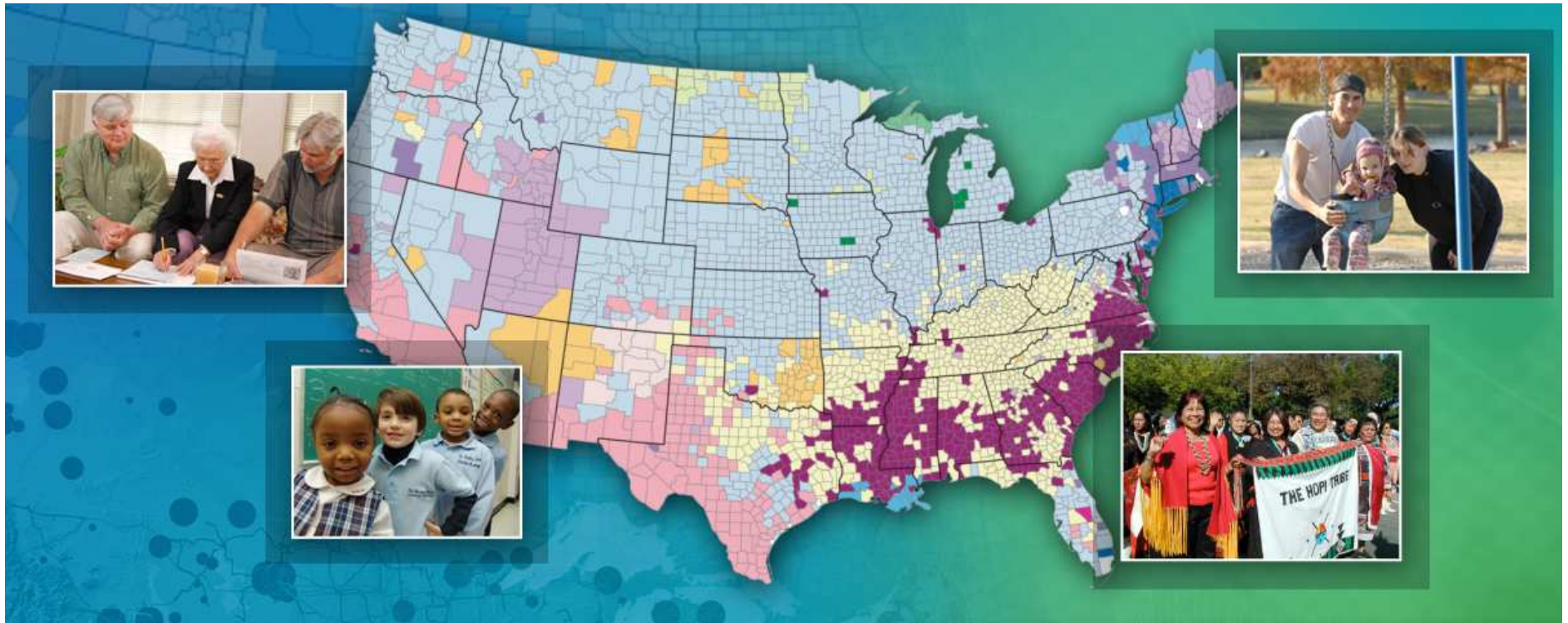# Why Geography is Important to Statistical Information

Tim Trainor

Chief, Geography Division, U.S. Census Bureau

The Importance of Geography

Basic Components of Geographic Information

- Space - a coordinate reference frame

- Time - a temporal reference frame

- Attributes – characteristics of information in the reference frame

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Why is GIS unique?

Can combine spatial and non-spatial data from different datasets in a spatial analysis operation in order to answer questions such as:

- What is here . . .   *Identification*

- Where is . . .   *Location*

- What has changed since . . .   *Trends*

- What relationships exist between . . .   *Patterns*

- What is the best route between . . .   *Optimal path*

- What if . . .   *Model*

What are Geographical Data Files?

- Files that contain the coordinates describing the geographic features

- Examples:
  - Streets and roads
  - Legal, statistical and administrative area boundaries
    - City limits
    - Census tracts
    - Health districts
  - Rivers, lakes, and flood zones
  - Locations of toxic release sites

What are Statistical Data Files?

- Files that contain statistical data

- Examples:
  - Census population and housing data files
  - Patient files
  - Soil data
  - Animal sighting
  - Cancer registry
  - Police records
  - School records (assignments, attendance)

Geocode

- Any alphanumeric or numeric-only value that will uniquely identify one and only one geographical entity within the set of all similar entities

- Examples:

  - Mailing address

  - First and second level administrative areas with their name or number

  - Census statistical area numbers, e.g., census tract codes, block groups

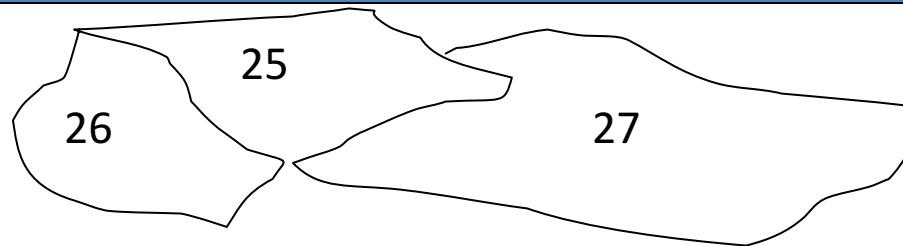 - Health district number

  - Watershed ID

A GIS Works on Geocoded Data

Statistical Data

Geocodes

Geographical Data

GIS

Maps, tables, reports

Linking Geographical and Statistical Data Files

Health Area 25, $15,132, M, 27

Health Area 27, $17,322, F, 25

Health Area 30, $27,417, M, 24

Common geocode

25

26

27

Health Area 25, 45.1, 18.3, 45.6, 18.3, 45.6, 19.7, 45.1, 18.3
Health Area 26, 53.2, 23.3, 53.7, 23.3, 53.3, 24.8, 53.2, 24.8
Health Area 27, 16.7, . . .

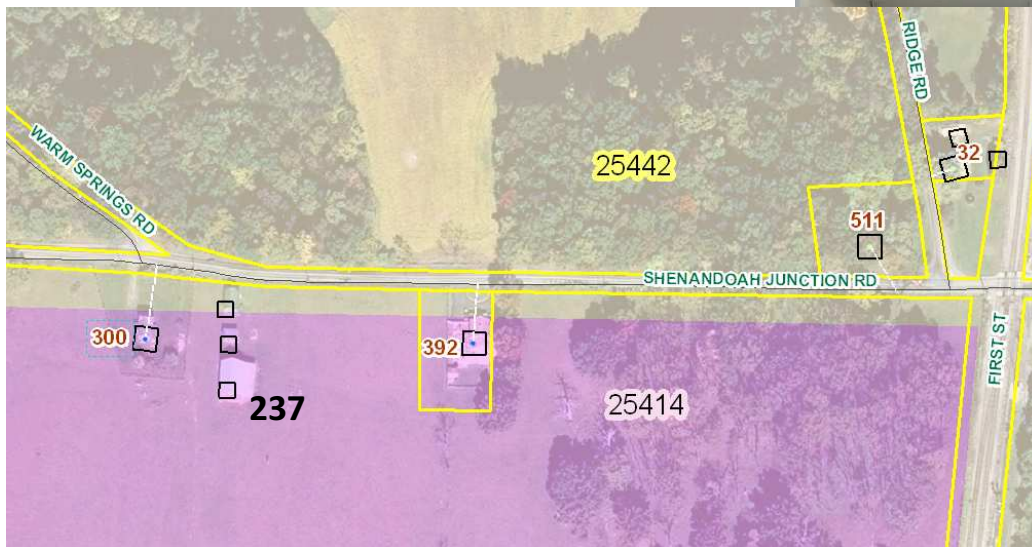. . . . .

Geography adds value

- Helps to understand the story the data we collect tells
- Generates innumerable hypotheses
- Reveals patterns, relationships and trends not obvious in a statistical table
- Provides bounds and simplifies complex and dense information

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Bureau

Geography Provides the Framework

*Collecting data from households and business establishments and assigning to the correct **Location***

- **Respondents** are associated with a location
- A **Location** is an **address** or a location description

Geography provides context

312,458,917 Persons , United States

6,687,961 Persons , Cairo, Egypt

717,148 Employees in construction ,Turkey

184,866 Cost of average house in Belguim in euros (first semester 2011)

12,855 Total dwelling units approved in August 2011, Austrailia

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Census
Bureau

Geographical knowledge is critical

- Geography can impact data collection operations

- Remote Alaska: landscape, weather conditions, and timing of the spring thaw affect data collection

- Red River flooding: timing, pattern, and extent of spring flooding can affect data collection

Issues Using Statistical Data

- Vintage

- Geographic construct

- Definitions

- Disclosure avoidance

Geography and Vintage

- Different vintages of boundaries for the same level of geography
- Different sets of geographic entities to present data
- Different reference dates for data
- Differences in the lowest level of geography for which data are available

Boundaries change over time

- New areas (incorporations, delineated areas)
- Areas merge into new entities
- Areas cease to exist (disincorporations)
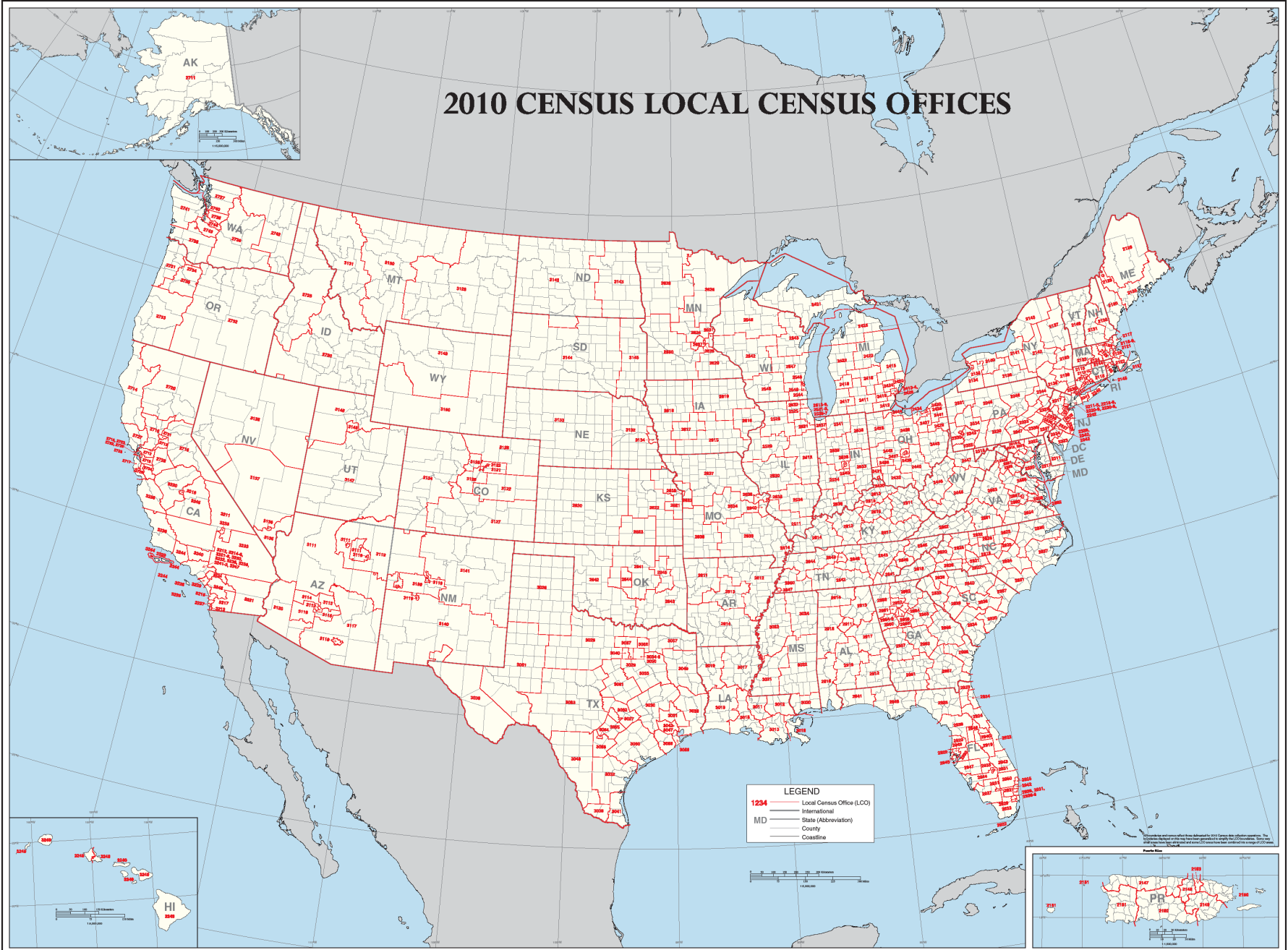
Change in definition affects integration

- Storing data
- Processing data
- Displaying data
- Documenting data

Geography should always be considered

- Administrative planning
- Data collection
- Data tabulation
- Data dissemination

2010 CENSUS LOCAL CENSUS OFFICES

AK

WA

OR

ID

MT

ND

MN

MI

NY

VT NH

ME

MA
CT RI

SD

WY

IA

WI

PA

NJ

NV

UT

CO

NE

KS

MO

IL

IN

OH

WV

VA

DC
DE
MD

CA

AZ

NM

OK

AR

KY

TN

NC

MS

AL

GA

SC

TX

LA

FL

HI

LEGEND

1234	Local Census Office (LCO)
	International
MD	State (Abbreviation)
	County
	Coastline

PR

Dissemination Challenges

- How to present the right data with the right context to meet users needs

- How to ensure that the most recent and most correct data are used and displayed

Presentation and analysis of data

- Maps help to:
  - Relate statistical data to the geographic areas to which they apply
  - Present data in a way that can be readily understood
    - Difficult to see population distribution, relationships, and patterns in a table
  - Increase use of data by the public
    - Effective distribution and widespread use of data will increase support for future work

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Statistical Data

|					
AL0100124Abbeville city	2987	1353	40301945	120383	15.560669	0.04648
AL0100460Adamsville city	4965	2042	50779330	14126	19.606010	0.00545
AL0100484Addison town	723	339	9101325	0	3.514041	0.00000
AL0100676Akron town	521	239	1436797	0	0.554750	0.00000
AL0100820Alabaster city	22619	8594	53023800	141711	20.472605	0.05471
AL0100988Albertville city	17247	7090	67212867	258738	25.951034	0.09989
AL0101132Alexander City city	15008	6855	100534344	433413	38.816529	0.16734
AL0101180Alexandria CDP	3692	1467	28736198	0	11.095109	0.00000
AL0101228Aliceville city	2567	1092	11645143	0	4.496215	0.00000
AL0101396Allgood town	629	198	2685621	1451	1.036924	0.00056
AL0101660Altoona town	984	437	9851874	28111	3.803830	0.01085
AL0101708Andalusia city	8794	4279	48884652	242897	18.874470	0.09378
AL0101756Anderson town	354	174	3345099	0	1.291550	0.00000
AL0101852Anniston city	24276	12787	117651320	85700	45.425431	0.03308
AL0102116Arab city	7174	3223	33070427	211423	12.768564	0.08163
AL0102260Ardmore town	1034	506	5284061	0	2.040187	0.00000
AL0102320Argo town	1780	726	31519227	252950	12.169642	0.09766
AL0102428Ariton town	772	335	13129325	0	5.069261	0.00000

Spatial Data
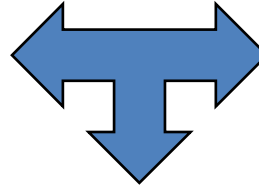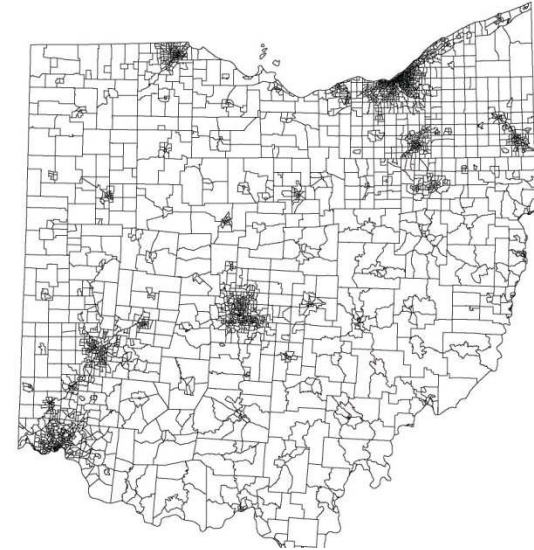
Figure 1. Percent Change in Resident Population for the 50 States, the District of Columbia, and Puerto Rico: 1990 to 2000
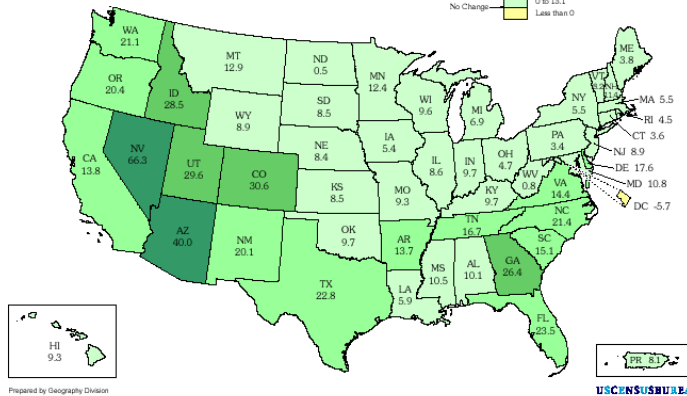
So what makes a good statistical map?

- A good map …
  - must be true to the data it presents – it must present the statistics in a valid way
  - should be easy to use and understand
  - should give the reader an overview of the information
  - should be pleasing to look at and add value to the presentation of the data

Maps are symbolic abstractions--"generalizations" or "representations"--of reality
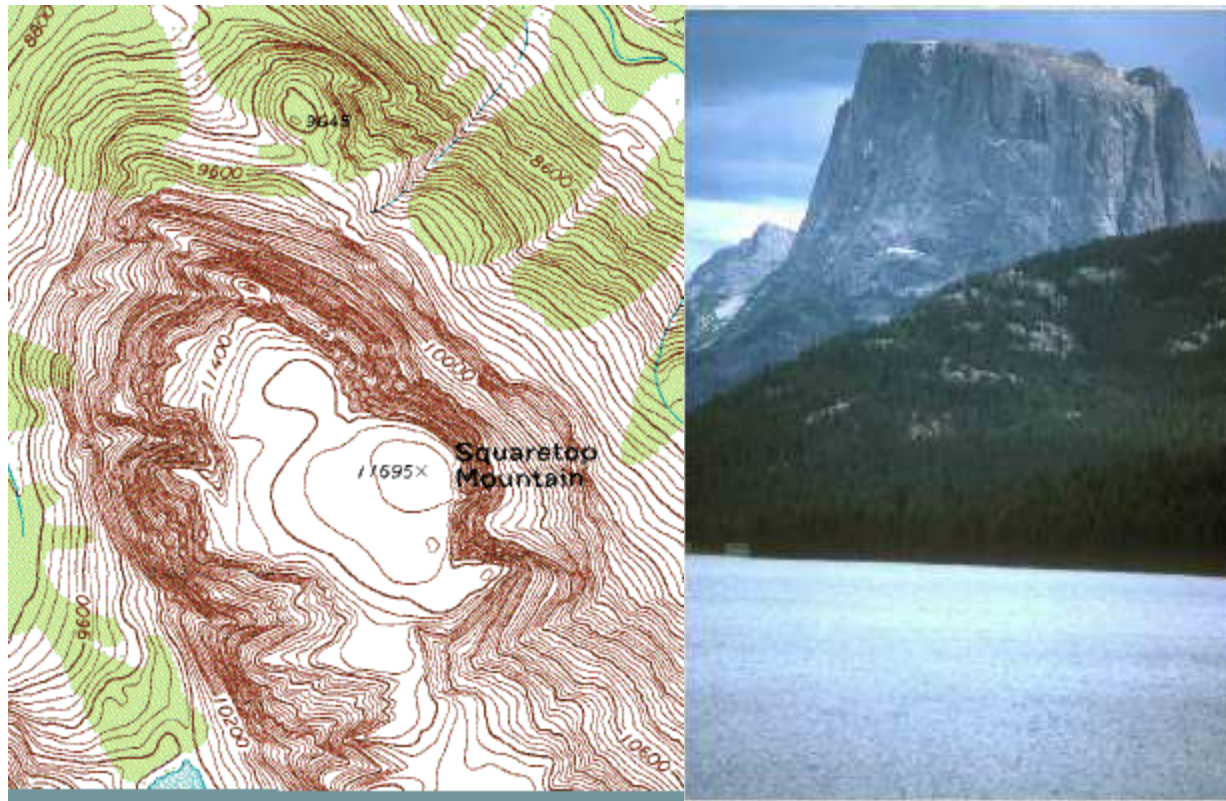
Maps can help analyze locational distributions and spatial patterns
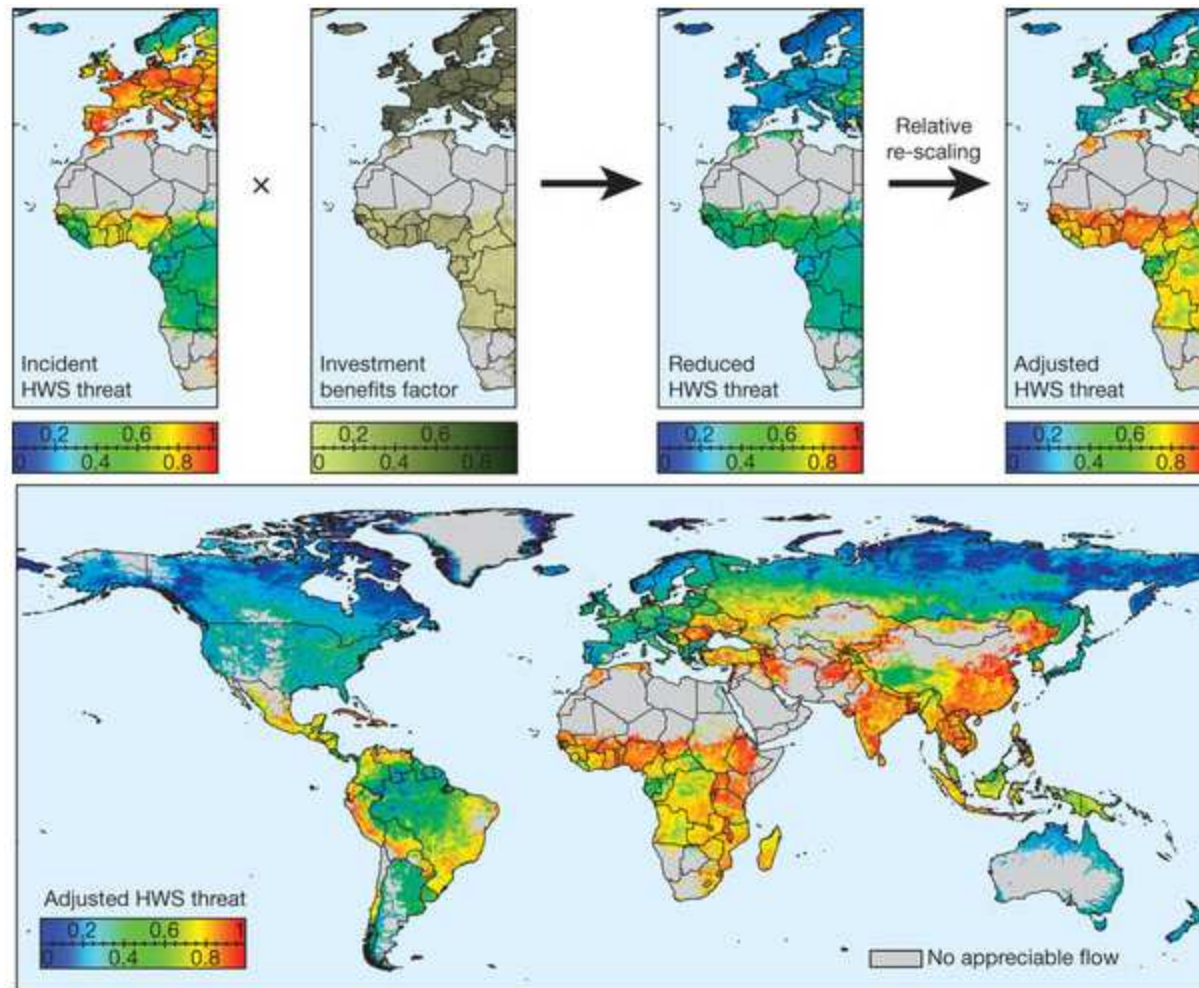
Maps can be used as a method of presenting information and communicating findings

Community Economic Development HotReport

Employment & Training Administration
Census Bureau
Economic Development Administration

Change County: Bronx County, New York   Go!   Select Another State

IE Printer Friendly

Bronx County, New York

Summary Reports: Overview | Economics | Demographics | Housing | Transportation | Community Assets

Overview

Population Size (in thousands)

Thousands
- ☐ 5+ -- 502
- ☐ 502+ -- 999
- ☐ 999+ -- 1496
- ☐ 1496+ -- 1993
- ☐ 1993+ -- 2487

Click on map to enlarge.

Data Sponsored By: U.S. Census Bureau - Population Division
**Data Source: POPEST/Census Bureau Version/County Population Estimates by Age, Sex, Race and Hispanic Origin/2005

General Area Statistics for Bronx County, New York

Indicator	Value
Population	1,357,589
Average annual wage	$36,182
Number in labor force	503,926
Number employed	458,018
Percent unemployed	9.1%
Median household income	$29,228
Median housing value	$330,500
Median gross rent	$778
Per capita income	$15,546
Poverty rate	29.2%
High school graduates	68.1%
Bachelor's degree or higher	16.1%

Information on sources of data, confidentiality protection, sampling error, nonsampling error, and definitions.

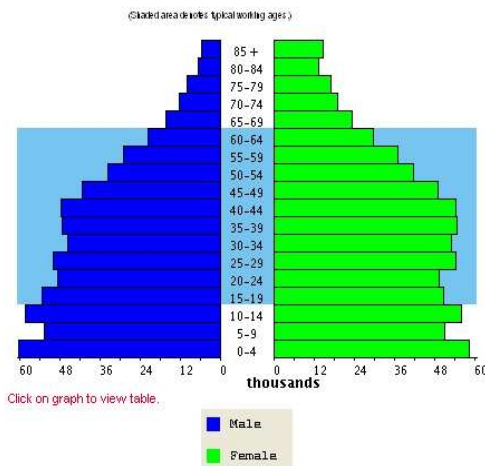### Relocation Data for Industry

Industries looking to relocate often consider areas in terms of the number of people in its workforce and their education, its unemployment rate, its wage rates, its housing stock, and educational and transportation infrastructures.

The percent unemployment of the nation in 2004 was **5.5%**.

**Data Source: USA Counties/2004

Population by Age and Sex for Bronx County, New York

(Shaded area denotes typical working ages)

Age groups: 85+, 80-84, 75-79, 70-74, 65-69, 60-64, 55-59, 50-54, 45-49, 40-44, 35-39, 30-29, 25-29, 20-24, 15-19, 10-14, 5-9, 0-4

thousands: 60 48 36 24 12 0 | 0 12 24 36 48 60

Click on graph to view table.

☐ Male
☐ Female

Data Sponsored By: U.S. Census Bureau - Population Division
**Data Source: POPEST/Census Bureau Version/County Population Estimates by Age, Sex, Race

NOTE: The data on this page are subject to error.

U.S. Census Bureau

Local Employment Dynamics   **All About Jobs**

Home | Local Employment Dynamics | Data Tools | Research | Library | About Us
QWI Online | On The Map | Industry Focus | Cornell Restricted Access Data Center | Case Studies and Examples

''' BRAC *Prototype* HotReport ''' ''' BRAC *Prototype* HotReport ''' ''' BRAC *Prototype* HotReport ''' ''' BRAC *Prototype* HotReport '''

...or Market and Economic Characteristics of Counties
...rating Data from Local Employment Dynamics* and Census 2000
(...uding Military and Federal Labor Data)

Select a different report: Characteristics of Counties

...our state: Virginia

...our Local Employment Dynamics selections:

...icator: Employment stable jobs: Counts
...Sector: All industry groups
...group: 14-99   Gender: Male and Female
...to map: Two-year Average

Choose your Census 2000 Map Theme:
Travel time to work: 60 or more minutes

Generate Maps and Table

...ap

...a map of counties showing quarterly workforce indicators for the ...wo-year Average. The selection shows **Employment: Counts** for ...sector **All industry groups**, filtered by an age group **14-99** created ...e HotReport and **Male and Female**.

...lap will not plot if data are not available for the selected ...or industry.

- ☐ 1,451 - 102,399
- ☐ 102,400 - 203,347
- ☐ 203,348 - 304,295
- ☐ 304,296 - 405,243
- ☐ 405,244 - 506,191
- ☐ 506,192 - 607,139
- ☐ 607,140 - 708,083

Census 2000 Map

Alabama map of counties showing **Median household income in 1999 (dollars)** from the 2000 decennial census.

- ☐ 16,646 - 22,188
- ☐ 22,189 - 27,730
- ☐ 27,731 - 33,272
- ☐ 33,273 - 38,814
- ☐ 38,815 - 44,356
- ☐ 44,357 - 49,898
- ☐ 49,899 - 55,440

...onsored By: U.S. Census Bureau and participating ...agencies
...ource: LED//Quarterly Workforce Indicators/Time

Data Sponsored By: State Data Centers - AR and GA
**Data Source: Decennial/Summary File 3/2000/Summary File 3

...muting Patterns

... Local Employment Dynamic's On the Map, you can begin to see ...pacts of BRAC on the community surrounding a military ...ation. For this prototype we have provided examples for Scott ...n St. Clair Co., IL. You can select:

...re people work who live around the AFB (a commute shed)
...re workers live who work in or around the AFB (a labor shed)

Statistical data can be overwhelming

Income of Household						
Total	118,682	67,530	97,574	70,422	96,144	70,572
Under $5,000	4,176	1,249	2,741	1,243	2,665	1,246
$5,000 to $9,999	5,055	7,927	3,490	7,932	3,417	7,930
$10,000 to $14,999	7,061	12,388	5,397	12,435	5,309	12,440
$15,000 to $19,999	7,260	17,278	5,858	17,285	5,763	17,289
$20,000 to $24,999	6,937	22,165	5,477	22,186	5,390	22,181
$25,000 to $29,999	6,730	27,186	5,459	27,222	5,361	27,218
$30,000 to $34,999	6,148	32,085	4,990	32,094	4,910	32,103
$35,000 to $39,999	5,907	37,183	4,910	37,208	4,834	37,200
$40,000 to $44,999	5,624	42,013	4,623	42,047	4,537	42,049
$45,000 to $49,999	4,933	47,198	4,081	47,205	4,007	47,200
$50,000 to $54,999	5,088	51,984	4,222	52,016	4,175	52,012
$55,000 to $59,999	4,203	57,154	3,580	57,186	3,535	57,181
$60,000 to $64,999	4,412	61,941	3,696	61,935	3,654	61,935
$65,000 to $69,999	3,579	67,095	3,021	67,109	2,981	67,103
$70,000 to $74,999	3,769	72,042	3,166	72,064	3,134	72,062
$75,000 to $79,999	3,118	77,007	2,656	77,023	2,622	77,020
$80,000 to $84,999	3,143	81,979	2,709	82,015	2,671	82,016
$85,000 to $89,999	2,680	87,142	2,339	87,141	2,303	87,136
$90,000 to $94,999	2,516	92,009	2,187	91,994	2,162	91,999
$95,000 to $99,999	2,110	97,155	1,867	97,156	1,840	97,163
$100,000 to $104,999	2,498	101,830	2,186	101,875	2,170	101,872
$105,000 to $109,999	1,778	107,162	1,523	107,145	1,504	107,141
$110,000 to $114,999	1,782	111,973	1,541	111,997	1,529	111,993
$115,000 to $119,999	1,480	117,204	1,271	117,228	1,255	117,223
$120,000 to $124,999	1,470	121,842	1,263	121,860	1,246	121,851
$125,000 to $129,999	1,243	127,026	1,105	127,030	1,082	127,026
$130,000 to $134,999	1,236	132,066	1,074	132,127	1,061	132,122
$135,000 to $139,999	1,058	137,202	937	137,218	921	137,226
$140,000 to $144,999	974	141,989	828	142,055	823	142,058
$145,000 to $149,999	783	146,959	664	146,985	658	146,985
$150,000 to $154,999	983	151,788	849	151,794	843	151,792
$155,000 to $159,999	671	157,072	590	157,028	583	157,020
$160,000 to $164,999	636	162,151	537	162,125	530	162,121
$165,000 to $169,999	541	167,076	474	167,064	464	167,073
$170,000 to $174,999	555	171,948	466	171,981	461	171,986
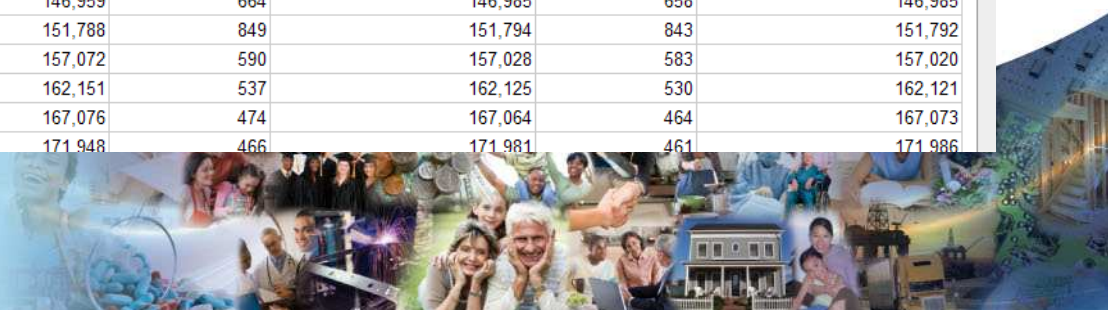
TheDataWeb Framework
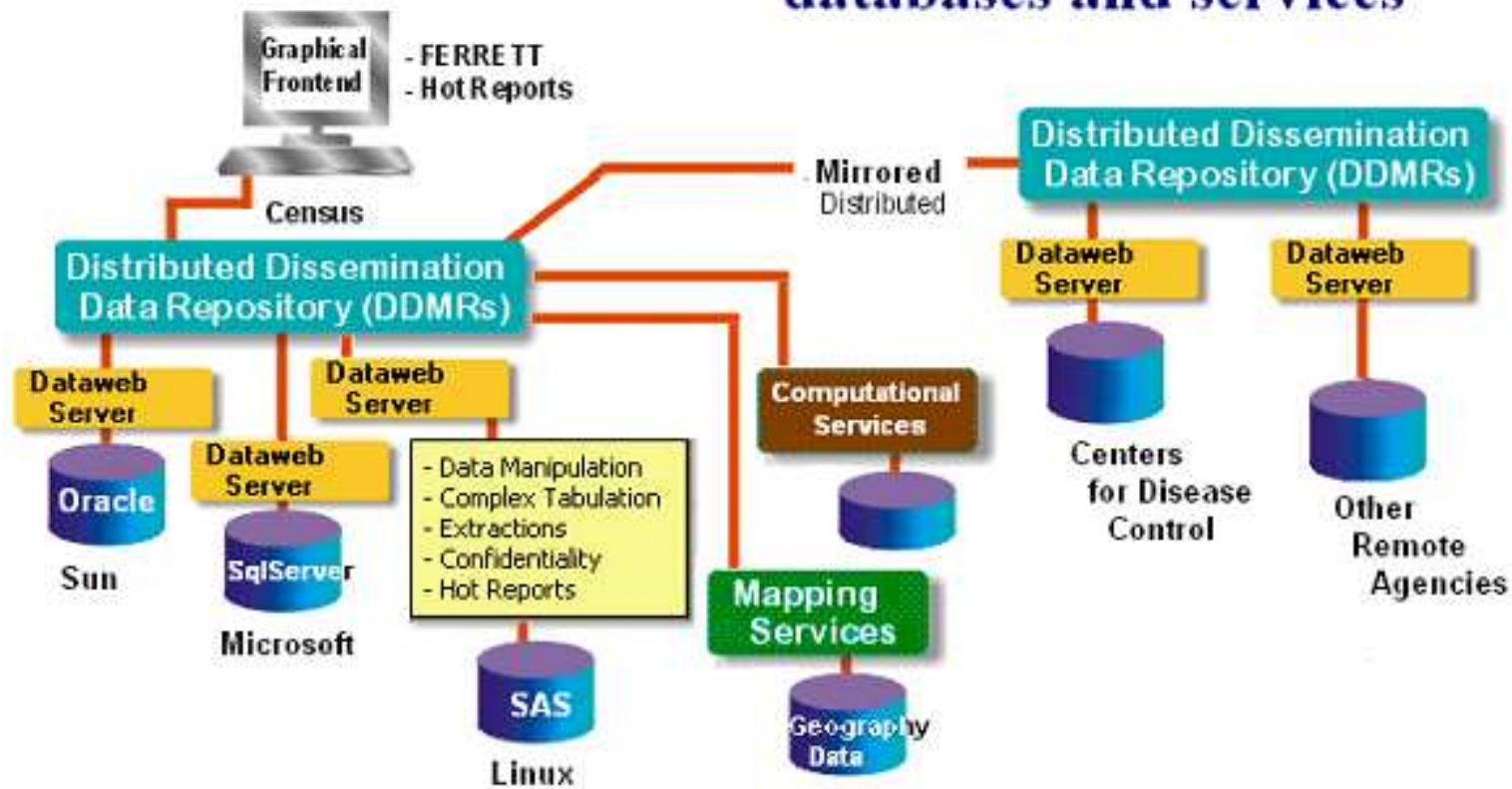
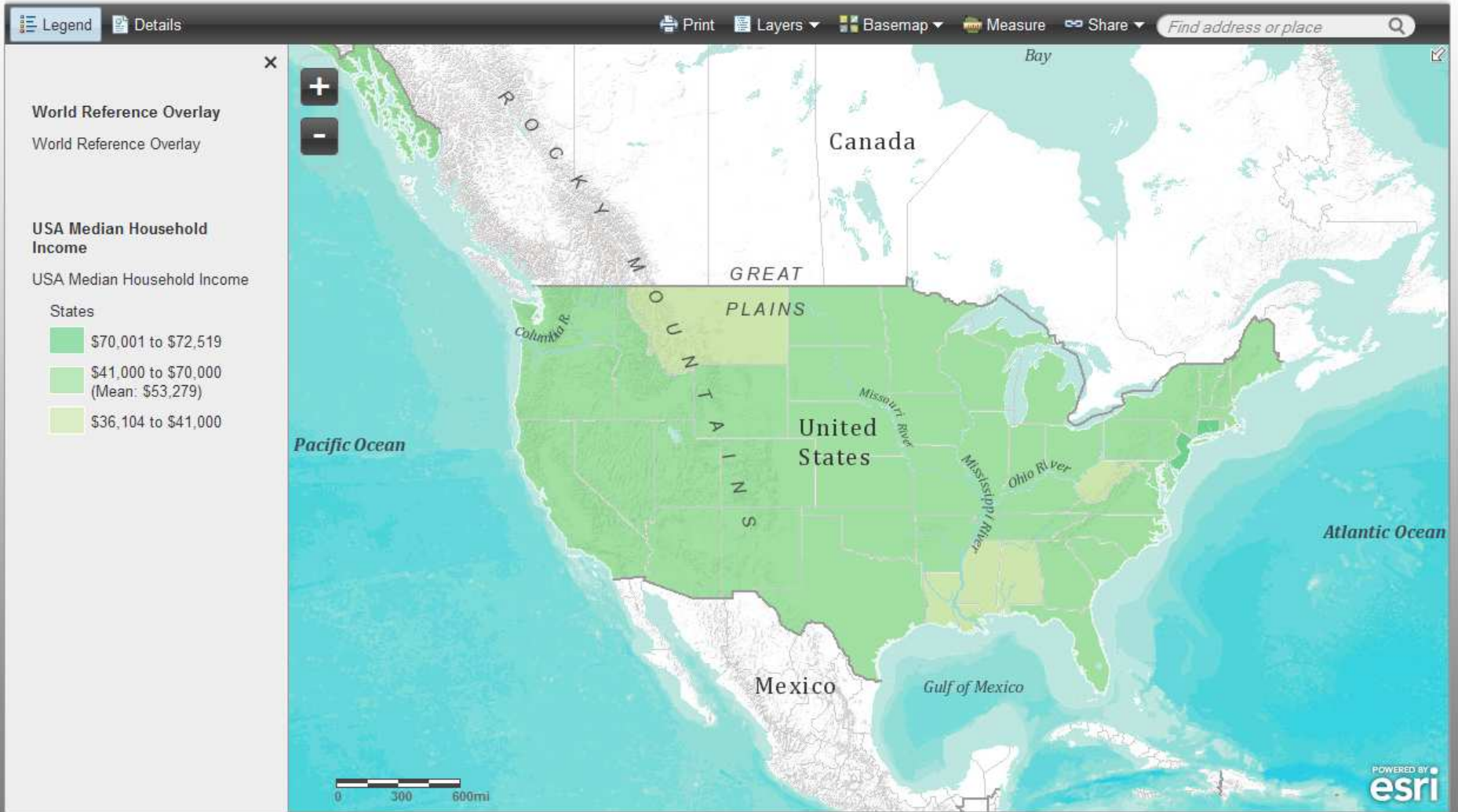**Reflects partnerships and collaborations linking separate data systems for common analysis**

USA Median Household Income

World Reference Overlay

World Reference Overlay

USA Median Household Income

USA Median Household Income

States

■	$70,001 to $72,519
■	$41,000 to $70,000 (Mean: $53,279)
■	$36,104 to $41,000

Asia

North America

Europe

Africa

South America

Australia

0   1000   2000mi

POWERED BY esri
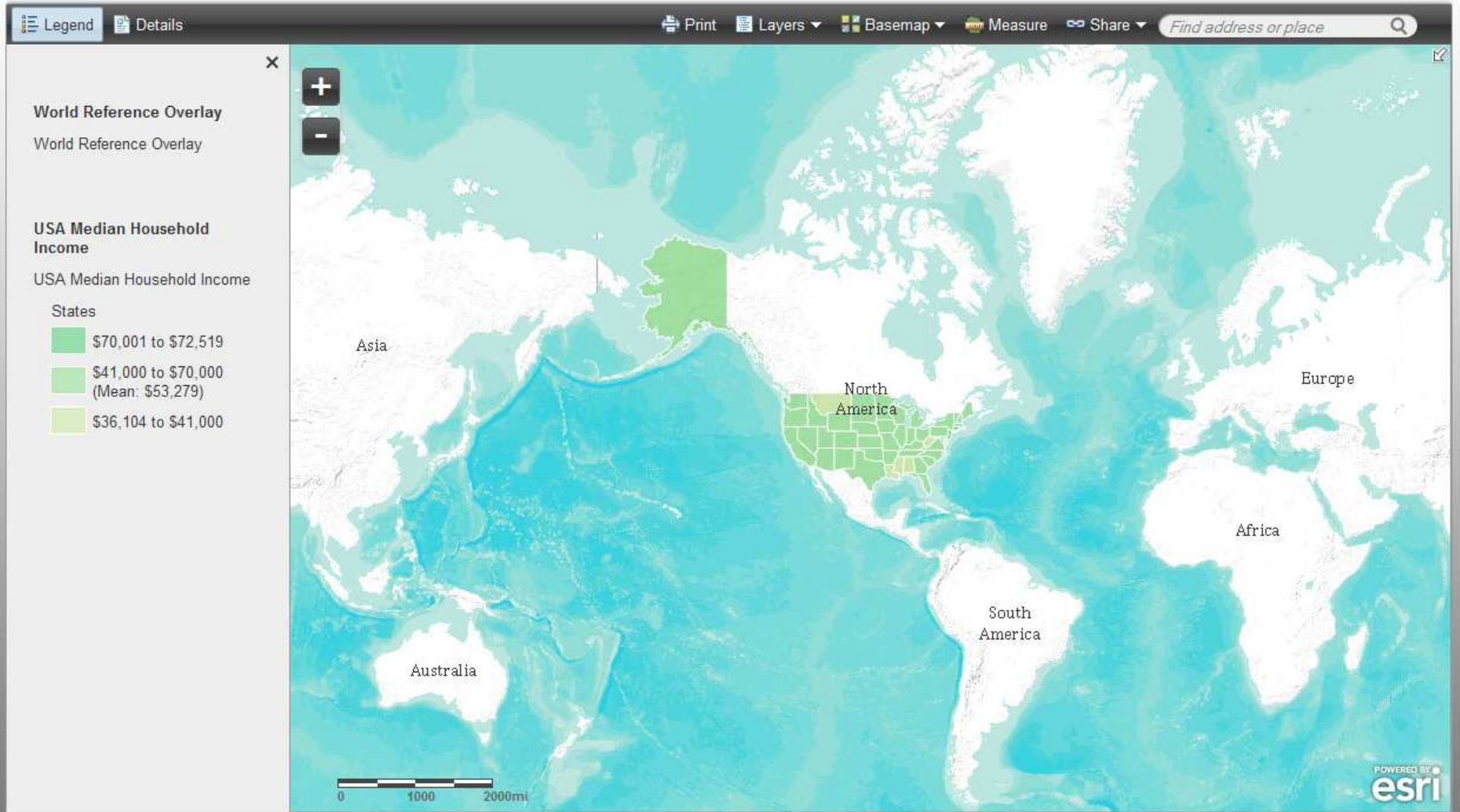
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Census
Bureau

USA Median Household Income

World Reference Overlay

World Reference Overlay

USA Median Household Income

USA Median Household Income

States

- $70,001 to $72,519
- $41,000 to $70,000 (Mean: $53,279)
- $36,104 to $41,000

Bay

Canada

ROCKY MOUNTAINS

GREAT PLAINS

Columbia R.

Pacific Ocean

Missouri River

United States

Mississippi River

Ohio River

Atlantic Ocean

Mexico

Gulf of Mexico

0   300   600mi

POWERED BY esri

USA Median Household Income

World Reference Overlay

World Reference Overlay

USA Median Household Income

USA Median Household Income

Counties

- $84,001 to $116,778
- $70,001 to $84,000
- $41,001 to $70,000 (Mean: $43,745)
- $27,001 to $41,000
- $8,889 to $27,000

USA Median Household Income

USA Median Household Income

World Reference Overlay

World Reference Overlay

USA Median Household Income

USA Median Household Income

Counties

- $84,001 to $116,778
- $70,001 to $84,000
- $41,001 to $70,000 (Mean: $43,745)
- $27,001 to $41,000
- $8,889 to $27,000

"In a world so shrunken in distance and time that you can almost instantly communicate with any other city on any other continent, and in which you can fly to virtually its remotest corner in a matter of hours, a knowledge of differing peoples and places can no longer be considered the luxury of a few but is, instead, a necessity of every individual. Our interdependence is now so complete that business decisions taken in Tokyo or Singapore have repercussions in Copenhagen and Peoria. Just to stay abreast of world events, much less to function effectively as informed global citizens, requires that we learn not only where these events are occurring, but also why they are taking place and how they will impact on our lives. Such considerations are the very essence of geography."

– Michael Peterson