

Wisconsin Legislative Redistricting Election Data Analysis

Legislative redistricting is the process of changing the way census data is combined to create 132 new state legislative districts in Wisconsin. For my term-long project I performed an election data analysis of the 2002 legislative districts that were drawn by the Eastern District Federal court and the 2011 legislative districts that were drawn by the political party that currently controls our state government.

Legislative redistricting in Wisconsin is the most political exercise that can happen in our state. Even relatively small changes made to a legislative district can change the political makeup of the district and could result in the election of a representative from a different party. If enough districts are altered in a redistricting plan to favor one party, political control of the legislature for one party could continue for the decade and possibly beyond.

Redistricting in Wisconsin “is mandated by article 4, section 3, of the Wisconsin Constitution, which requires that the state senate and assembly be redistricted following each federal census” “according to the number of inhabitants.” Since 1973, the Wisconsin Legislature has had 33 senate districts, each of which is divided 3 assembly districts, for a total of 99 assembly districts.” (Keane, 2005)

The process begins with the delivery of Public Law (PL) 94-171 data and corresponding geographic data (census blocks) to all 50 states (and territories) by the US Census Bureau. The PL 94-171 data is the population counts by race and ethnicity for each census block used for restricting. This data is to be delivered to the states no later than April 1st, one year after each decennial census.

Wisconsin is unique because after the census data is delivered to the state liaisons, the each municipality “with a population greater than 1,000 must divide itself into wards to facilitate elections and must provide these new ward lines to the legislature by August of the year ending in “1”.” (Keane, 2005) These new ward lines (built by combining census blocks) usually take the place of census blocks as the building blocks of new legislative districts. Municipal ward data is collected by my staff and is used to administer elections in Wisconsin. Currently, we maintain over 10 years of election data at the municipal ward level of geography.

Can we perform a type of spatial analysis that would give us a statistical idea of the effect a given redistricting plan would have on the partisan control of the legislature?

All of the data needed to perform this analysis is in my control and on my server.

- **2002 Wisconsin Legislative Districts**
- **2011 Wisconsin Legislative Districts**
- **2012 Wisconsin Municipal Ward Layer**
- **2002 – 2012 Election Data by Municipal Ward**

1. I would like to combine all of the election data we have collected over the decade (statewide races only) to create a three fields of data. From this data I like to create two maps showing the decade percentage of democrat and republican election data percentages.
 - a. Total Democrat
 - b. Total Republican

I was able to gather the required data and create the democrat and republican decade election data fields. I used only the statewide election results for this analysis, 2002, 2006, 2010 and 2012 (recall) gubernatorial; 2004, 2008 and 2012 presidential races. This is quite a bit of data to combine so, after I combined all the fields, I did some spot checks to

make sure I combined all the correct data fields. I also created two choropleth maps to verify the votes are in the correct location and to make some general observations before I completed the raster voter density analysis.

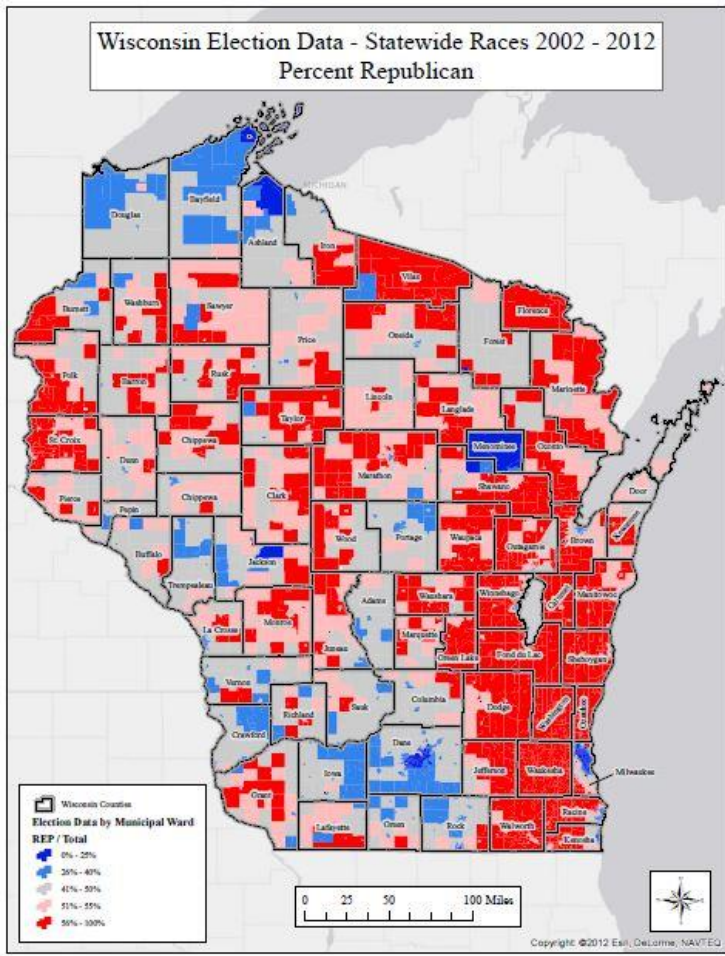


Figure 1: Percent Republican combined statewide election data by municipal ward.

Here are some general observations about the maps.

Percent Republican Map (Figure 1)

- Most of the high republican percentage areas are in the suburbs surrounding major cities and the rural areas of the state.
- There are more high percentage republication areas (dark red) than areas leaning republican (light red).

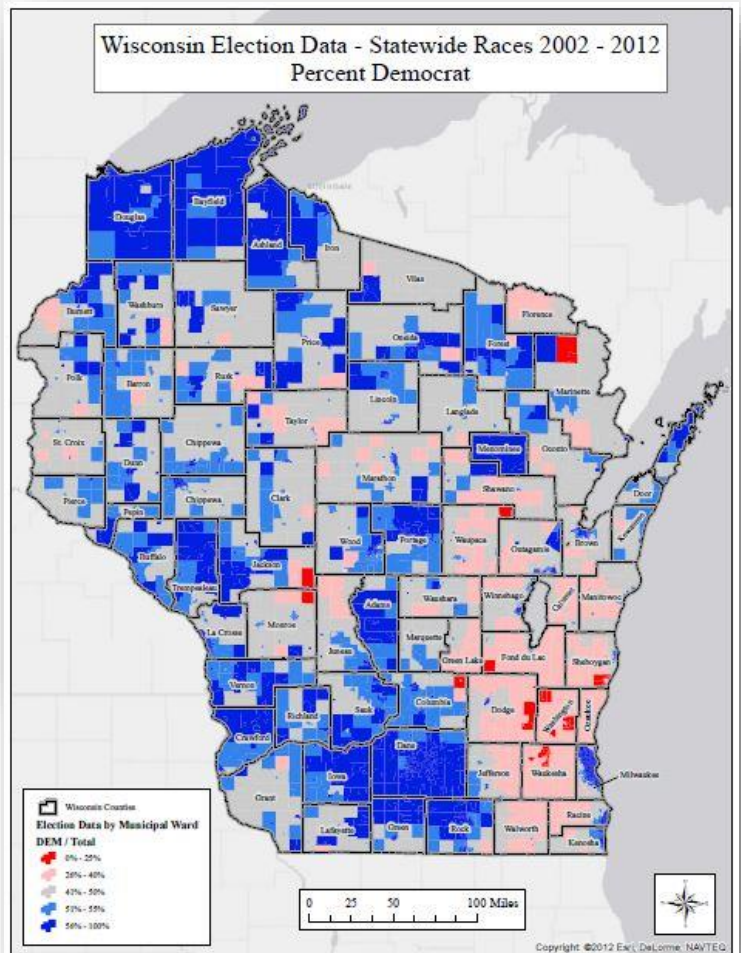


Figure 2: Percent Democrat combined statewide election data by municipal ward.

Percent Democrat Map (Figure 2)

- Most of the high democrat percentage areas are in the major cities and in and around Dane County.
 - Dane county is Wisconsin's Capital, the county seat, and the home to the University of Wisconsin – Madison.
- There looks to be more high percentage democratic areas (dark blue) than areas leaning democrat (light blue).

Just by looking at these maps you can tell the most of the State of Wisconsin is very politically divided. Most of the areas of the state are either dark blue (Highly Democrat, dark red (Highly Republican or gray (split).

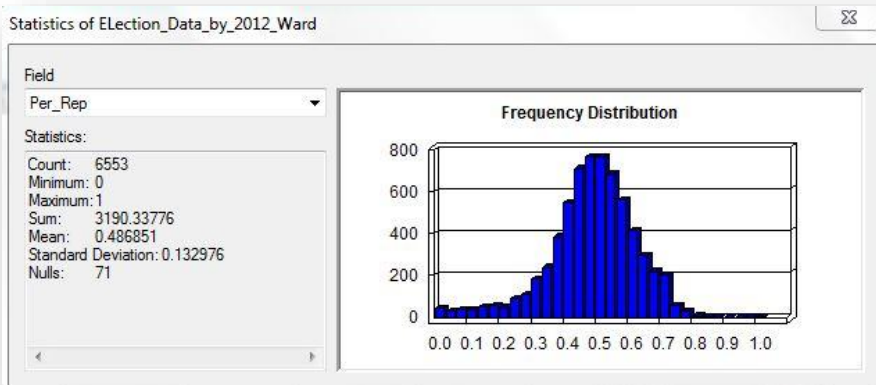


Figure 3: Statistics for the Percentage Republican field

the dataset. The datasets seem to be fairly normalized (bell shaped curve). The top of the democrat percentage distribution is a little more spiked, but there really isn't anything that stands out from either one of the field's distribution. The mean democrat vote percentage is just over 51%, while the mean republican vote percentage is just over 48.5%. The statewide percentages for the 10 year combined election data fields are 46.8% republican and 53.2% democrat.

Election Data Density Analysis

To do this analysis I performed the following steps:

I needed to adjust the Geoprocessing Environment within ArcMap. First, I set the Geoprocessing extent to match the 2012 municipal ward layer. I then set the initial default cell size for Raster Analysis to 2,000, I can up with this number by finding the shorter of the length and width of the 2012 municipal ward layer (in this case width) and dividing it by 250. The result of this calculation ($478,466/250$)

I created percentage democrat and republican fields in the ward dataset by dividing the by the democrat and republican by the total votes for each ward.

I wanted to get some basic statistical information on the data so, I tried to get the data into the R Studio software but, after several tries I was unable to get the data into R. I used the statistics tab in ArcMap to get some basic stats on

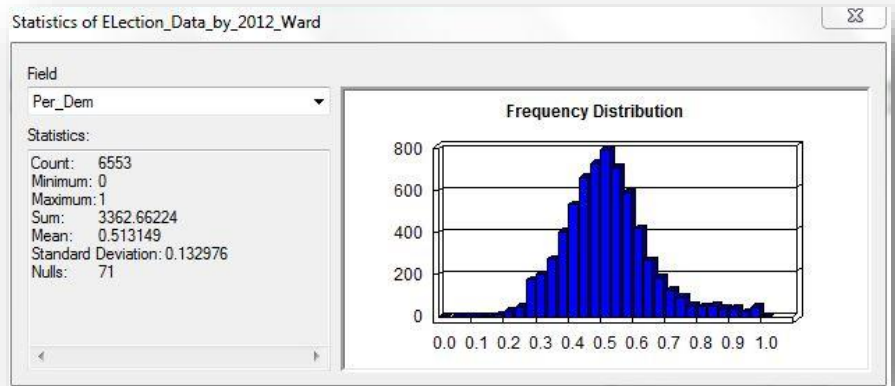


Figure 3: Statistics for the Percentage Democrat field

resulted in a default cell size of 1,913 which I rounded up to 2,000. After creating the first raster, I determined the cell size to be too large to represent the municipal ward layer adequately. I ended up using a default cell size of 1,000.

I then converted the 2012 Municipal Ward Layer into rasters by using the “Conversion Tools” – “To Raster” – “Polygon to Raster” tool in ArcMap’s toolbox. I used the new aggregate election data fields (Democrat and Republican) as the “field(s) used to assign values to the output raster.” (ESRI, 2013)

I also created a raster using “OBJECTID” as the value field. I then used this “OBJECTID” raster with the “Conditional” – “Con” tool within the Spatial Analyst toolbox to count the size of each ward area in raster cells, in square meters. I named the resulting raster “OBJECTID_Count”.

I then used the “Raster Calculator” in the Spatial Analyst toolbox to calculate two rasters that contain the Republican and Democrat voter densities for each raster cell. This was done by dividing the

Democrat and Republican rasters by the “OBJECTID_Count” raster.

Now that I have two rasters that represent voter density for democrats and republicans, I can now use the “Raster Calculator” to subtract the republican votes from the democrat votes. This calculation will result in a raster image that represents the partisan majority in each cell. High values in this dataset

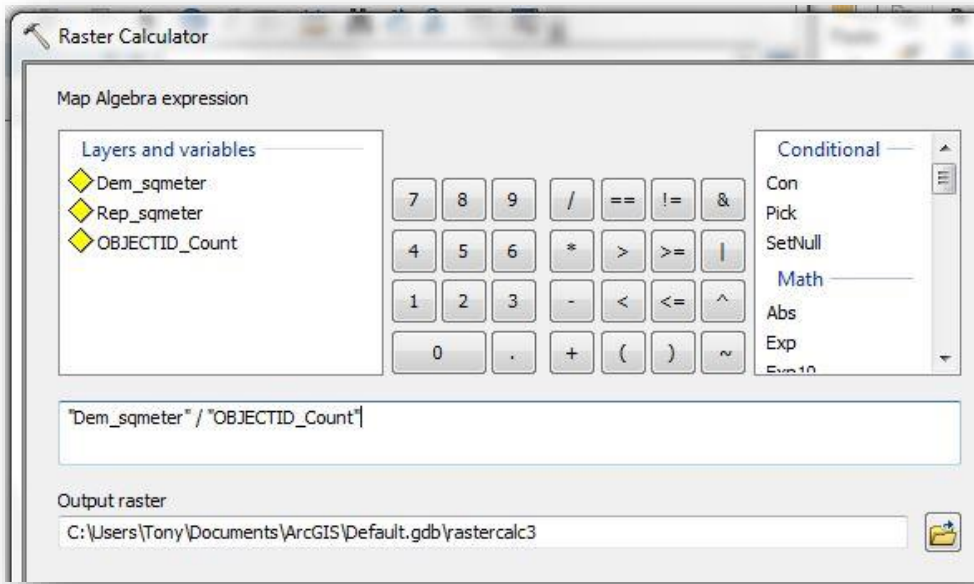


Figure 4: Using the Raster Calculator to calculate Republican and Democrat voter density.

represent a republican majority and low values represent a democrat majority.

I then used the “Zonal Statistics” tool in Spatial Analyst with the 2002 Assembly District Layer and the 2011 Assembly district layer to calculate (sum) the voter density majority in each of the districts and output the data as tables. The resulting tables show the partisan majority by district for both the 2002 and 2011 assembly districts.

Election Data Analysis Results

The 2002 districts had a Republican majority in 41 of the 99 state assembly districts. After redistricting the 2011 state assembly districts show a republican majority in 51 of the 99 districts. This is net gain of 10 districts. The map I have included shows the 2002 legislative districts with the 2011 districts overlaid as a 55%

transparent layer. Here you can see the areas that changed from democrat to republican in purple. It looks like there was some stretching of the new districts into areas where election data leaned more democrat. This fractures the democrat votes while still maintaining a safe republican percentage in the core of the new district. Fracturing would potentially allow the republicans to be more competitive in surrounding districts as well.

The overall result of the new redistricting plan is a net gain of 10 legislative districts whose aggregate elections data now leans in favor of the republicans.

Election results are not always a good indication on the outcome of future elections. In fact, during the last decade using the 2002 federal court plan, control of the state assembly and state senate changed hands several times and a democrat and a republican each won two gubernatorial elections.

If I Had More Time

If I had more time I would look at certain areas in more detail like the western parts of Marquette, Columbia, Jefferson, and Rock counties. I would also like to explore the possibility of doing

this analysis at the census block level to get a more detailed estimate of consequence a particular redistricting plan has in specific areas. I do think this type of analysis could be built into future redistricting systems to help legislators and citizens understand the impact a redistricting plan could have on future elections.

Works Cited

ESRI. (2013, April 26). ESRI Polygon to Raster Help. Redlands, CA, USA.

Keane, M. (2005, September). Redistricting: Why Legislative Districts Are Redrawn, How It Is Done, And by Whom. *Governing Wisconsin*.

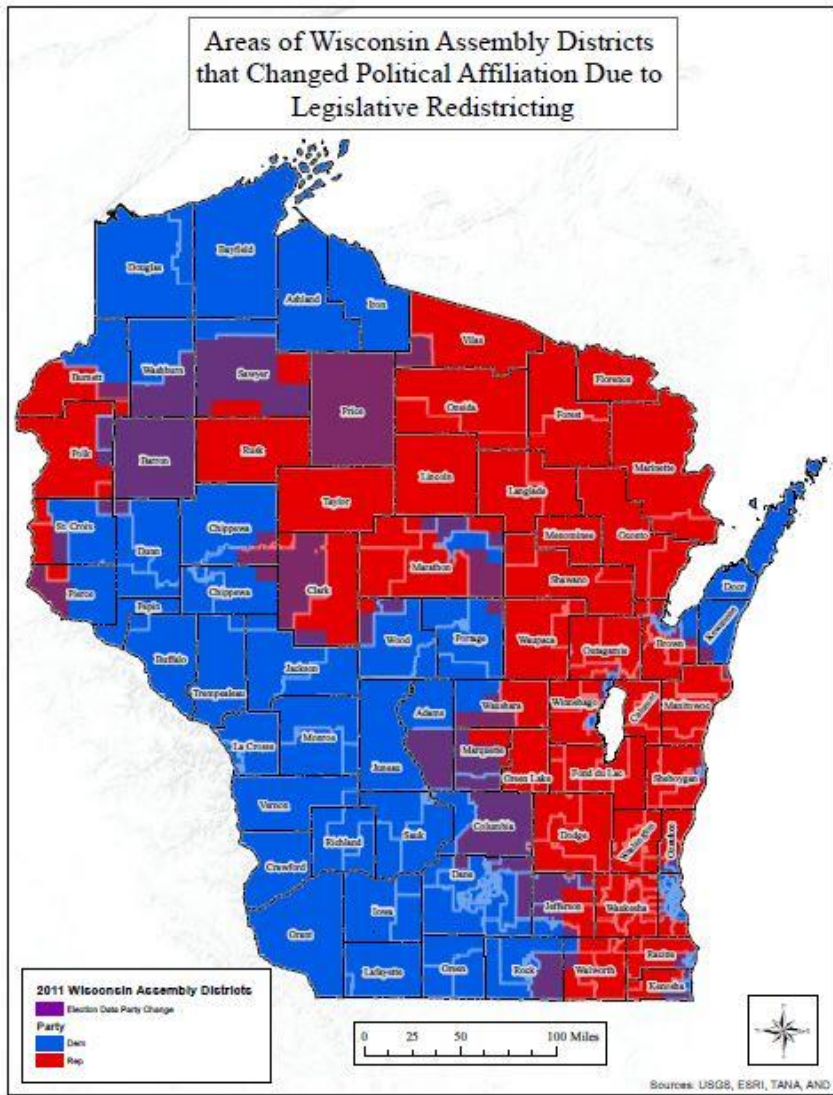


Figure 5: Political affiliation change due to legislative redistricting.