



Jinwen Xu, Yi Qiang

Department of Geography and Environment, University of Hawaii at Manoa

Introduction

Night-time light captured from satellites has been proved to be a reliable indicator of human settlements and economic activities. Night-time light can show human dynamics and economic decline after natural hazards, such as disastrous hurricane.

Social media, as a platform for public discussion and exchanging opinions, can show the disturbance from disastrous events as well. In addition, it can identify different phases in a disaster, such as preparation and recover stage.

This analysis conducted a case study on Hurricane Sandy, one of the deadliest hurricanes happened in 2012. Hurricane Sandy caused over 60 billion dollars damage and large disturbance on both nighttime light and social media (Fig 1 & 2). This research verified the disturbance caused by Hurricane Sandy on both nighttime light and social media. The study also explores the relationship among disaster loss, social media disturbance, and nighttime light disturbance.

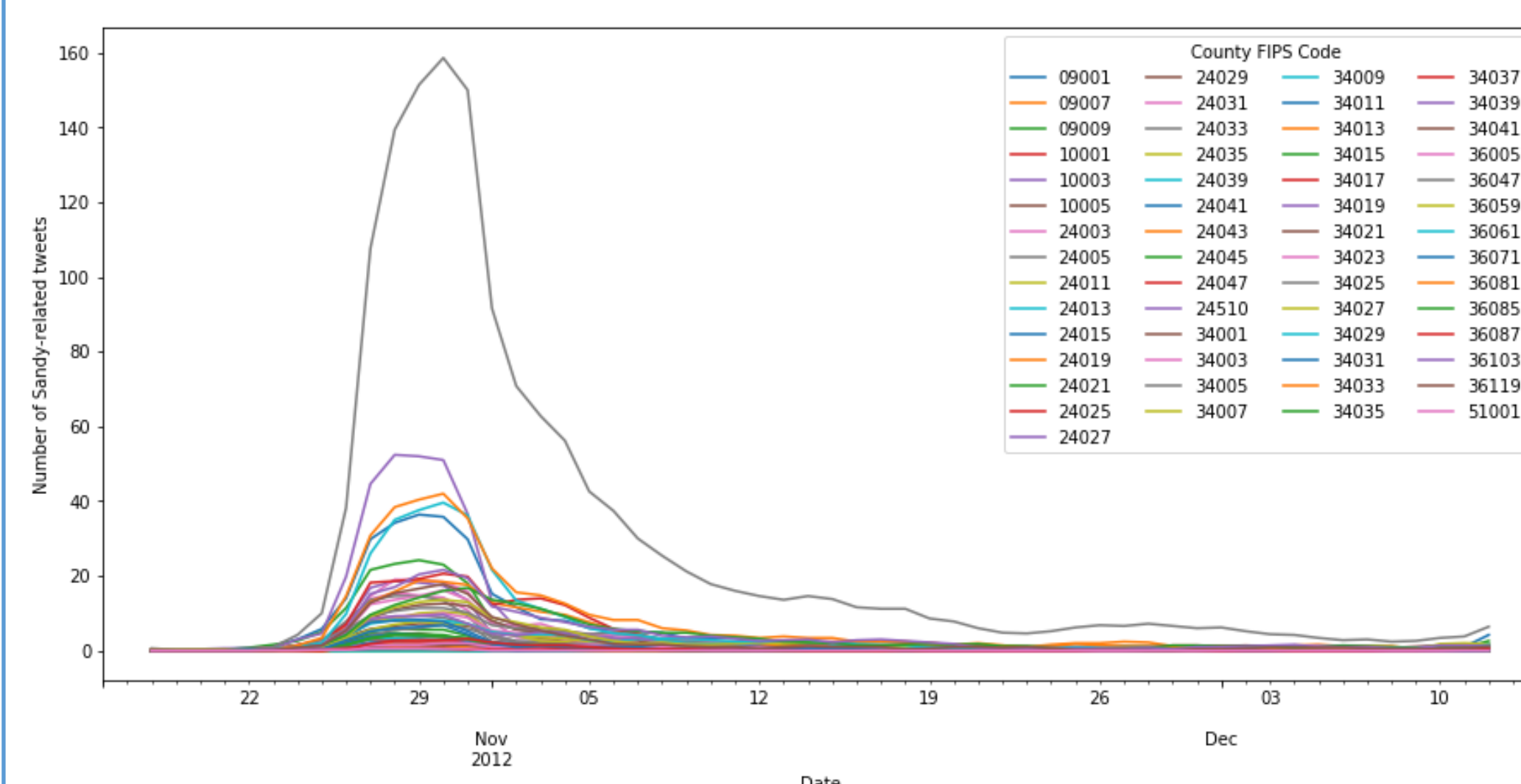


Fig 1. Disturbance of Hurricane Sandy shown in Twitter (by county)

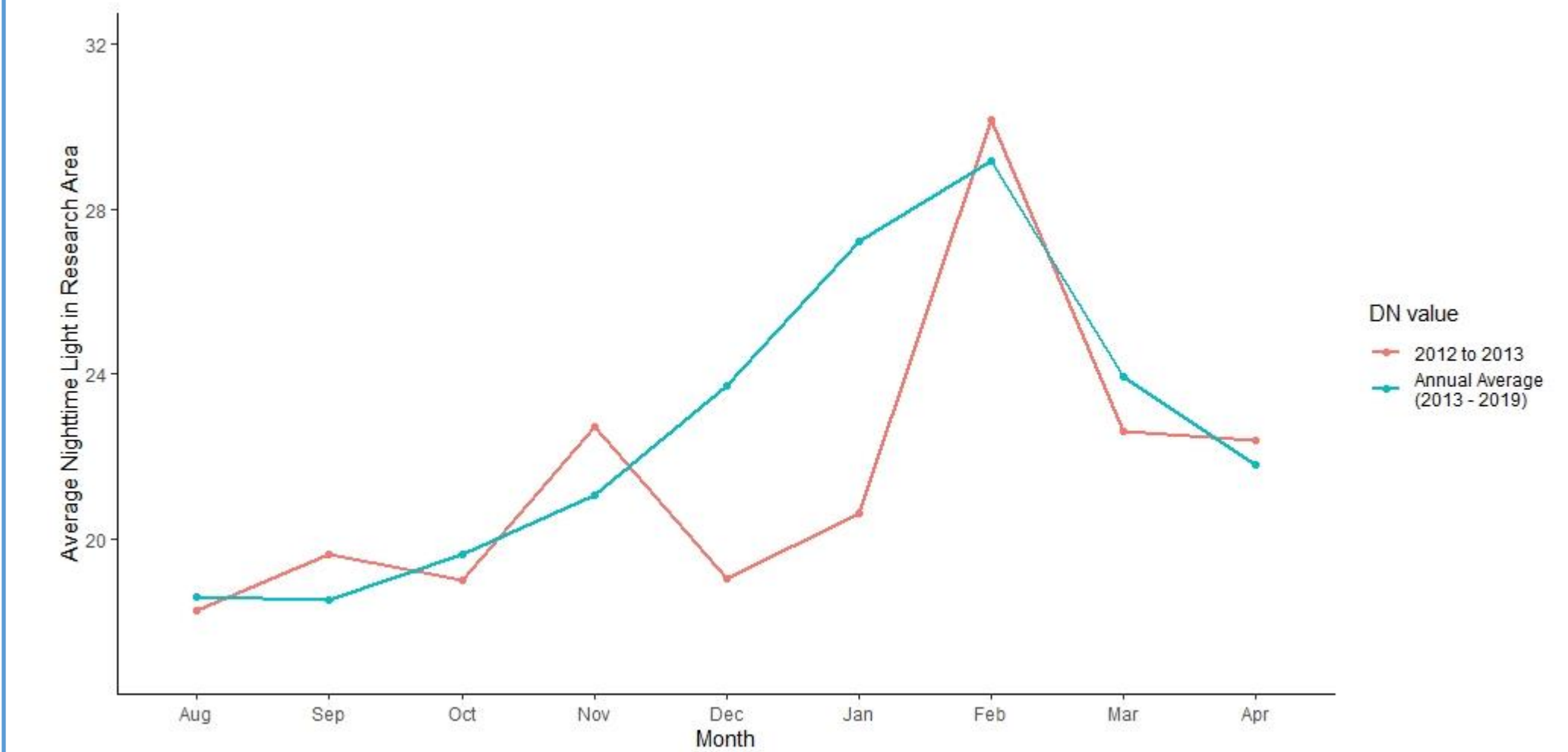


Fig 2. Disturbance of Hurricane Sandy (2012) shown in Nighttime light

Objectives

- Verify the disturbance in nighttime light and social media
- Measure how indicative social media and nighttime light data can be when estimating disaster damage

Research Area

Regions that under the influence of Hurricane Sandy is counted as research area. In addition, according to the data availability, this study only focused on counties with valid damage data (Fig 3). Urban areas within each county are utilized to extract nighttime light DN value.

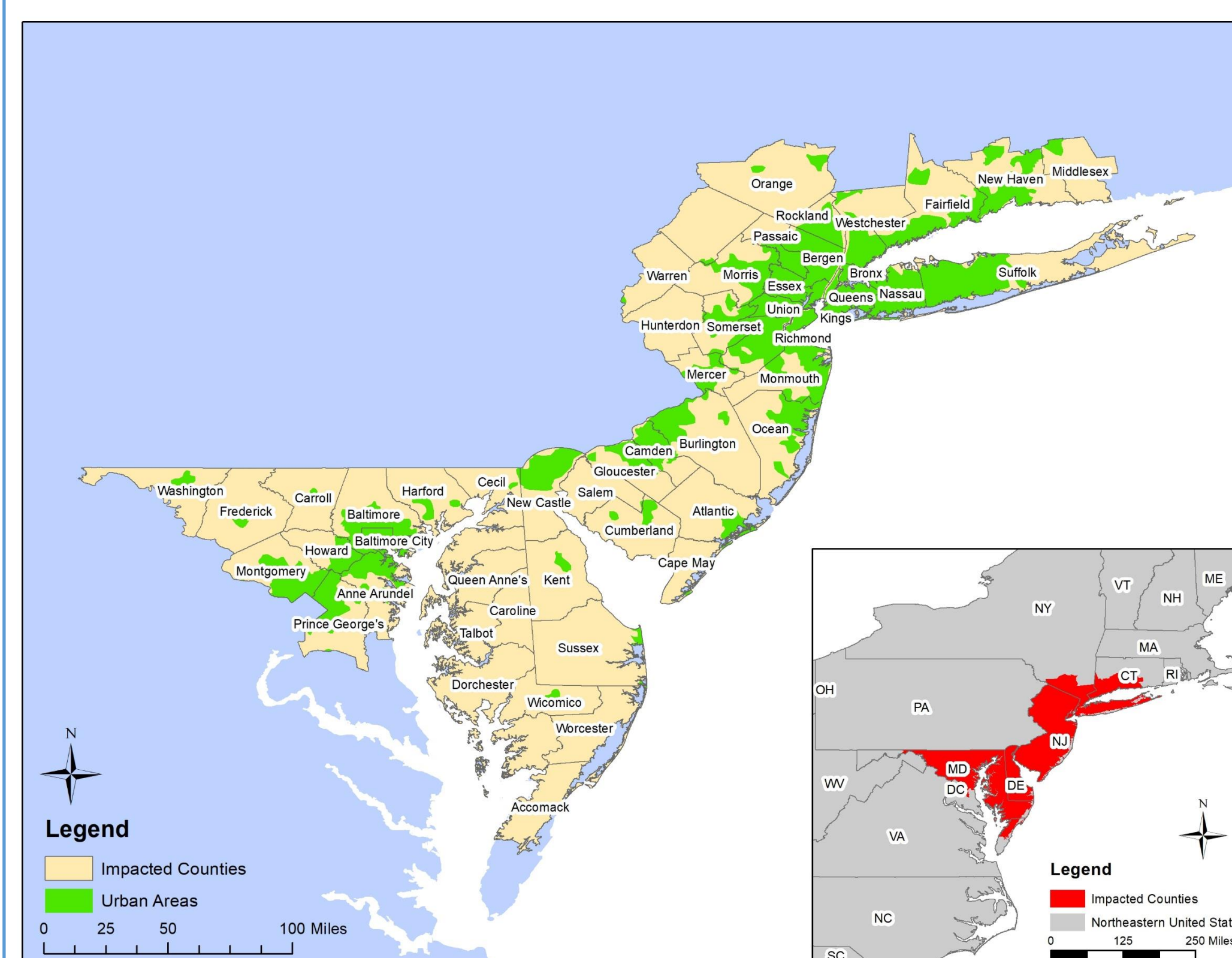


Fig 3. Research Area

Data

Damage data

- Damage report was simulated from Hazus 4.2 historical hazard scenario of Hurricane Sandy

Social Media data

- Social media data was downloaded and extracted from Twitter Stream Archives between October 2012 and December 2012

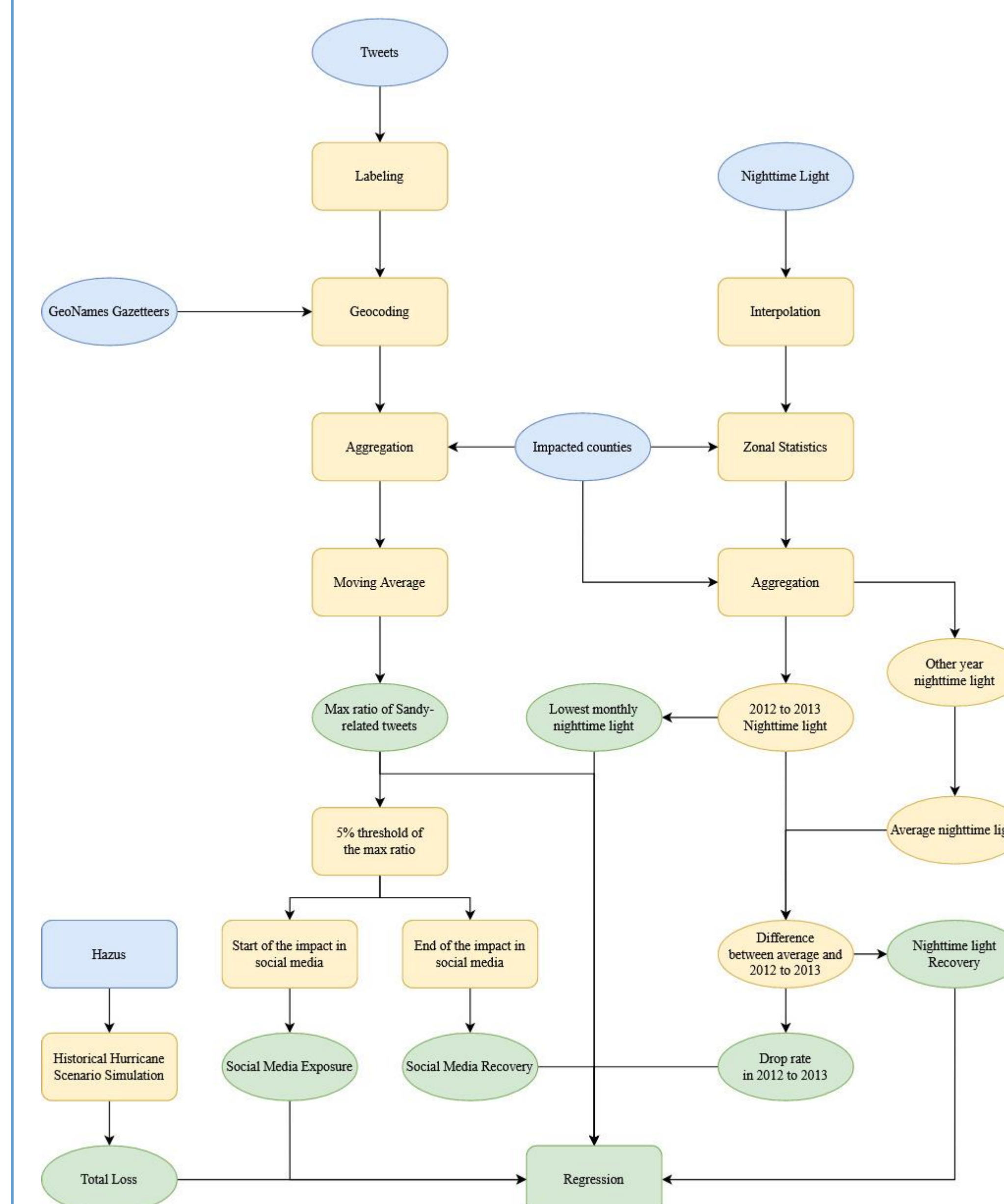
Nighttime Light data

- Monthly nighttime light composites were downloaded from the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB) between August 2012 to April 2019.

Limitations

- Sample size is small, only 57 counties are analyzed
- Nighttime light can be disturbed by other impact factors, this study only focuses on the impact caused by Hurricane Sandy in this study
- Monthly nighttime light composites can be affected by cloud cover and moon phases

Methodology



Results

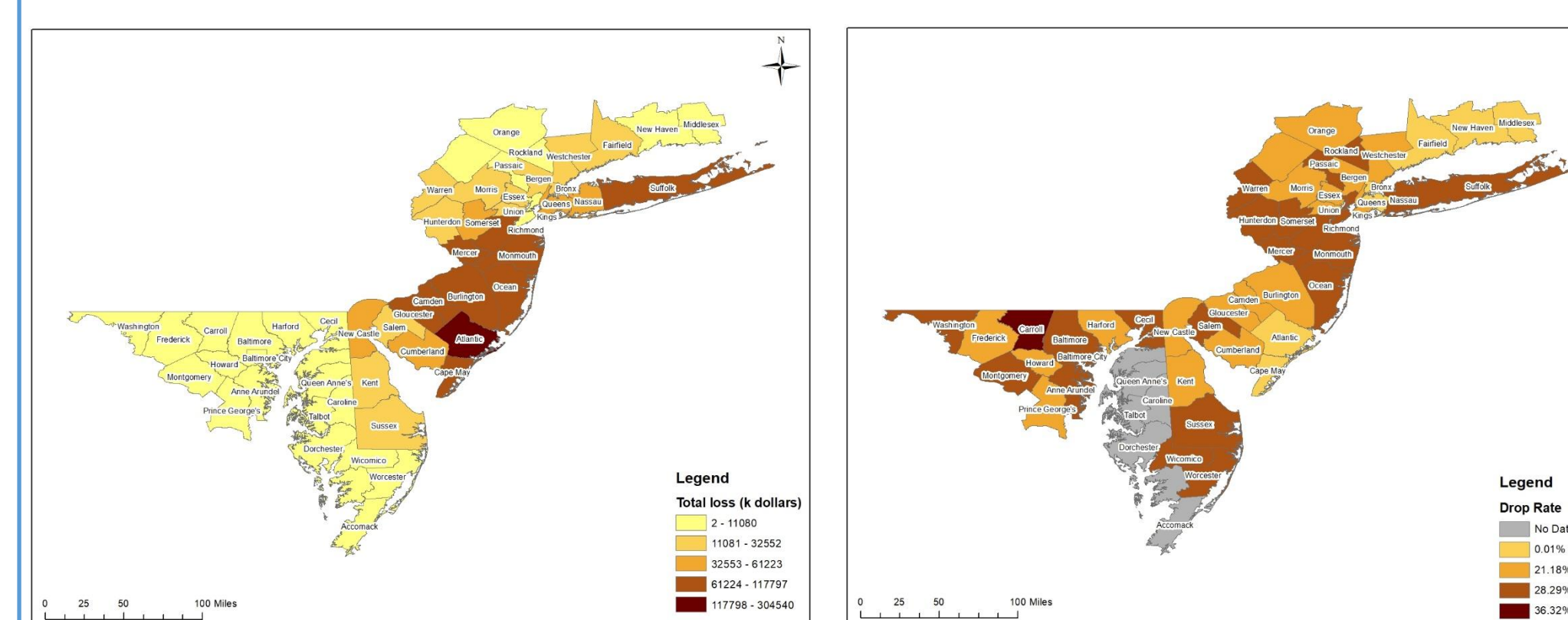


Fig 4. Total Loss

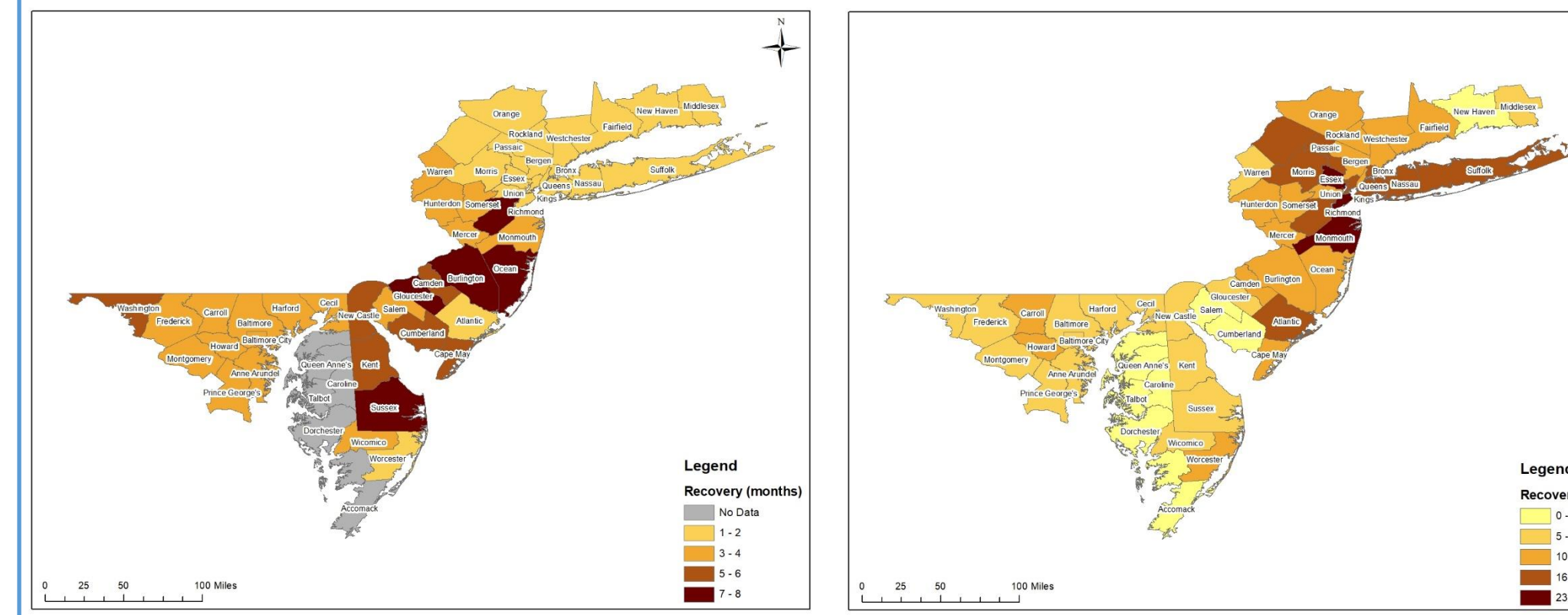


Fig 5. Drop Rate (nighttime light)

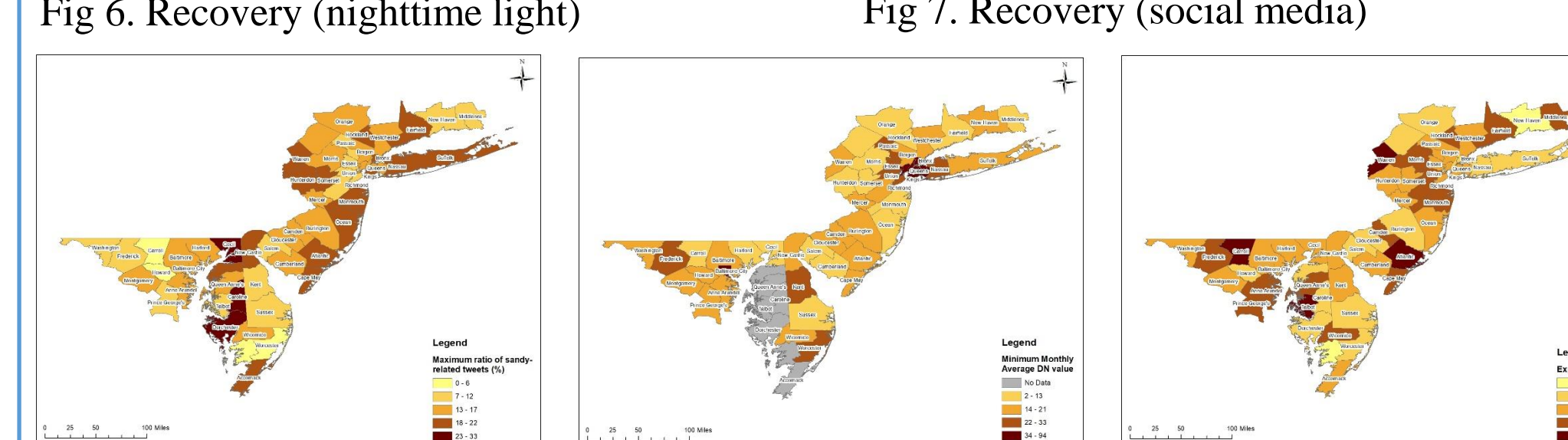


Fig 6. Recovery (nighttime light)

Fig 7. Recovery (social media)

Fig 8. Max ratio (social media)

Fig 9. Min DN (nighttime light)

Fig 10. Exposure (social media)

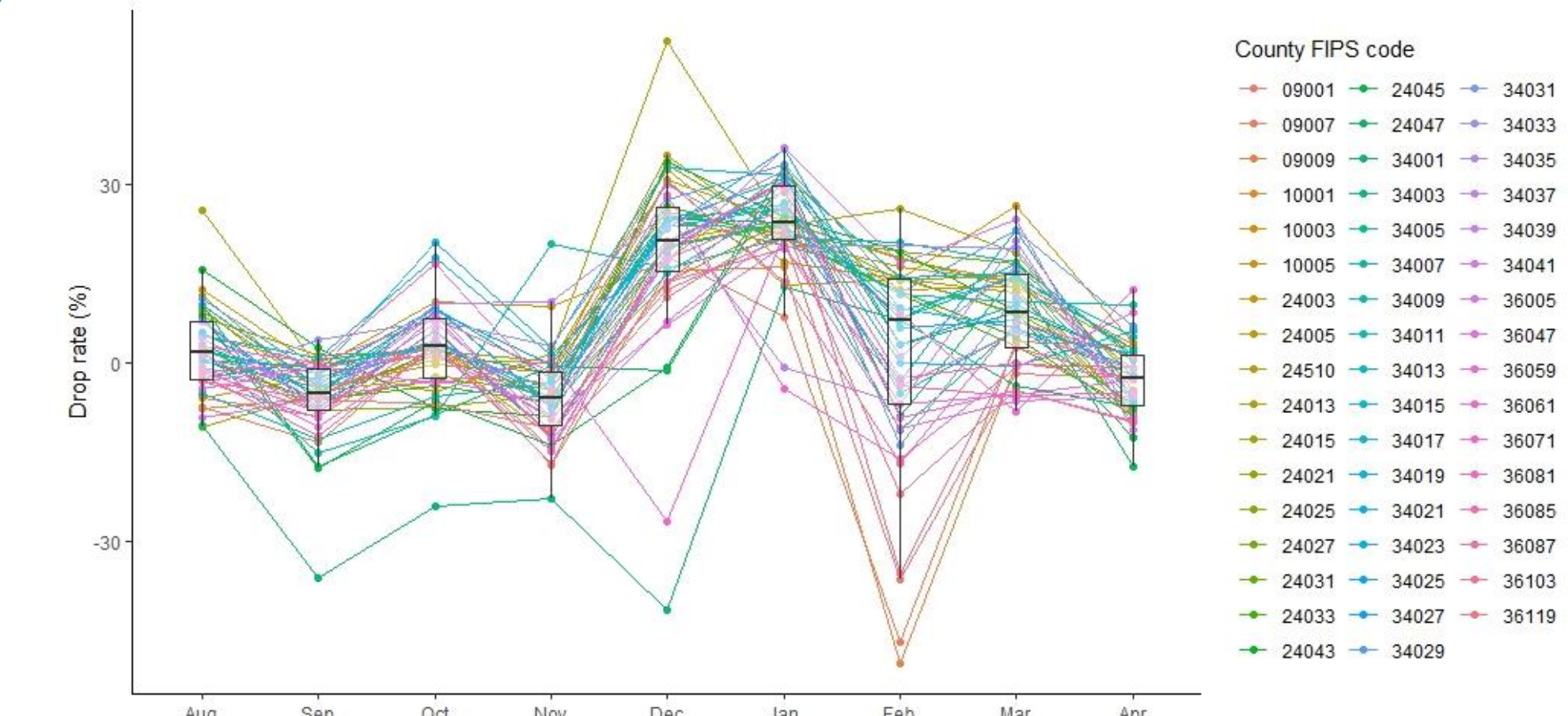


Fig 11. Nighttime light drop rate by county

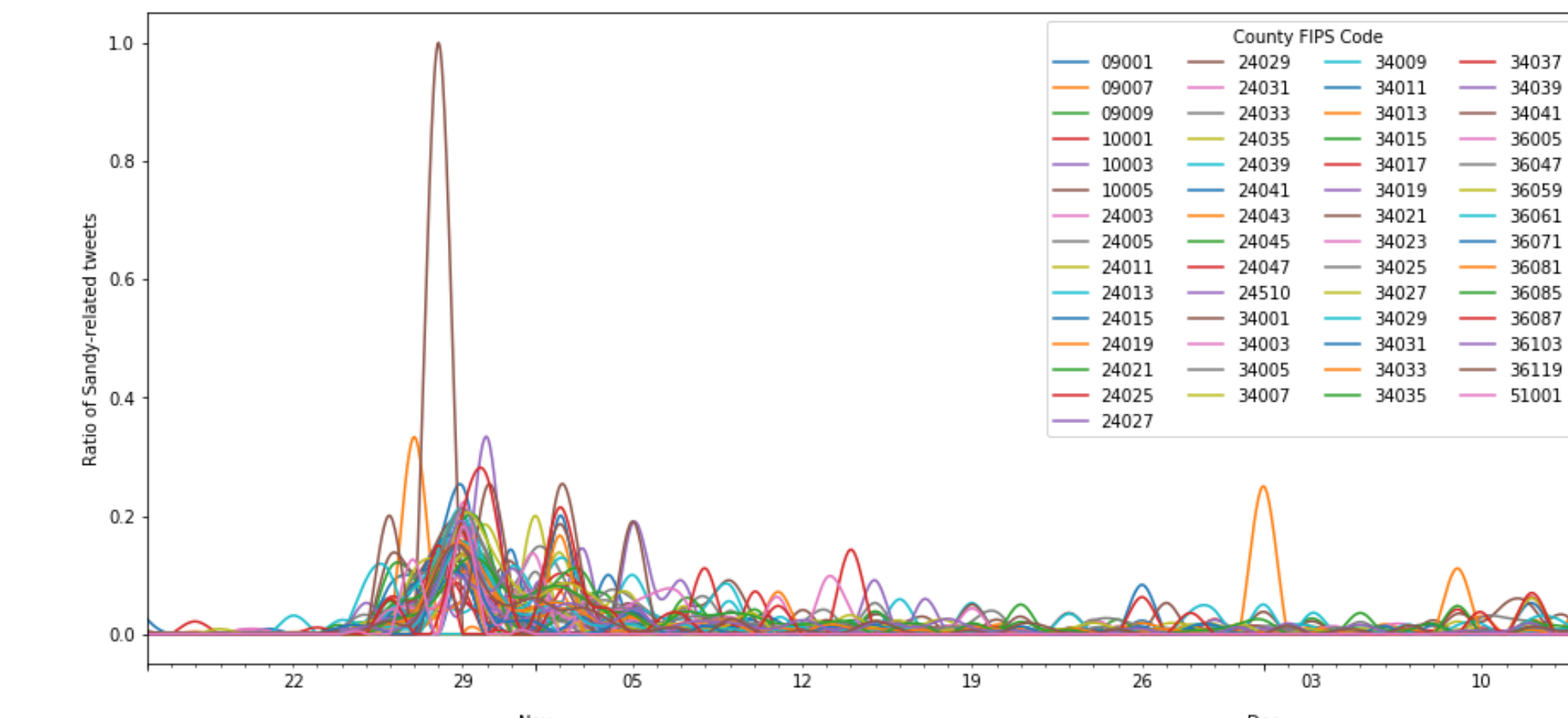


Fig 12. Ratio of Sandy-related tweets by county

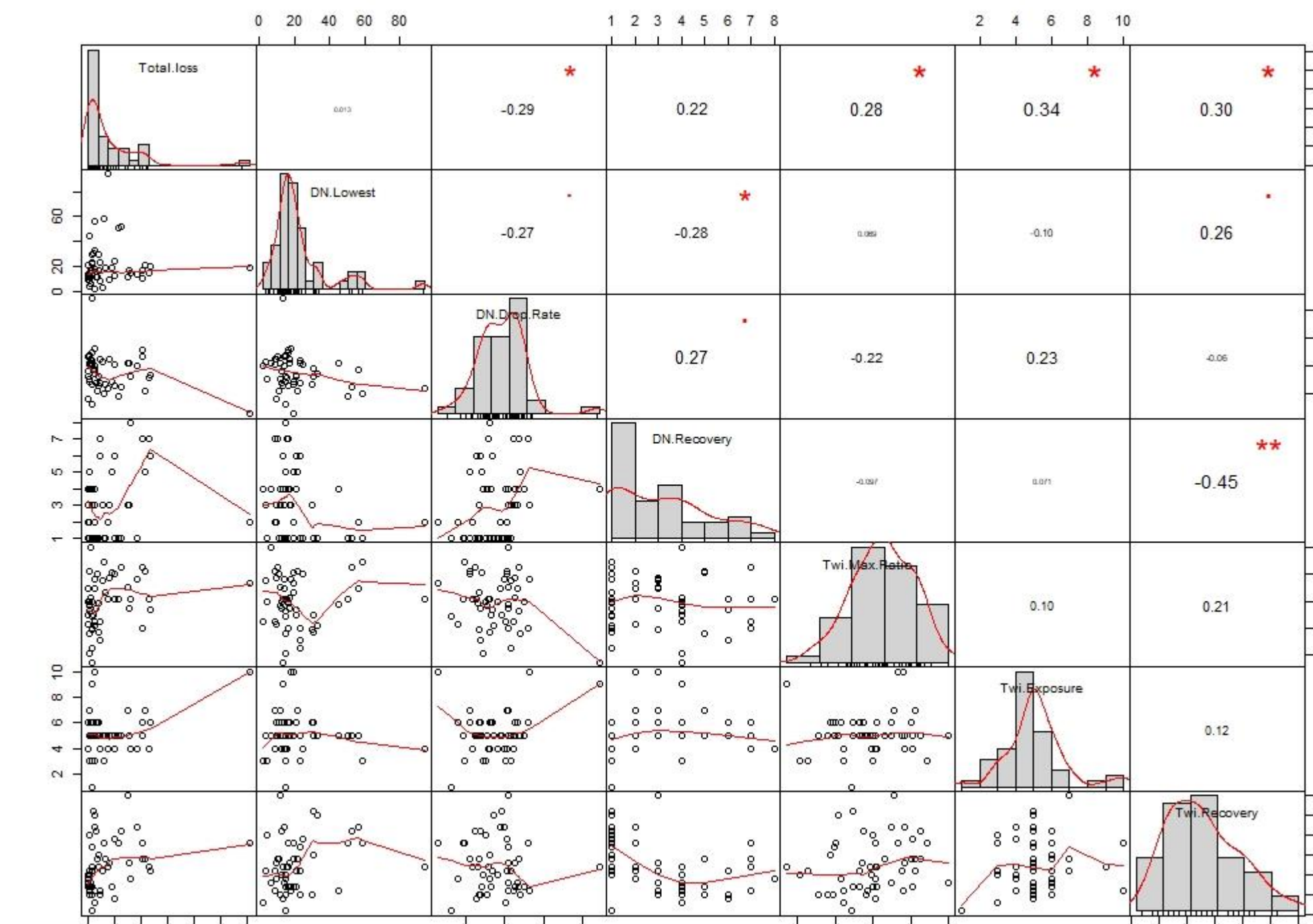


Fig 13. Regression result

Findings

- Nighttime light and social media both show disturbance caused by Hurricane Sandy (Fig 11, 12).
- Total loss (Fig 4) is related to social media variables (Fig 7, 8, 10) and nighttime light drop rate (Fig 5).
- The negative correlation between social media recovery (Fig 7) and nighttime light recovery (Fig 6) is significant.
- Large lowest nighttime light (Fig 9) during the disaster can lead to a rapid nighttime light recovery (Fig 6).
- Large drop rate (Fig 5) in nighttime light can lead to a long recovery (Fig 6) in nighttime light.

Future Steps

- Analyze spatial patterns to assess community resilience
- Identify resilient community based on indicators