



# Forecasting Natural Disaster Damage From Property Values

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# Agenda

- Discuss Problem
- Solution Method
- Hurricane Sandy
- Examples/Demos
- Conclusions/Recommendations
- Next Steps



Credit: DOB/Dan Eschanasy

The effects of flooding and storm surge resulted in severe structural damage to many buildings during Sandy.

# Problem Statement



During a disaster, it is important to estimate the potential effects, including damage in the affected area.

Our project aims to evaluate total residential property value of a zip code or neighborhood in Manhattan or Brooklyn in the event of a natural disaster.

This can allow residents or local governments to receive an up-to-date valuation of their area, and prepare for potential damage costs.

# Method



- **Data Collection**
  - **Realtor.com:** Monthly and Historical data by zip code
  - **Zillow API:** Able to pull home estimates by individual addresses
  - **USZIPCODE Python Library:** Search engine that has many data points by zip code
  - **NYC.gov:** List of addresses
- **Model Creation/Visualizations**
  - A function that utilizes Zillow home estimates to calculate the estimated property value of a zip code or neighborhood.
  - Interactive map by zip code
  - Input functions for graphing historical data
- **Outside Research:** Hurricane Sandy figures

# Hurricane Sandy

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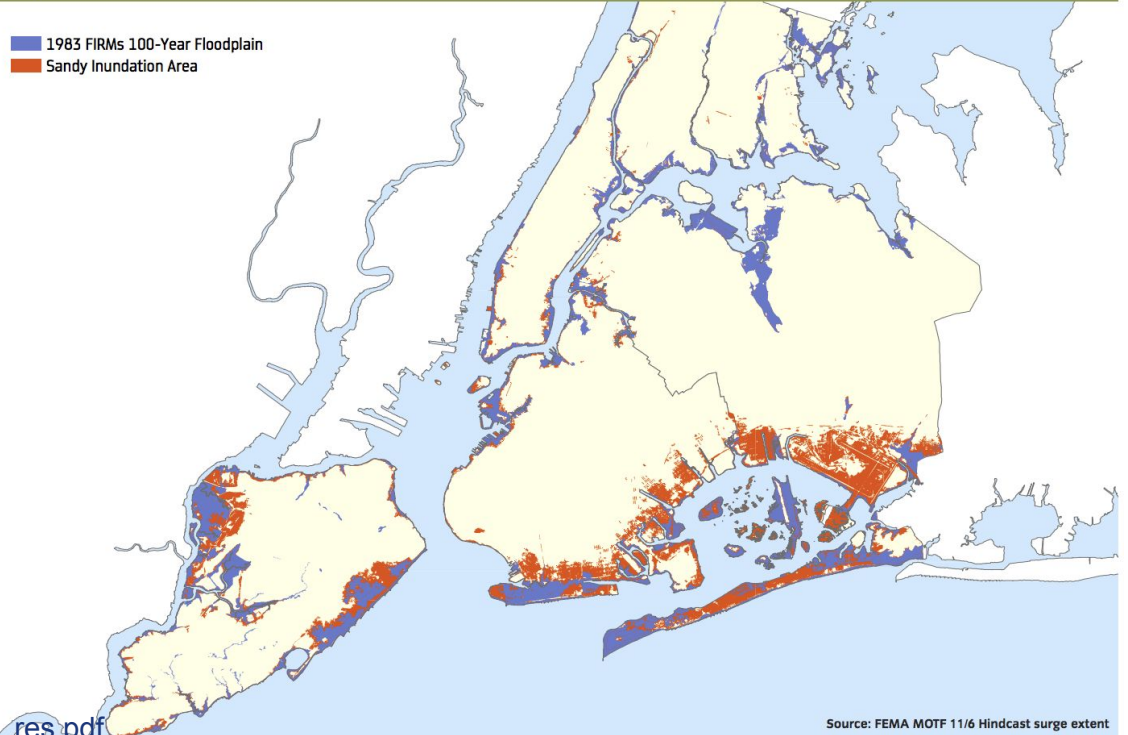
- \$19 billion in damage in NYC
- 51 square miles flooded
  - 17% of city's landmass
- 2 million people without power
- 88,700 buildings in inundation zone
- More than 300,000 homes and 23,400 businesses affected.



# Inundation Zone

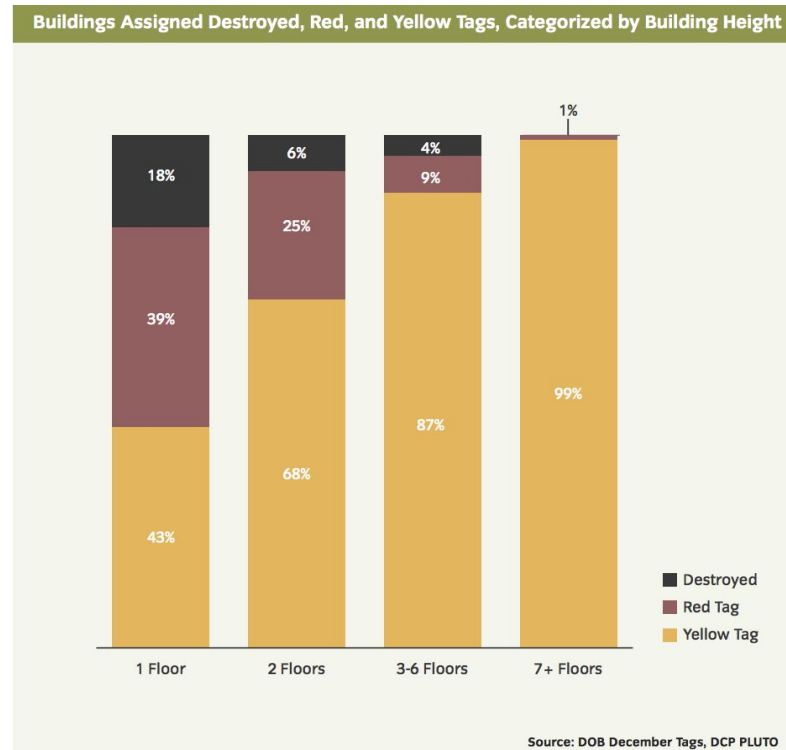
- Critical Infrastructure within flooded areas:
  - Hospitals
  - Nursing homes
  - Museums
  - Power Facilities
  - Transportation Networks
- 82% of buildings in the inundated area were greater than 1-story.

Comparison of 100-Year Floodplain in 1983 FIRMs and Sandy Inundation Area



# Sandy - Property Damage

- 1-Story buildings suffered the most property damage.
  - 76% of buildings tagged with damage
- Most damage caused was non-structural
  - 35,000 housing units in NYC lost power
- Of the 47,000 housing units inspected by FEMA, 49% had damage in excess of \$10K and 12 % in excess of \$30K.



# Example 1: Lower Manhattan

```
zip_value([10038, 10280, 10005, 10006, 10007], title = 'Lower Manhattan')
```

Total Values Estimated for zip code(s)[10038, 10280, 10005, 10006, 10007]: 813

Avg. Value for zip code(s)[10038, 10280, 10005, 10006, 10007]: \$2295414.89

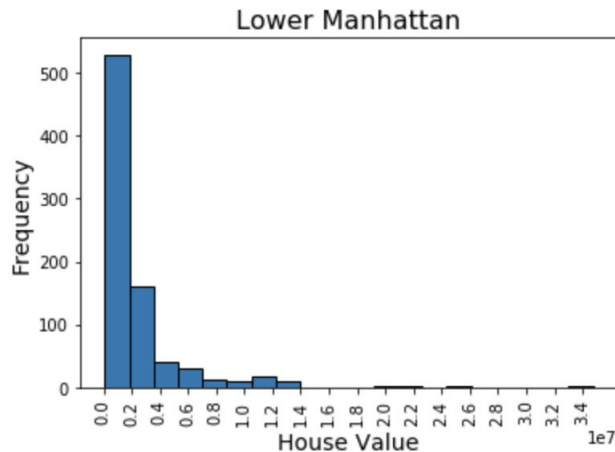
Total units for zip code(s)[10038, 10280, 10005, 10006, 10007]: 25624

Approximate Total Property Value for zip code(s)[10038, 10280, 10005, 10006, 10007]: \$58817711141.36

Max Property Value for zip code(s)[10038, 10280, 10005, 10006, 10007]: \$34749999

Min Property Value for zip code(s)[10038, 10280, 10005, 10006, 10007]: \$85521

Median Property Value for zip code(s)[10038, 10280, 10005, 10006, 10007]: \$1095210.0





# Example 2: Lower East Side

```
zip_value([10002, 10003, 10009], title = 'Lower East Side')
```

Total Values Estimated for zip code(s)[10002, 10003, 10009]: 1038

Avg. Value for zip code(s)[10002, 10003, 10009]: \$1829841.82

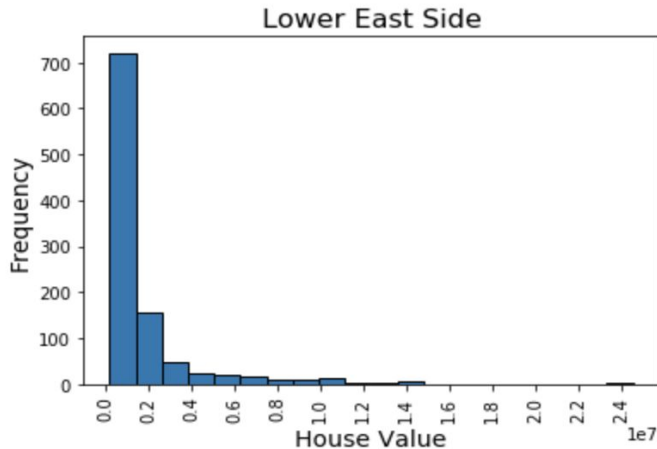
Total units for zip code(s)[10002, 10003, 10009]: 97328

Approximate Total Property Value for zip code(s)[10002, 10003, 10009]: \$178094844656.96

Max Property Value for zip code(s)[10002, 10003, 10009]: \$24521846

Min Property Value for zip code(s)[10002, 10003, 10009]: \$148182

Median Property Value for zip code(s)[10002, 10003, 10009]: \$921666.0



# Example 3: Coney Island

```
zip_value([11224], title = 'Coney Island')
```

Total Values Estimated for zip code(s)[11224]: 776

Avg. Value for zip code(s)[11224]: \$781691.9

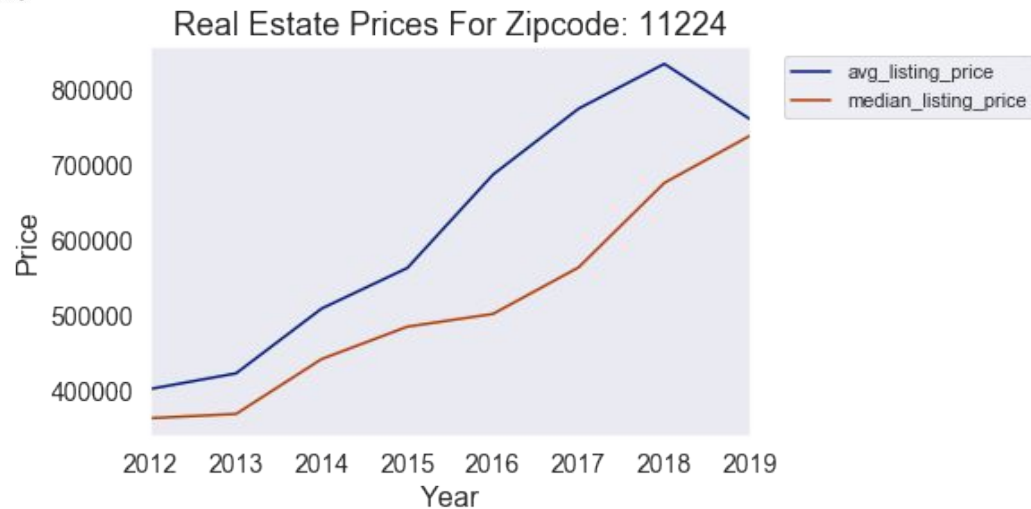
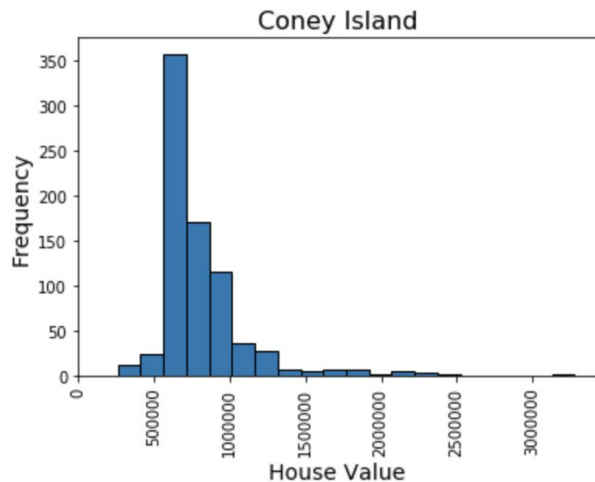
Total units for zip code(s)[11224]: 20768

Approximate Total Property Value for zip code(s)[11224]: \$16234177379.2

Max Property Value for zip code(s)[11224]: \$3276001

Min Property Value for zip code(s)[11224]: \$260960

Median Property Value for zip code(s)[11224]: \$706135.5





# Historical Chart: Demo



# Interactive Maps

- Lower Manhattan:
  - <https://sites.google.com/view/dotheseamapswork/lower-manhattan?authuser=0>
- Lower East Side :
  - <https://sites.google.com/view/dotheseamapswork/lower-east-side?authuser=0>
- Coney Island:
  - <https://sites.google.com/view/dotheseamapswork/coney-island?authuser=0>

# Usefulness of the Tool



- The potential use of what we have created is especially notable in regions more prone to natural disasters
- Expanding the range of available addresses to reflect areas historically affected by natural disasters is an achievable goal
- Local governments and residents can simply enter a zip code in a forecasted disaster zone, and receive real-time values with which to make decision on requested relief amounts

# Next Steps



- Expand tool to include more zip codes in New York as well as other states.
- Obtain more comprehensive list of addresses for the Zillow API.
- Obtain property values for commercial real estate and municipal infrastructure, not just residential homes.
- Build a model to estimate property value damage based on housing types within a specified zip code.

# Conclusions



- Our model is a useful tool, but is not a stand alone predictor
- Overall damage cost can be broken down into various factors: property value, value relative to building type, relative damage area vs total property area
- Combined with other valuation tools, what we have built offers critical information to build an overall view of damage after a disaster



# Resources

- <https://www.health.ny.gov/statistics/cancer/registry/appendix/neighborhoods.htm>)
- <https://uszipcode.readthedocs.io/>
- <https://python-visualization.github.io/folium/>
- <https://www.zillow.com/howto/api/APIOverview.htm>
- <https://www.realtor.com/research/data/>
- [http://s-media.nyc.gov/agencies/sirr/SIRR singles Lo res.pdf](http://s-media.nyc.gov/agencies/sirr/SIRR_singles_Lo_res.pdf)