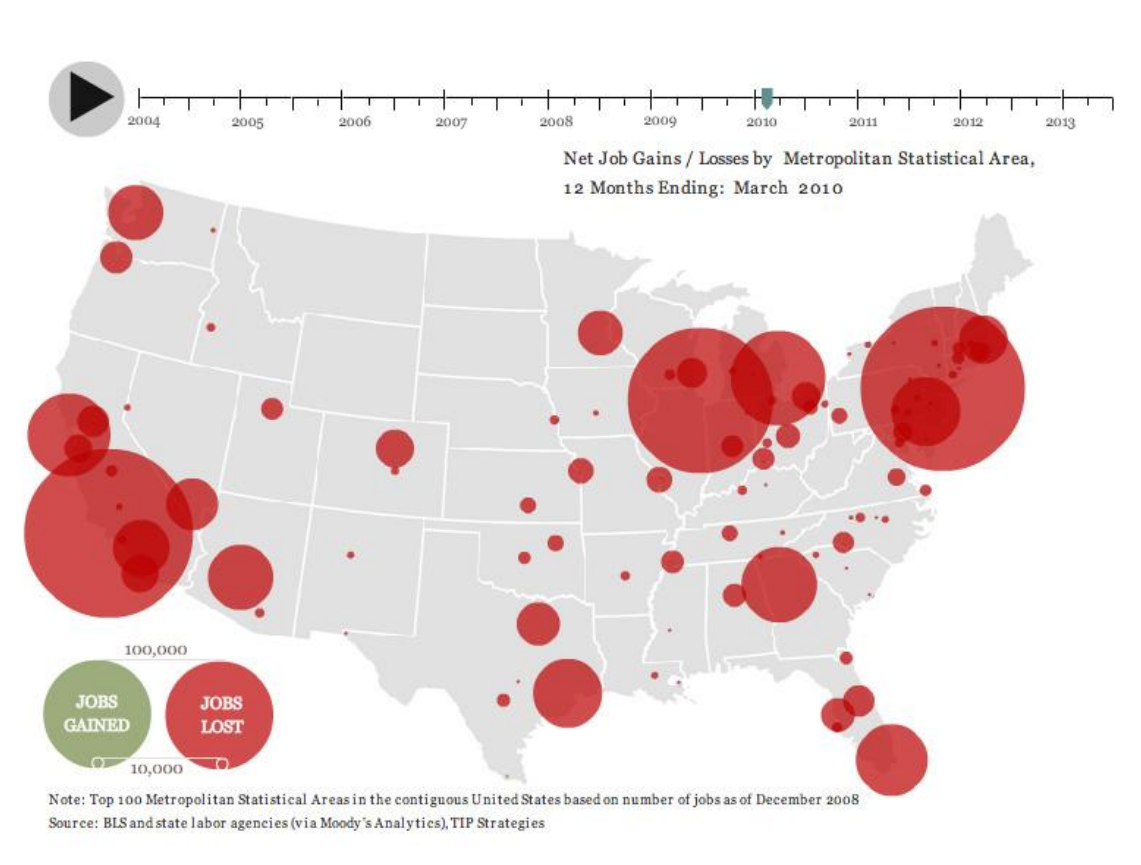
"Percent of Obese (BMI≥30) in U.S. Adults 1985-2009"
Center for Disease Control



- **What**: Simple animation of dramatic changes in obesity from 1985-2009
- **Source**: CDC
- **Platform**: HTML, PDF
- **Development**: Custom programming
- **Application**: Dramatic changes conveyed with animation. Show relationships between health indicators, disability and VR needs over time

View Online

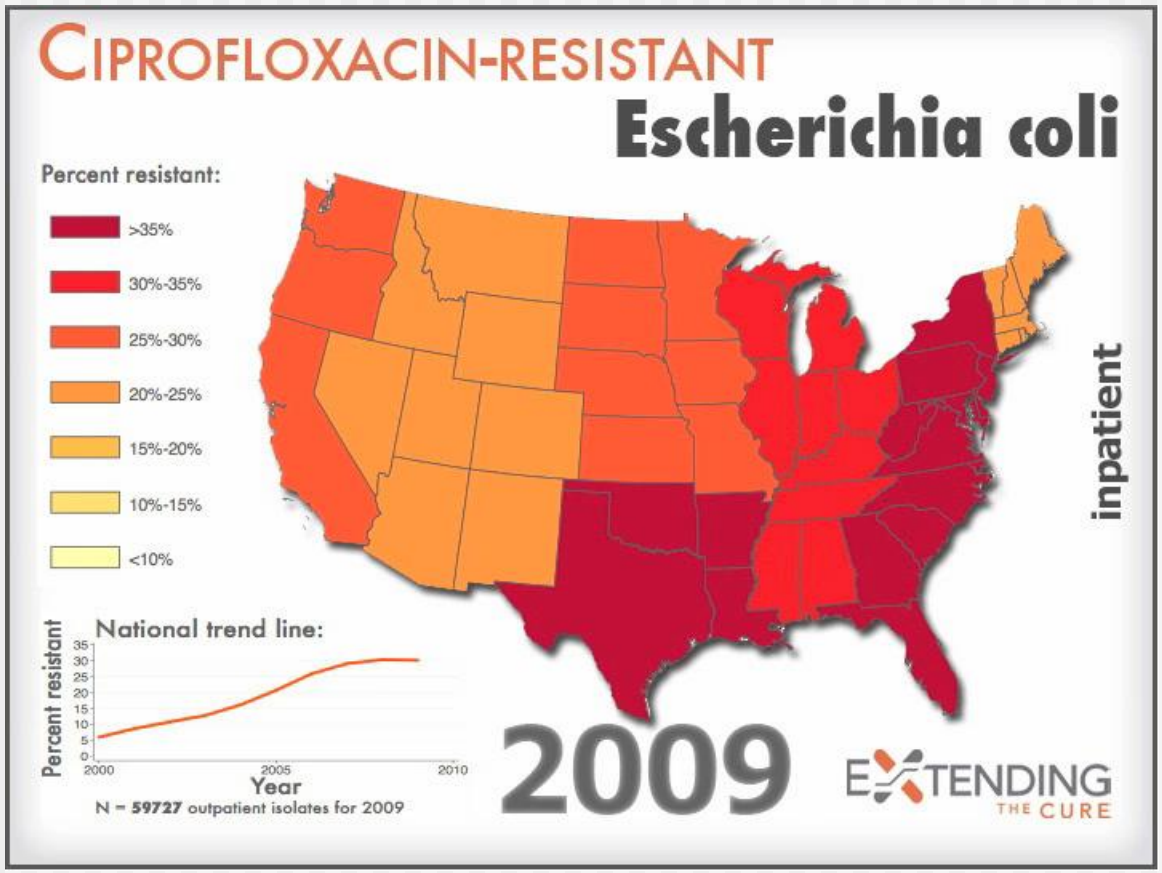
Example: "The Geography of Jobs"
TIP Strategies



- **What:** Animated map of job loss and gain by metropolitan statistical area
- **Source:** BLS and state labor agencies via Moody's Analytics. TIP strategies.
- **Platform:** Flash Player
- **Development:** Custom programming
- **Application:**
- Animated maps are a good way to demonstrate very dramatic trends and events
- VR rehabilitation rate compared with labor trends by state
- Other VR performance measures visualized over time

View Online

"ResistanceMap"
Center for Disease Dynamics, Economics & Policy



- **What**: Animated map showing increasing abundance of drug resistant bacteria over time.
- **Source**: Center for Disease Dynamics, Economics & Policy
- **Platform**: Flash Player
- **Tool**: Custom Flash development
- **Application**:
- Animated maps great way to demonstrate dramatic change over time
- RSA state statistics over time (where the story is a dramatic one): state rankings, rehab rate, cost per rehab
- State Vocational Rehab Performance visualized over time (using something similar to FY 2009 poster data)

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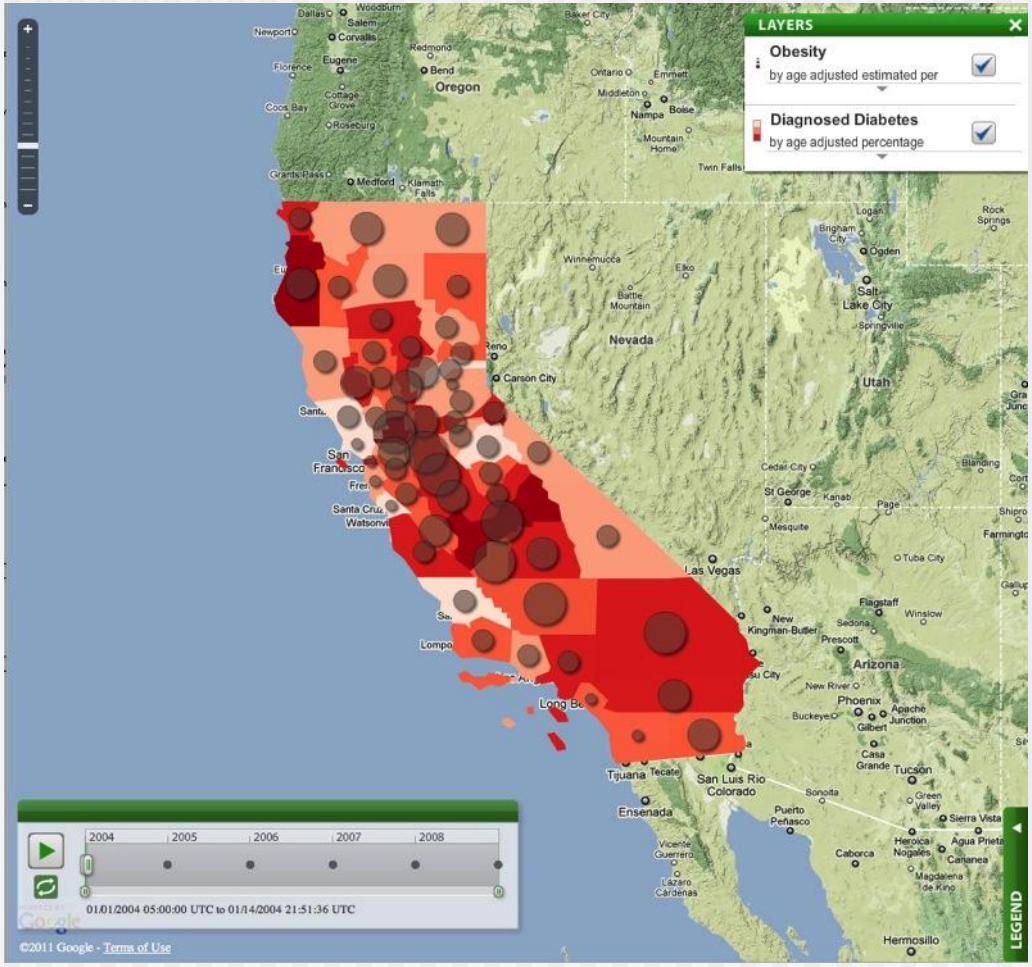
Example: "Diagnosed Diabetes and Obesity in California"
CDC Data Mapped by InfoUse



- **What**: An animated map of the changing rates of obesity and diagnosed diabetes in California 2004-2008
- **Platform**: Flash Player
- **Development**: GeoCommons/GeoIQ
  Application:
- Rapid creation and publication of VR related maps
- Share RSA data and geo-spatial visualizations privately within a group
- Problems still exist with the GeoCommons animation user interface

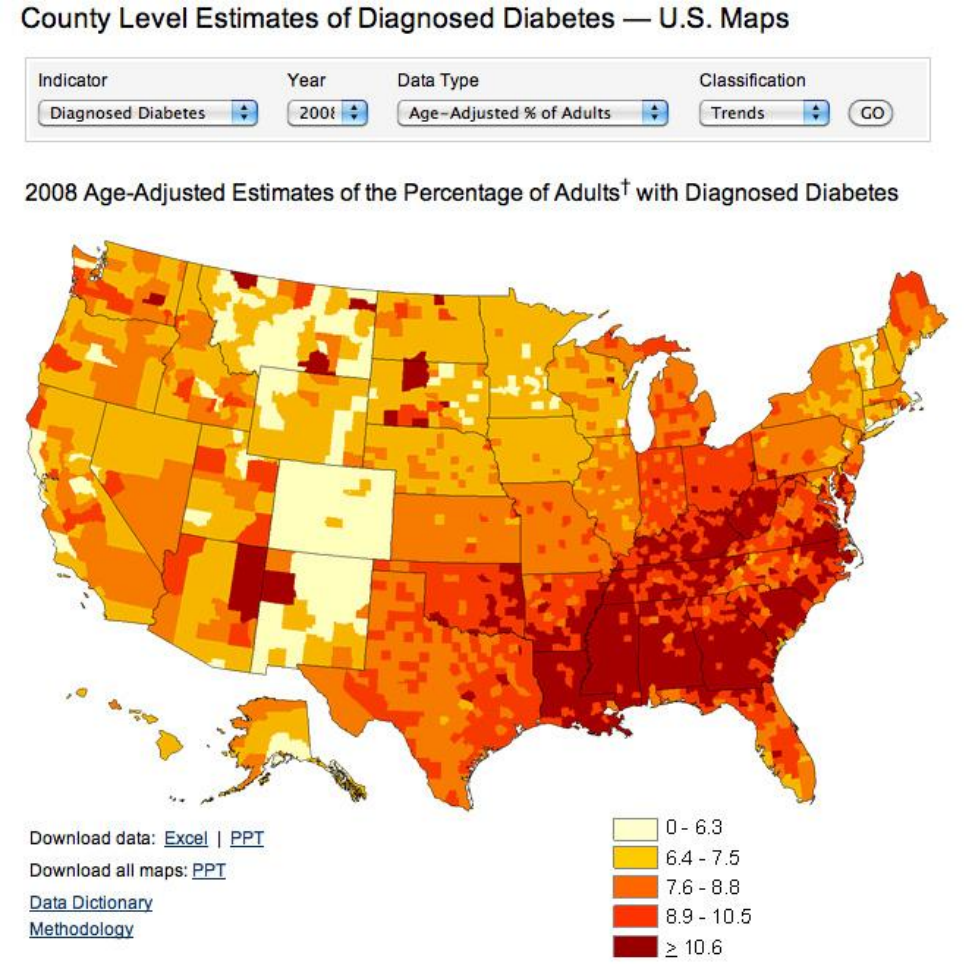
View Online

Examples: Geovisualization "Dynamic Geospatial Queries"

Dynamic geospatial queries give users

- Access to large, complex datasets
- The ability to create maps from their own queries to visualize trends

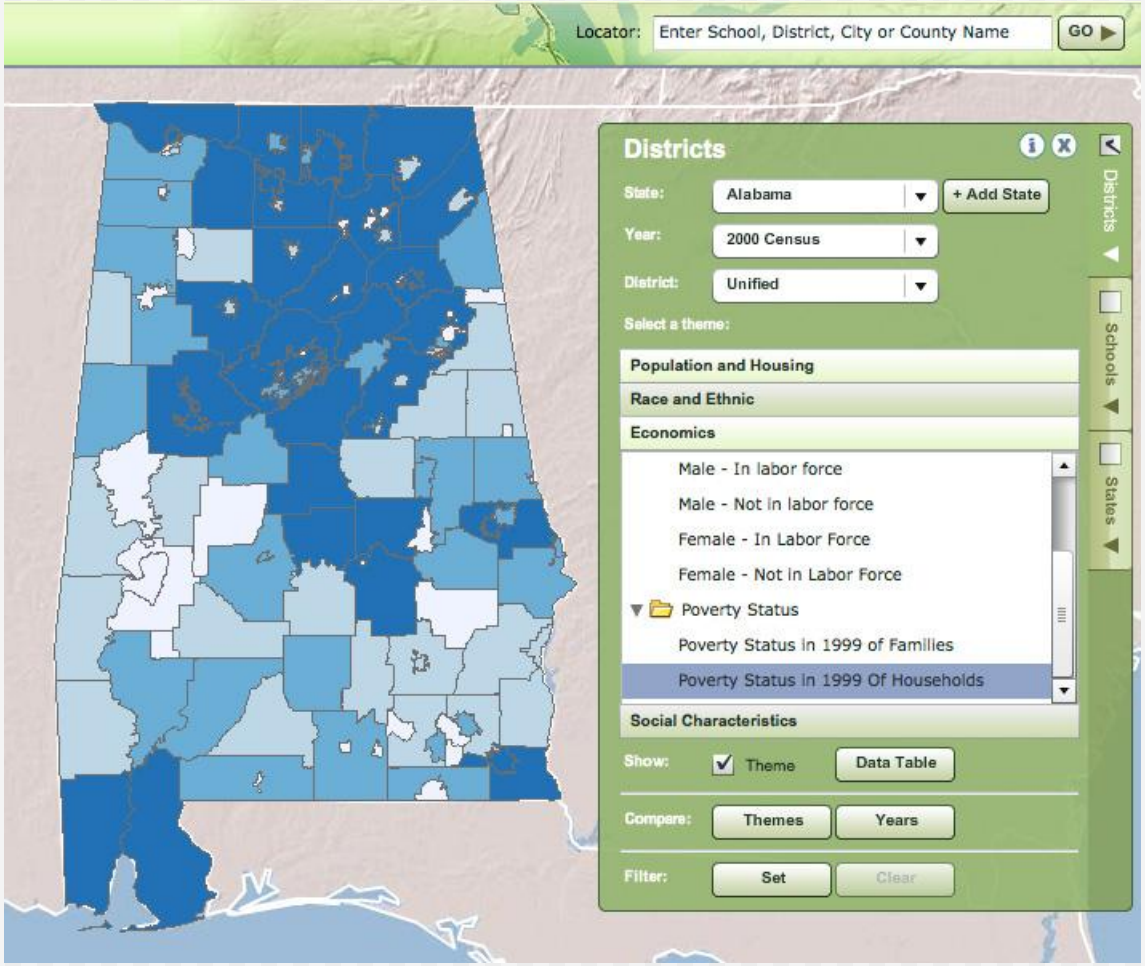
"County Level Estimates of Diagnosed Diabetes"
Center for Disease Control



- **What**: Interactive map of diagnosed diabetes, obesity and physical inactivity by county 2004-2008
- **Platform**: Webpage
- **Development**: Custom programming
- **Application**:
- VR statistics and changes over time
- Show relationship between health indicators like obesity, diabetes, disability and VR needs.

View Online

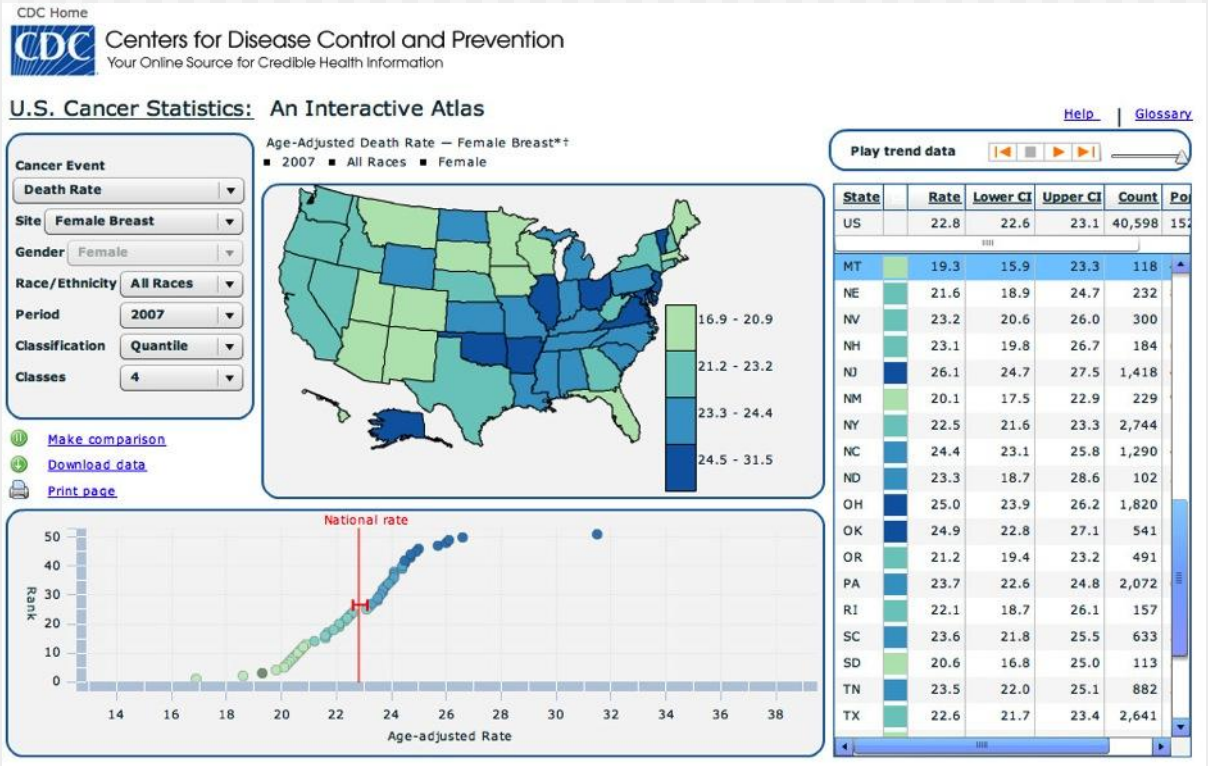
"School District Demographics System - Map Viewer"
National Center for Education Statistics



- **What**: Choropleth map of school district population information from ACS and Census data
- **Source**: National Center for Education Statistics
- **Platform**: Flash Player
- **Development**: ESRI software products ArcGIS Server, custom programming with ArcGIS API for Flex
- **Application**:
- Potential visualization when disability data becomes available at county level from ACS (2013 the 5 year sample will have substate disability measures),
- RSA data at zipcode level across United States

View Online

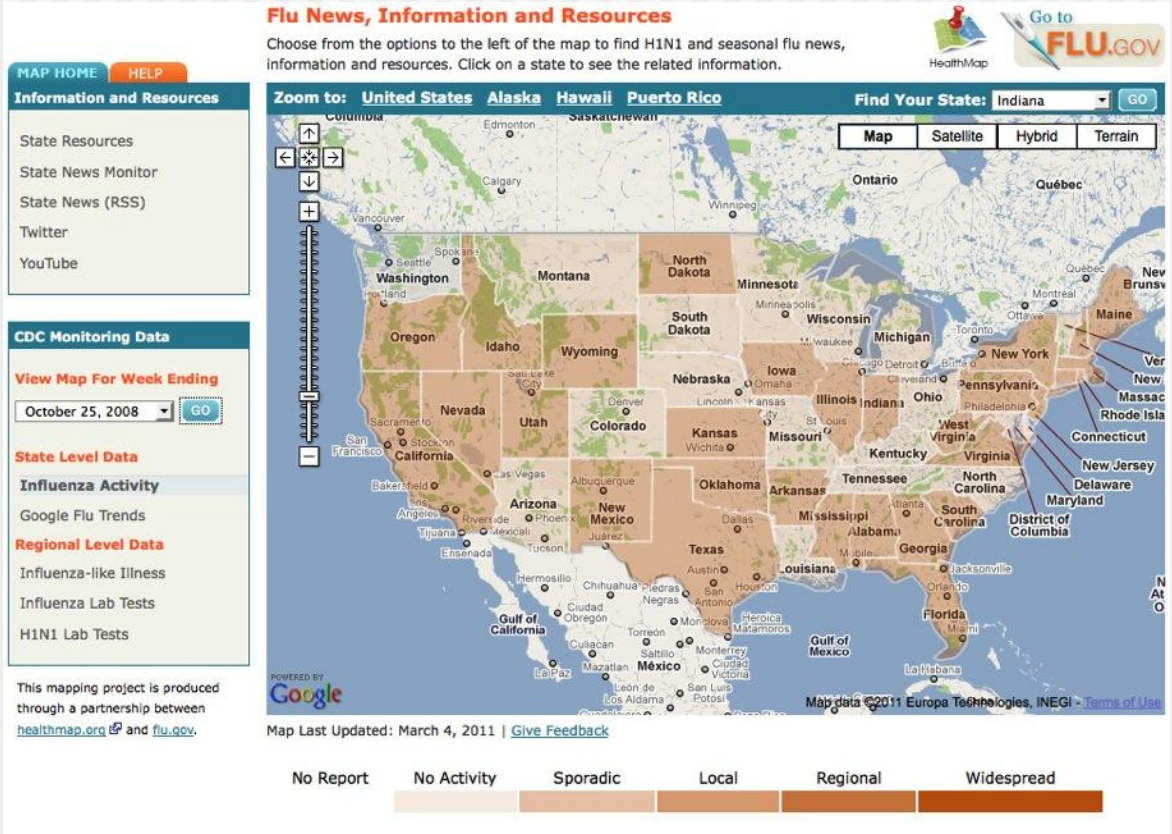
"US Cancer Statistics: An Interactive Atlas"
Center for Disease Control



- **What**: Dynamic map showing increasing abundance of drug resistant bacteria over time.
- **Platform**: Flash player
- **Development**: Adobe Flex/Flash
- **Application**:
- RSA state statistics over time (where the story is a dramatic one): state rankings, rehab rate, cost per rehab
- State Vocational Rehab Performance visualized over time

View Online

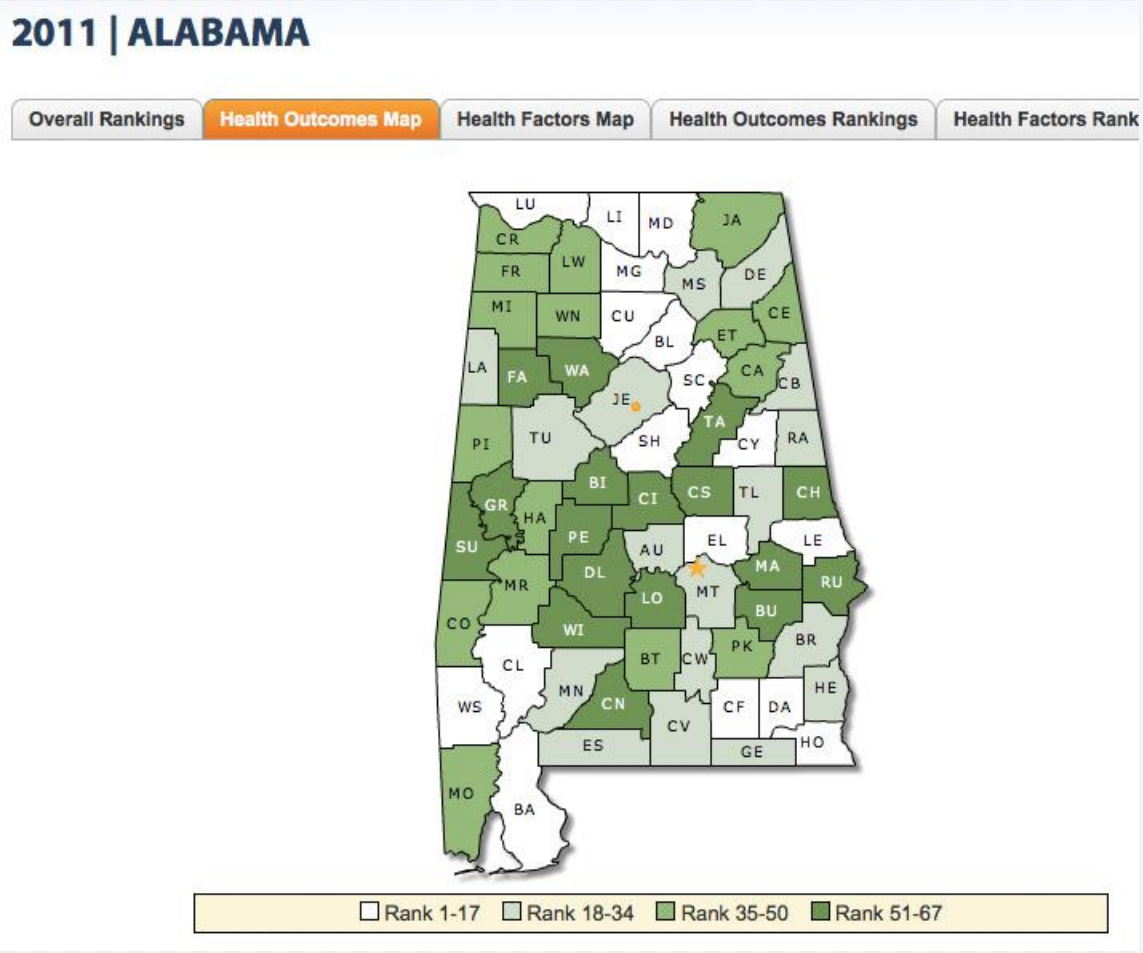
"Flu News, Information and Resources"
HealthMap.org/flu.gov



- **What**: Visualizing Flu outbreaks in the US
- **Platform**: Google Maps
- **Development**: Custom programming for Google Maps API
- **Sources**: CDC monitoring data
- **Application**:
- Example of a visualization that could be improved with an animation of flu trends over time

View Online

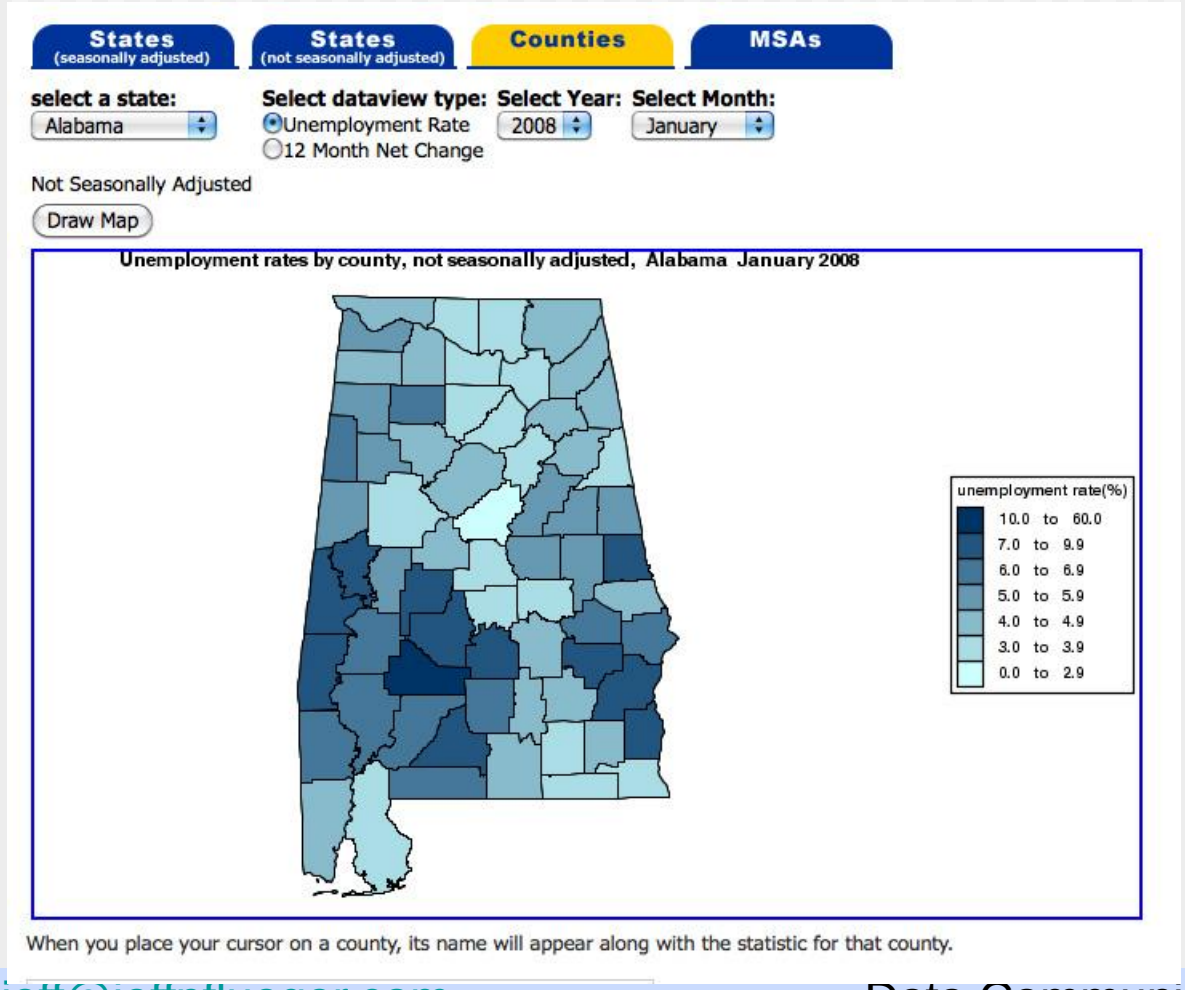
"County Health Rankings - Mobilizing Action Toward Community Health"
Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute



- **What:** County level health ranking and datasets with a sophisticated map interface
- **Platform**: Flash Player
- **Tool**: Custom development
- **Application**:
- County level health data can be downloaded for use in combination with VR data
- VR statistics such as employment outcomes, VR needs, demographics and more can be similarly presented at the county and even ZIP code level.

View Online

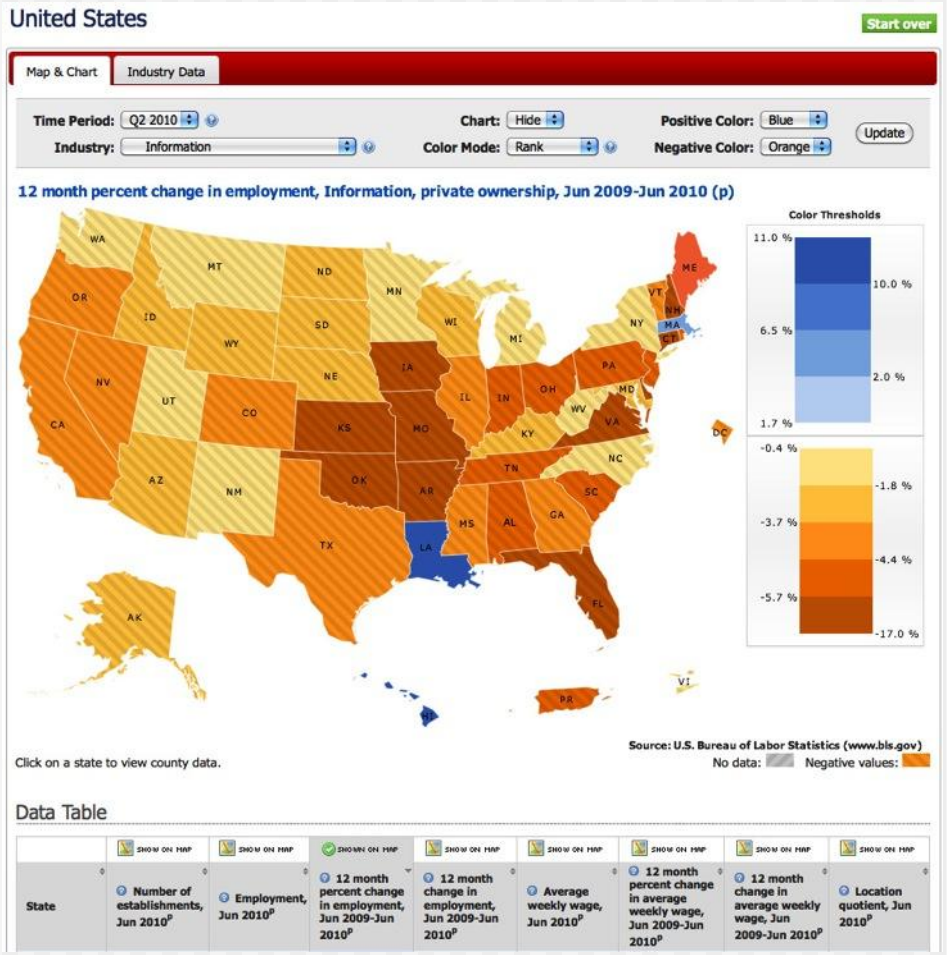
"Bureau of Labor Statistics Custom Maps"
BLS



- **What:** BLS has an online tool to visualize state, county and Metro Area data.
- **Source**: BLS
- **Platform**: HTML
- **Tool**: Custom development
- **Application**:
- Several sources of county level employment data exist on the BLS website.
- Provides an example of how a large dataset such as the RSA data can be visualized by providing users the ability to create custom maps.

Tutorial View Online

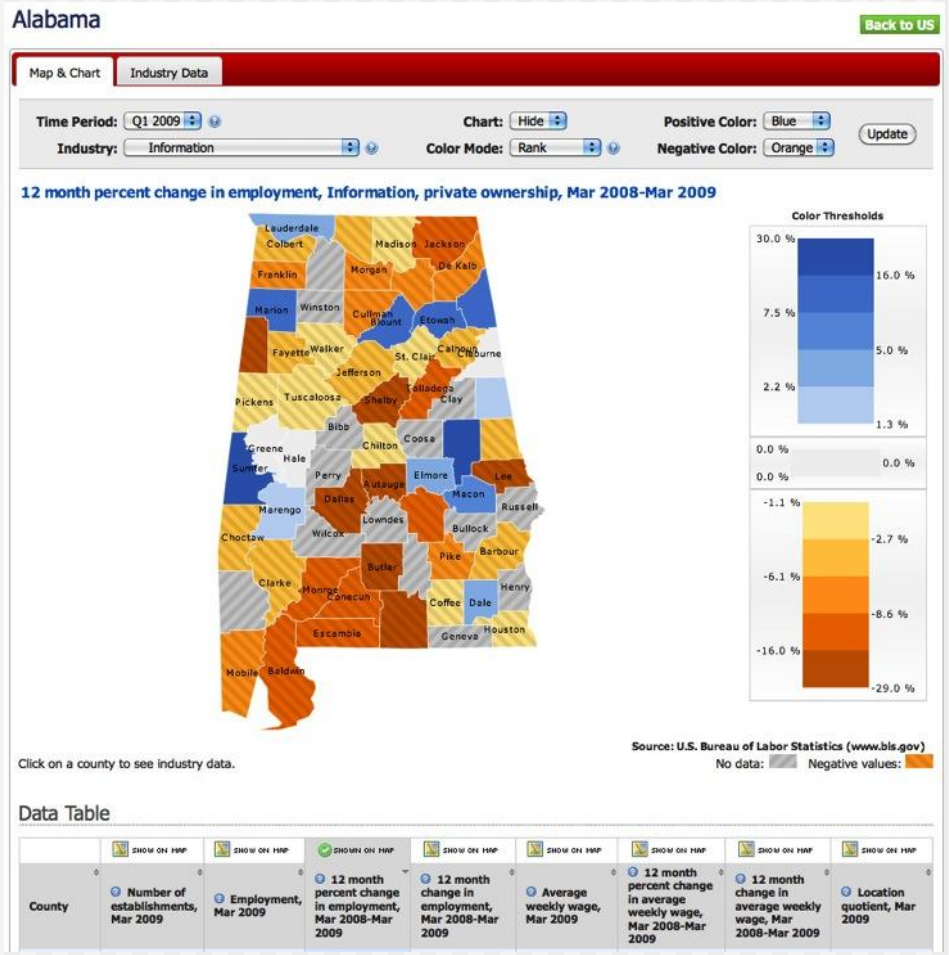
"Quarterly Census of Employment and Wages"
Bureau of Labor Statistics



- **What**: Interactive geovisualization of Bureau of Labor Statistics QCEW (Quarterly Census of Employment and Wages)
- **Platform**: Flash Player
- **Development**: Extensive custom Flash programming tied with database and web programming
- **Application**: Compare wages, industries, employment and the 12 month change of these with VR employment data by State. If VR data available at ZIP code, can be compared with 2012 ACS information to be available at ZIP code

View Online

"Quarterly Census of Employment and Wages"
Bureau of Labor Statistics



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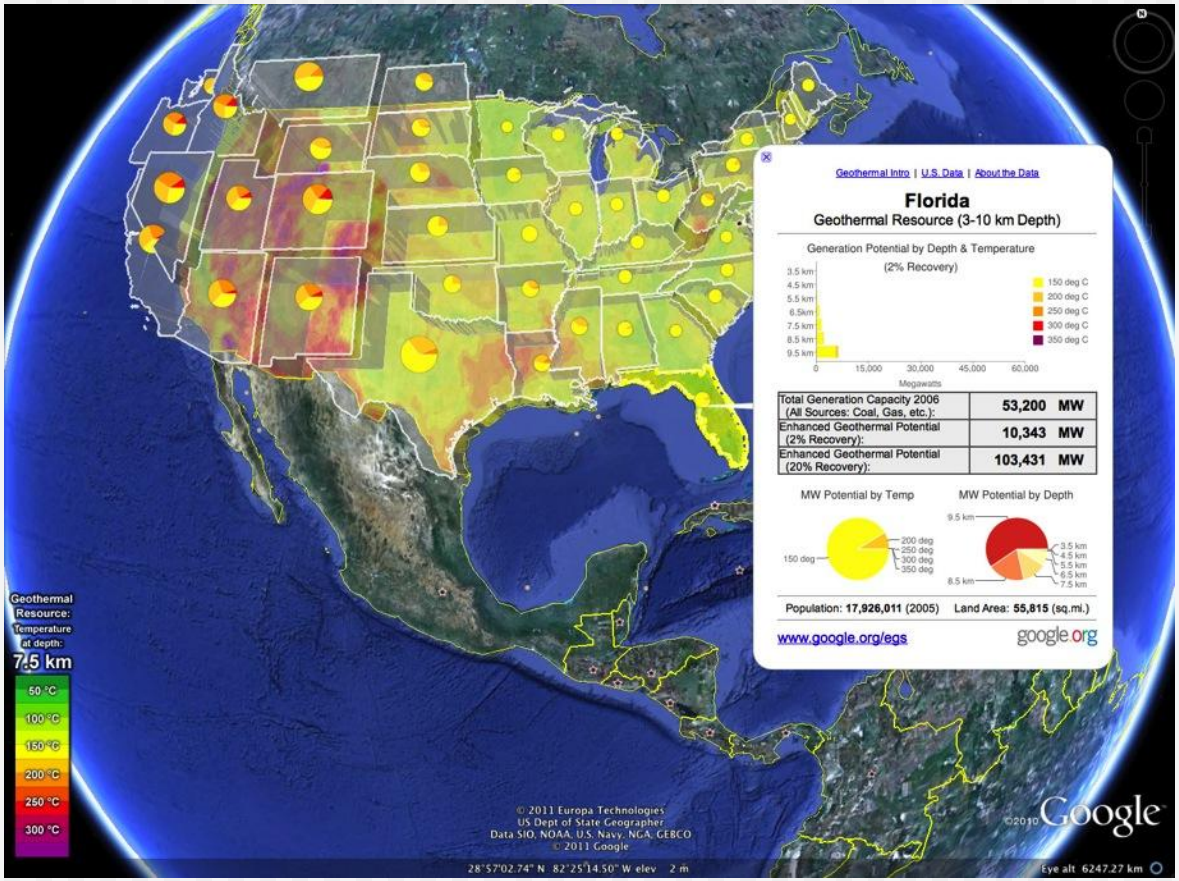
View Online

Examples: Geovisualization Other Examples

- These examples highlight
  - Development tools
  - Datasets
  - Approaches relevant to VR

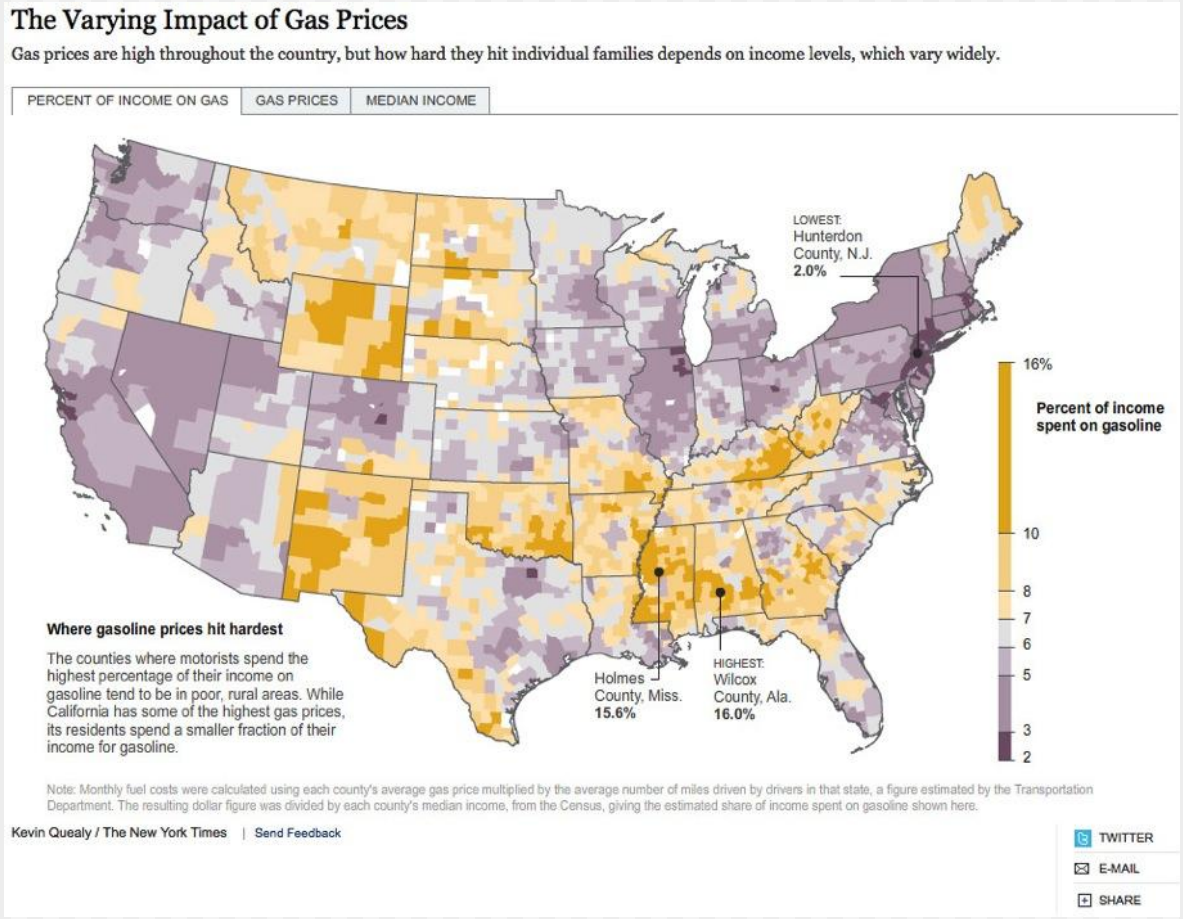
"Geothermal Energy Potential in the US"
Google Earth Outreach



- **What**: Interactive map comparing state geothermal energy potential
- **Source**: Google.org
- **Platform**: Google Earth
- **Development**: Google Earth, Google Charts API, custom programming
- **Application**:
- RSA related charts/tables presented in tandem with a map
- Google maps (as opposed to Earth) could be used similarly
- Comparison of state VR programs
- Comparison of state VR programs and needs

View Online (with Google Earth)

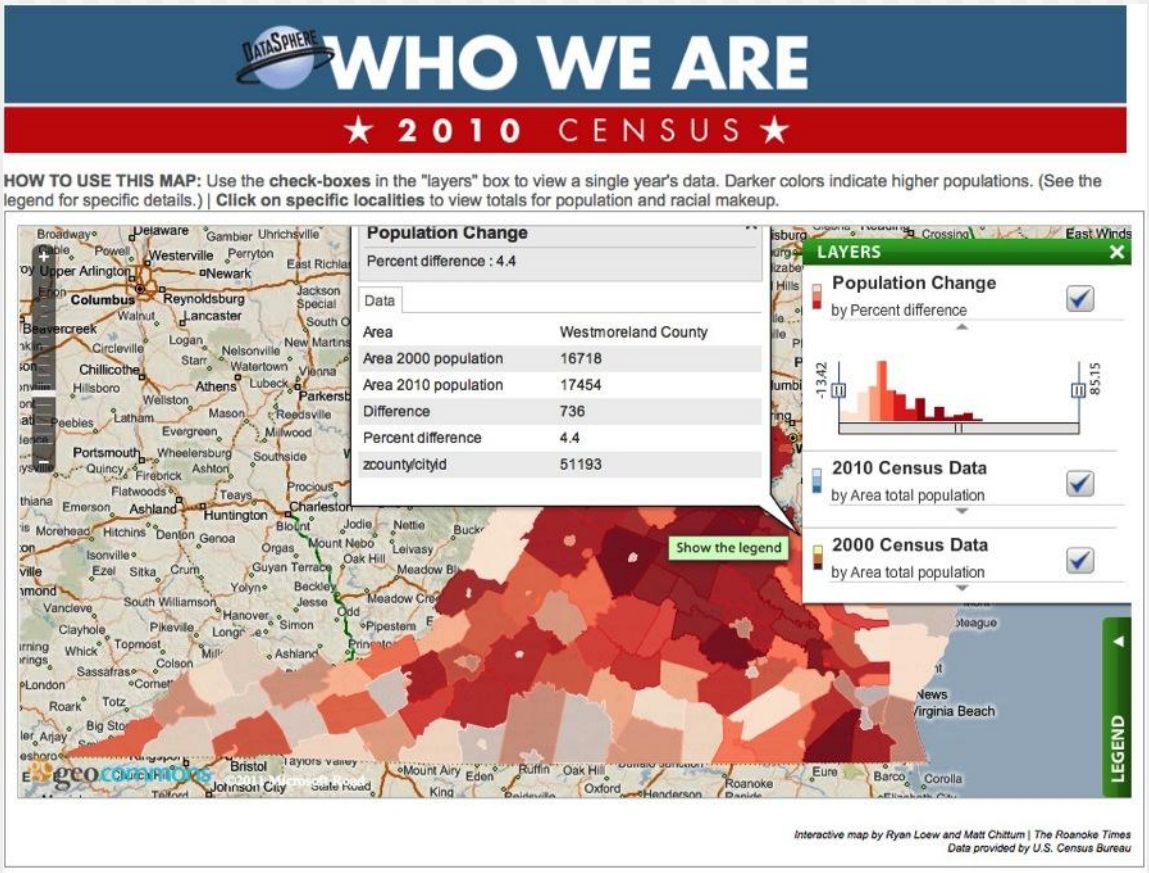
"The Varying Impact of Gas Prices"
New York Times



- **What**: Static map by county of the estimated percentage of income spent on gas
- **Platform**: Static webpage
- **Source**: Department of Transportation, US Census, and a source of county average gas prices
- **Application**: Examine relationship of transportation and fuel prices to program participation and success.

View Online

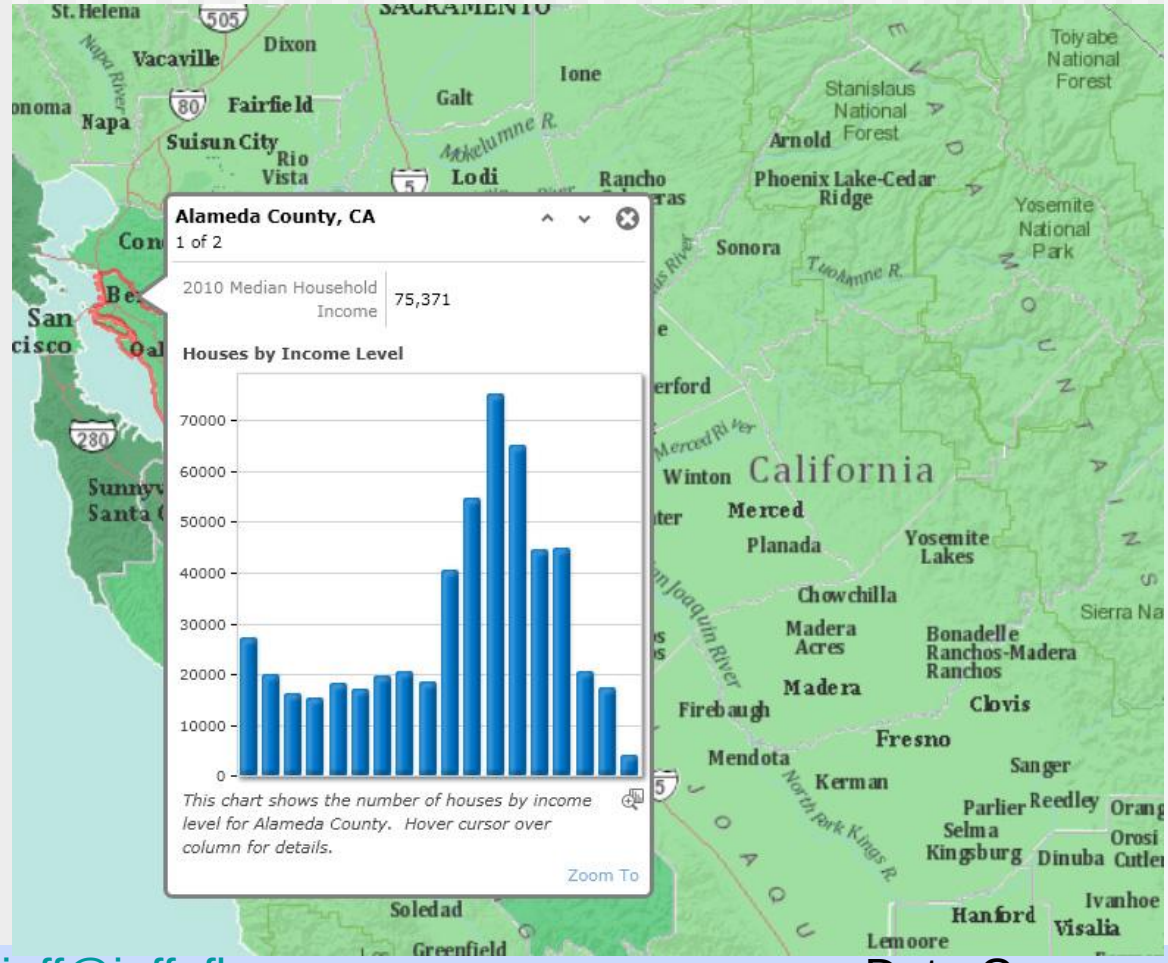
Example: "Who We Are 2010 Census"
Roanoke Times



- **What**: Interactive map of changes in population in Virginia counties from Census 2000 and 2010 data
- **Platform**: Flash Player
- **Development**: GeoCommons/GeoIQ
- **Application**:
- Use GeoCommons/GeoIQ to quickly present RSA geospatial data at the county level

View Online

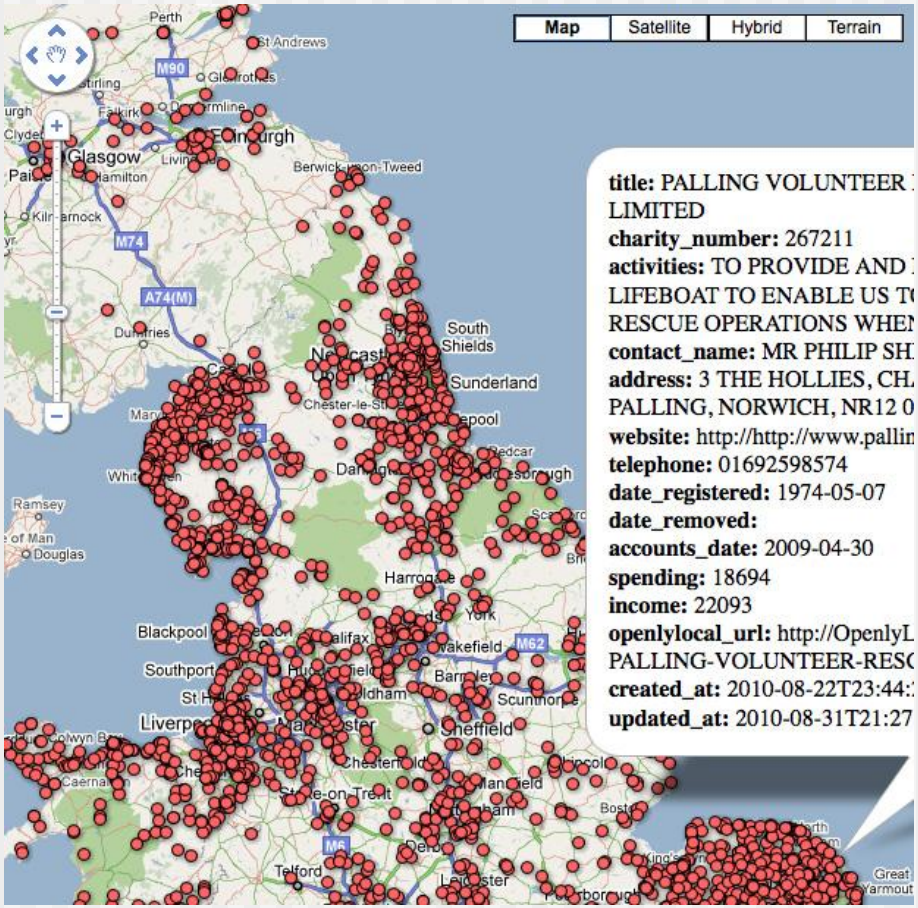
Example: "USA Household Income"
ESRI



- **What**: County and state level data about income in the US
- **Platform**: Flash Player
- **Development**: ArcGIS Explorer Online. Created with ArcGIS
- **Application**:
- Charts of income, disability and health statistics presented on a map
- Sharing of maps with a simple URL when completed

View Online

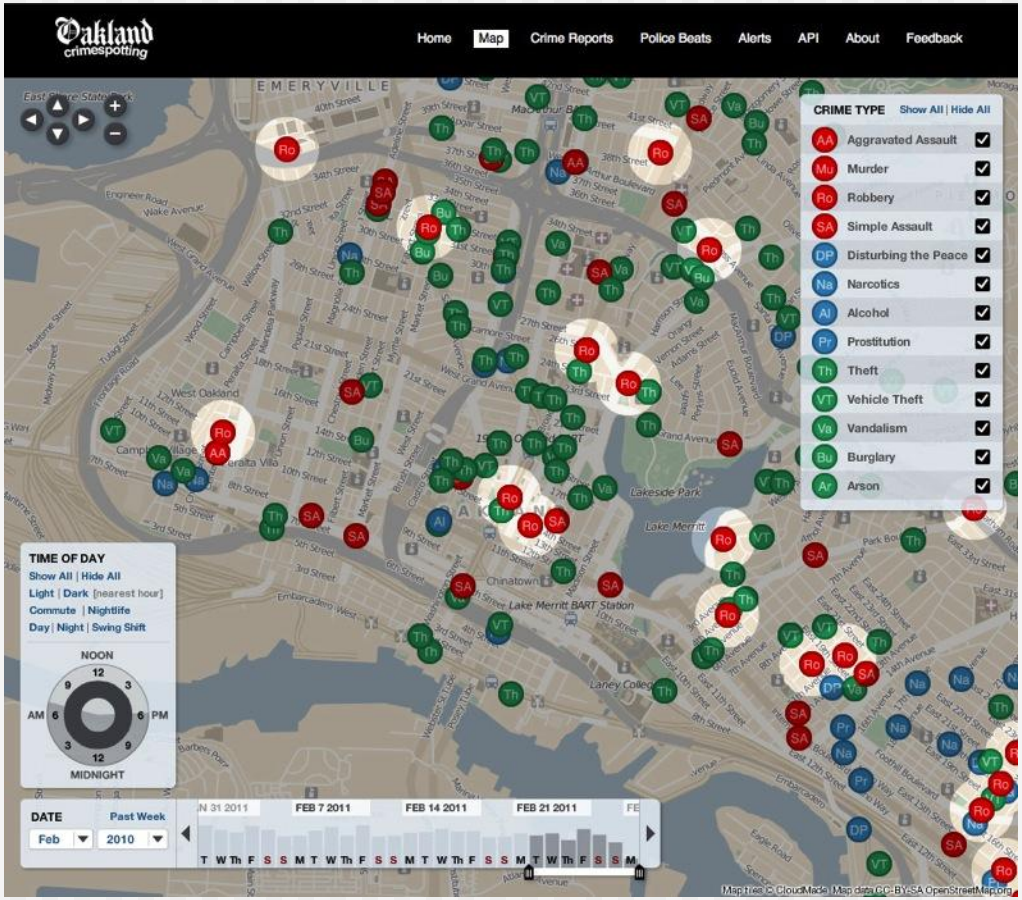
Example: "UK Charities Map"
UK Telegraph



- **What**: All UK Charities and contact information presented in a map
- **Platform**: Google Maps
- **Development**: Google Fusion Tables Visualize feature can produce map quickly from a spreadsheet with street addresses
- **Applications**:
- Locations of VR offices with contact information. Bubbles could include phone numbers, links, directions, etc
- Rapidly geolocating and geovisualize addresses using online tools

View Online

"Oakland Crimespotting"
crimespotting.org



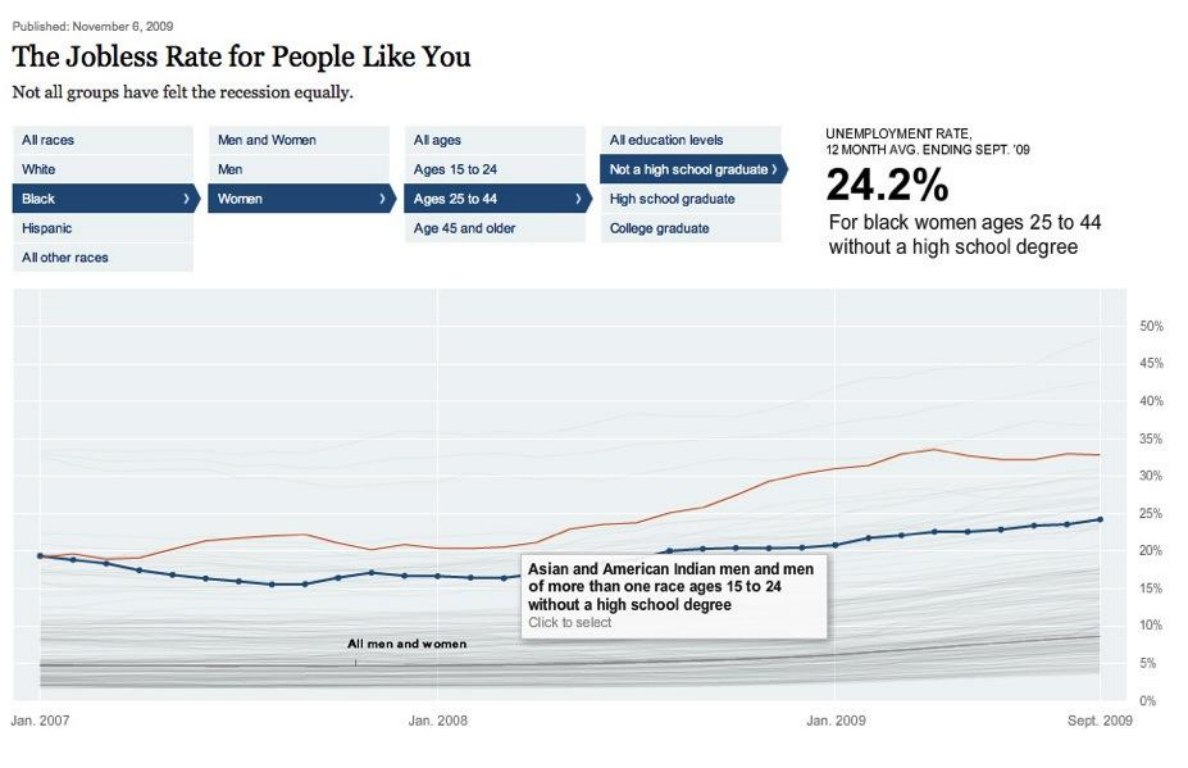
- **What**: Using public, live data, crime events are geovisualized
- **Platform**: Flash Player
- **Development**: Custom programming, openstreetdata.org and database
- **Applications**:
- National outreach: Location of state VR resources with related data

View Online

Examples: Other Visualizations

Innovative Data Visualization relevant to VR which aren't maps

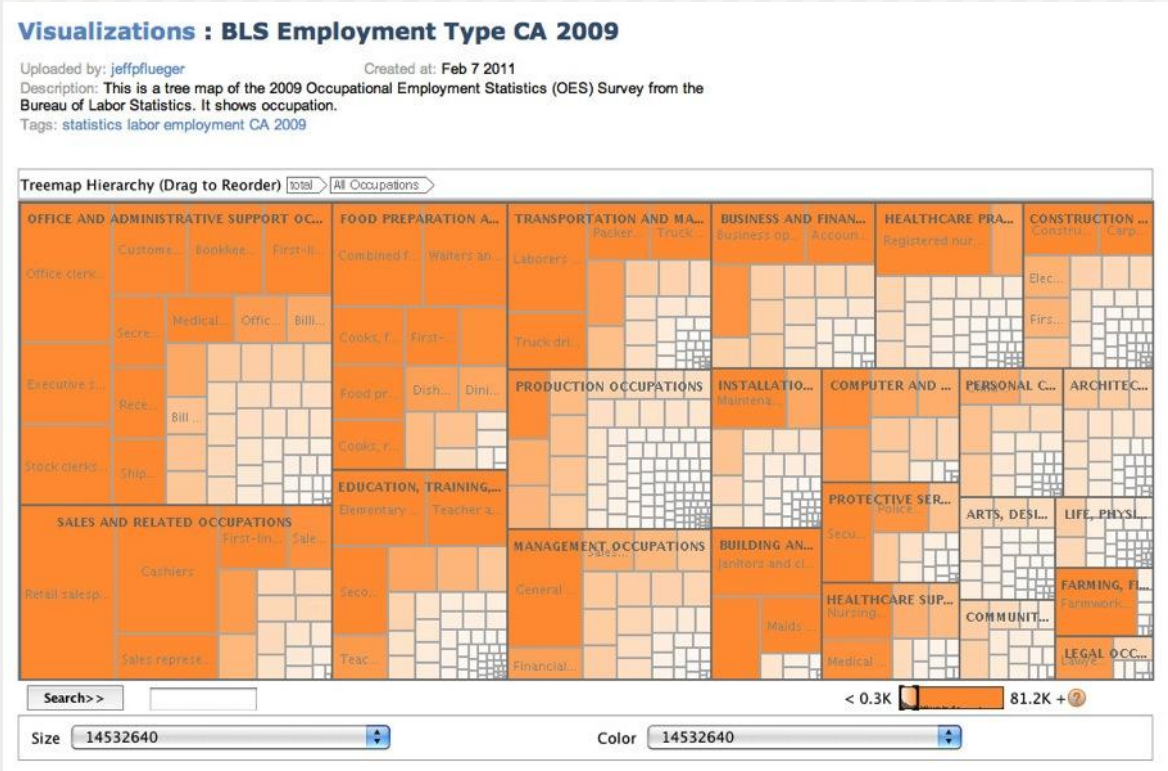
"The Jobless Rate for People Like You"
New York Times



- **What**: Interactive chart of unemployment by race, sex, age and education level
- **Platform**: Flash Player
- **Development**: Custom programming
- **Application**:
- Rehabilitation rates by state
- Rehabilitation rates by race, gender, disability category
- Unemployment rates by disability category

View Online

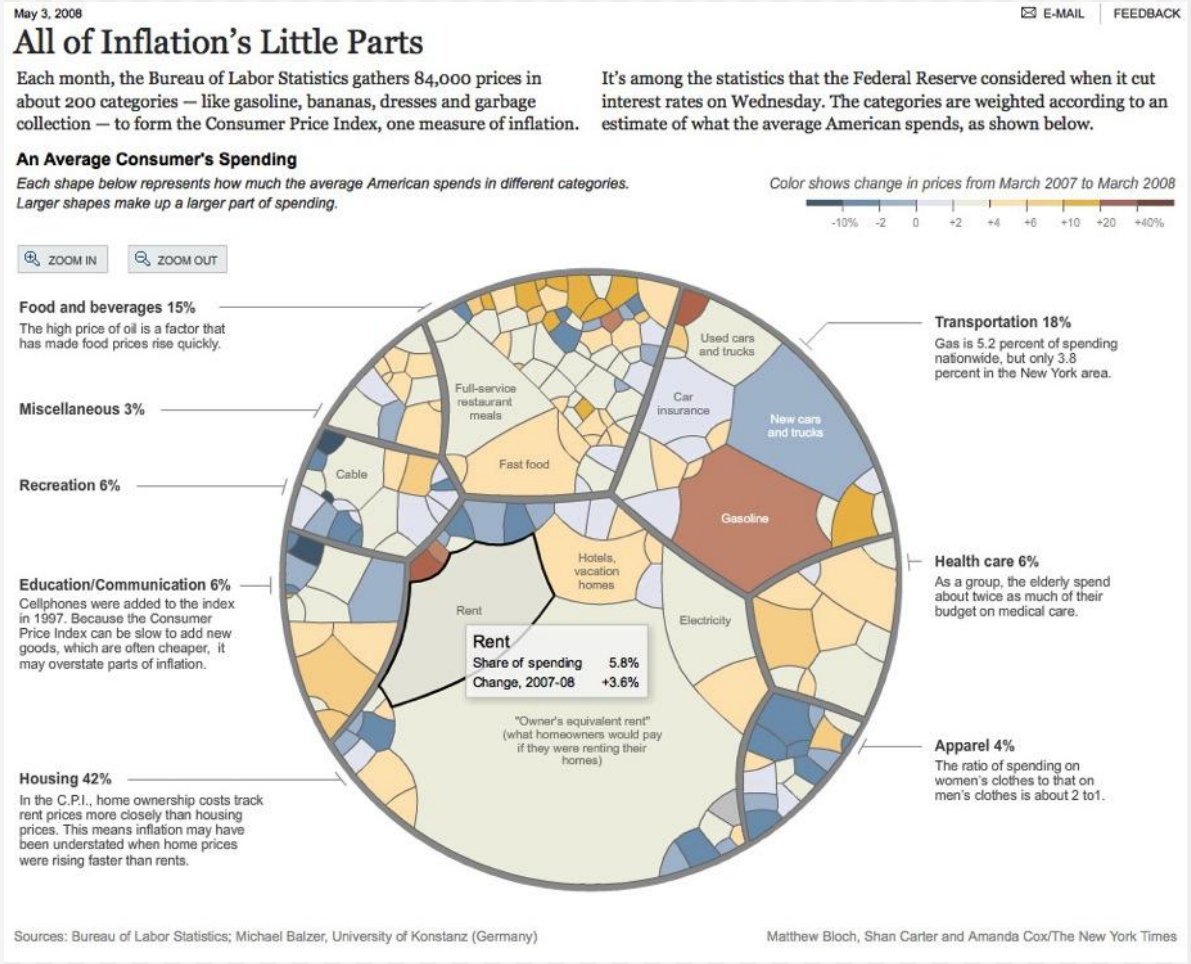
BLS Employment Type CA 2009
Created by InfoUse with IBM's "Many Eyes"



- **What**: A "Tree Map" of proportions of people in different occupation types within California
- **Platform**: HTML/javascript
- **Development**: IBM's "Many Eyes"
- **Source**: InfoUse and Bureau of Labor Statistics 2009 Occupational Employment Statistics
- **Application**: A modified Tree Map could be used to visually compare state or national occupation types to VR outcomes.

View Online

Example: "All of Inflation's Little Parts"
New York Times



- **What**: A "Voronoi Tree Map" communicates aspects of US inflation.
- **Source**: NYT, Bureau of Labor Statistics Consumer Price Index
- **Platform**: Flash Player
- **Development**: Custom programming
- **Application**: VR program changes over time at either the state or Federal level (individual characteristics, services purchased, referral sources, occupation at closure, etc.)

View Online

Examples: State Agency Case Studies Alaska and Alabama

How two states are using innovative data visualization

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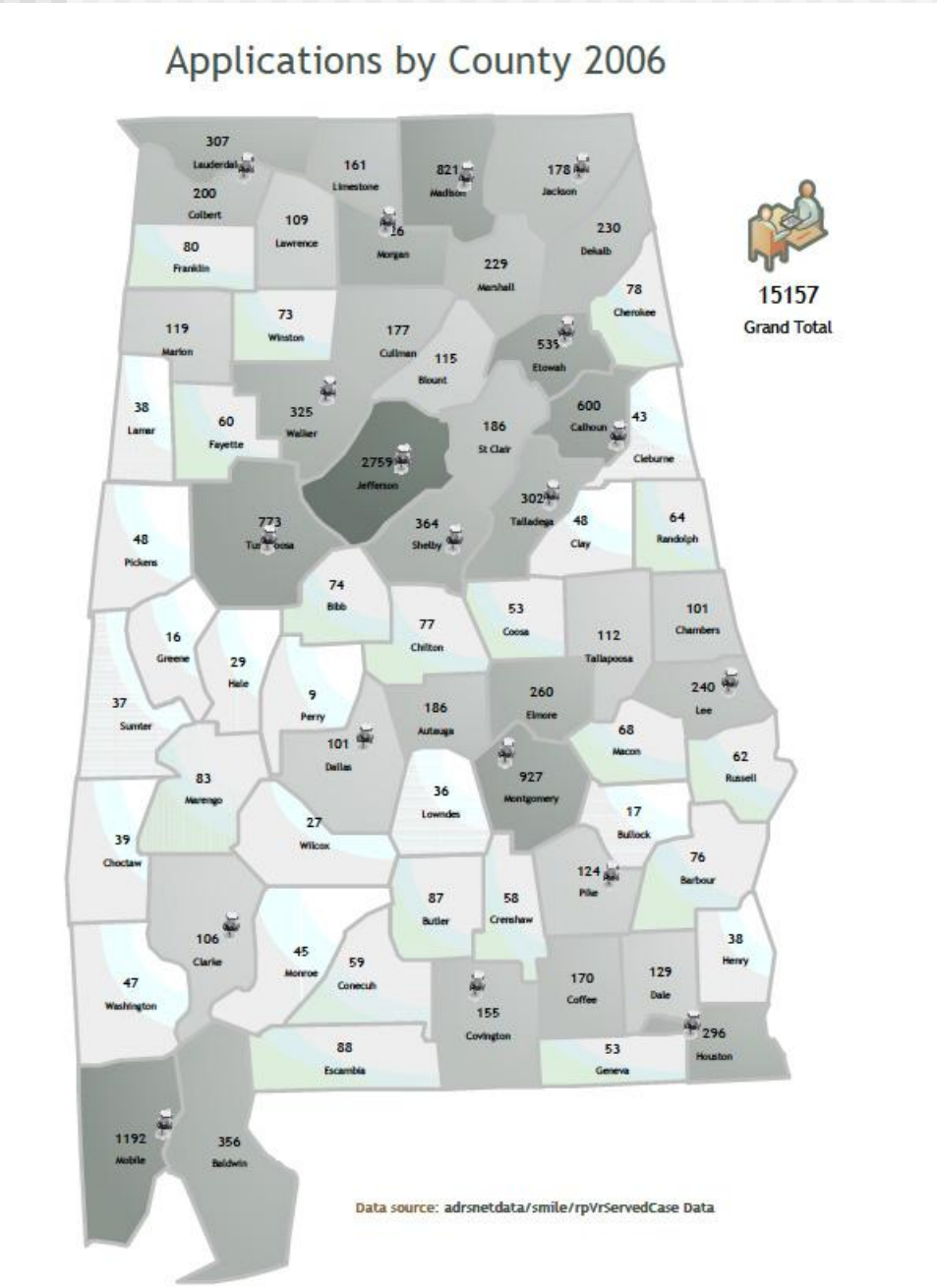
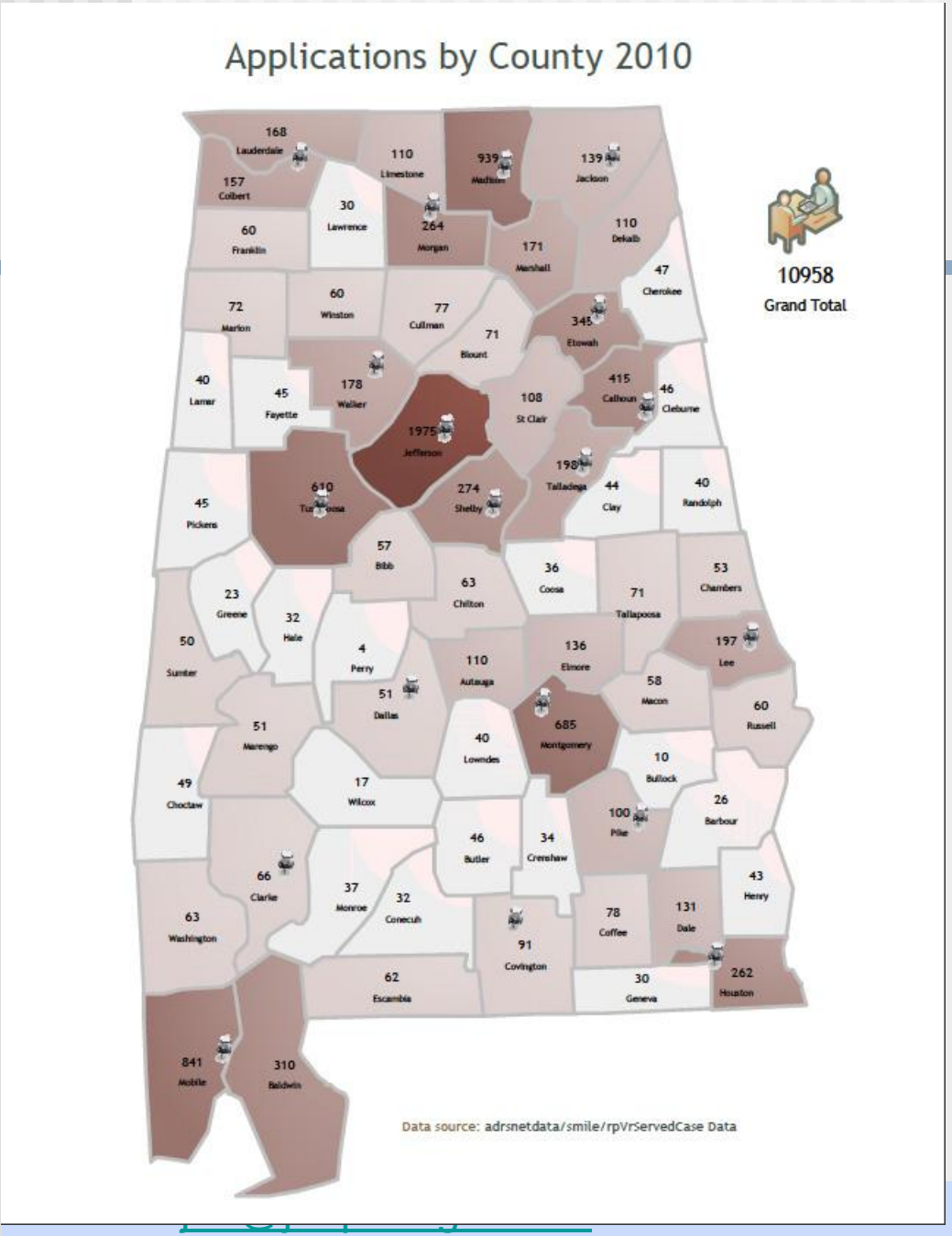


Example: Alabama Data Visualization 1

Alabama State Vocational Rehabilitation

- **What**: Alabama tracks yearly change in VR applications by county using mapping.
- **Development**: SharePoint, AWARE Case Management System, Microsoft Visio 2010 for mapping.
- **Application**:
- "Live data" visualization of VR outreach efforts
- Rapid creation of county-level maps allows the state to evaluate if they are meeting their outreach objectives



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- **Application**:
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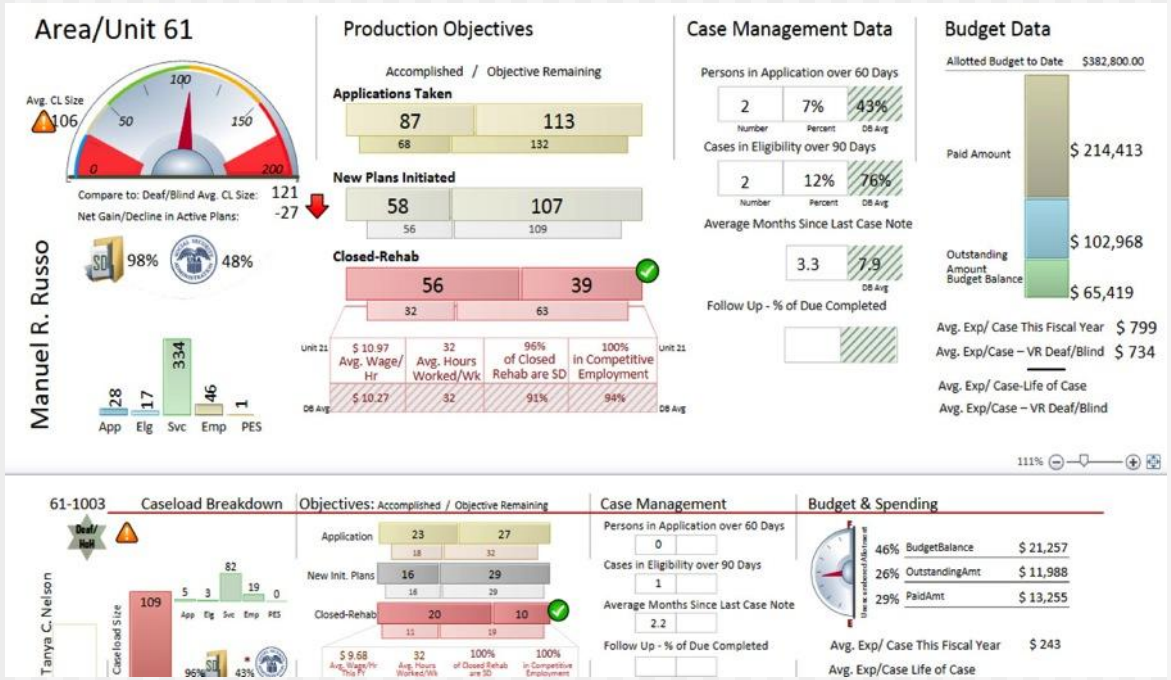
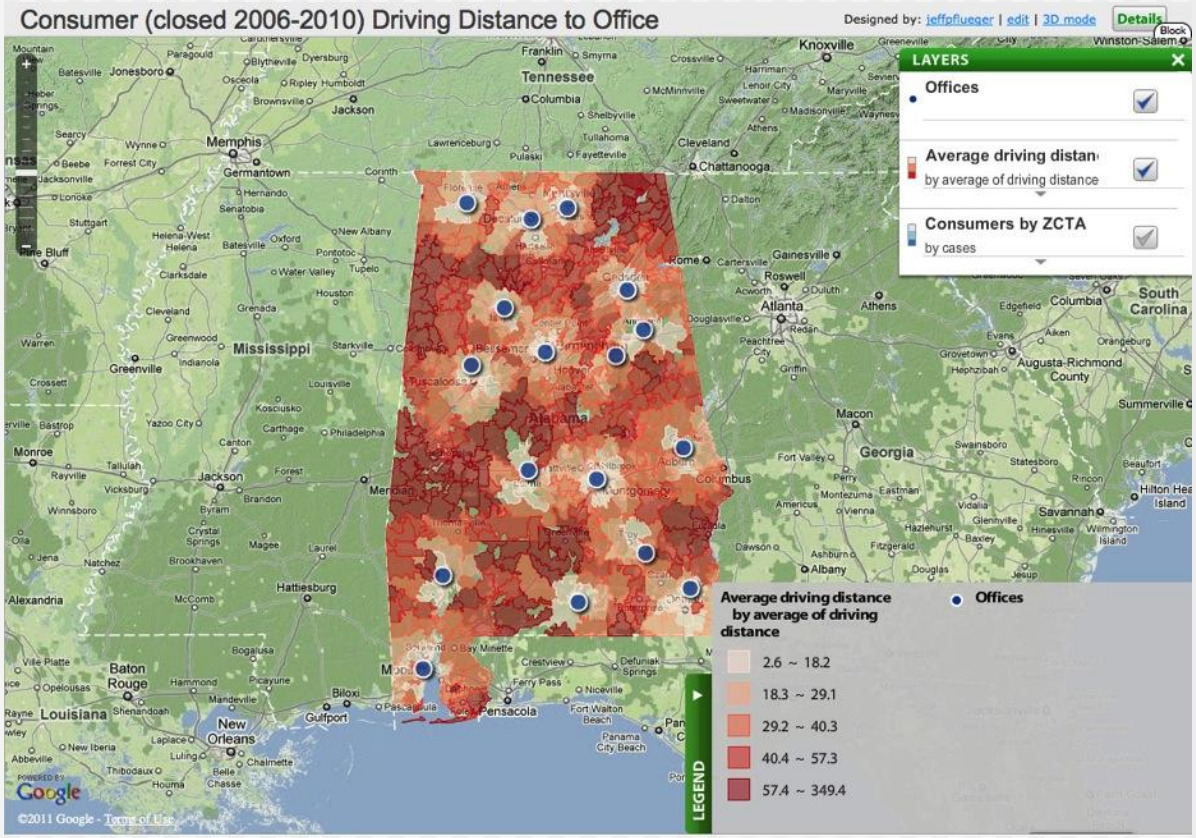
- Rapid creation of county-level maps allows the state to evaluate if they are meeting their outreach objectives

Example: Alabama Data Visualization 2
Alabama State Vocational Rehabilitation



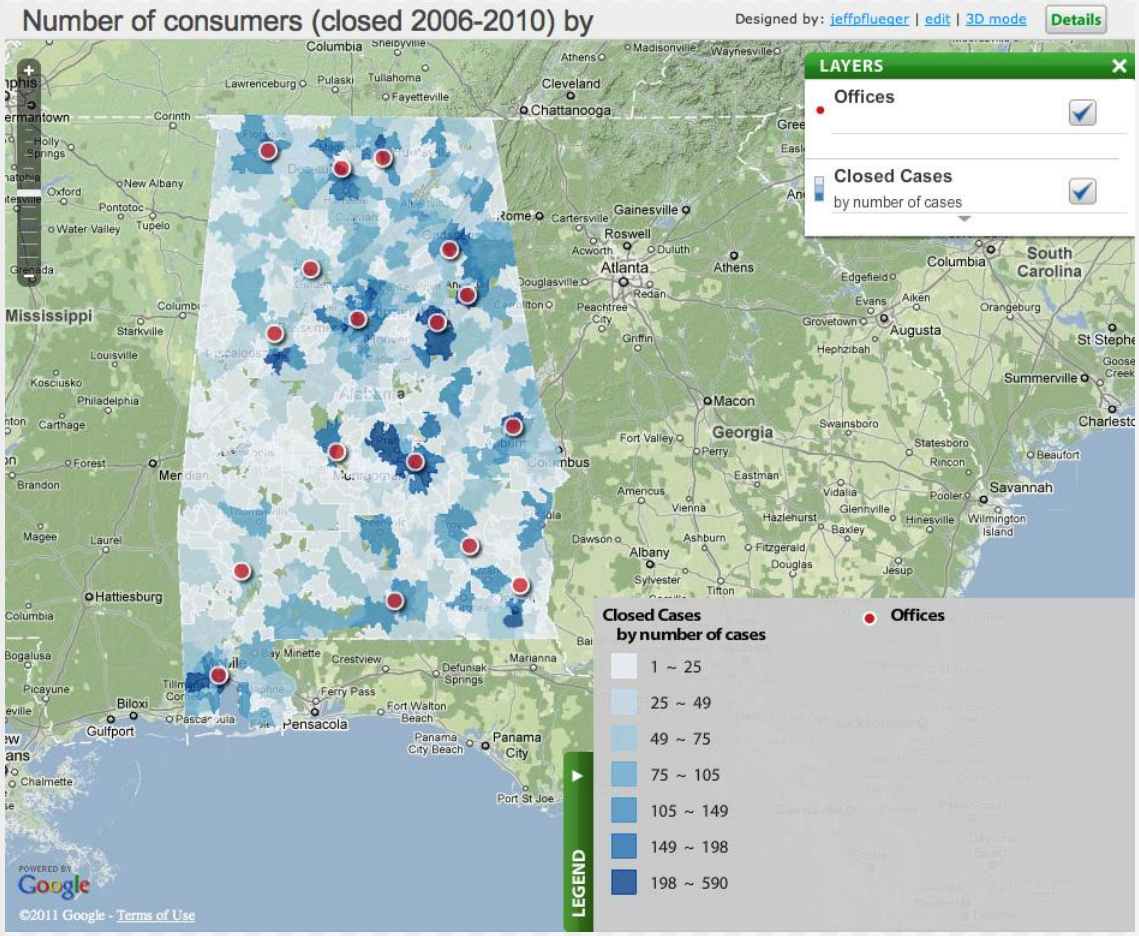
- Alabama's review of its VR program focuses on assessing the program's effectiveness in four areas:
  - Public Outreach
  - Service Delivery
  - Service Quality
  - Independence and Self-Sufficiency
- Alabama developed a business intelligence dashboard aimed at assessing these areas with live data from their AWARE case management system
- Tools: SharePoint, AWARE case management system
- Application: Real-time presentation about VR program internally, with states, and with the public.

"Consumer Driving Distance to Office (Closed 2006-2010) by ZCTA" InfoUse



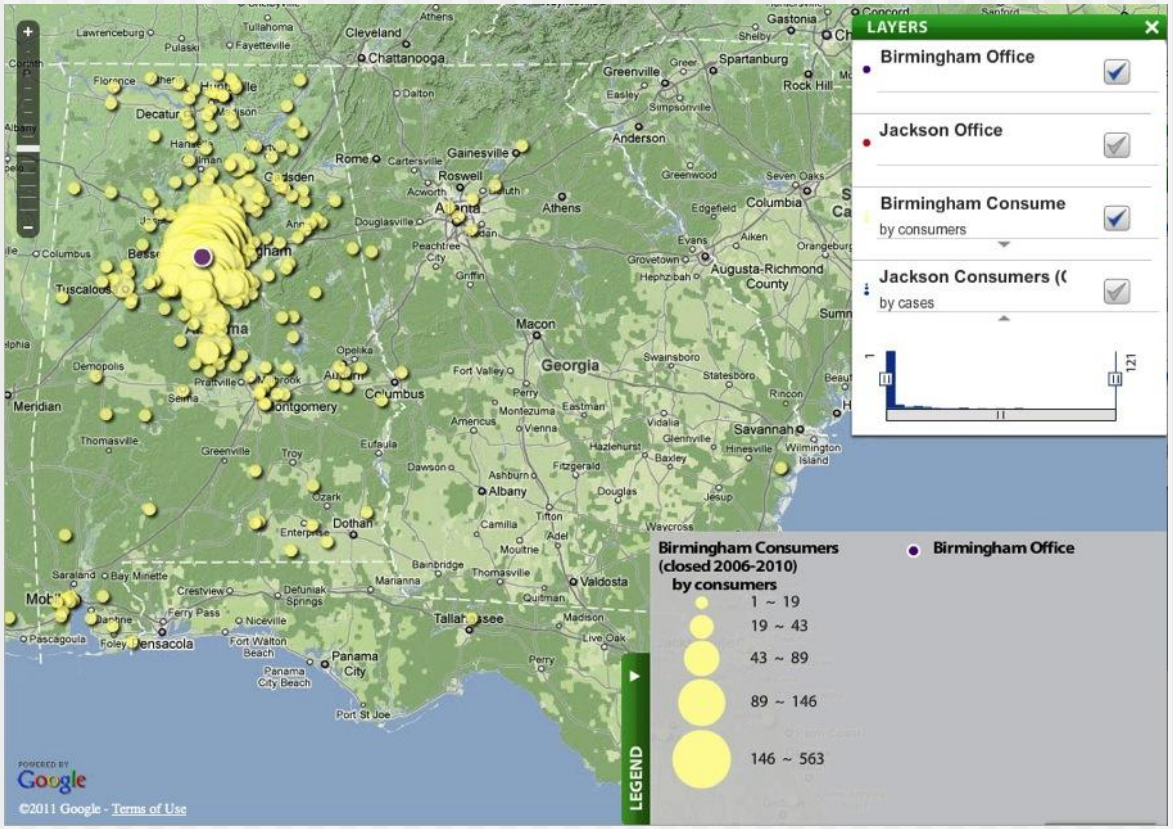
- **What**: Driving distances calculated between consumer primary address zipcodes and their VR offices and averaged by ZCTA
- **Source**: Alabama State VR, open.mapquest.com API
- **Platform**: Geocommons
- **Development**: Geocommons, custom programming for open.mapquest.com API

"Number of Consumers (closed 2006-2010) by ZCTA"
InfoUse



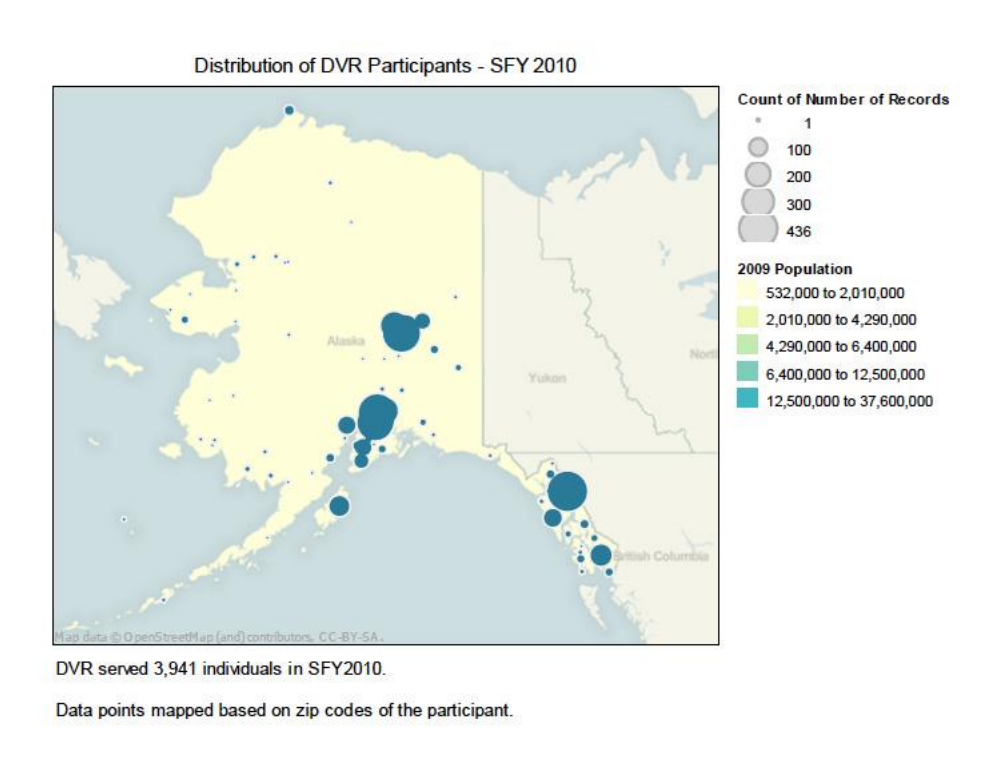
- **What**: Number of consumers by ZCTA with VR office locations with average driving times and distances
- **Source**: Alabama State VR, Census 2000 Tiger ZCTA shape files, open.mapquest.com API
- **Platform**: Geocommons
- **Development**: Geocommons, custom programming for open.mapquest.com API
- **Application**:
- Zipcode level data useful for RSA for analysis
- New data service (driving distances) may have other applications

"Jackson and Birmingham Office Consumers Primary Address ZIP code (closed 2006-2010)" InfoUse



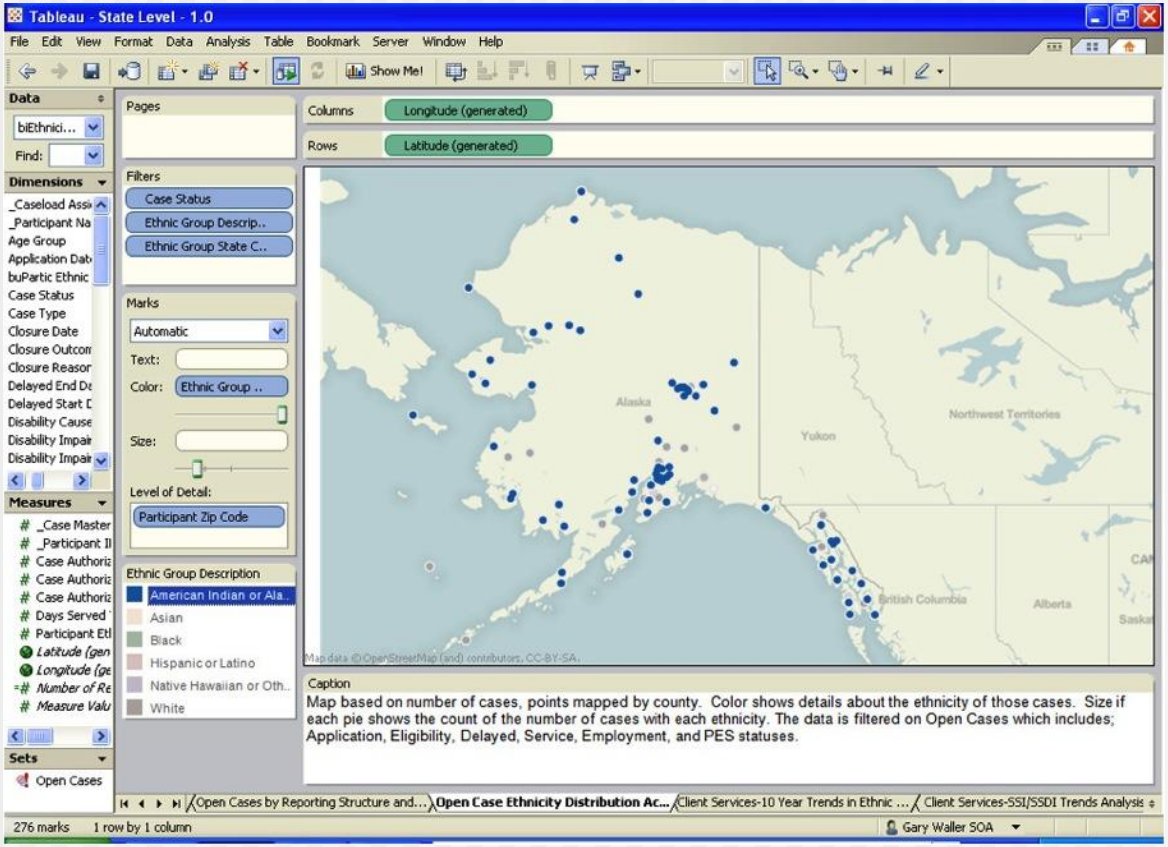
- **What**: Consumer permanent addresses by ZIP code served by the Birmingham Office
- **Source**: Alabama State VR, open.mapquest.com API
- **Platform**: Geocommons
- **Development**: Geocommons, custom programming for open.mapquest.com API
- **Application**:
- If RSA 911 included ZIP code, analysis would be possible of geographically who is being served by each office

Example: Alaska Data Visualization 1
Alaska State Vocational Rehabilitation



- Map of VR cases by zipcode created by Alaska Dept of VR
- Alaska Department of VR uses software to share data within the department
- Tools: Tableau Server tied with the AWARE case management system
- Alaska uses ZIP code for analysis because "boroughs" and US Census Areas are less meaningful in a large state with so much wilderness and many remote populations.
- Application: Real-time presentation of VR program data internally, with states, and with the public. RSA 911 ZIP code data would be useful to AK if available.

Example: Alaska Data Visualization 2
Alaska State Vocational Rehabilitation



- Alaska Dept of VR shares live case load data visualizations internally. Here we have an interactive map presenting the number of cases by zipcode by race/ethnicity.
- Tools: Tableau Server tied with the AWARE case management system
- Alaska uses ZIP code as most useful sub-state geography for analysis.
- Application: Real-time mapping of VR program data internally, with states, and with the public.

Important Datasets and Data Services

Examples of datasets and data services important to VR

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Overview

- Important Data Sources
  - American Community Survey
  - Bureau of Labor Statistics
  - CountyHealthRankings.com
  - Geocoding, transportation time/distance services

Datasets: The ACS - American Community Survey

- ACS is an annual survey by the US Census Bureau and provides important demographic information.
- The ACS has replaced the Decennial US Census Long Form
- The most important national source for sub-state disability data
- Disability questions changed in 2008. And so:
  - 2005-2007 Three year estimates best source of sub-state disability data at this point
  - 2008-2010 3 year estimate will have disability data. Available for geographies with more than 20,000 people
  - 2008-2012 Five Year estimate will be the best, for areas with fewer than 20,000 including ZCTA, census tract and block group

Datasets: The ACS - American Community Survey

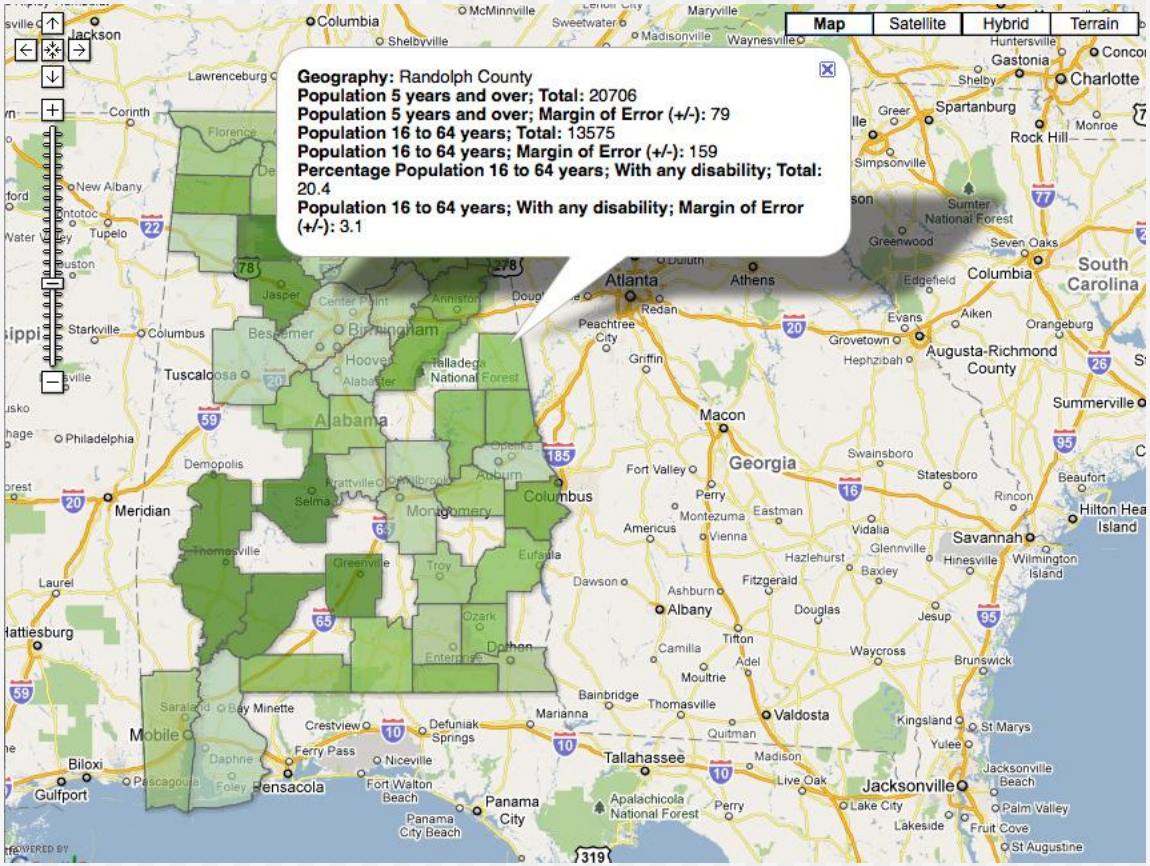
ZIP and ZCTA – Potential for linking VR data to ACS data

- The ACS will offer ZCTAs in:
  - 2012 for three and five year estimates
  - 2013 for three and five year estimates of disability data

Datasets: The ACS - American Community Survey

- What is available
  - Subject Tables:
    - S1801: Disablity Characteristics
    - S1802: Selected Economic Characteristics for the Civilian Non institutionalized Population by Disability Status
  - MicroData
    - Can do more detailed analysis, custom tables. Only available at the Public Use Microdata Area level.
    - DisabilityPlanningData.com maps PUMA data to counties by aggregating counties

“Disability Rate for ages 16-64 by County in Alabama”
InfoUse



- **What**: Percentage of the population 16-64 years of age with a disability by county
- **Source**: American Community Survey subject Table S1801
- **Platform**: Google Fusion Tables
- **Development**: Google Fusion Tables, shpescape, Census Tiger Shape Files for US Counties
- **Application**:
- ACS disability data currently only available for 3 year sample 2005-2007
- 3 year sample not available for geographies < 20,000. This is why counties are missing
- 5-year estimates will provide for geographies < 20,000 - including ZCTA, census tract and block group
- First 5 year estimate for disability will be 2008-2012

View Online 46

Data Visualization Tools

From software to libraries for developers, a survey of the tools of the trade.

Geovisualization Tools - Tools primarily focused on creation of maps

Web applications

Creator builds visualizations using a website

- Google Fusion Tables with Google Maps Visualization
  - Spreadsheet meets database
  - Query, aggregate and share data easily
  - Create data visualizations - including geovisualizations
  - Free
  - Subscription service available for private datasets and maps
- GeoCommons/GeoIQ
  - Simple upload of data and geovisualization
  - Geocommons is free (and everything made is public)
  - GeoIQ is a paid service with more features and privacy
  - Beautiful design. Great user interface
  - Perhaps the simplest way to produce geovisualizations to share online
- ArcGIS Explorer Online
  - Create, view and share maps and geovisualizations
  - Can create simple maps only. Need ArcGIS to create more sophisticated maps for Explorer Online
  - Requires Microsoft Silverlight to be installed
  - Silverlight is not likely to become a widely adopted platform

Geovisualization Tools - Tools primarily focused on creation of maps

Geovisualization Desktop Applications

Creator makes visualizations with desktop software

- ArcGIS and other ESRI products
  - The gold standard in GIS
  - Extremely robust, providing everything from an application programming interface to create custom applications with ArcGIS functionality, to choices of platform from desktop to server to mobile, and a variety of ways to share maps
  - Pricing depends on solution
  - Extremely powerful. Requires substantial learning

Business Intelligence Tools

Communicate data, reports, dashboards and maps privately among a team

- **Tableau Desktop and Tableau Server** - tableausoftware.com
  - Creates interactive web browser based visualizations and dashboards from large datasets
  - Tableau Free version: Desktop software. Limited capabilities.
  - Tableau Personal ($999) and Professional ($1999)
  - Tableau Server: To share interactive visualizations and data securely within a workgroup. (Cost depends on application) Depends on a desktop application to create visualizations
- **FusionCharts & FusionMaps** - fusioncharts.com
  - Desktop applications to creates web browser based interactive and animated maps and charts from datasets to share
  - FusionMaps and Charts creates Flash based visualizations
  - FusionCharts appears to output non-flash based visualizations now compatible with iphone/ipad
  - FusionCharts ($1999) FusionMaps ($1999)
- **Sharepoint** - sharepoint.microsoft.com
  - Helps work groups share documents, data and more
  - Create visualizations and dashboards
  - Used by Alabama State VR for dashboards and evaluation of VR programs
- **LogiXML** - logixml.com
  - Access and analyze real-time data through interactive, Web-based dashboards.
  - An application development platform to create more advanced BI applications
  - Price depends on end application