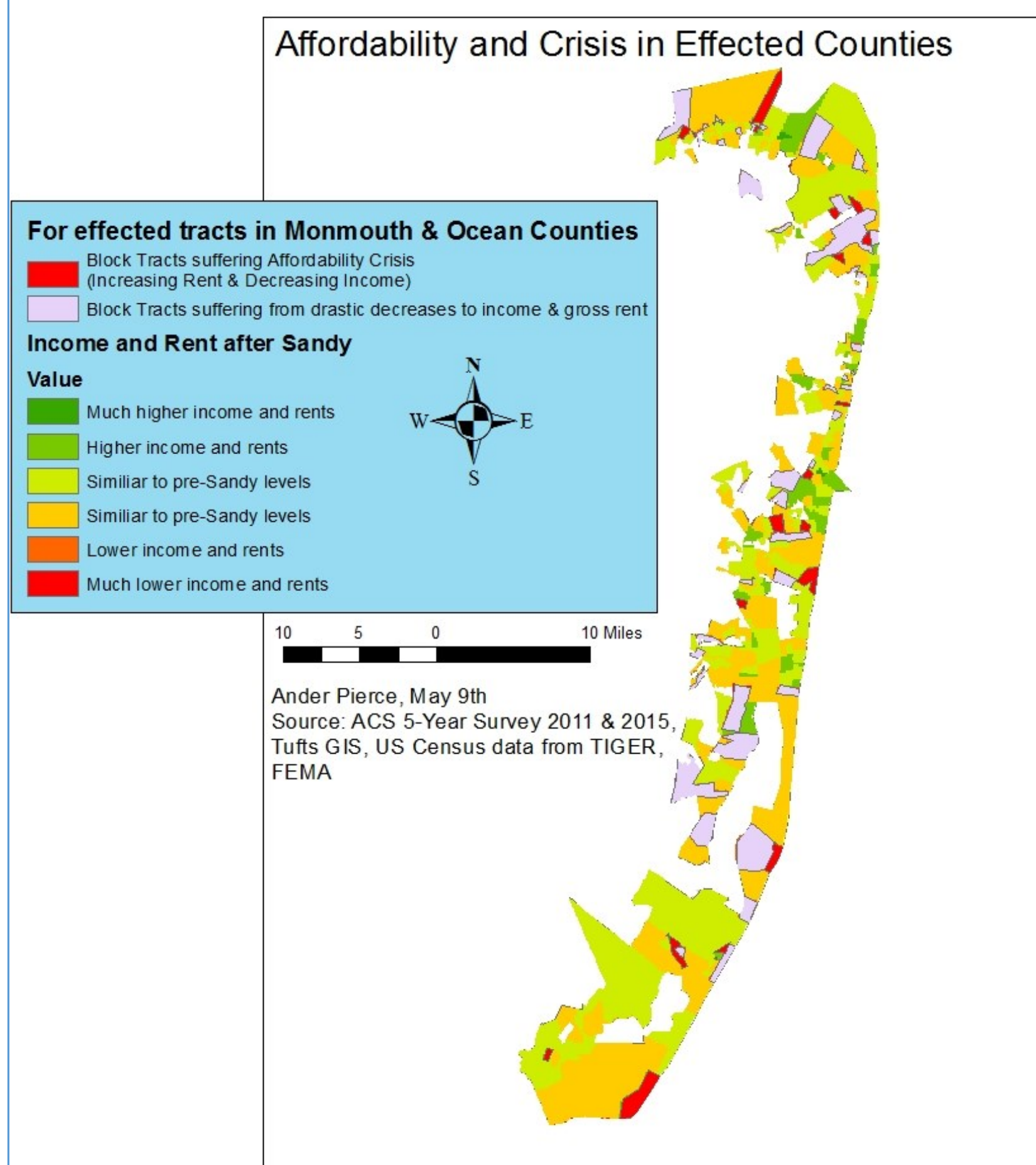
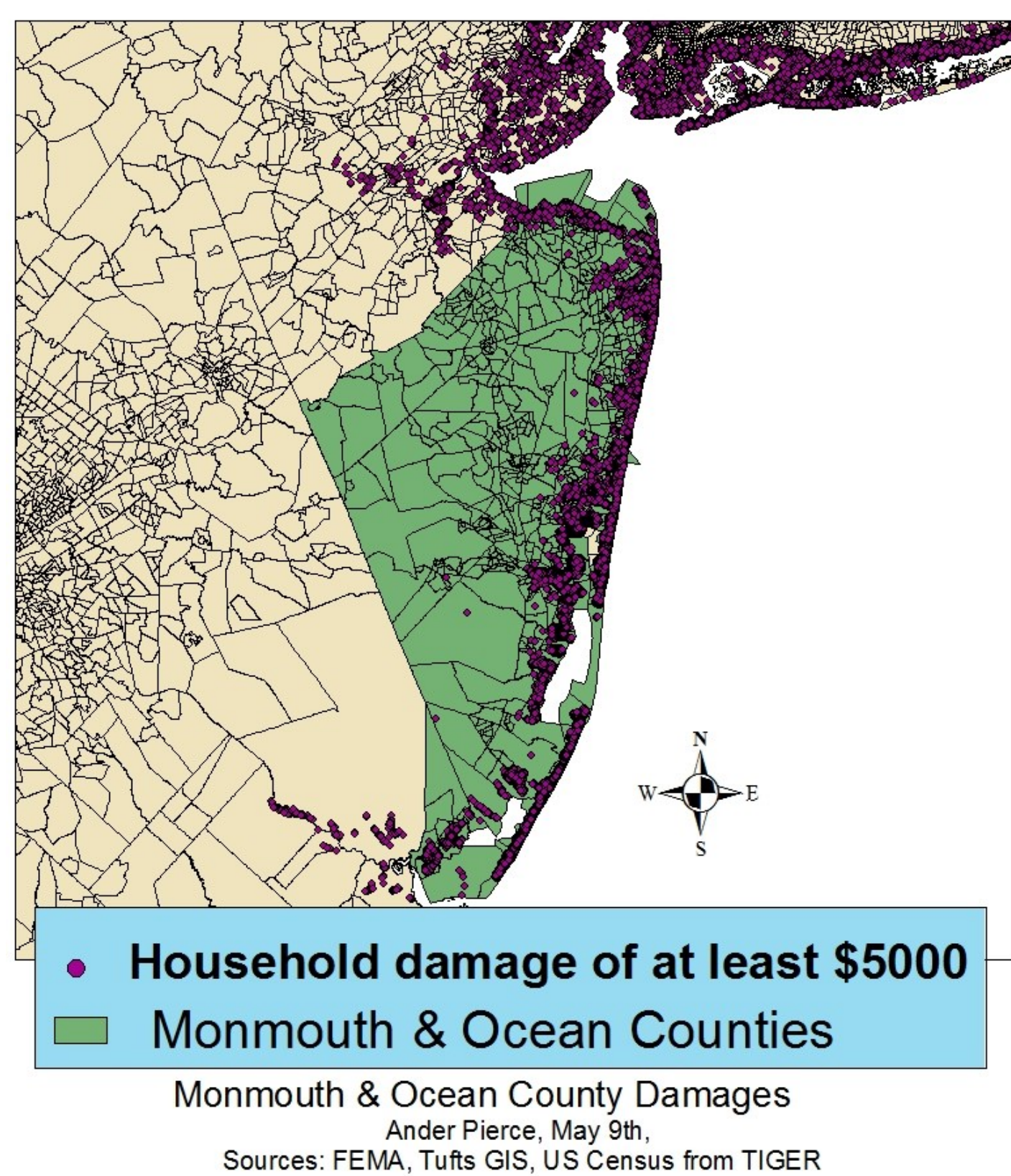


## Background:

In October 2012, Superstorm Sandy rocked several US states. New Jersey arguably suffered the most extreme damage, with over 161,000 families displaced following the Superstorm (IDMC 2015). Two counties within New Jersey that experienced heavy damage were Monmouth and Ocean counties (FEMA 2015). To demonstrate the long-lasting economic con-



sequences of disaster, this project uses two American Community Surveys, one before Superstorm Sandy and one after, to analyze changes Monmouth and Ocean counties suffered as a result of the Superstorm.



Data was chosen that would provide insight on quality of life, it included: median income, gross rent, and owner occupancy, and was analyzed against block group levels of total homeowner damage as measured by FEMA.

```

. mean ChangeGR
Mean estimation      Number of obs   =      836
_____
|               |      Mean   |      Std. Err.   |      [95% Conf. Interval]
|-----|-----|-----|
| ChangeGR     |    52.38995 |    12.18162     |    28.47977   76.30014
|-----|-----|-----|

. mean ChangeGR if SandyCoast >5000
Mean estimation      Number of obs   =      63
_____
|               |      Mean   |      Std. Err.   |      [95% Conf. Interval]
|-----|-----|-----|
| ChangeGR     |   -298.381 |    66.9423     |   -432.1967  -164.5652
|-----|-----|-----|

```

Figure 2:

Changes in gross rent between the 2010 and 2015 ACS 5 year Surveys indicate a significant association between rent and damage from the Superstorm. A comparison be-

# After the Superstorm

Ander Pierce, May 9th, GIS 101

## Methods:

I started by gathering block group level ACS data from the 2006-2010 (pre-Sandy) and 2011-2015 (post-Sandy) 5-year surveys. Data was selected to include demographic information, as well as data on median income, gross rent, and owner occupancy. Data was spliced together on a separate excel sheet, and differences in owner occupancy (OO), gross rent (GR), and median income between each survey were calculated. This data was spliced onto a basemap that used US census tracts at the block group level.

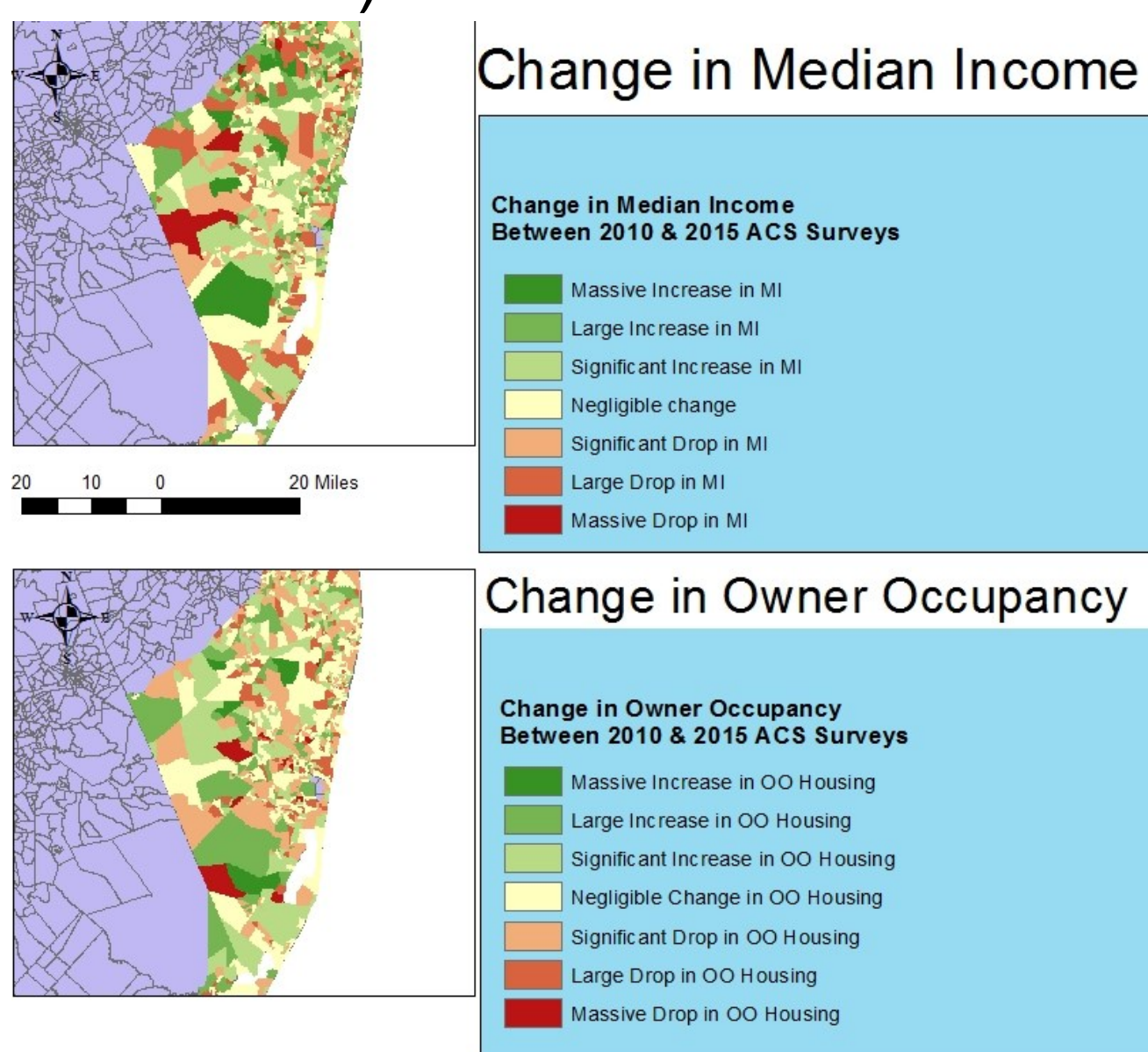
A series of points representing Household Damage inspections carried out by FEMA were added the map. These points were joined to the polygons and used to estimate the total household damages each county suffered, using guidelines for \$ cost of damages included in a FEMA readme file. For this, the **field calculator** tool was used.

From there, I converted data on economic change into a series of rasters. Then, I reclassified these rasters creating abstract visual charts of economic change in Monmouth and Ocean counties.

Each raster had 7 categories, higher values represented more significant negative changes in economic status for a block group. This means a 'Change in Gross Rent' value of 7 represents a massive drop in dollar cost for gross rent.

After this, I decided to use the **raster calculator** tool to try and find block groups that were beleaguered by economic depression, or that suffered from an intense affordability crisis. To do this, I constructed two scenarios (see map below):

- Scenario 1: Rent increases while median income decreases provoking an **Affordability Crisis**
  - Formula: Change in Median Income (a value from 1-7) – Change in Gross Rent (a value from 1-7)
  - Example: 5 MI (significant drop in median income) and 3 rent (significant increase in mean rent) results in a score of 2



(Decreased affordability)

- Scenario 2: Rent decreases as does median income resulting in **Economic Depression**
  - Formula: Change in Median Income + Change in Gross Rent) / 2

I converted the rasters generated by these calculations into polygons, used them to select polygons from the original block groups joined to the census. These polygons had data on both estimated dollar cost of damages and change in economic conditions. I used the **table to excel** tool to convert the tables of these maps into excel documents.

Finally, I imported these excel documents into STATA. From there, I compared the mean change in median income, gross rent, and owner occupancy between 2006-2011 FEMA and 2011-2015 FEMA by levels of damage between counties with and without Superstorm damage. These analyses allowed me to indicate association between the Superstorm and long lasting changes in quality of life (figures 1-4).

## Results:

The STATA tables demonstrate the massive changes in economic status suffered by counties effected by the storm. Even though the results of these analyses clearly demonstrate economic change associated with the Superstorm, they do not even begin to hit at some of the brutal effects of the storm. They make no account of displaced individuals. It does not track infrastructure damage, only household damage. It totally fails to account for mental health damage incurred by disaster. If we truly wish to comprehend and combat the suffering caused by disasters such as Superstorm Sandy, we must develop new modes of data gathering that seek to meet the needs of displaced and traumatized people.

```

. generate ChangeMI = ChangeMedi
. mean ChangeMI
Mean estimation      Number of obs   =      836
_____
|               |      Mean   |      Std. Err.   |      [95% Conf. Interval]
|-----|-----|-----|
| ChangeMI     |   3076.312 |    790.6484     |   1524.42   4628.204
|-----|-----|-----|

. mean ChangeMI if SandyCost>5000
Mean estimation      Number of obs   =      63
_____
|               |      Mean   |      Std. Err.   |      [95% Conf. Interval]
|-----|-----|-----|
| ChangeMI     |  -21031.95 |   2139.223     | -25308.2  -16755.71
|-----|-----|-----|

```

Figure #1:

The mean change of income in Monmouth and Ocean counties tracts, for all tracts and just for tracts with at least \$5000 in damages.

Note that tracts with at least \$5000 in damages had an average reduction in mean income of more than \$21,000 between the 2010 and 2015 ACS 5-year surveys.

```

Mean estimation      Number of obs   =      836
_____
|               |      Mean   |      Std. Err.   |      [95% Conf. Interval]
|-----|-----|-----|
| ChangeOO     |   -8.929426 |    3.150698     |   -15.11364  -2.745208
|-----|-----|-----|

. mean ChangeOO if SandyCost>5000
Mean estimation      Number of obs   =      63
_____
|               |      Mean   |      Std. Err.   |      [95% Conf. Interval]
|-----|-----|-----|
| ChangeOO     |   -8.539683 |    8.828712     |   -26.18803   9.10866
|-----|-----|-----|

```

Figure 4:

Owner Occupancy appeared to only have a slight association with damage from Superstorm Sandy. Here we can see that the mean change in Owner Occupancy between the 2010 and 2015 ACS 5-year surveys is fairly similar between tracts with storm damage and tracts without.

## Sources:

FEMA Modeling Task Force *Hurricane Sandy Impact Analysis* (2015) retrieved from <https://fema.maps.arcgis.com/home/item.html?id=307dd522499d4a44a33d7296a5da5ea0>  
 IDMC Sebastian Albuja et al (2015) *Global Estimates 2015* (2015) retrieved from <http://www.internal-displacement.org/assets/library/Media/201507-globalEstimates-2015/20150713-global-estimates-2015-en-v1.pdf>  
 ACS 5 year Community Surveys 2010 and 2015  
 US Census Tracts for 2010 and 2015  
 Tufts GIS