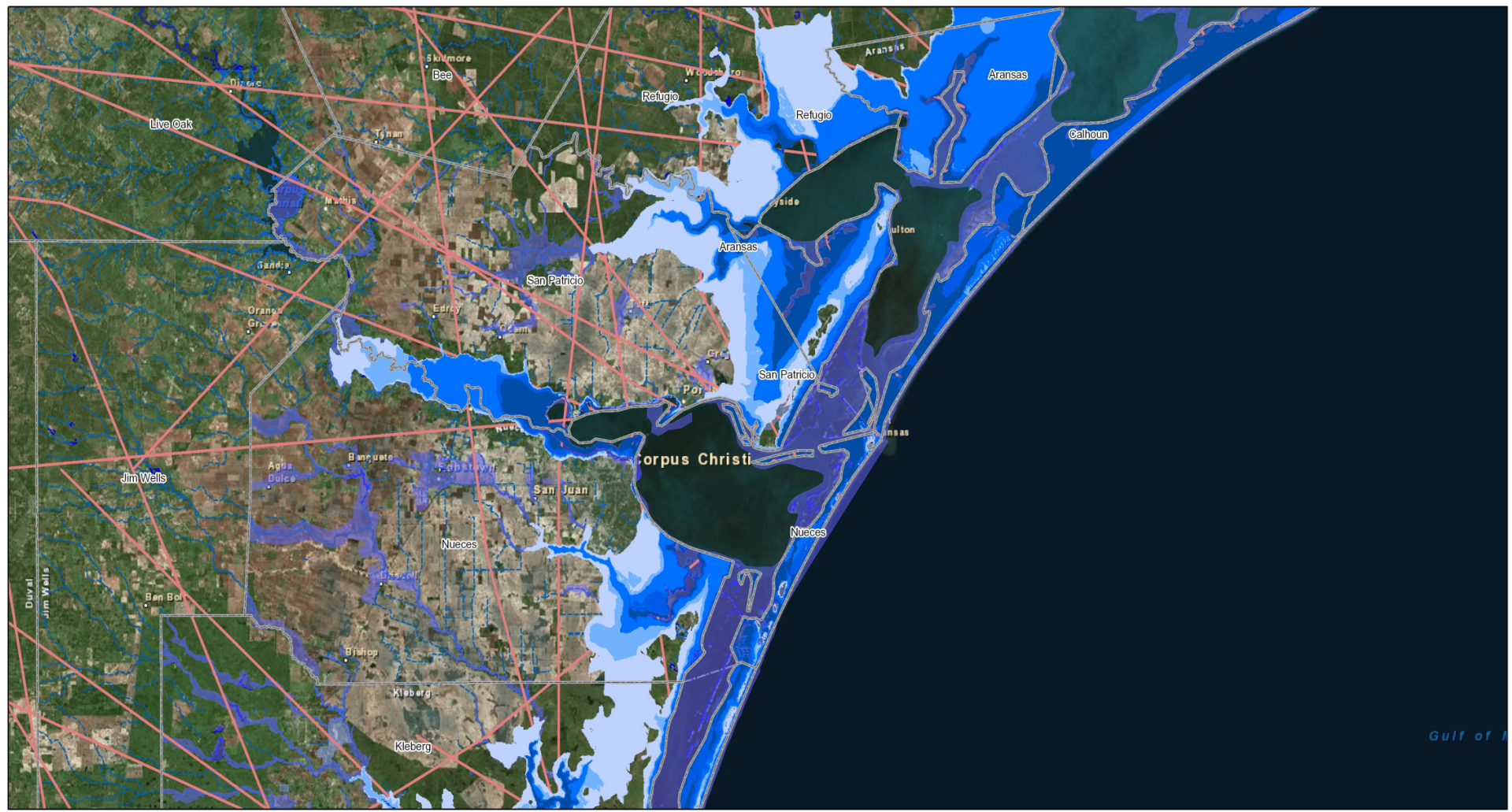


# Coastal Communities at Risk



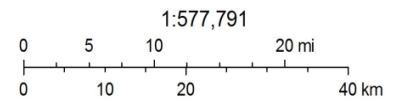
Samuel D. Brody  
Texas A&M University at Galveston

# Flood Risk Composit



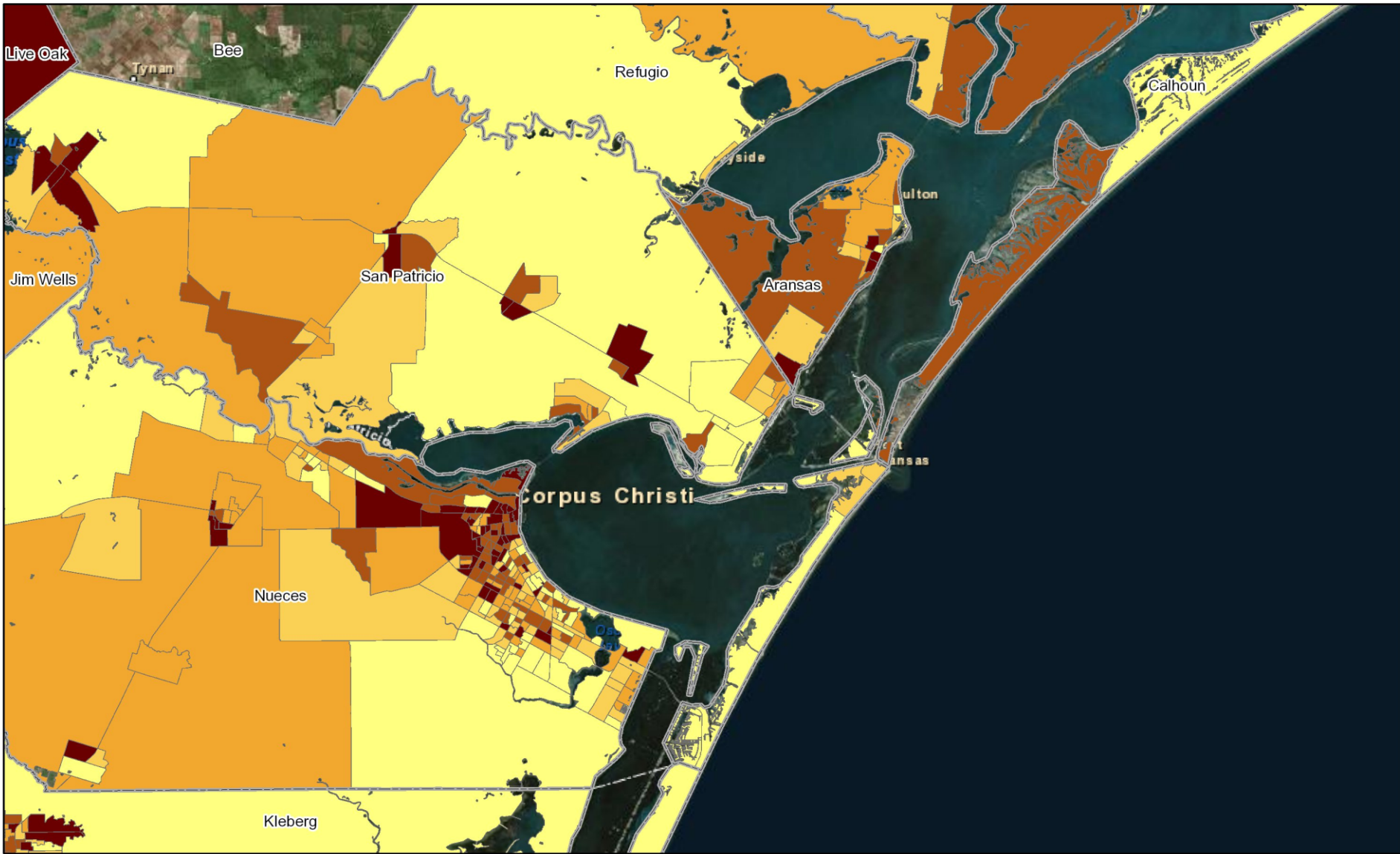
July 31, 2015

- |                  |                                 |                           |                    |
|------------------|---------------------------------|---------------------------|--------------------|
| County Labels    | Surge Category 5                | AO                        | Major River        |
| County Bds       | Hurricane Tracks                | <b>Rivers and Streams</b> | Major Stream       |
| Surge Category 1 | <b>FEMA 100 Year Flood Risk</b> | Dam                       | Stream, Water Body |
| Surge Category 2 | A                               | Intermittent Lake         | Water Body         |
| Surge Category 3 | AE                              | Intermittent Stream       |                    |
| Surge Category 4 | ANI                             | Inundation Area           |                    |









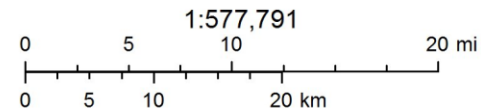
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community  
 Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

# Socially Vulnerable Neighborhoods



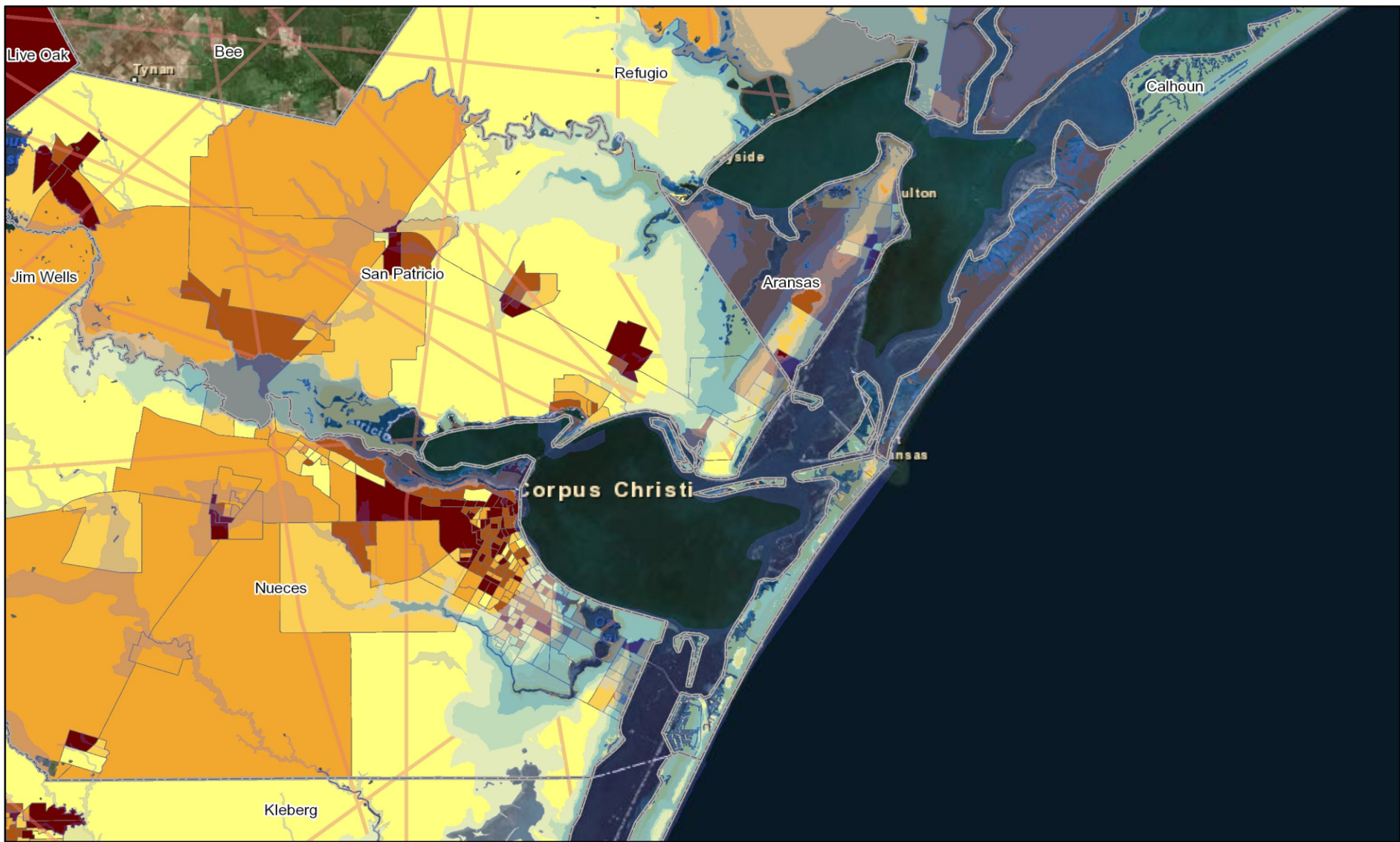
July 31, 2015

County Labels	<b>SVI ACS 2009</b>	 Medium
 County Bdys	 V. Low	 High
	 Low	 V. High



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and

# Flood Vulnerability



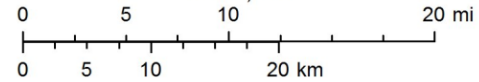
July 31, 2015

County Labels

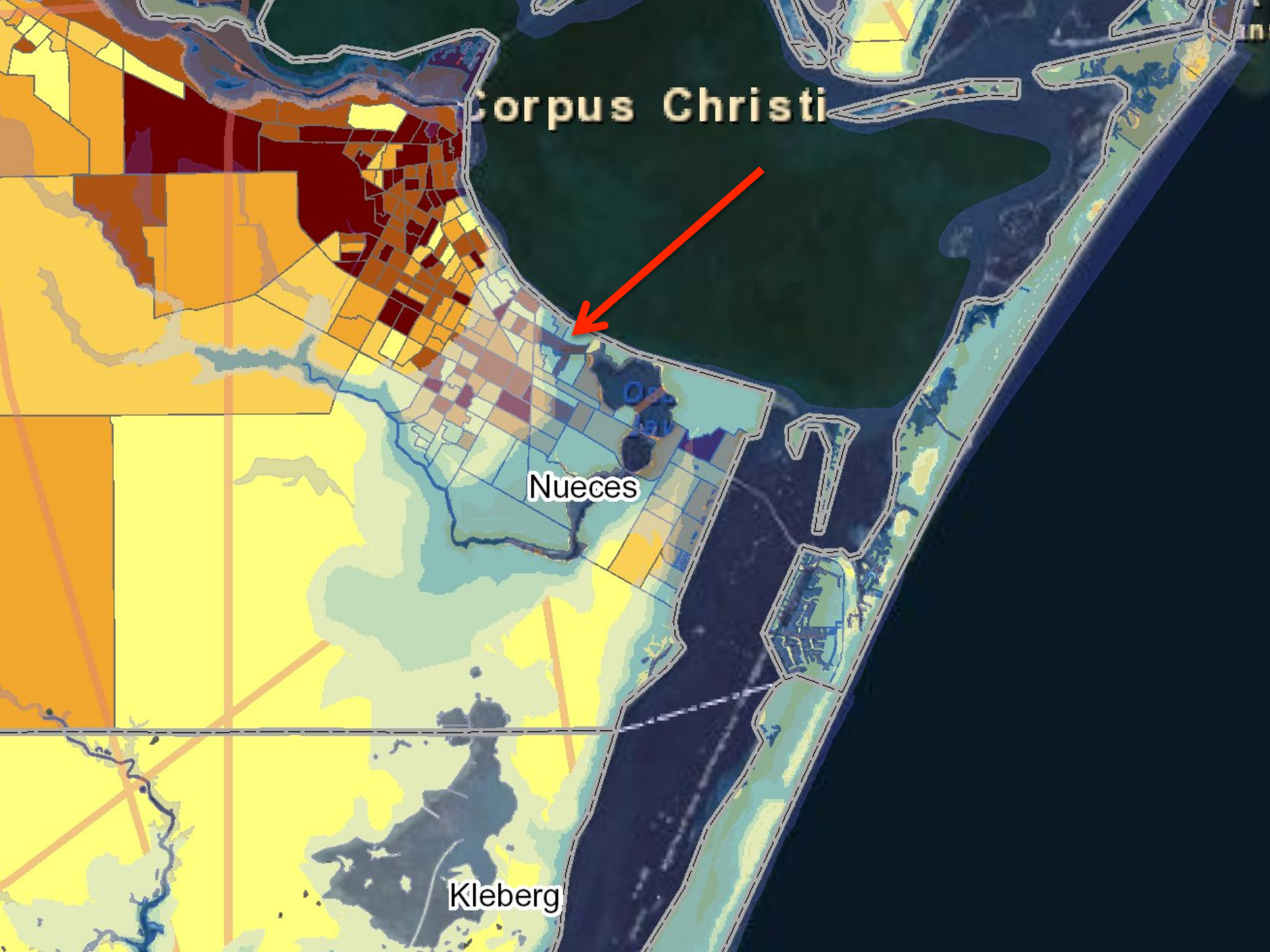
County Bdys

Surge Category 1

1:577,791



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and



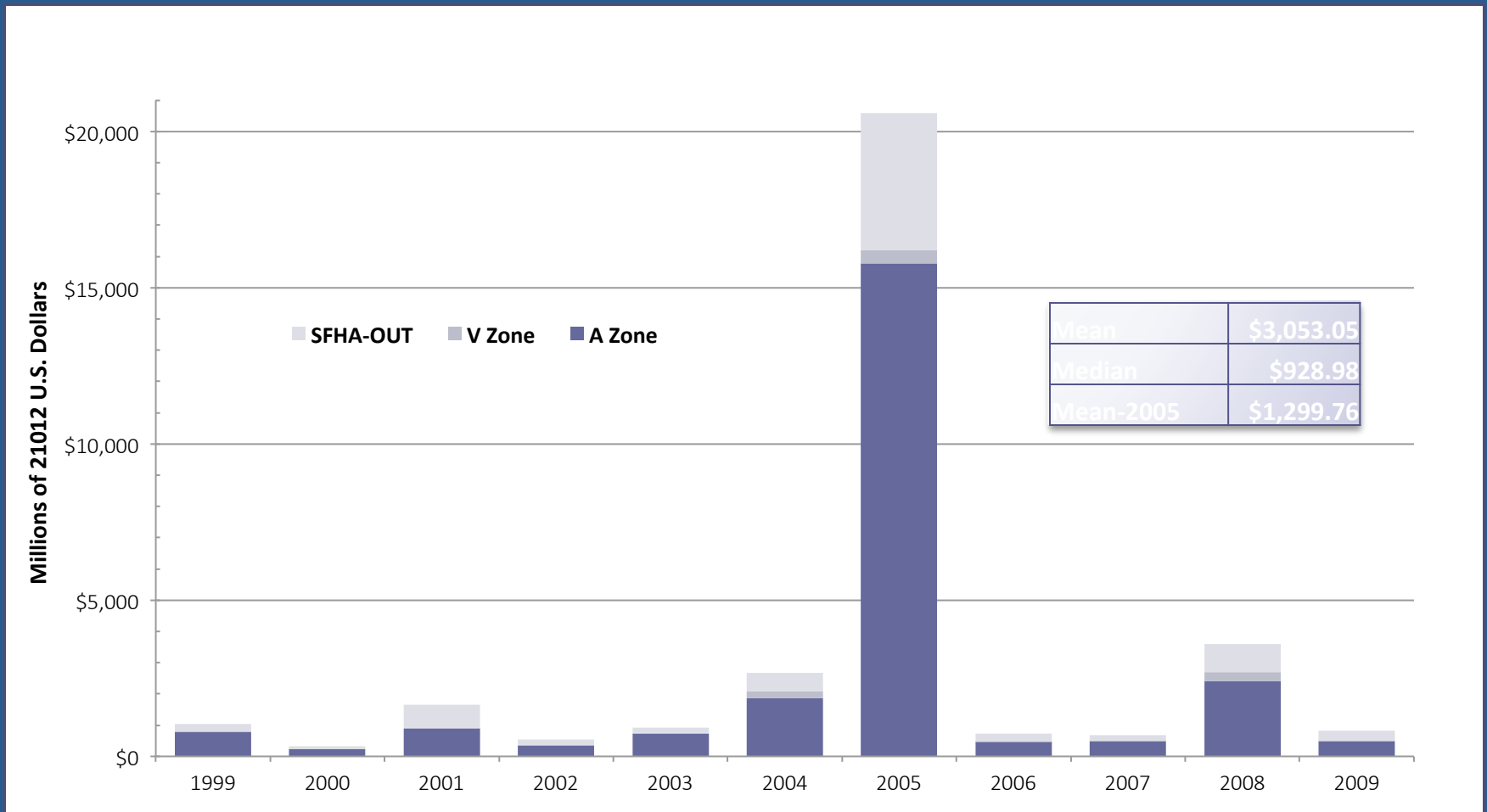
Corpus Christi

Nueces

Kleberg

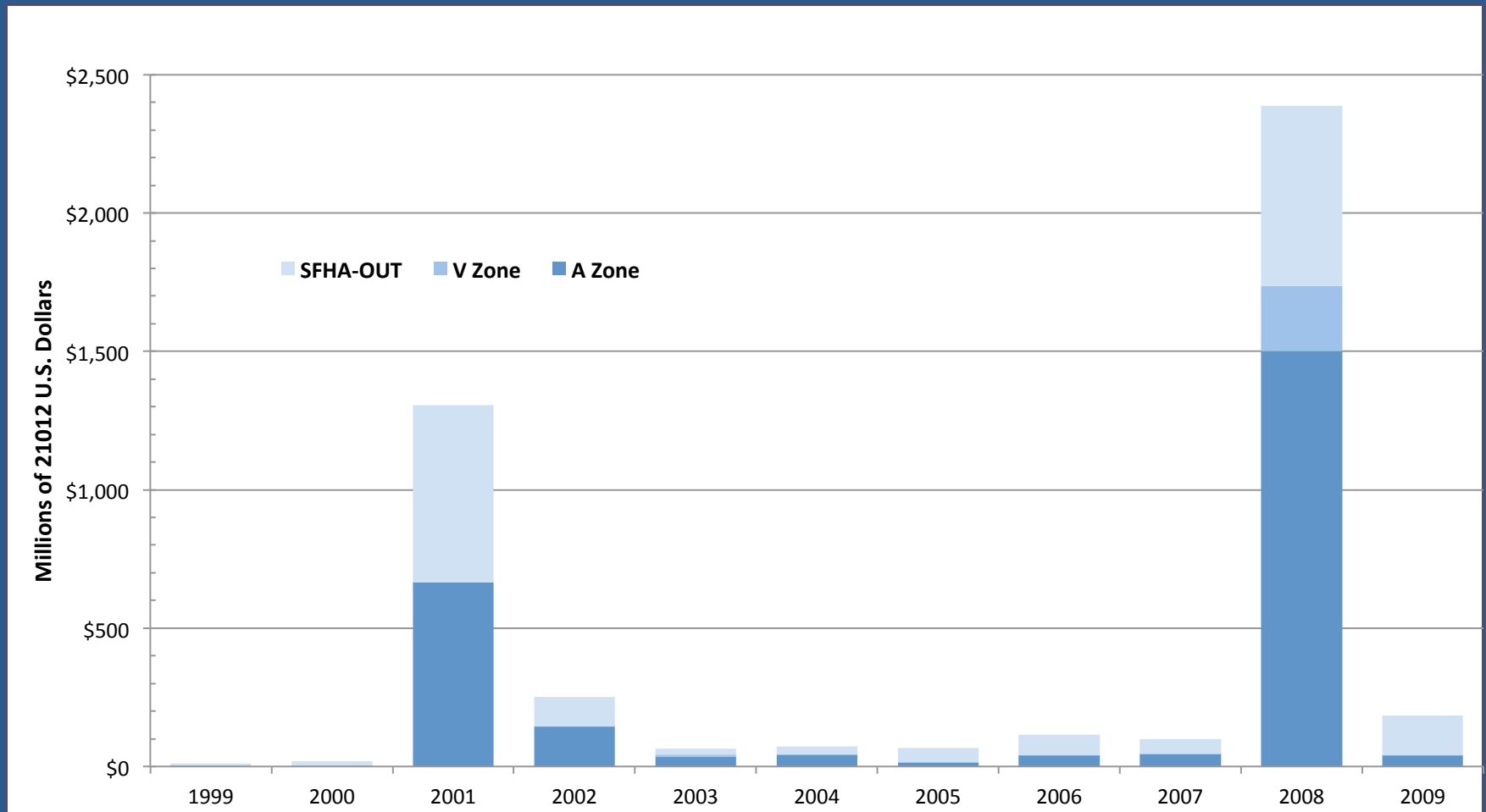
# U.S. INSURED FLOOD LOSSES: 1999 – 2009

(MILLIONS OF 2012 U.S. DOLLARS)

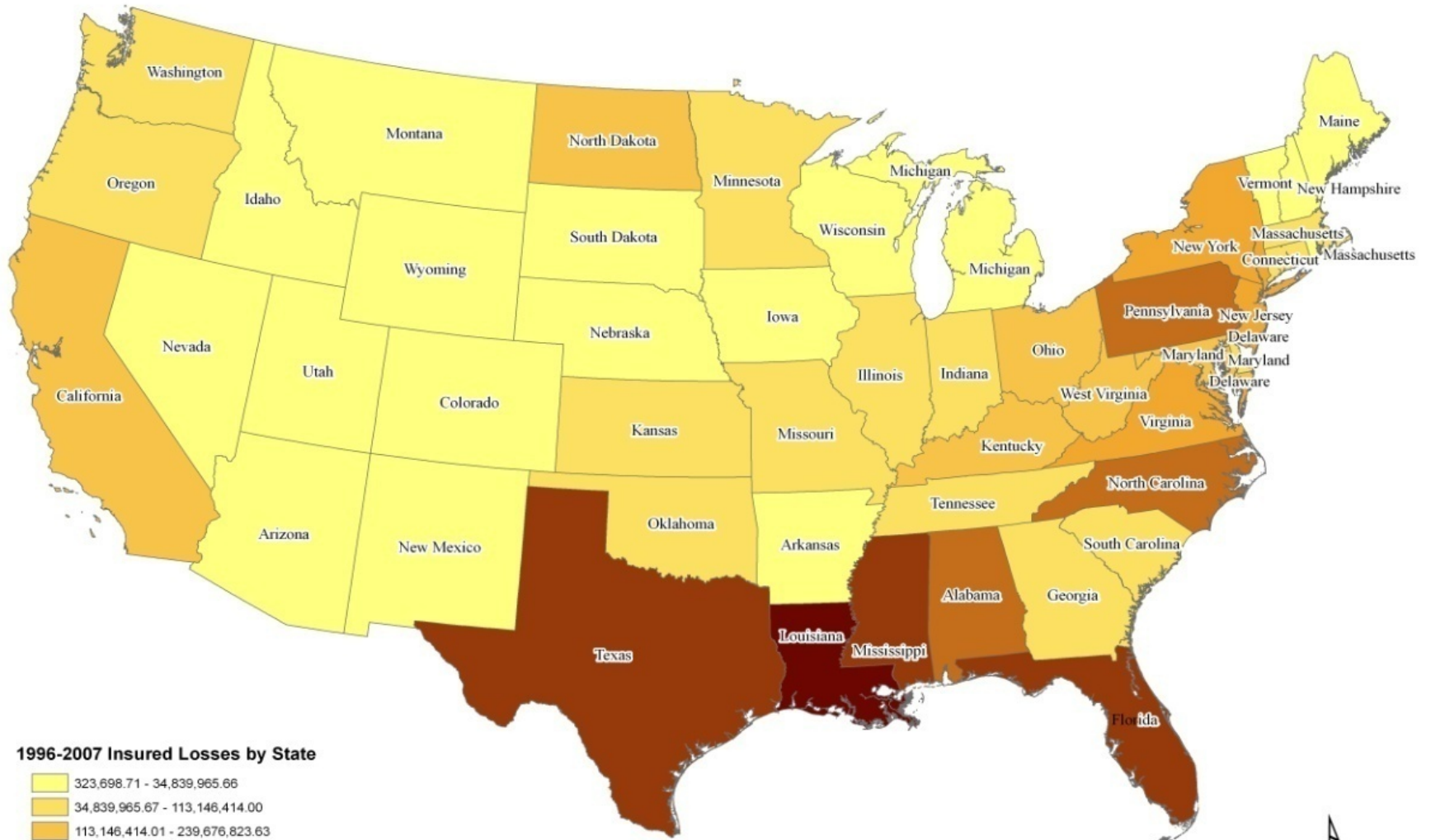


# TEXAS INSURED LOSSES: 1999 – 2009

(MILLIONS OF 2012 U.S. DOLLARS)



# Flood Insured Losses, 1996-2007



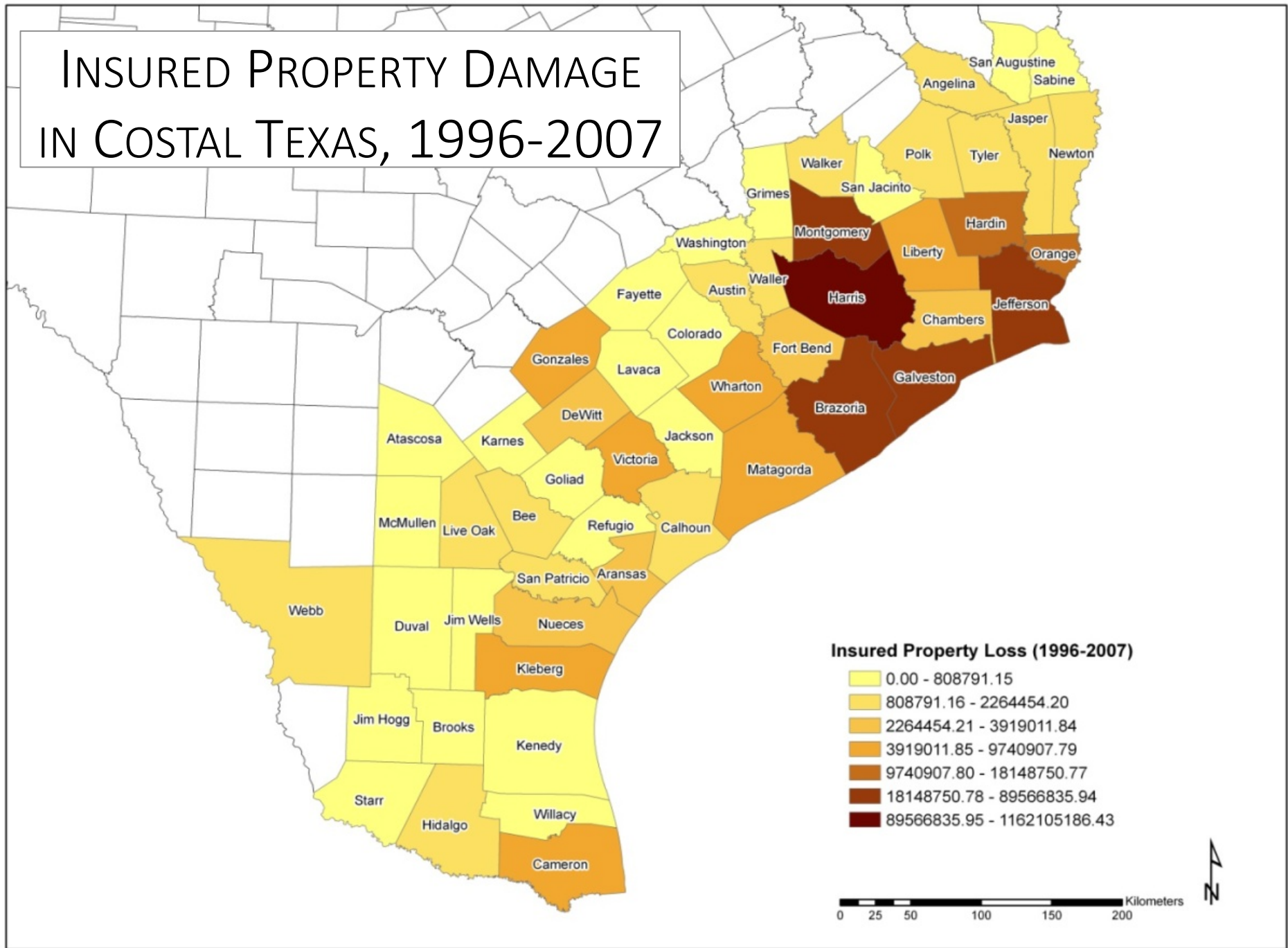
**1996-2007 Insured Losses by State**

Lightest Yellow	323,698.71 - 34,839,965.66
Light Yellow	34,839,965.67 - 113,146,414.00
Yellow-Orange	113,146,414.01 - 239,676,823.63
Orange	239,676,823.64 - 481,982,065.38
Dark Orange	481,982,065.39 - 793,074,011.71
Brown	793,074,011.72 - 2,592,491,915.67
Darkest Brown	2,592,491,915.68 - 13,871,148,943.70

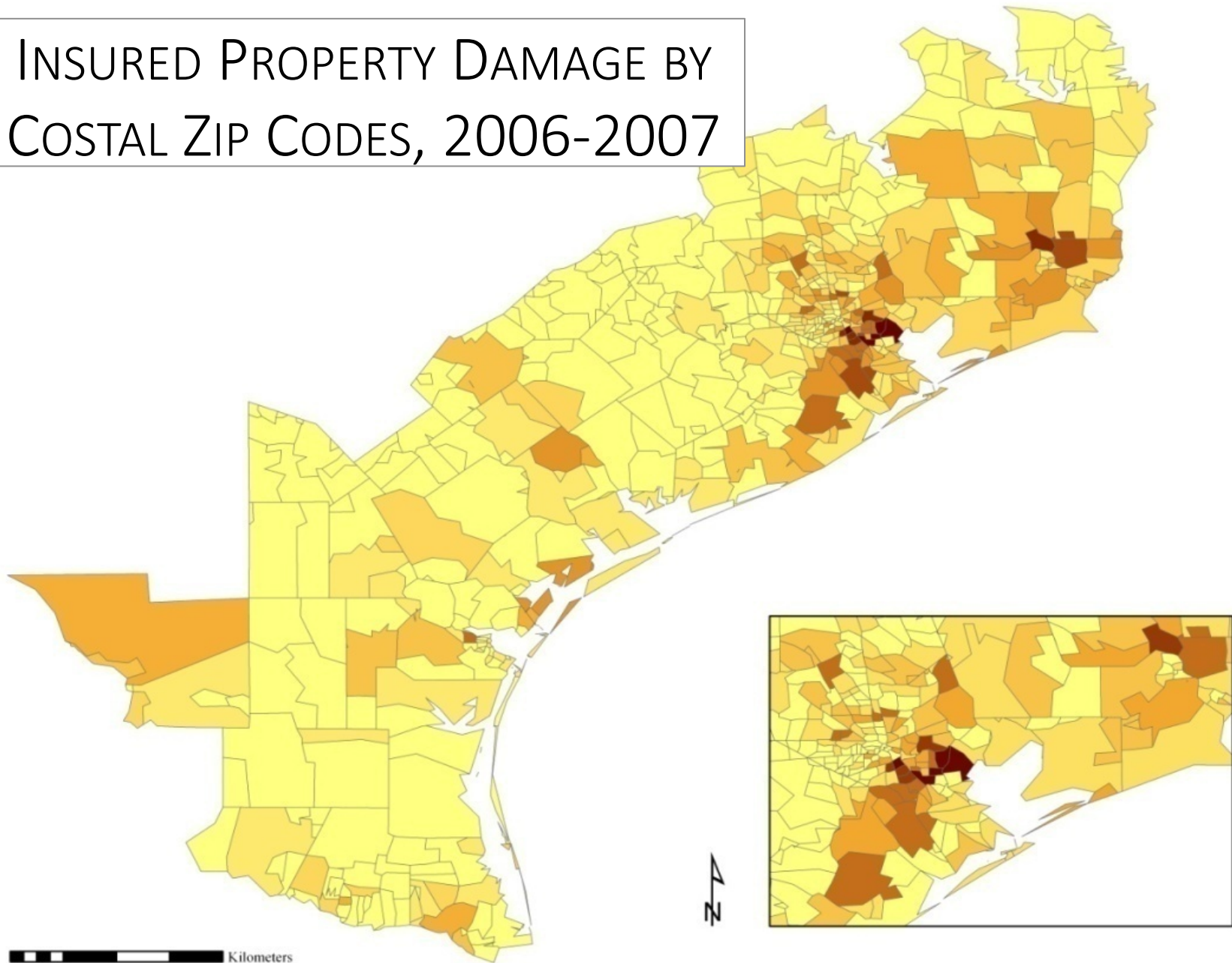




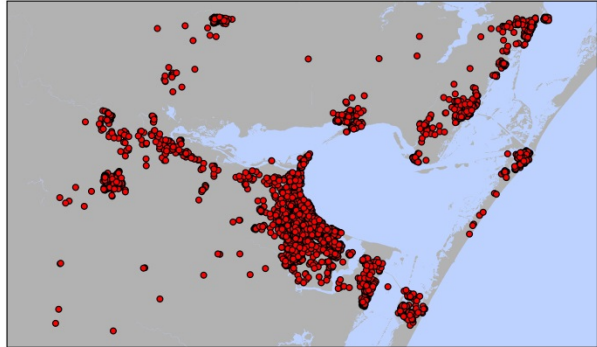
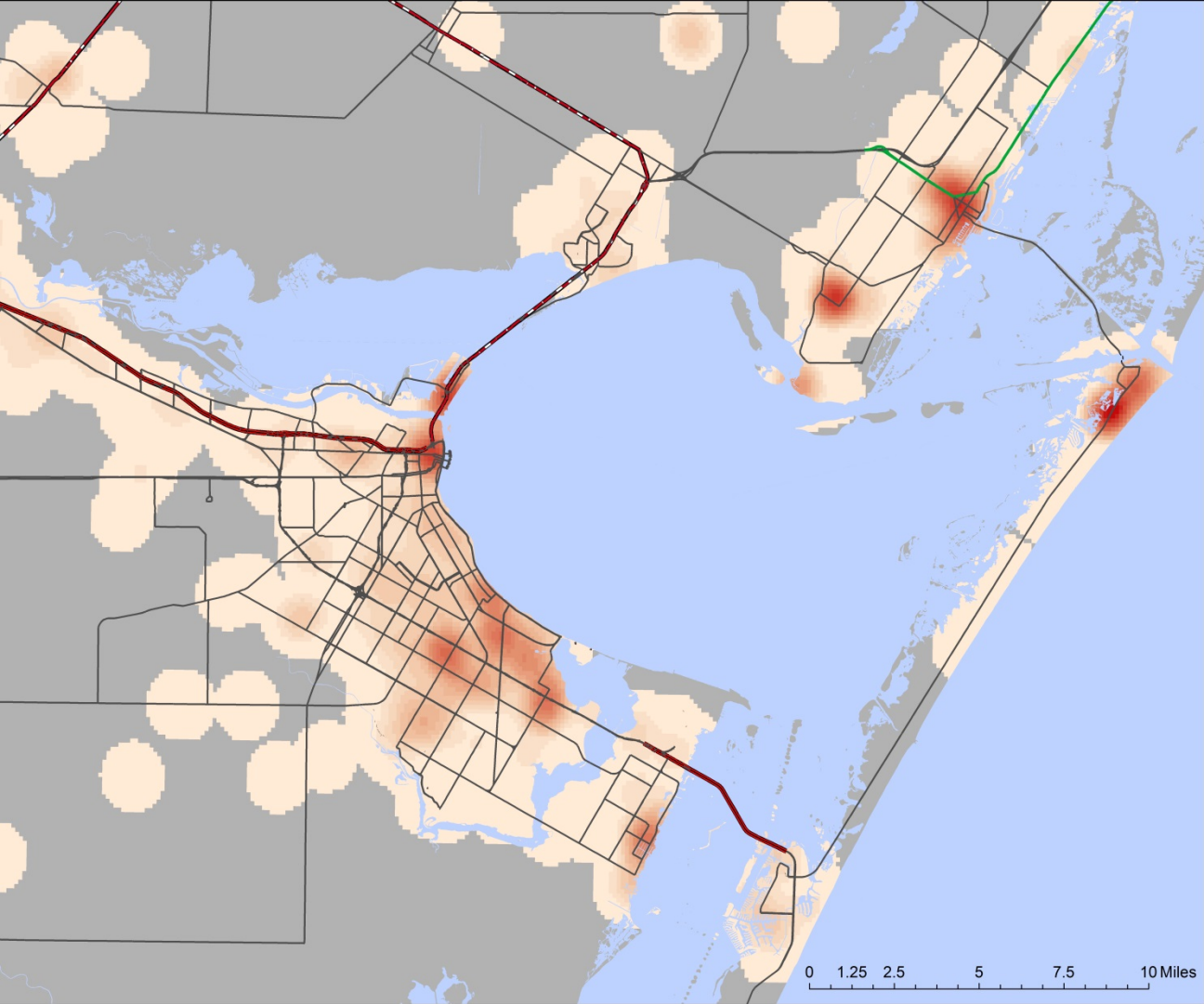
# INSURED PROPERTY DAMAGE IN COSTAL TEXAS, 1996-2007



# INSURED PROPERTY DAMAGE BY COSTAL ZIP CODES, 2006-2007



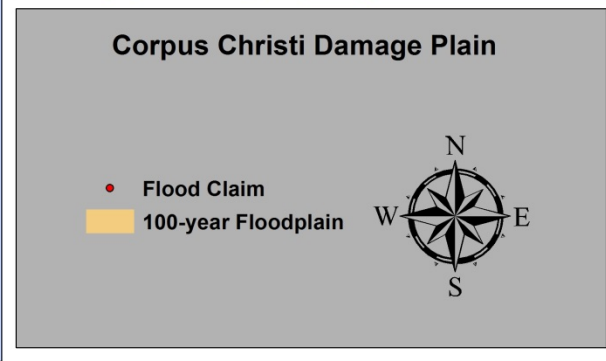
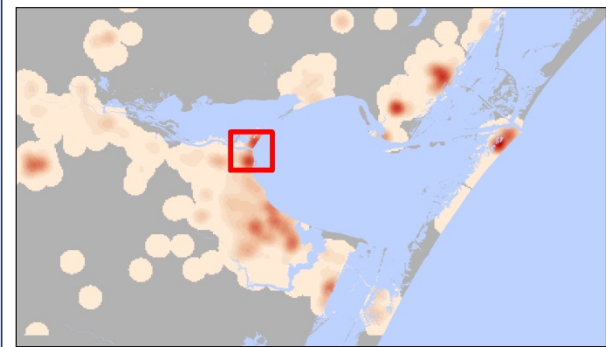
0 12.5 25 50 75 100 Kilometers

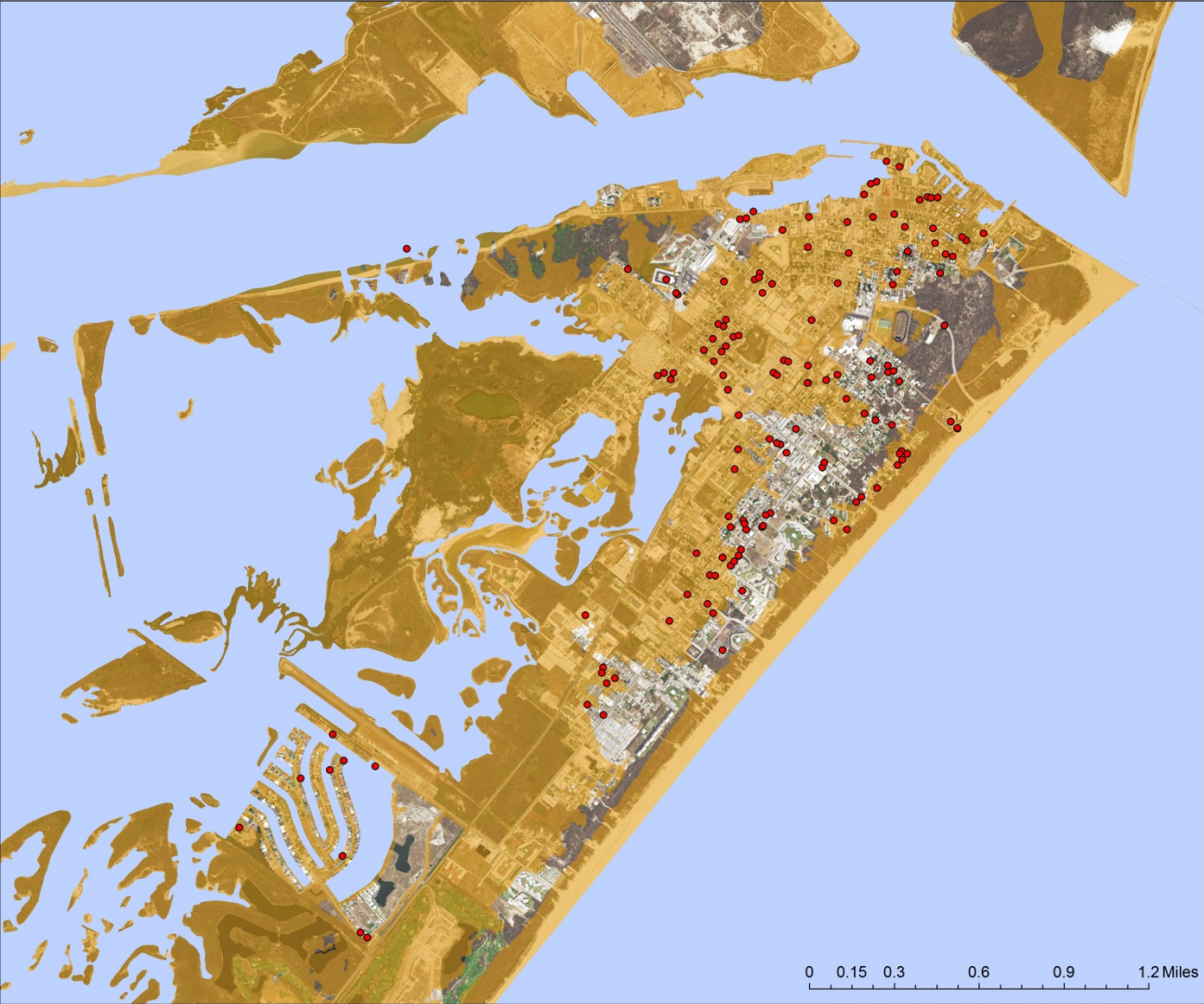


### Corpus Christi-Port Aransas Damage Plain

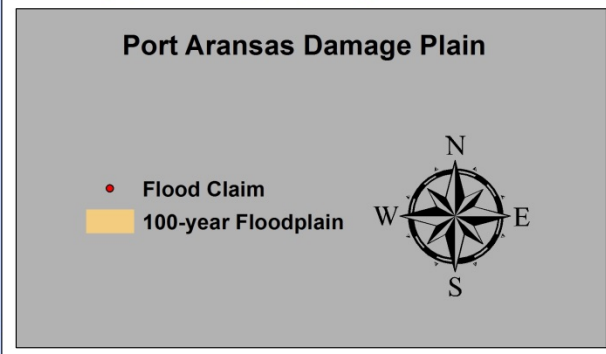
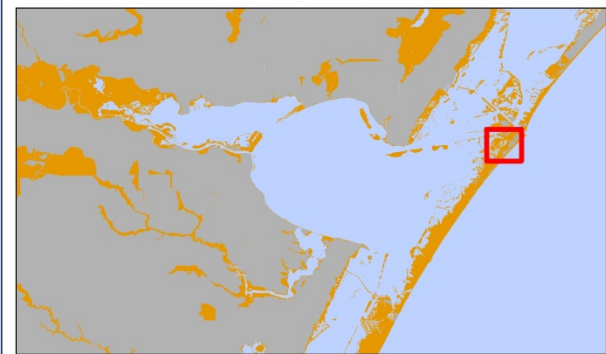
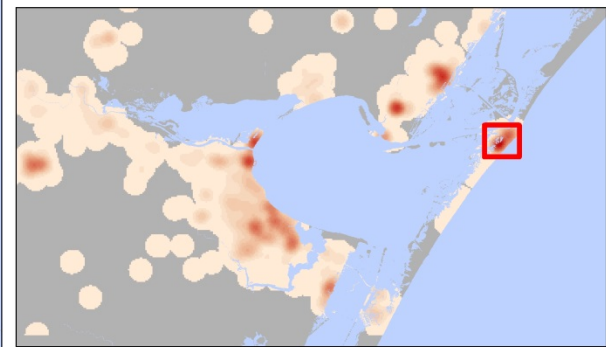
- Flood Claims
- Interstate
- US Highway
- Major Road
- Business
- - - Ferry Crossing

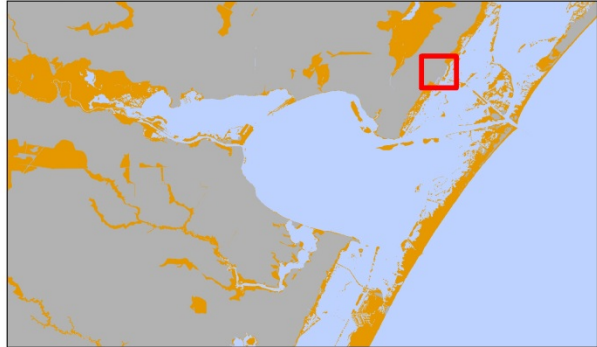
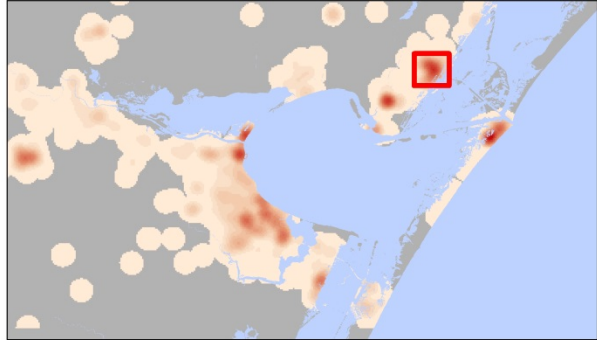
A compass rose is located in the bottom right corner of the legend area, with 'N' for North, 'S' for South, 'E' for East, and 'W' for West.





0 0.15 0.3 0.6 0.9 1.2 Miles

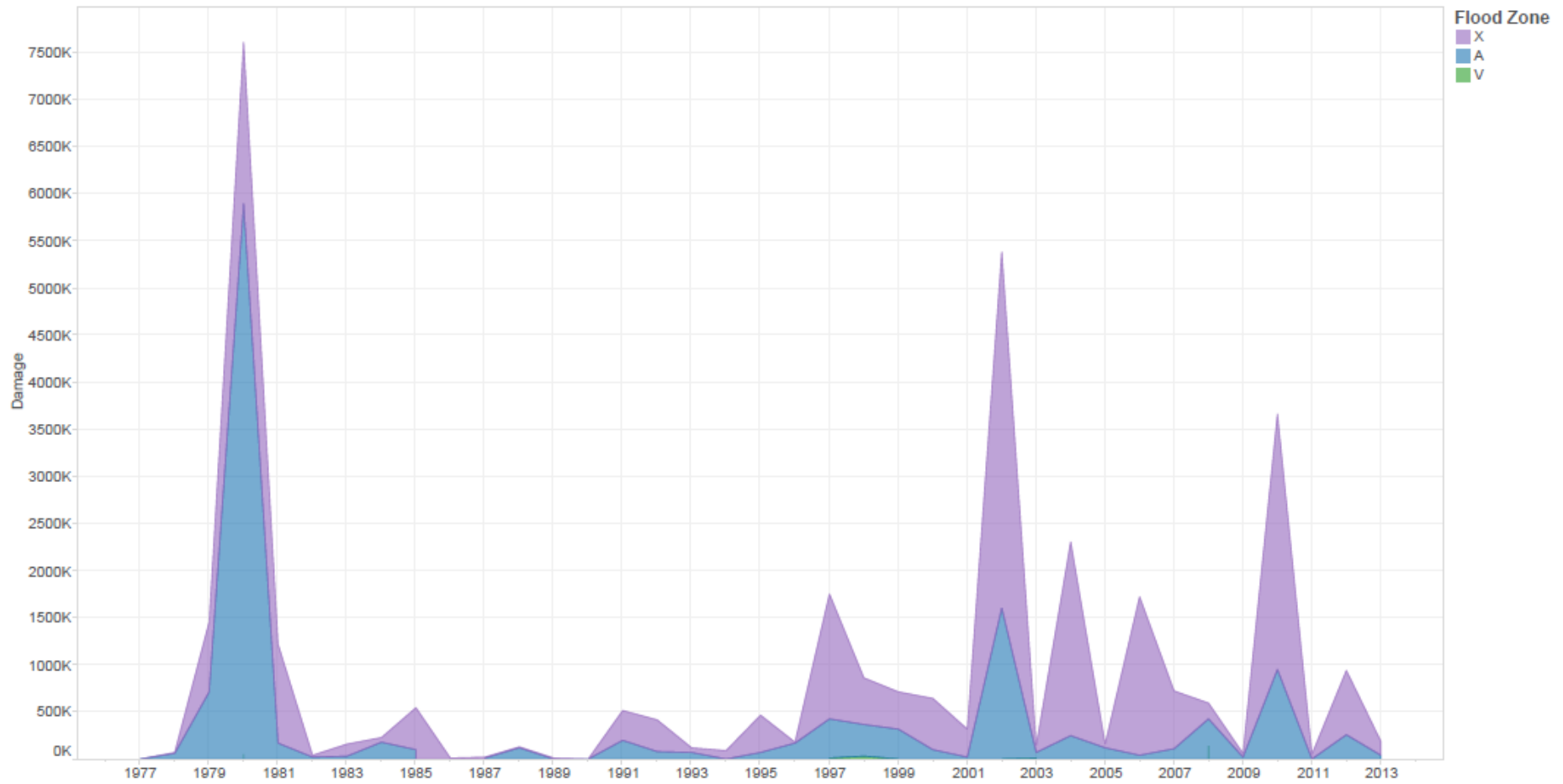




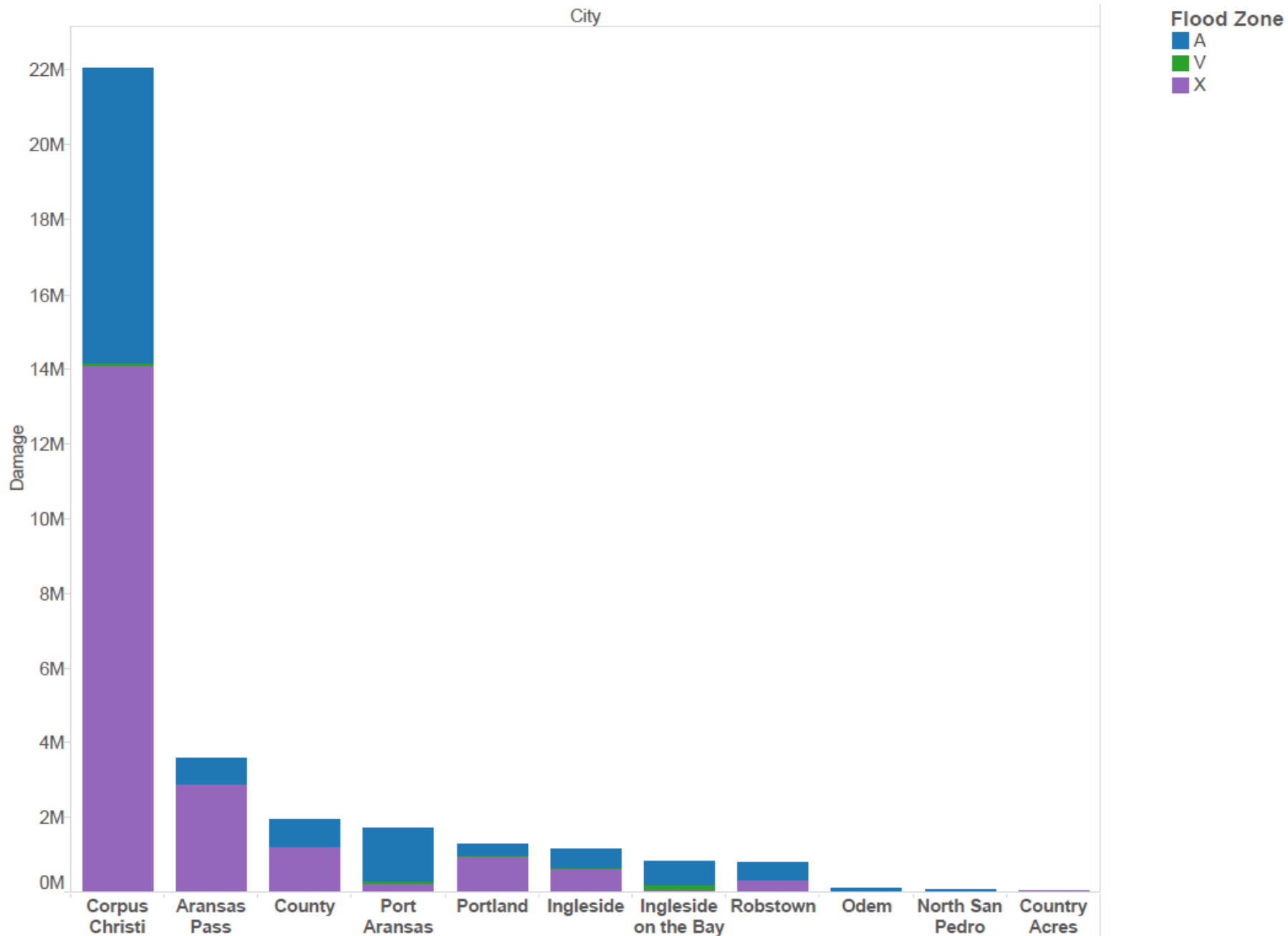
**Aransas Pass Damage Plain**

- Flood Claim
- 100-year Floodplain

0 0.1 0.2 0.4 0.6 0.8 Miles



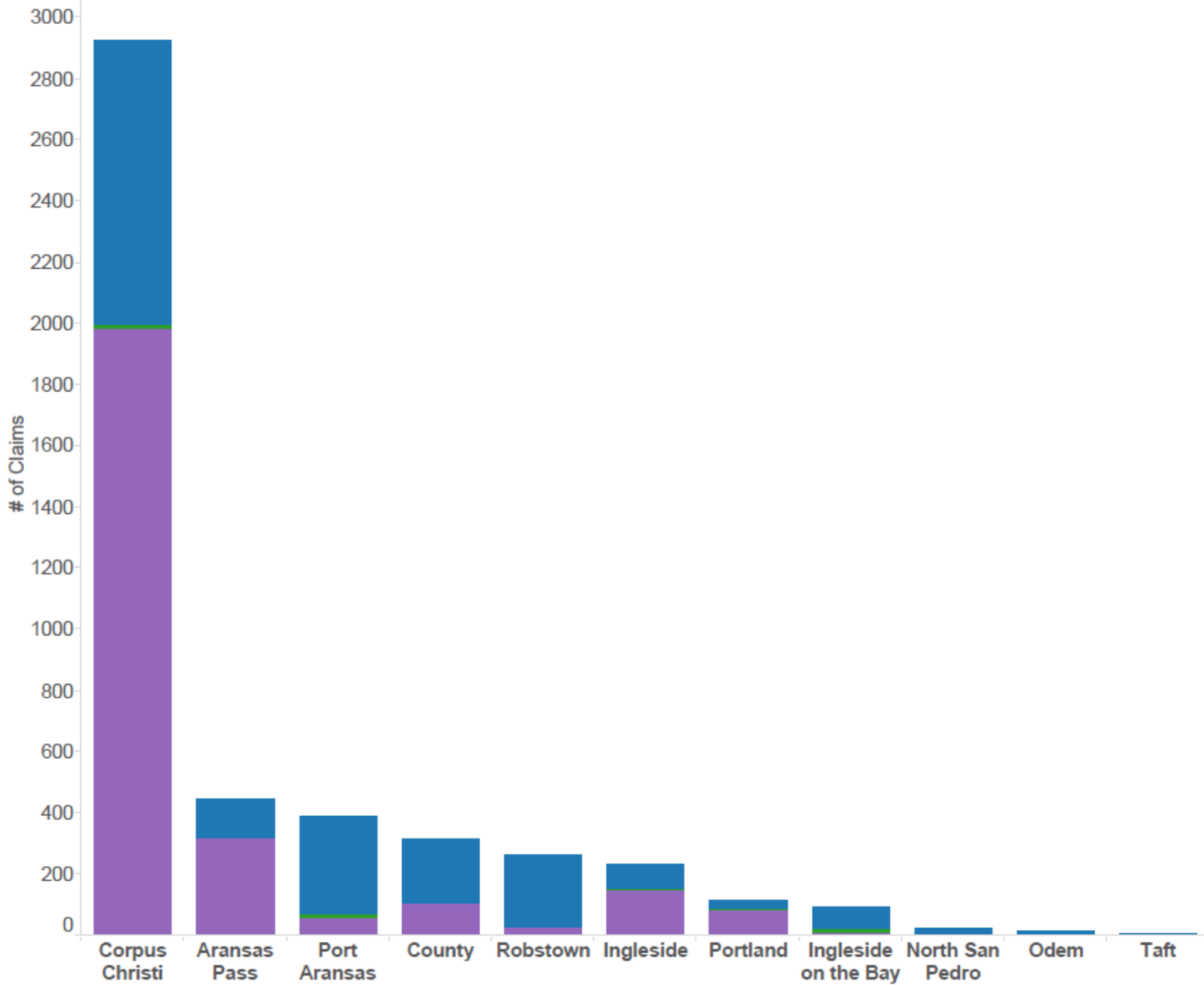
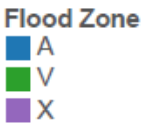
The plot of sum of Damage for Dt Of Loss Year. Color shows details about Flood Zone .



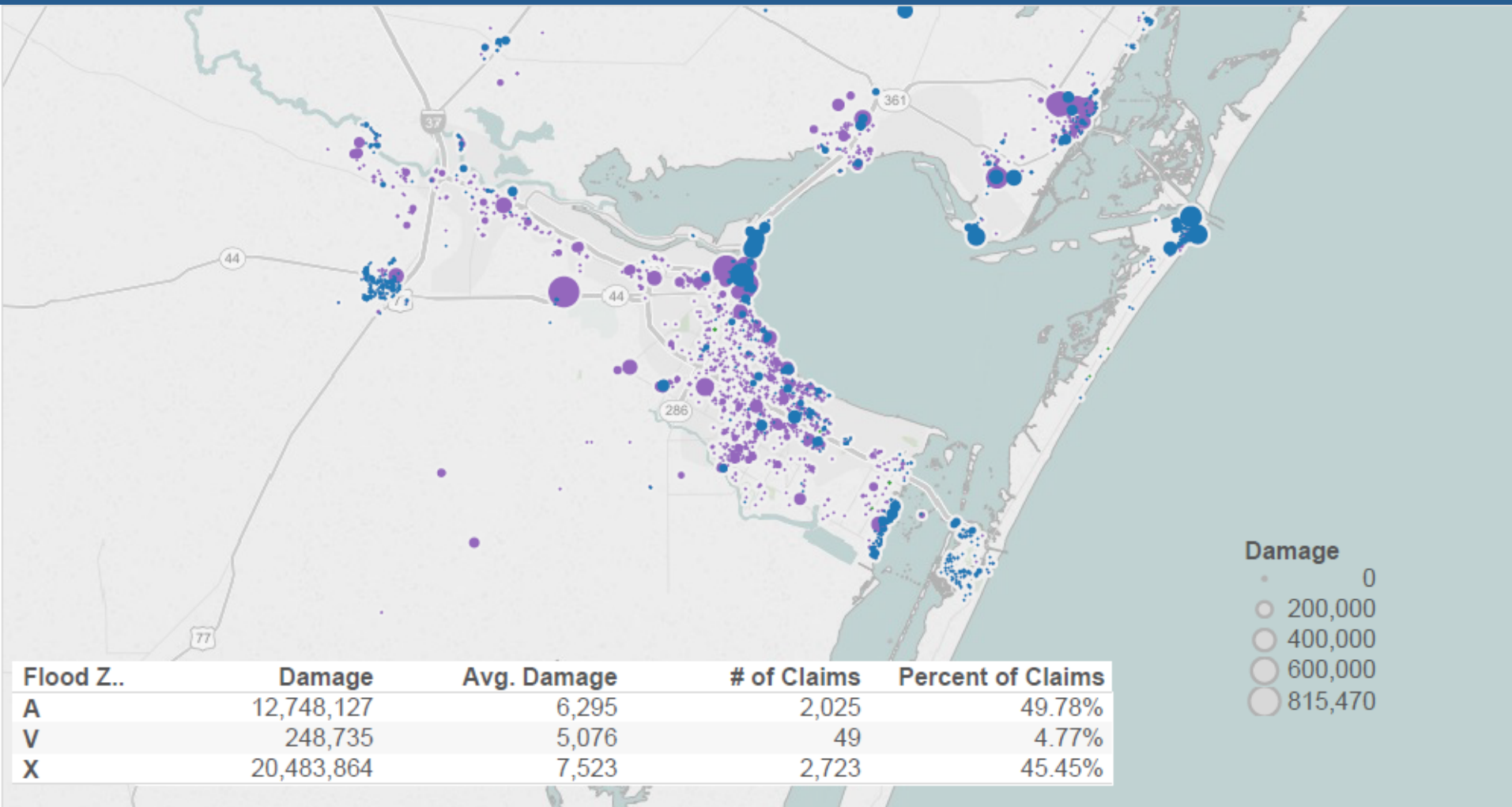
Sum of Damage for each City . Color shows details about Flood Zone .



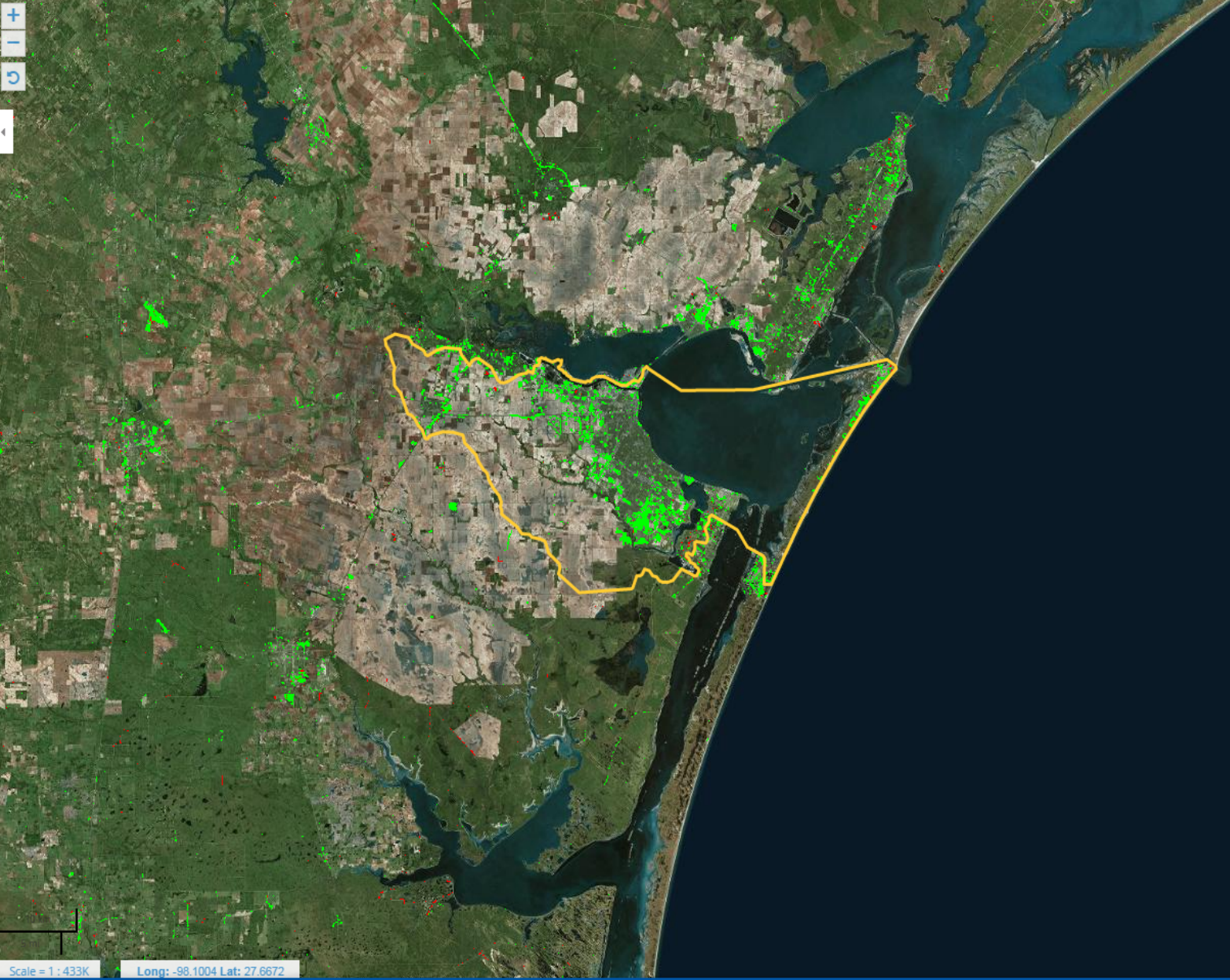
City



Count of Damage for each City . Color shows details about Flood Zone .



# DEVELOPMENT CHANGE – 1996-2010



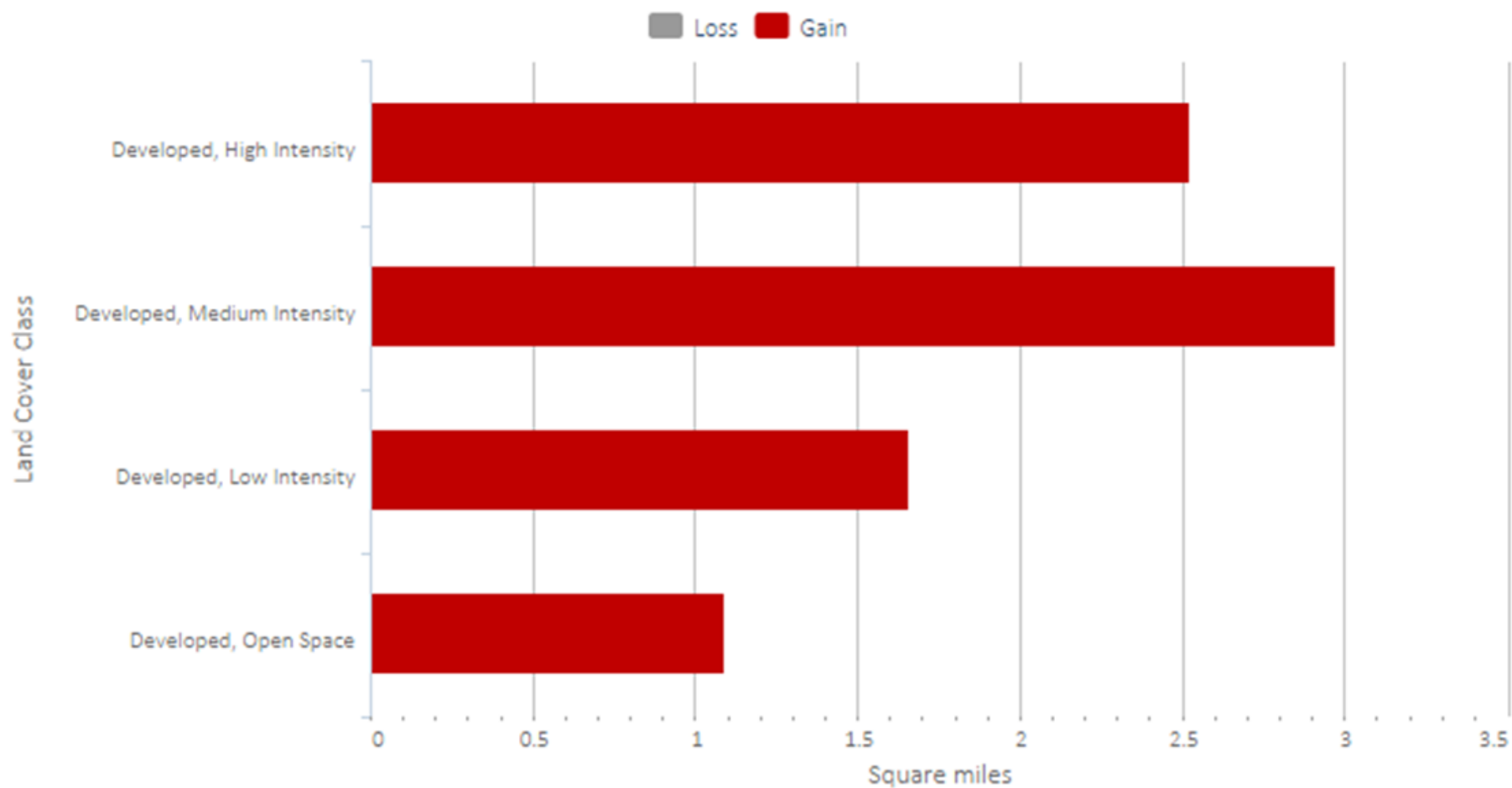
Land Cover: none

Data Transparency

Developed Area Losses/Gains

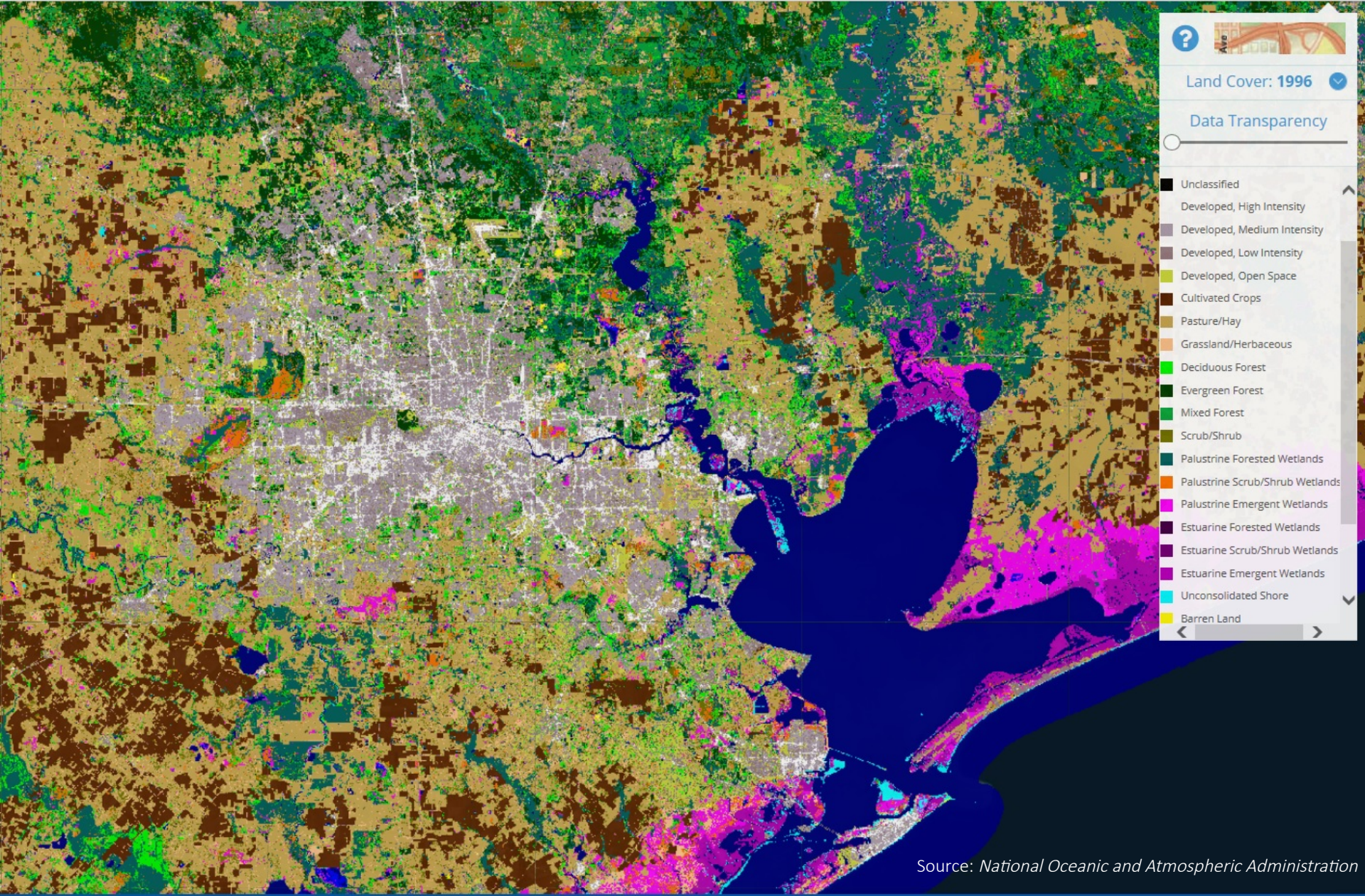
- Development Gain
- Development Losses

# DEVELOPMENT BY AREA AND TYPE – 1996-2010



# LAND USE CHANGE

HOUSTON AREA 1996 LAND COVER



?

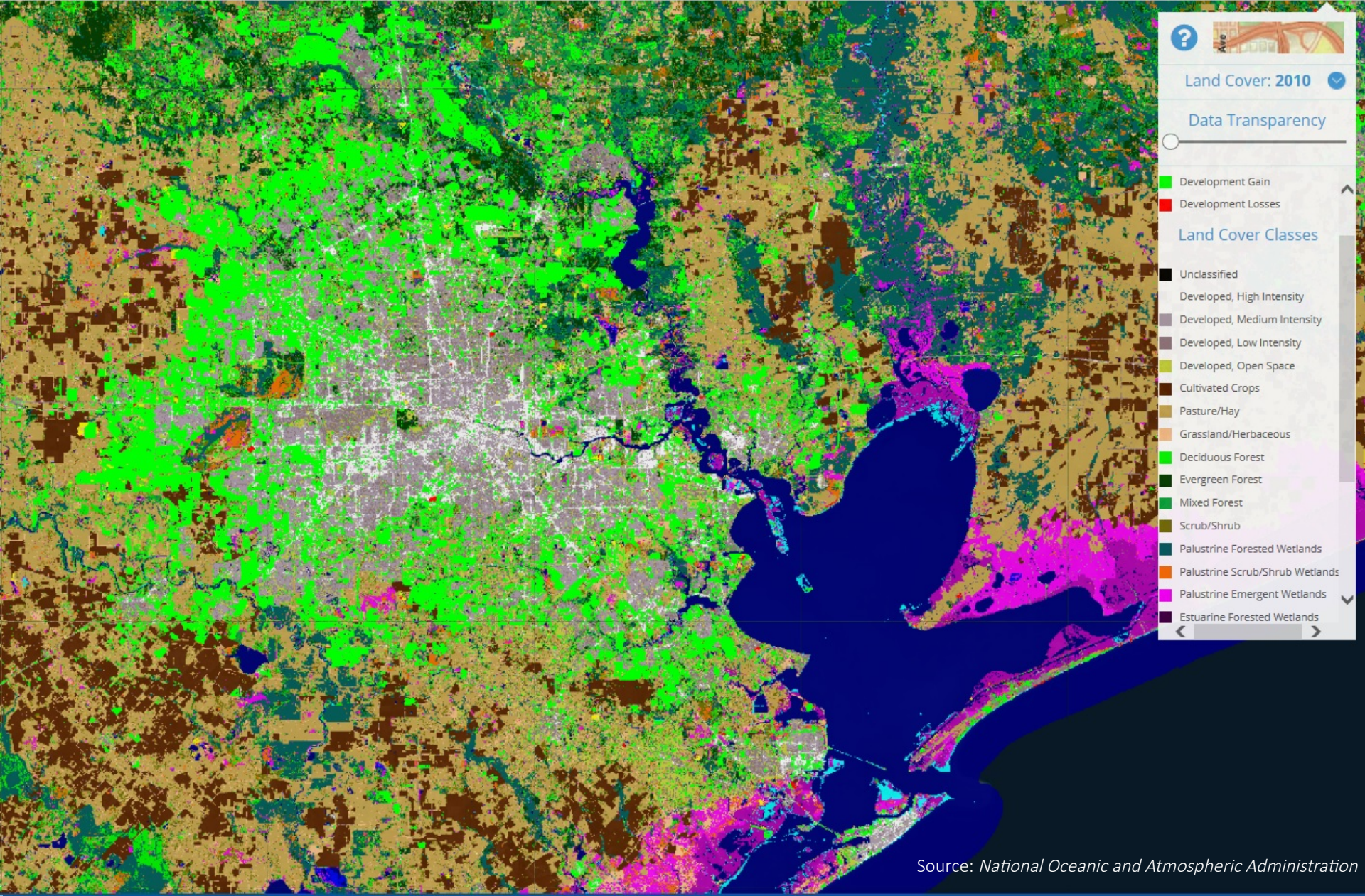
Land Cover: 1996

Data Transparency

- Unclassified
- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space
- Cultivated Crops
- Pasture/Hay
- Grassland/Herbaceous
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Palustrine Forested Wetlands
- Palustrine Scrub/Shrub Wetlands
- Palustrine Emergent Wetlands
- Estuarine Forested Wetlands
- Estuarine Scrub/Shrub Wetlands
- Estuarine Emergent Wetlands
- Unconsolidated Shore
- Barren Land

# LAND USE CHANGE

HOUSTON AREA DEVELOPMENT CHANGE 2011



?

Land Cover: 2010

Data Transparency

Development Gain

Development Losses

Land Cover Classes

- Unclassified
- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space
- Cultivated Crops
- Pasture/Hay
- Grassland/Herbaceous
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Palustrine Forested Wetlands
- Palustrine Scrub/Shrub Wetlands
- Palustrine Emergent Wetlands
- Estuarine Forested Wetlands

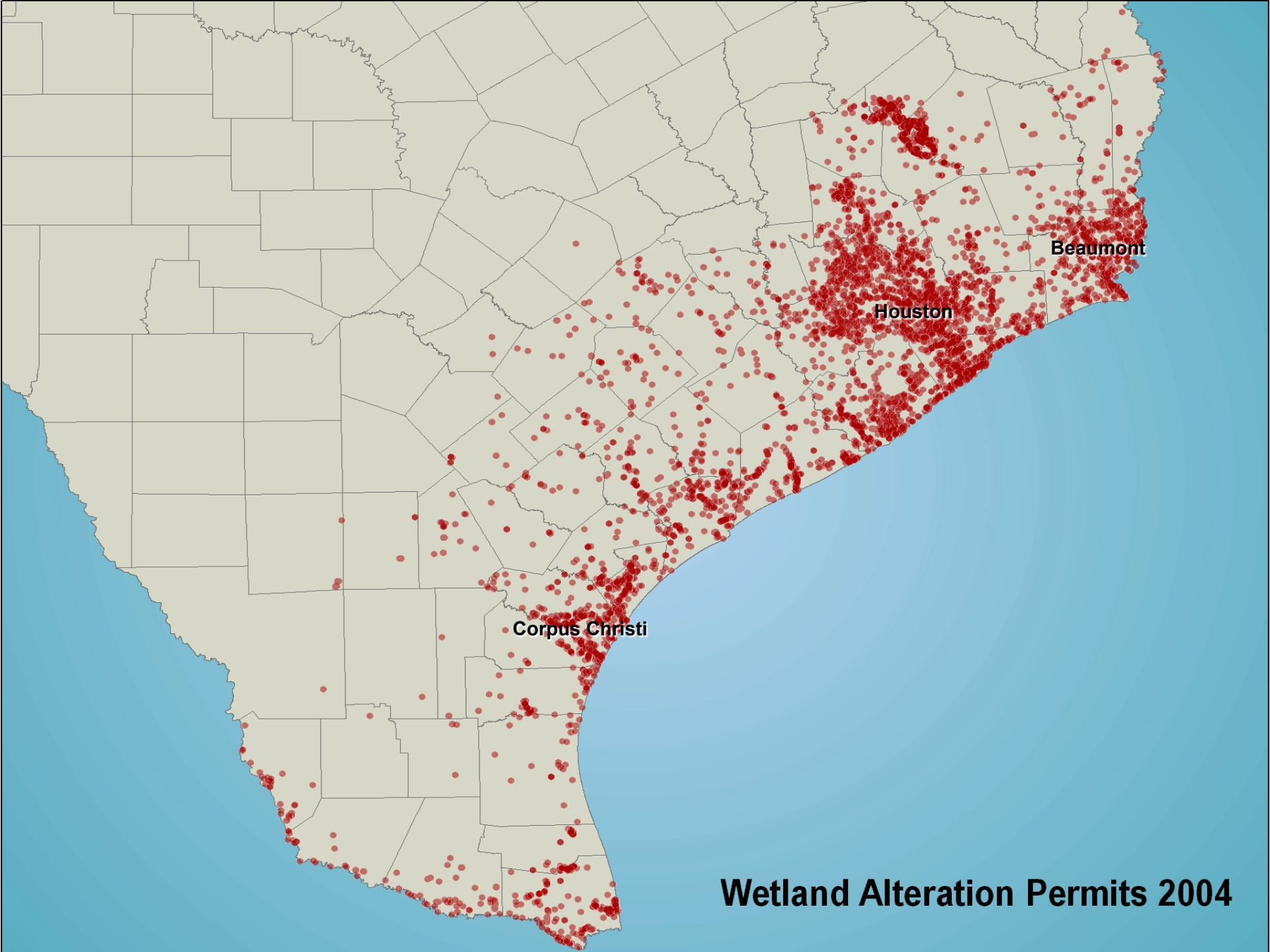
# IMPACT OF DEVELOPMENT PATTERNS

- Efficacy of well-defined urban cores in reducing loss.
  - Added square mile of high-intensity development decreases losses by approximately \$9.7 million.
  - Outwardly expanding, low-density development patterns can amplify flooding.
  - Added square mile of low-intensity development increases flood damage by \$5.7 million.
    - Harris County has 227 square miles.
-

# LAND USE – LAND COVER RESULTS

- Surrounding development consisting of 50-79% (medium intensity) impervious surface most resilient.
  - Sprawling, low intensity development with 21-49% impervious surface significantly increases flood loss.
  - *Percent increase adds \$1,734 in property damage.*
  - Embedded open space land use significantly reduces flood losses.
  - Surrounding forest and grass cover reduces flood loss.
  - Palustrine wetlands strong predictor of flood loss reduction, but **not** estuarine wetlands.
-





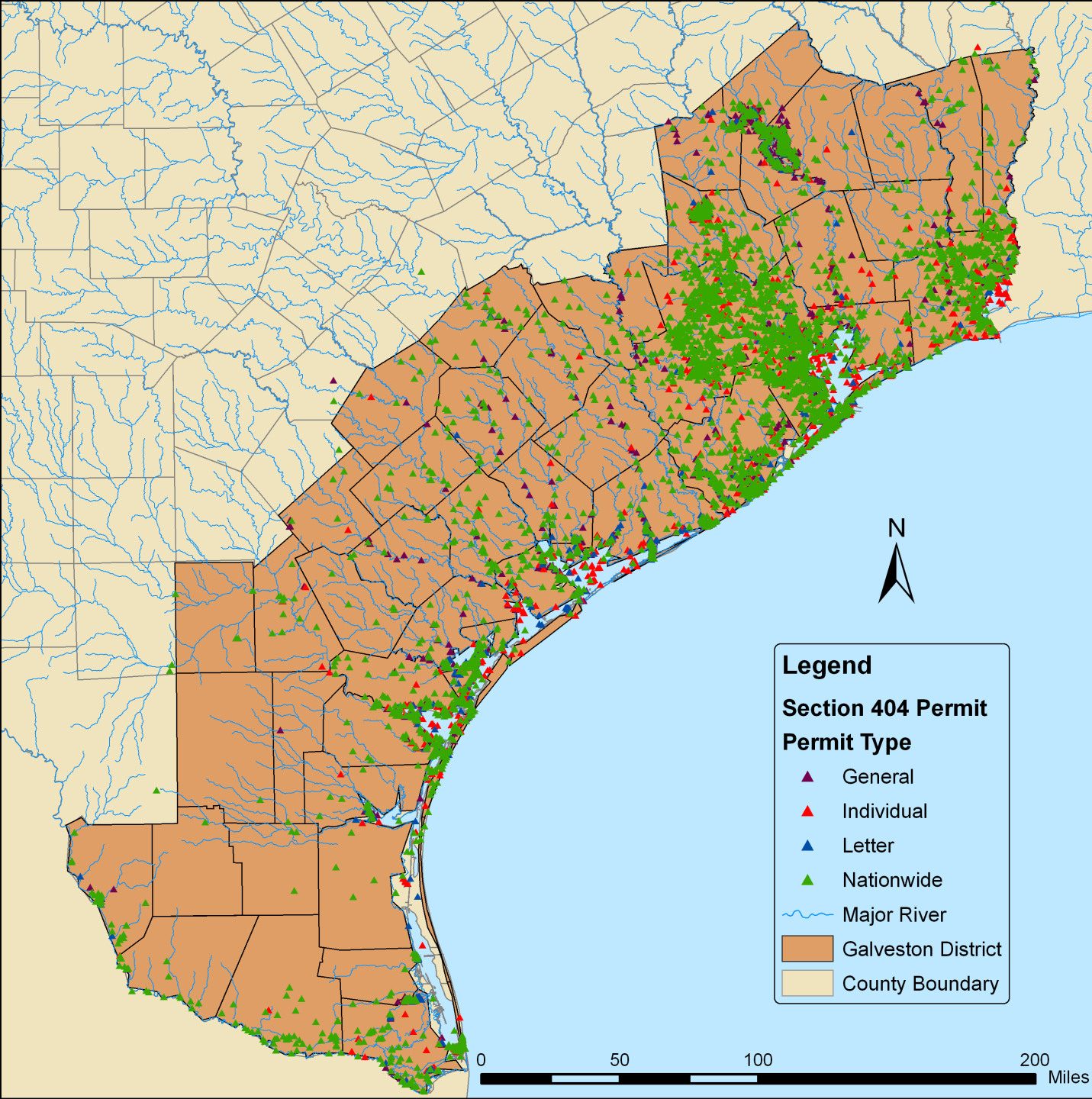
Corpus Christi

Houston

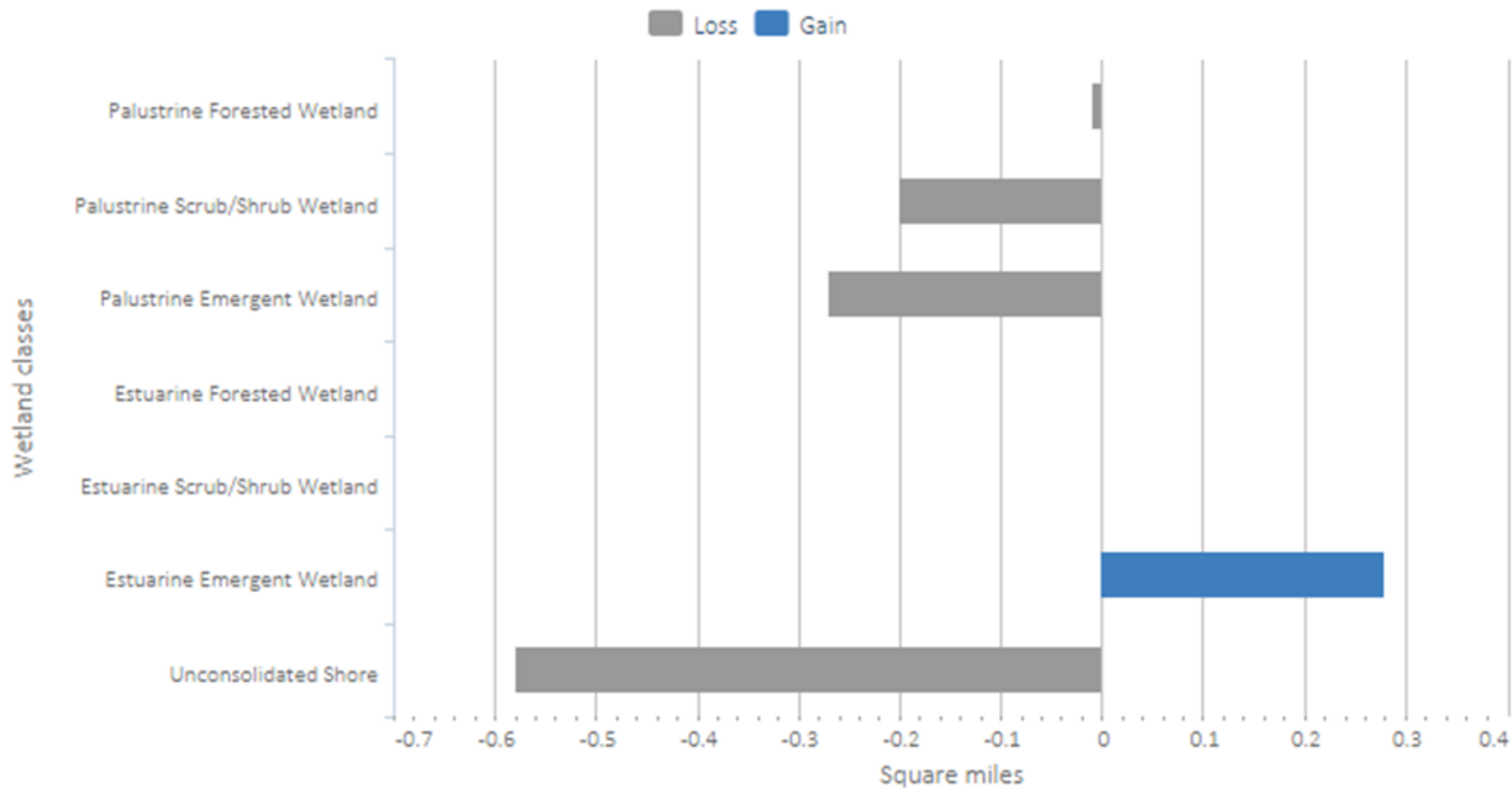
Beaumont

**Wetland Alteration Permits 2004**

# SECTION 404 PERMITS: 1991 - 2003



# WETLAND LOSS BY AREA AND TYPE – 1996-2010





[www.tamug.edu/ISCC](http://www.tamug.edu/ISCC)