

Crime in Pennsylvania

A Five-Year County Overview of Part I and Part II Crimes

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Advanced Geospatial Course
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Research Questions

With respect to Type I and Type II Crimes, how have the occurrences of these crimes changed in Pennsylvania by County over a recent five year period?

Could actionable patterns emerge through visualization of temporal data?

Methodology

***Reprojected Boundary File to
USA Contiguous Albers Equal Area Conic***

***Prepared Statistics Tables for
Join to Boundary File***

***Symbolized Normalized Summary and
Percent Change Statistics***

***Compared Traditional Chloropleth Maps
to Ring Maps for Temporal Change***

Special Thanks for Contributions

Data Sources:

**County Boundaries 2013,
Pennsylvania Department of
Transportation, Pennsylvania
Spatial Data Access (PASDA)**

ftp://www.pasda.psu.edu/pub/pasda/padot/boundary_layers/

**Pennsylvania Uniform Crime
Reporting System**

<http://www.paucrs.pa.gov/UCR/Reporting/Annual/AnnualSumArrestUI.asp>

Projection:

**USA Contiguous Albers
Equal Area Conic**

References:

**Chan, Ta-Chien, Chien-Min Wang,
Yung-Mei Lee, "Looking at
Temporal Changes," ArcUser vol.
16 no. 4, 2013: pp. 42-44.**

<http://www.esri.com/esri-news/arcuser/fall-2013>

**Huang, Guilan, Sergio Govoni, Jae
Choi, David M. Hartley, James M.
Wilson, "Geovisualizing Data with
Ring Maps," ArcUser vol. 10 no. 2,
2008: pp. 54-55.**

<http://www.esri.com/news/arcuser/0408/winter2008.html>

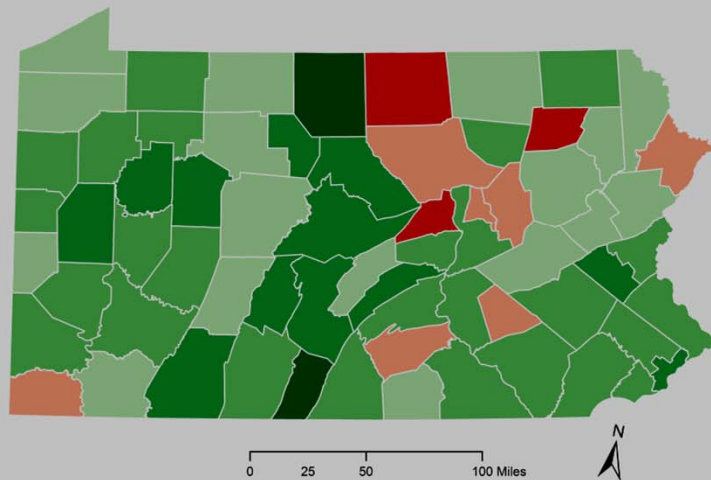
Software:

ESRI's ArcGIS ArcMap for Desktop

Understanding Temporal Change

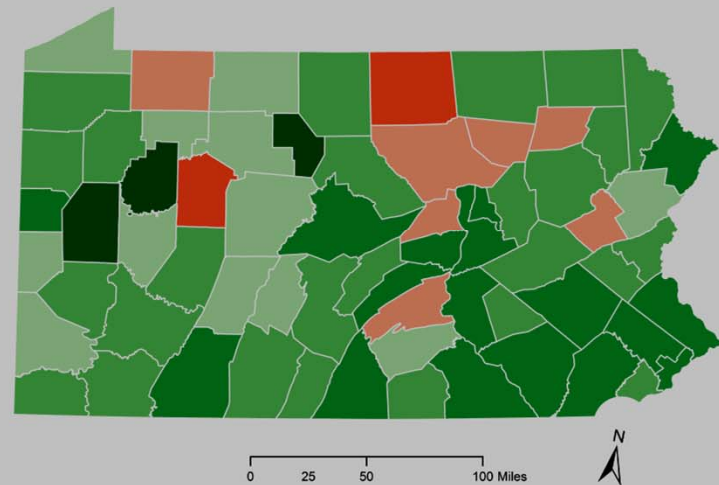
Data which changes, while the geography remains the same, is known as temporal data. Showing temporal change often leads to a series of tables, charts, or graphs; these may be difficult to visualize the comparison, and then to interpret any relationship to their appropriate locations. Actionable decisions would depend upon successful interpretation, and therefore vary by individual interpretation. Using many choropleth maps would be one possible solution.

**2008 - 2012 Part I Crimes Percent Change
Crime Rate Per 100,000 Population By County**



Increased (50.1% to 75%)	Increased (15.1% to 25%)	Constant (-4.9% - 5%)	Decreased (-24.9% to -15%)
Increased (25.1% to 50%)	Increased (5.1% to 15%)	Decreased (-14.9% to -5%)	Decreased (-49.9% to -25%)

**2008 - 2012 Part II Crimes Percent Change
Crime Rate Per 100,000 Population By County**

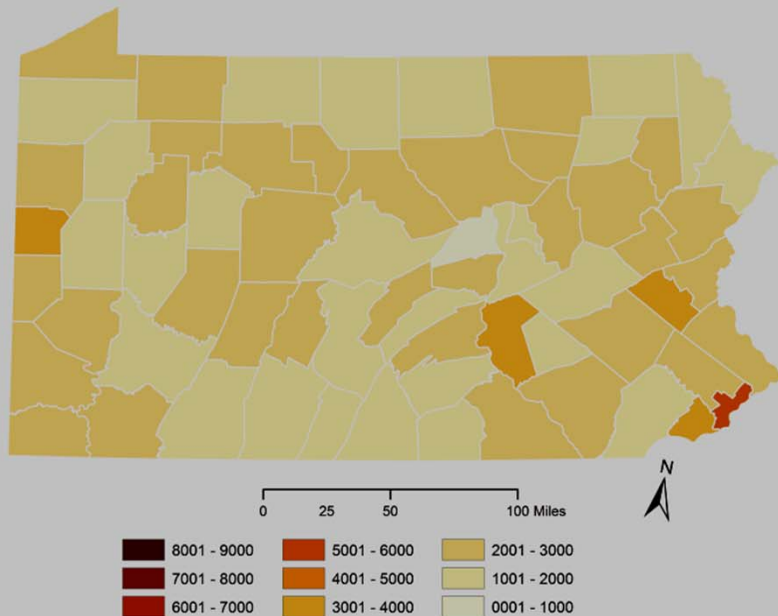


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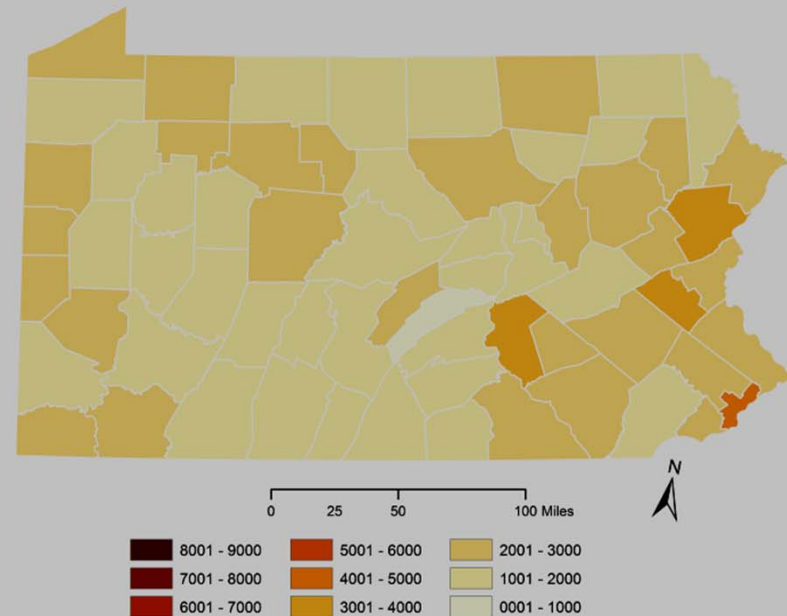
Crime Index and Part I Offenses

“Crime Index offenses are considered to be both the most serious and most likely to be reported, and are used nationally as the standard base for comparisons. They include: murder and nonnegligent manslaughter, forcible rape, robbery, aggravated assault, burglary, larceny-theft, motor vehicle theft, and arson. Manslaughter by negligence is a Part I offense, but is not considered part of the Crime Index.” -- Executive Summary Crime in Pennsylvania 2011 Annual Uniform Crime Report

**2008 Part I Crime Rate
Per 100,000 Population By County**



**2012 Part I Crime Rate
Per 100,000 Population By County**

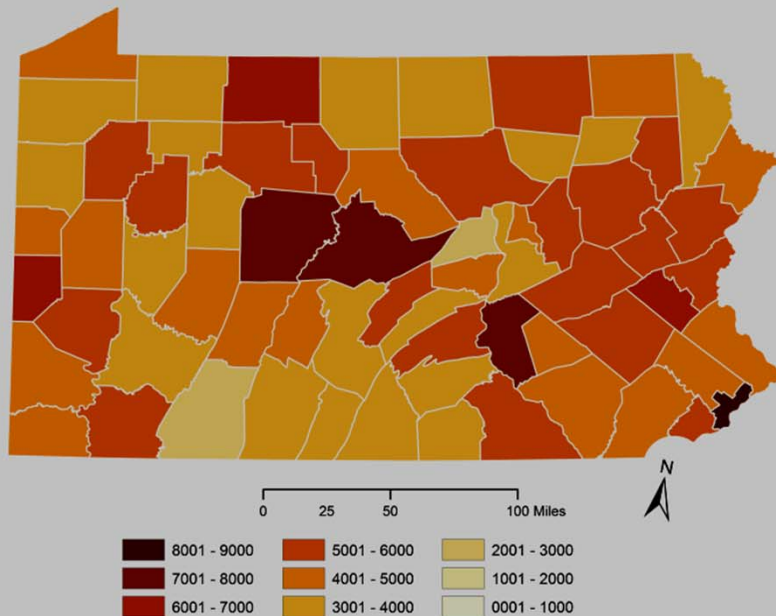


Part II Offenses

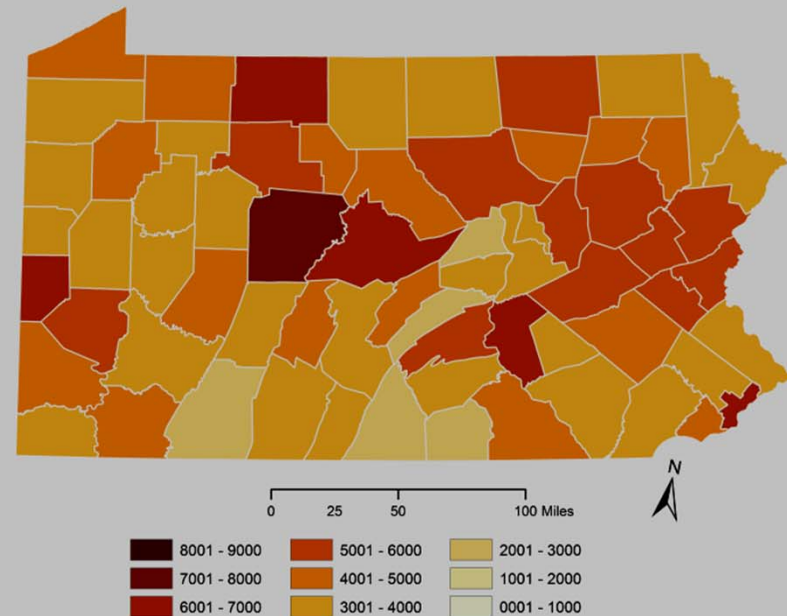
“Part II offenses include: other assaults, forgery and counterfeiting, fraud, embezzlement, stolen property, vandalism, weapons, prostitution, other sex offenses, drug abuse violations, gambling, offenses against the family, driving under the influence, liquor law violations, drunkenness, disorderly conduct, vagrancy, and all other offenses.”

-- Executive Summary Crime in Pennsylvania 2011 Annual Uniform Crime Report

**2008 Part II Crime Rate
Per 100,000 Population By County**



**2012 Part II Crime Rate
Per 100,000 Population By County**



Ring Map Tool Becomes Available

Ring maps provide a way to successfully show the temporal changes for any desired number of intervals.



This article appeared in a recent edition of ArcUser.

Looking at Temporal Changes

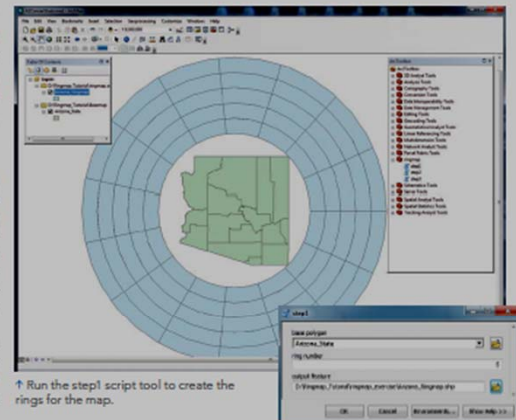
Use this Python tool for creating ring maps

By Ta-Chien Chan, Chien-Min Wang, and Yung-Mei Lee, Center for Geographic Information Science, Research Center for Humanities and Social Sciences, Academia Sinica, Taiwan

The authors have developed a Python tool that steps users through the process of creating a ring map. They have provided this tool in a toolbox along with some sample data that can be used to create a ring map.

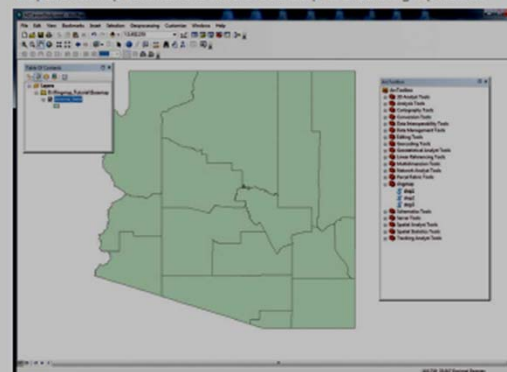
The multitemporal dimensions of attribute data are difficult to display in a single map. Traditionally, users either make the multiple line graphs for presenting the temporal trends in different locations or create bar charts on a GIS map. However, multiple line graphs cannot visualize the spatiotemporal correlation together, and bar charts are sometimes problematic because charts may overlap.

In 2008, researchers at the Georgetown University Medical Center in Washington, DC, proposed using ring maps to integrate the multidimensions or multiattributes data



↑ Run the step1 script tool to create the rings for the map.

↓ Open a new map document and add the Arizona.shp file and the ringmap toolbox.



into one simple map. [This work by Guilan Huang, Sergio Govoni, Jae Choi, David M. Harley, and James M. Wilson was described in "Geovisualizing Data with Ring Maps: Improves comprehension when mapping many variables," which appeared in the Spring 2008 issue of ArcUser.] Ring maps use a basemap as the central feature, and surrounding rings represent the corresponding attributes in each location. Data that varies over time, such as weekly disease surveillance counts, annual cancer incidence/mortality, or monthly crime rates, can all be visualized using ring maps. Other data can be joined and used for exploring the potential contextual associations among the attributes.

Although a ring map is a powerful tool, there was no step-by-step tutorial describing how to make one. The authors developed a tool for creating a ring map in ArcGIS 10.1 using

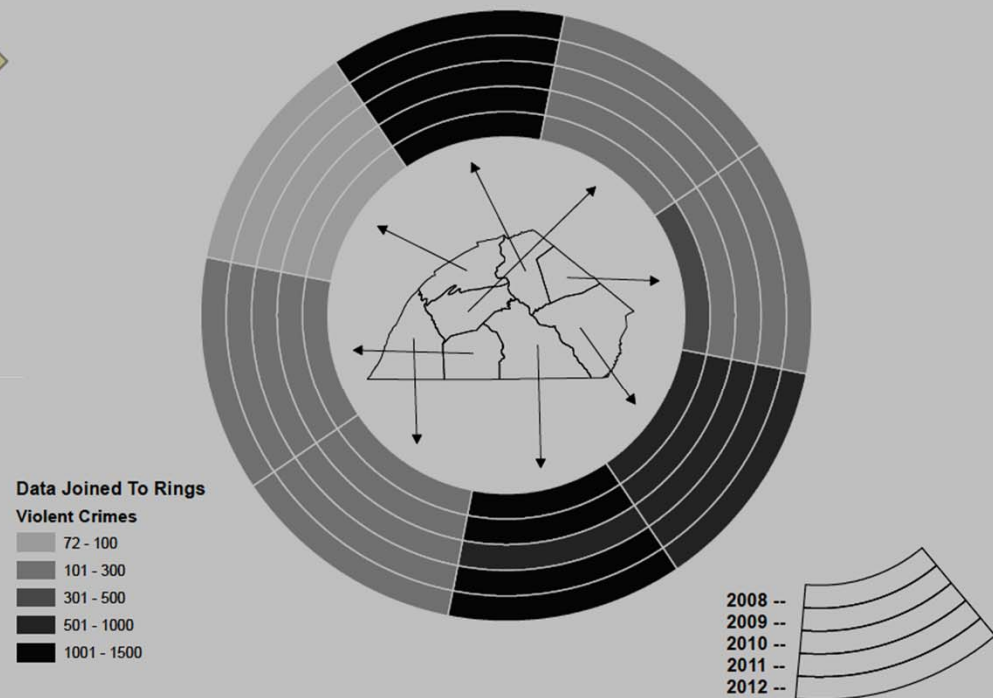
Testing Data Join Options

It is a good plan to test a simple data join process first, in order to better understand the limitations of the ring map tool. Smaller sections of the data keep it manageable for visual interpretation.



Ring sections must be named to match for desired location during data join.

Violent Crimes In South Central Pennsylvania, 2008 - 2012



Analysis Results

This project involved determining the best visualization available using ESRI's ArcMap for Desktop, in order to answer the question of temporal change of Part I and Part II Crimes in Pennsylvania during the recent five year period. The decision to normalize the data by population was to provide a level field of comparison.

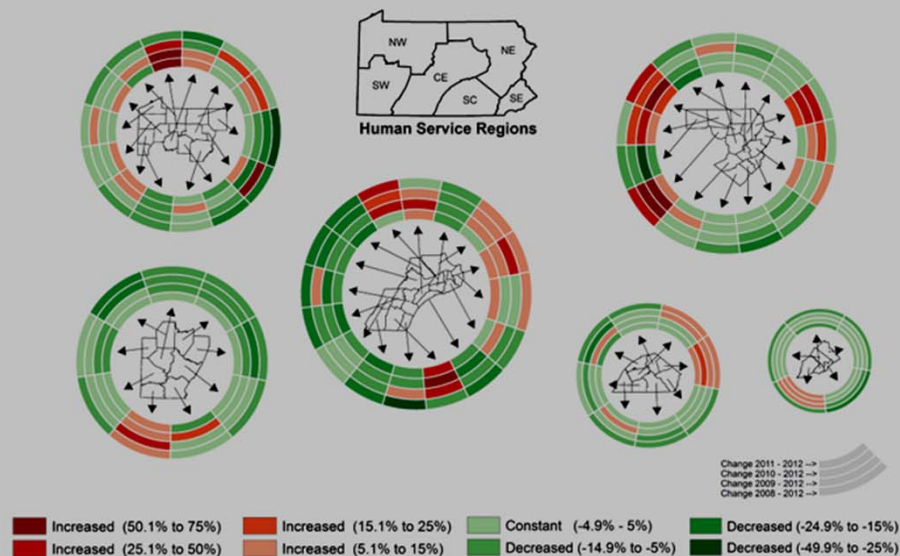
Could actionable patterns emerge through visualization of temporal data?

The ring map representation appeared to be the best method for visual interpretation of this temporal data, showing changes over time on a common scale.

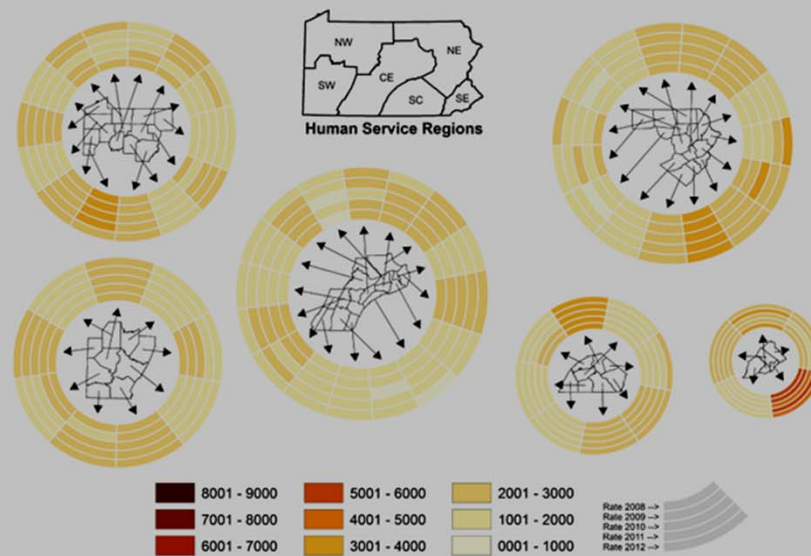
Since the Common Human Service Regions were already defined within the datasets, this was the obvious choice for grouping.

Part I Crimes in Pennsylvania, 2008 - 2012

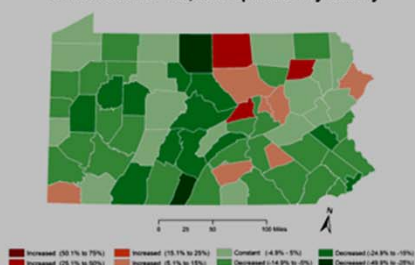
**2008 - 2012 Part I Crimes Percent Change
Crime Rate Per 100,000 Population By County**



2008 - 2012 Part I Crime Rate Per 100,000 Population By County



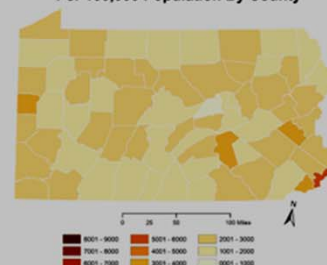
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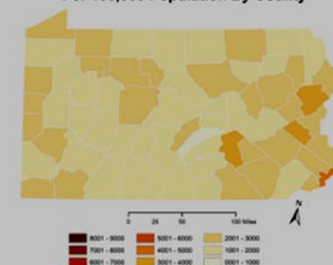
Pennsylvania Counties



**2008 Part I Crime Rate
Per 100,000 Population By County**



**2012 Part I Crime Rate
Per 100,000 Population By County**



Data Sources:
County Boundaries 2013, Pennsylvania Department of Transportation, Pennsylvania Spatial Data Access (PASDA):
http://www.pasda.pa.gov/pub/pasda/padot/boundary_layers/PennsylvaniaUniformCrimeReportingSystem
Annual/AnnualSumArrestUI.asp
<http://www.paucr.pa.gov/UCR/Reporting/Annual/AnnualSumArrestUI.asp>

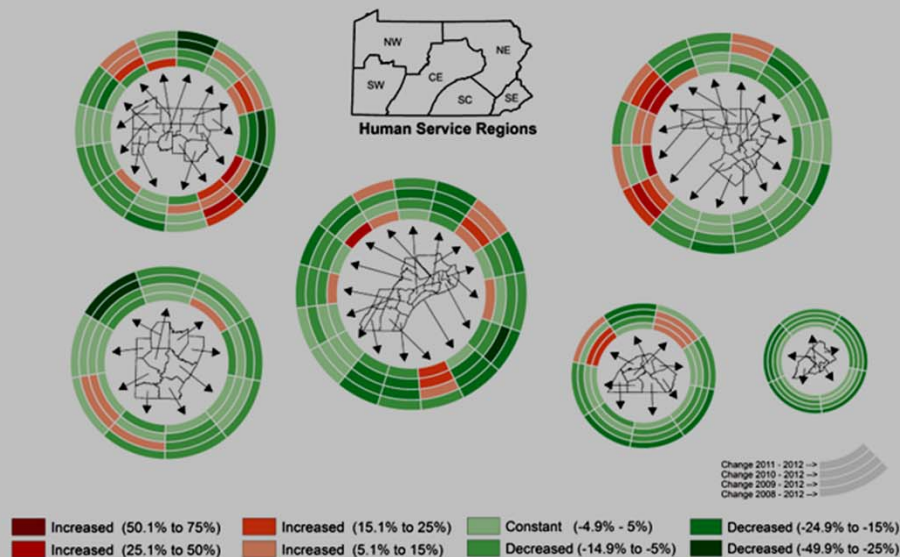
References:
 Chan, Ta-Chien, Chien-Min Wang, Yung-Mei Lee, "Looking at Temporal Changes," *ArcUser* vol. 16 no. 4, 2013: pp. 42-44.
<http://www.esri.com/test-news/arcuser/fall-2013/current-issue>
 Huang, Guilan, Sergio Givoni, Jae Choi, David M. Hartley, James M. Wilson, "Geovisualizing Data with Ring Maps," *ArcUser* vol. 10 no. 2, 2008: pp. 54-55.
<http://www.esri.com/news/arcuser/0406/winter2008.html>

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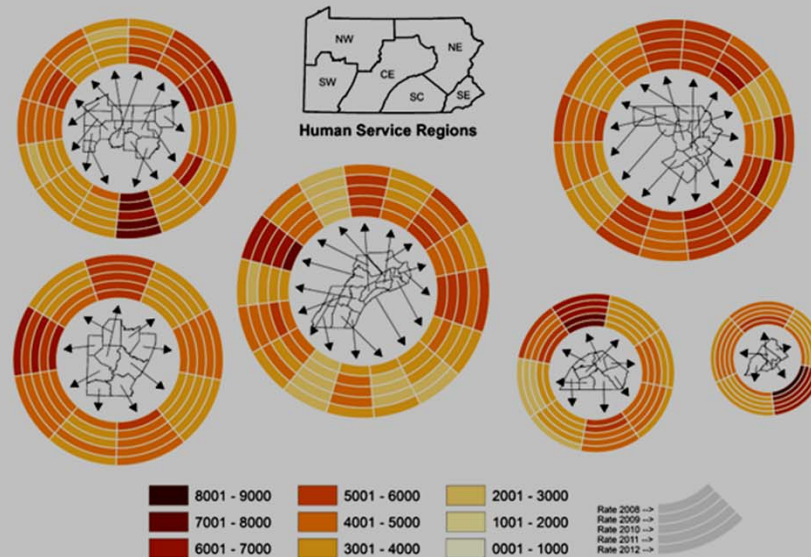
Projection: USA Contiguous Albers Equal Area Conic

Part II Crimes in Pennsylvania, 2008 - 2012

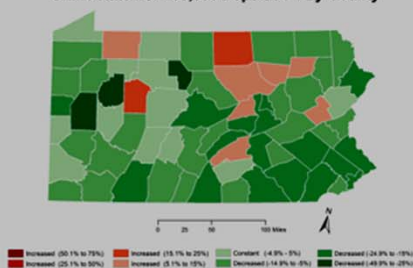
2008 - 2012 Part II Crimes Percent Change Crime Rate Per 100,000 Population By County



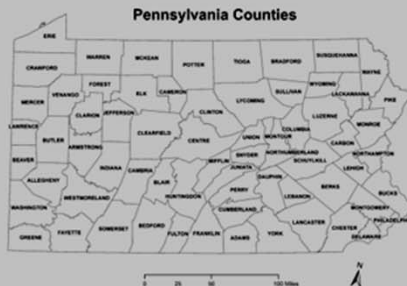
2008 - 2012 Part II Crime Rate Per 100,000 Population By County



**2008 - 2012 Part II Crimes Percent Change
Crime Rate Per 100,000 Population By County**

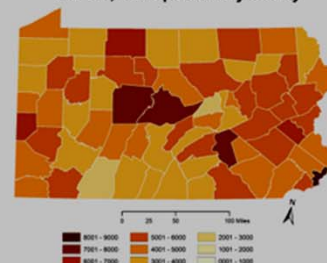


Pennsylvania Counties:

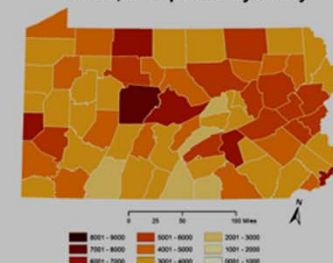


Data Sources:
County Boundaries 2013, Pennsylvania Department of Transportation, Pennsylvania Spatial Data Access (PASDA):
http://www.pasda.pa.gov/pub/pasda/podsi/boundary_layers/
Pennsylvania Uniform Crime Reporting System
<http://www.paucrs.pa.gov/UCR/Reporting/Annual/AnnualSumAccess.asp>

2008 Part II Crime Rate Per 100,000 Population By County



2012 Part II Crime Rate Per 100,000 Population By County



References:
 Chan, Ta-Chien, Chien-Min Wang, Yung-Mei Lee, "Looking at Temporal Changes," *ArcUser* vol. 16 no. 4, 2013: pp. 42-44.
<http://www.esri.com/esri-news/arcuserfall-2013> (current issue)
 Huang, Guilan, Sergio Govoni, Jae Chok, David M. Hartley, James M. Wilson, "Geovisualizing Data with Ring Maps," *ArcUser* vol. 10 no. 2, 2008: pp. 54-55.
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