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First Street Foundation Flood Model
and Data Availability

First Street Foundation.

A nonprofit formed to communicate risks from climate change to individual Americans - starting with flood risk.

We provide property-level comprehensive flood risk estimates.

We recognize an urgent need for consistent, property-level, publicly-available flood risk information for the entire United States.
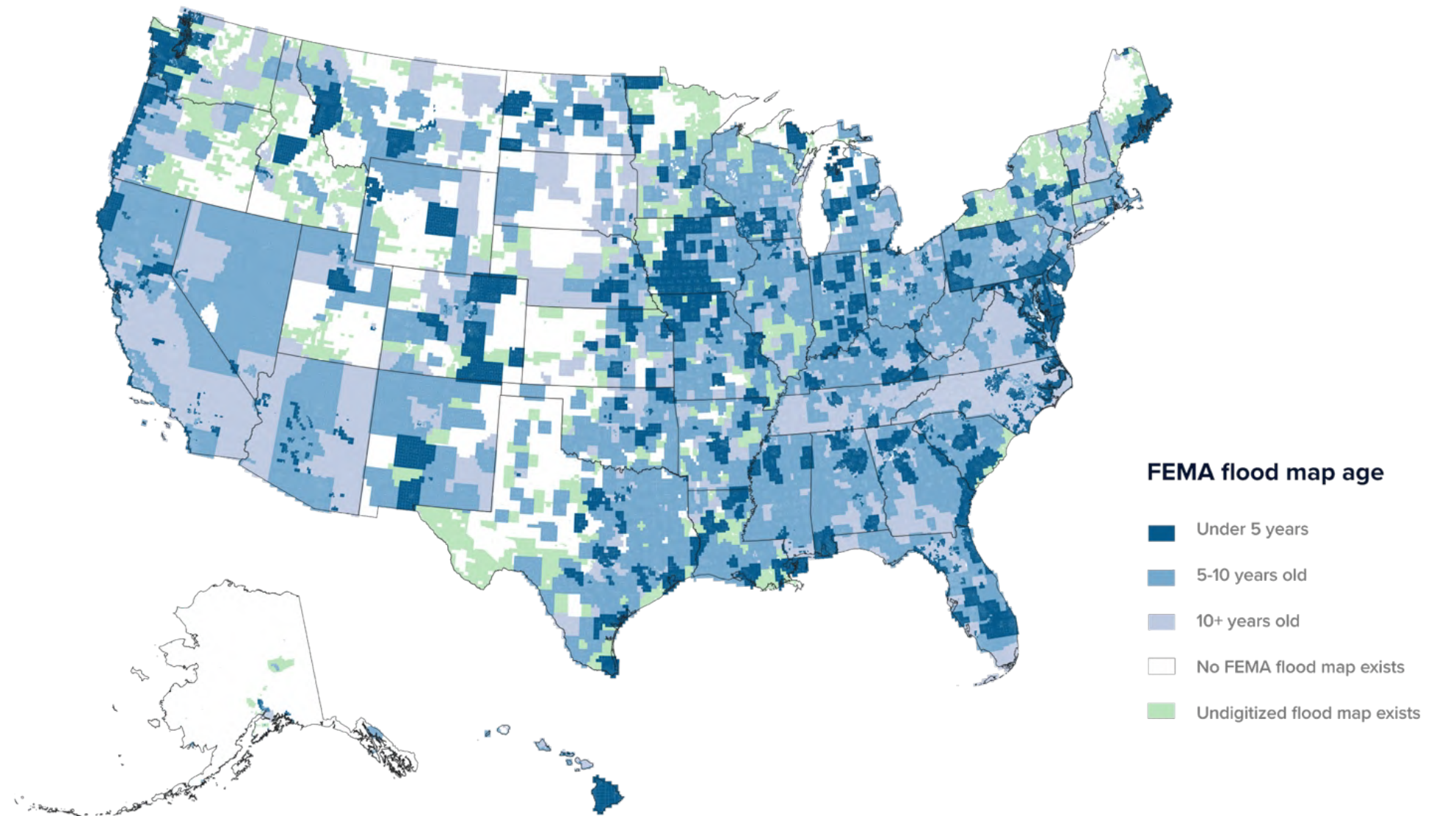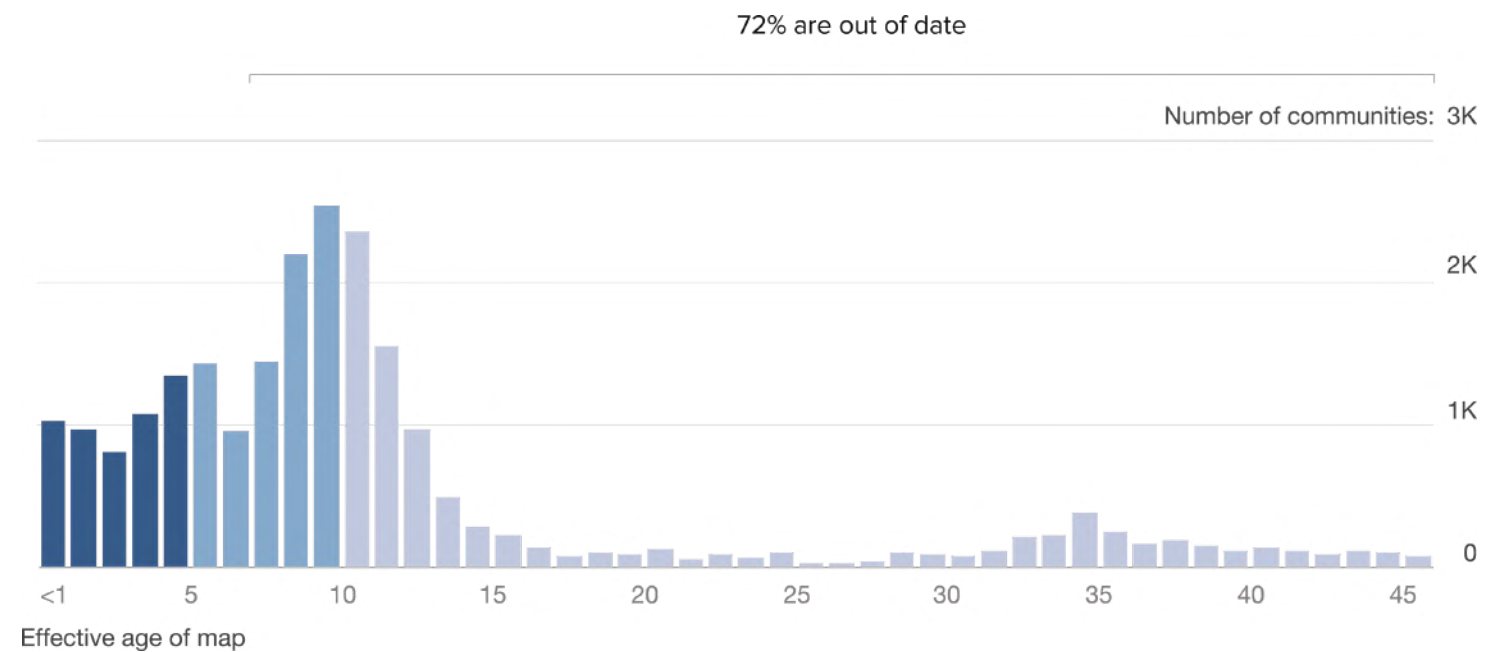
By democratizing this peer-reviewed flood risk data, First Street empowers Americans to protect their most valuable asset - their homes.

First Street build an expert team to develop the first comprehensive, publicly available flood risk assessment for each of 142M properties in the contiguous US.

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FEMA flood maps are out of date.

According to the National Flood Insurance Reform Act of 1994, FEMA must review and update all flood maps every 5 years. Currently 75% are out of date and 11% date back to 70's and 80's and roughly 40% of the country has never been mapped.


72% are out of date

Number of communities: 3K

2K

1K

0

<1   5   10   15   20   25   30   35   40   45

Effective age of map

FEMA flood map age

- Under 5 years
- 5-10 years old
- 10+ years old
- No FEMA flood map exists
- Undigitized flood map exists

We will complement FEMA's technical approach to solve this problem.

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F O U N D A T I O N

Until the total flood risk for every home in America is effectively calculated and communicated, property owners, buyers and renters will continue to suffer.

First Street Foundation has assembled a group of over 80 experts, scientists, economists and technologists to define flood risk and address this problem.

Difference in number of properties at *substantial flood risk* (FSF) compared to FEMA

More properties at risk in FSF model ⟶

0.5x 1x 2x 3x 4x 5x 6x 7x 8x   No data
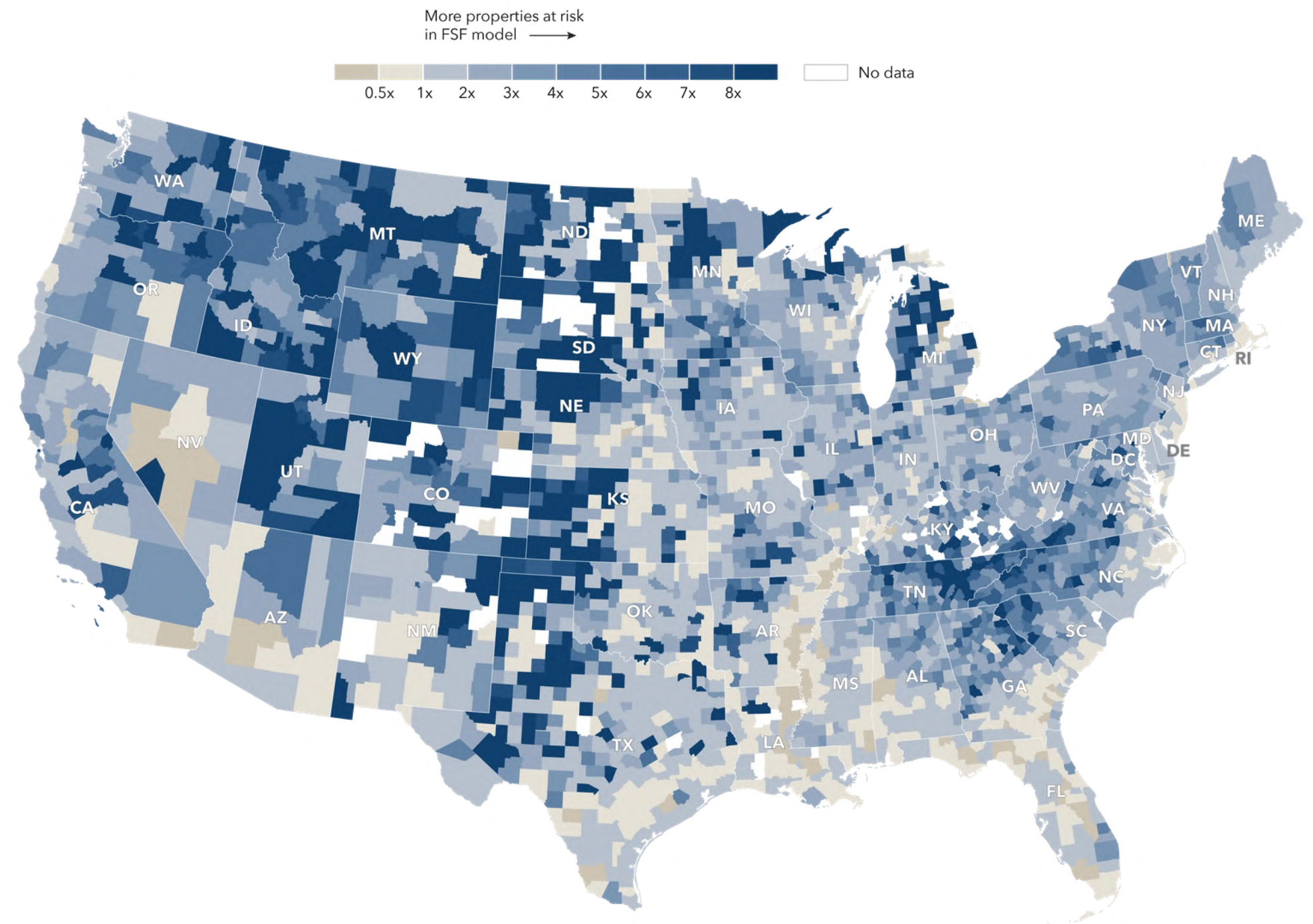
*Substantial risk is calculated as inundation 1 cm or more to the building in the 100-year return period (1% annual risk)

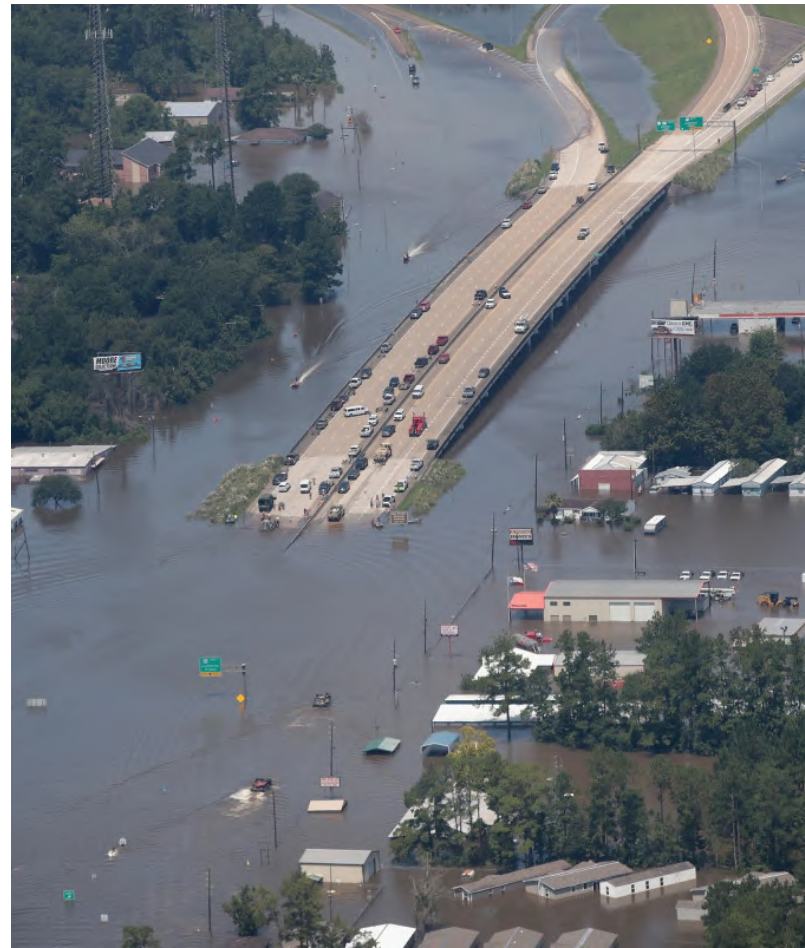# We began by modeling every major flood type.

KING TIDES

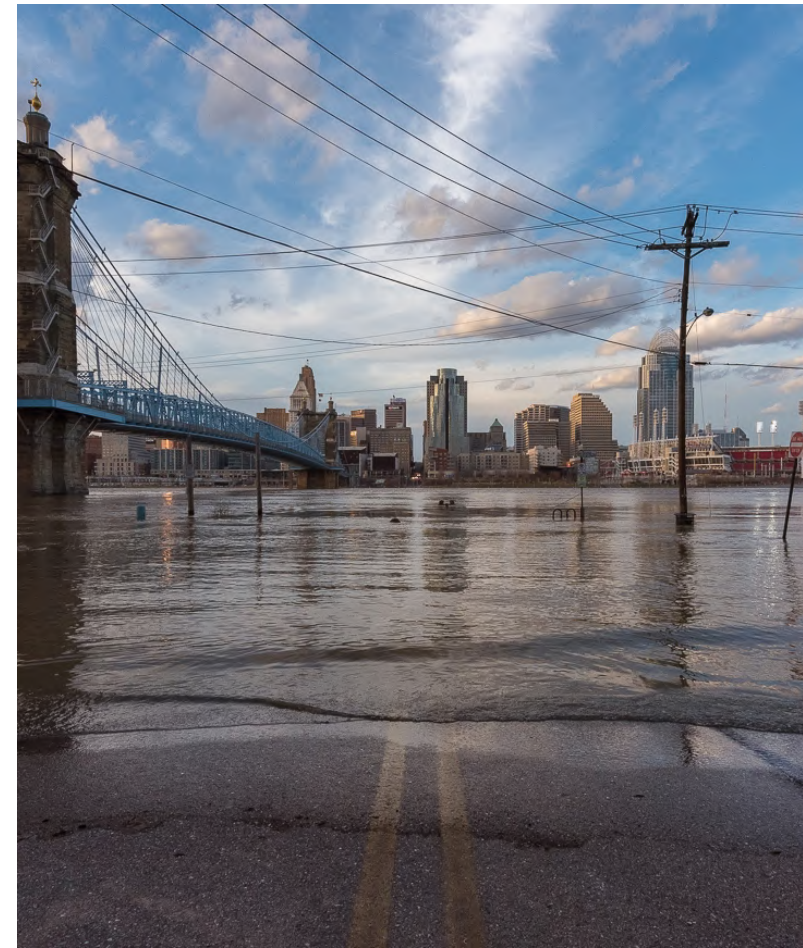## Tidal

Tidal flooding in Miami

PRECIPITATION

Pluvial

Pluvial flooding in Houston

RIVERINE

Fluvial

Fluvial flooding in Cincinnati
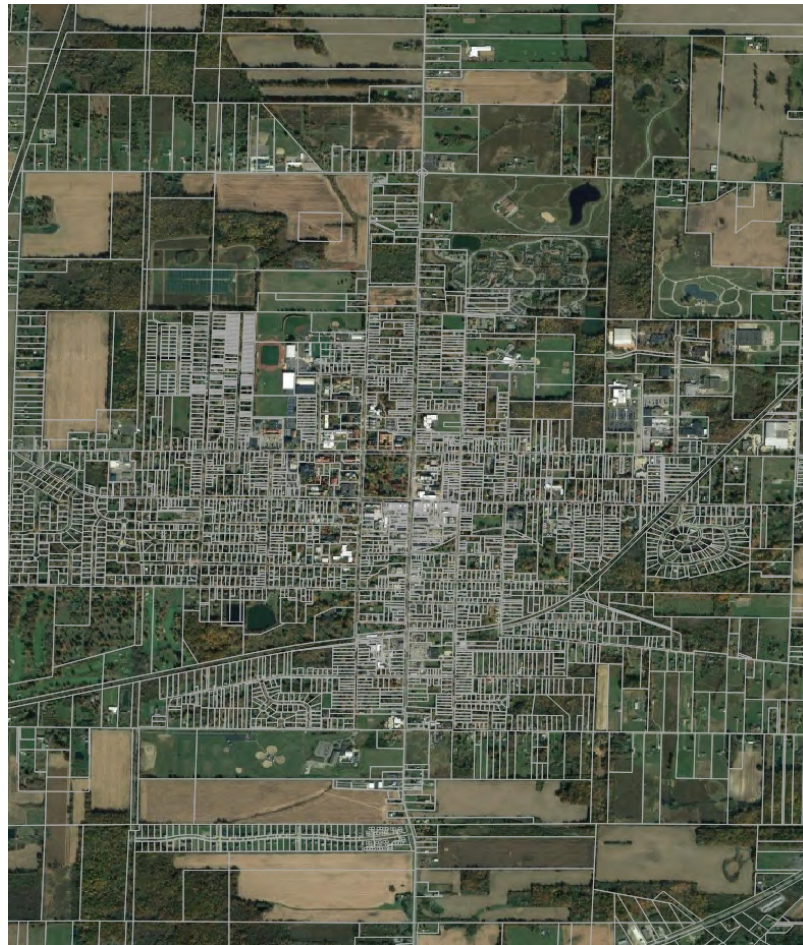
HURRICANE

Surge
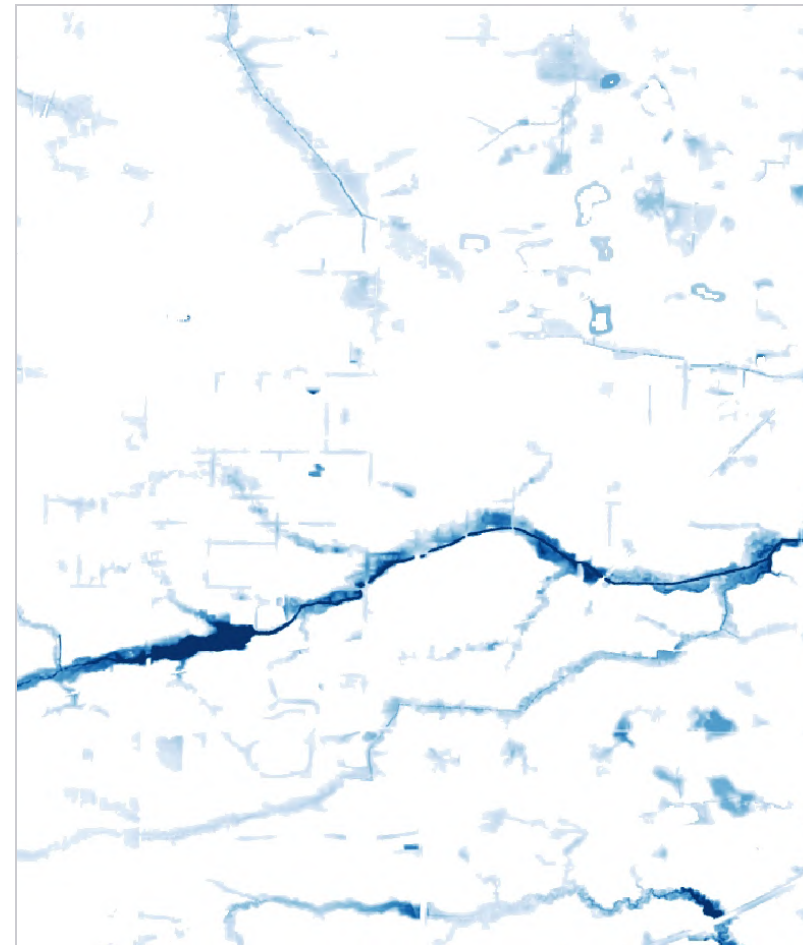

Surge flooding in Wilmington

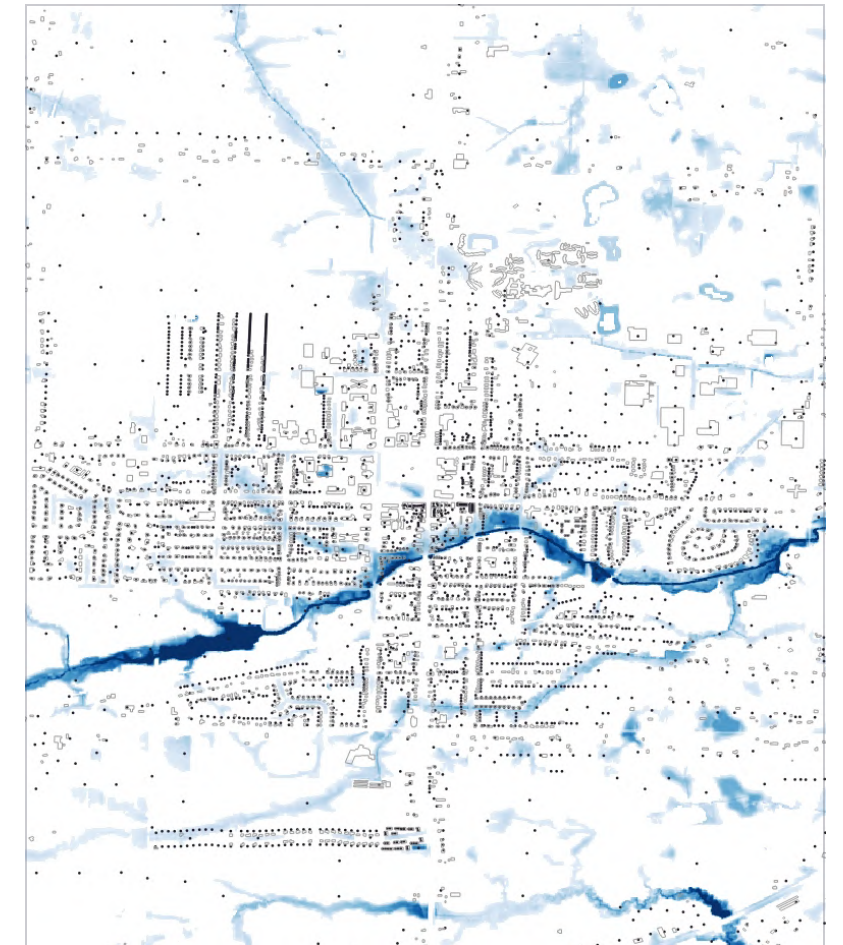# Determining a property's flood risk.

Parcel data

Building footprints


Hazard layer

Max depth

Edge of building footprint or depth at property centroid.

FEMA Flood maps only look at historical flooding events.

FEMA flood maps are created by calculating the frequency and impact of historic flooding events and do not account for any future environmental changes.

Sea levels

The ocean has risen 8.5 inches nationally since 1950 and is projected to rise another 4.5 inches by 2050. This increases tidal flooding and hurricane storm surge.

+13.0"
2050
+8.5"
2017
1950
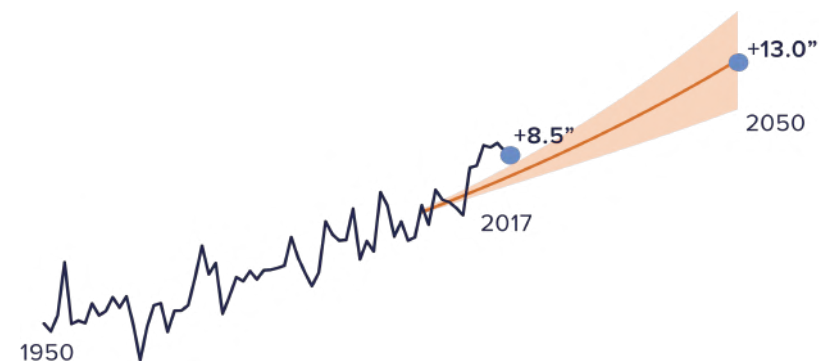
Observation Source: CSIRO
Projections Source: IPCC

Surface temperatures

The atmosphere is 1.9 degrees (F) warmer than it was in 1950. It is projected to warm another 1.28 degrees (F) by 2050. This impacts the frequency and intensity of pluvial (precipitation) and fluvial (riverine) flooding.

+3.19°
2050
+1.91°
2015
1950
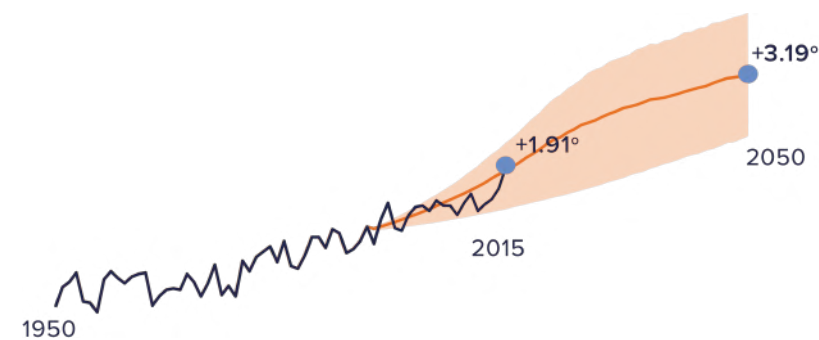
Observation Source: EPA
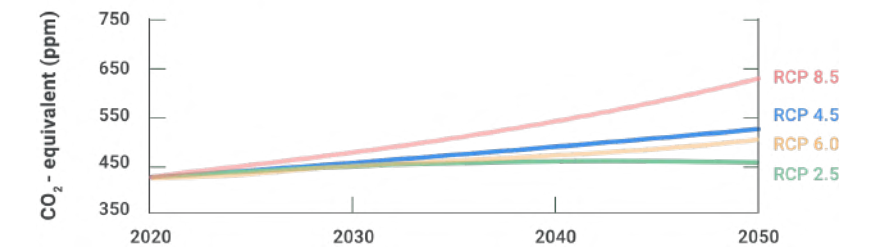Projections Source: IPCC

Sea surface temperatures

The sea's surface temperature is 1.5 degrees (F) warmer than it was in 1950. It will rise another 0.5 degrees (F) by 2050. This impacts the intensity and geographic area hurricanes make landfall.

+2.0°
2050
+1.5°
2015
1950
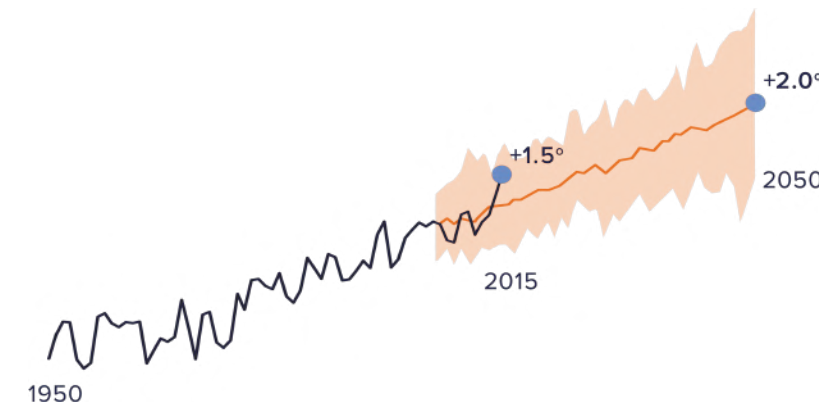
Observation Source: EPA
Projections Source: IPCC

IPCC Representative Concentration Pathways

CO$_2$ - equivalent (ppm)
750
650
550
450
350
2020   2030   2040   2050
RCP 8.5
RCP 4.5
RCP 6.0
RCP 2.5

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Adaptation database.

Over 23,000 features.

40 adaptation types (levees, seawalls, pumps, etc).

Green and grey infrastructure.

Post processing of hazard layers includes the effects of major infrastructure and adaptation features, with protection up to documented design standards (no dynamic operations).

Nationwide   ● **Cincinatti, Ohio**

23,044	**14.6M**	**Levee**	**500**	**Fluvial**	**7,862**
Total adaptation	Properties protected	Cincinnati Leveed Area	Return period	Scenario	Properties protected
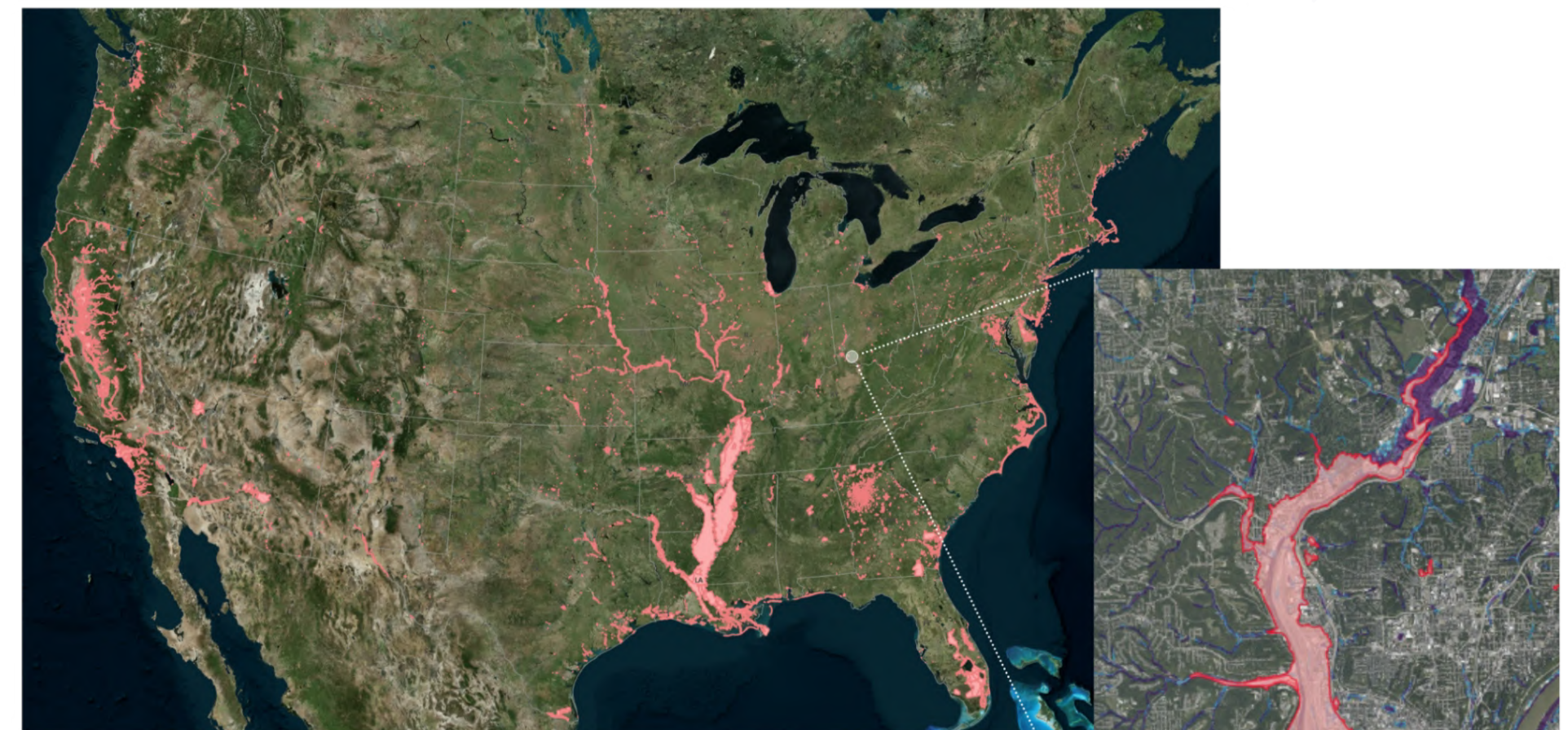
■ Areas of protection   ▮▮▮▮▮ Depth of flooding simulated
                          0.5 1   2   3+ ft   1/100 flood event in 2020

Sources of input data.

Precipitation frequency

NOAA Atlas 14

River flows

USGS Stream Gauge data

Tide and surge data

NOAA Tide Gauges

Elevation data

USGS National Elevation Database
supplemented with high res local
datasets (e.g. lidar)

Climate forecasts

CMIP5 simulations (21 models, RCP 4.5)

Downscaled data from NASA NEX-GDDP

Historic

USGS High Water Mark data

NFIP flood claims

FEMA Individual Assistance claims

Hurricanes

Synthetic Hurricane Tracks from K. Emmanuel

NOAA IBTrACS Historical Hurricane tracks

Property info

Property boundaries from LightBox/DMP

Building footprints from MapBox and Microsoft

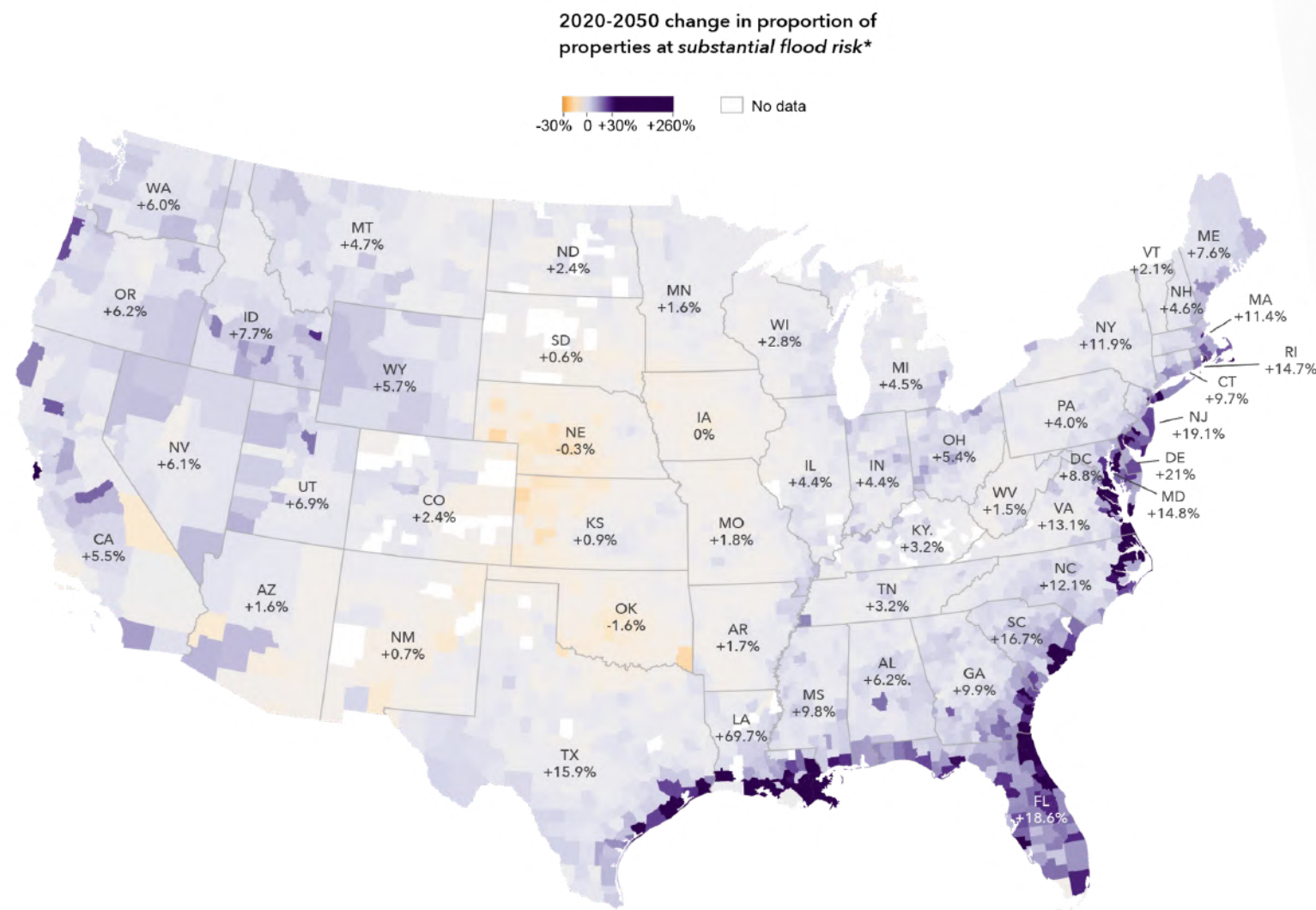FEMA Flood Zone (estimated) from MassiveCert

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Open, transparent methods and public data.

First Street's detailed technical methodology is publicly available on our website, providing transparency to how we built our national flood model and define risk. Numerous National Reports discussing our model's findings and are also freely available.
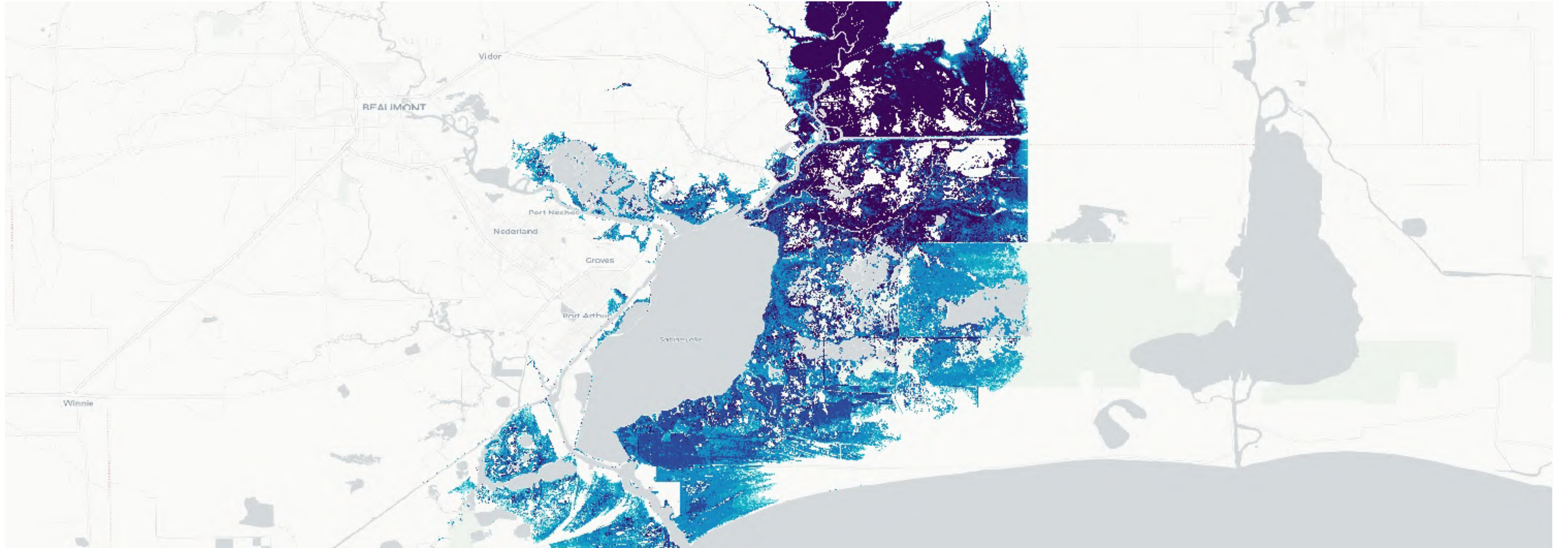
Sources:

Technical Methodology

National Report

Flood Factor

2020-2050 change in proportion of properties at *substantial flood risk**

-30%   0 +30%   +260%   ☐ No data

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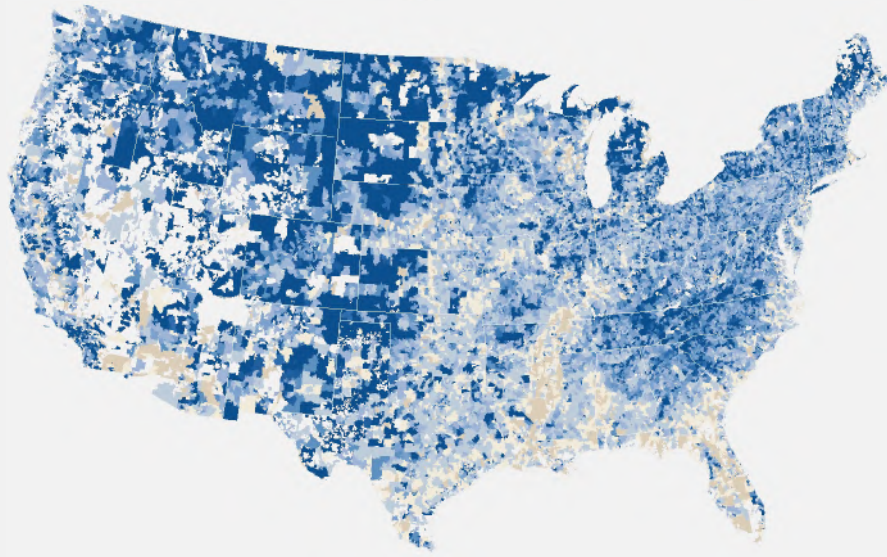
River flood near Beaumont, TX

Publicly available data

First Street climate risk statistics.

The aggregated flood risk summary statistics datasets that we currently offer through the AWS platform are formatted as comma separated value (CSV) files organized by congressional district, county, and ZIP code.
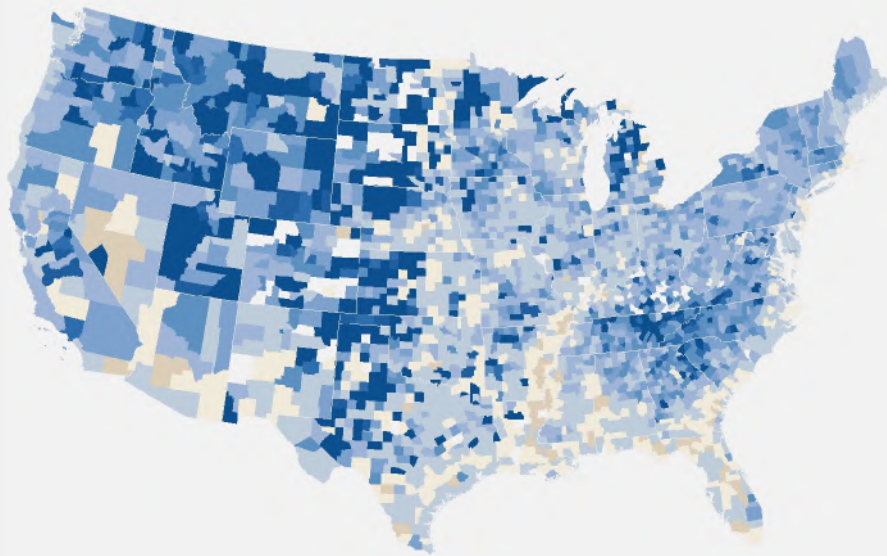
County level

Zip level

FEMA SFHA stats

FSF scenarios

FSF - FEMA comparison

Flood Factor scores

| Count property	Total properties
count_fema_sfha	Number of properties in FEMA SFHA
pct_fema_sfha	Percent of properties in FEMA SFHA
count_fs_risk_2020_5	Number of properties flooded in the First Street return period 5 scenario for 2020
pct_fs_risk_2020_5	Percent of properties flooded in the First Street return period 5 scenario for 2020
count_fs_risk_2050_5	Number of properties flooded in the First Street return period 5 scenario for 2050
pct_fs_risk_2050_5	Percent of properties flooded in the First Street return period 5 scenario for 2050
count_fs_risk_2020_100	Number of properties flooded in the First Street return period 100 scenario for 2020
pct_fs_risk_2020_100	Percent of properties flooded in the First Street return period 100 scenario for 2020
count_fs_risk_2050_100	Number of properties flooded in the First Street return period 100 scenario for 2050
pct_fs_risk_2050_100	Percent of properties flooded in the First Street return period 100 scenario for 2050
count_fs_risk_2020_500	Number of properties flooded in the First Street return period 500 scenario for 2020
pct_fs_risk_2020_500	Percent of properties flooded in the First Street return period 500 scenario for 2020
count_fs_risk_2050_500	Number of properties flooded in the First Street return period 500 scenario for 2050
pct_fs_risk_2050_500	Percent of properties flooded in the First Street return period 500 scenario for 2050
count_fs_fema_difference_2020	Difference in number of properties at risk between First Street and FEMA for the 100 year flood in 2020
pct_fs_fema_difference_2020	Percent-point difference in properties at risk between First Street and FEMA for the 100 year flood in 2020
avg_risk_score_all	Average Flood Factor risk score - all properties
avg_risk_score_2_10	Average Flood Factor risk score among properties with risk - properties with risk score 2-10, excluding 1 (minimal risk)
avg_risk_fsf_2020_100	Average Flood Factor risk score - properties with flooding in the First Street return period 100 scenario for 2020
avg_risk_fsf_2020_500	Average Flood Factor risk score - properties with flooding in the First Street return period 500 scenario for 2020
avg_risk_score_sfha	Average Flood Factor risk score - properties within FEMA SFHA
avg_risk_score_no_sfha	Average Flood Factor risk score - properties outside of FEMA SFHA
count_floodfactor1	Number of properties with Flood Factor risk score = 1
count_floodfactor2	Number of properties with Flood Factor risk score = 2
count_floodfactor3	Number of properties with Flood Factor risk score = 3
count_floodfactor4	Number of properties with Flood Factor risk score = 4
count_floodfactor5	Number of properties with Flood Factor risk score = 5
count_floodfactor6	Number of properties with Flood Factor risk score = 6
count_floodfactor7	Number of properties with Flood Factor risk score = 7
count_floodfactor8	Number of properties with Flood Factor risk score = 8
count_floodfactor9	Number of properties with Flood Factor risk score = 9
count_floodfactor10	Number of properties with Flood Factor risk score = 10

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Accessing First Street data on AWS.

1. Create a free AWS account here
2. Login
3. Go to the First Street Foundation AWS S3 Bucket
4. Open folder v1.0 (or other versions) to download available datasets
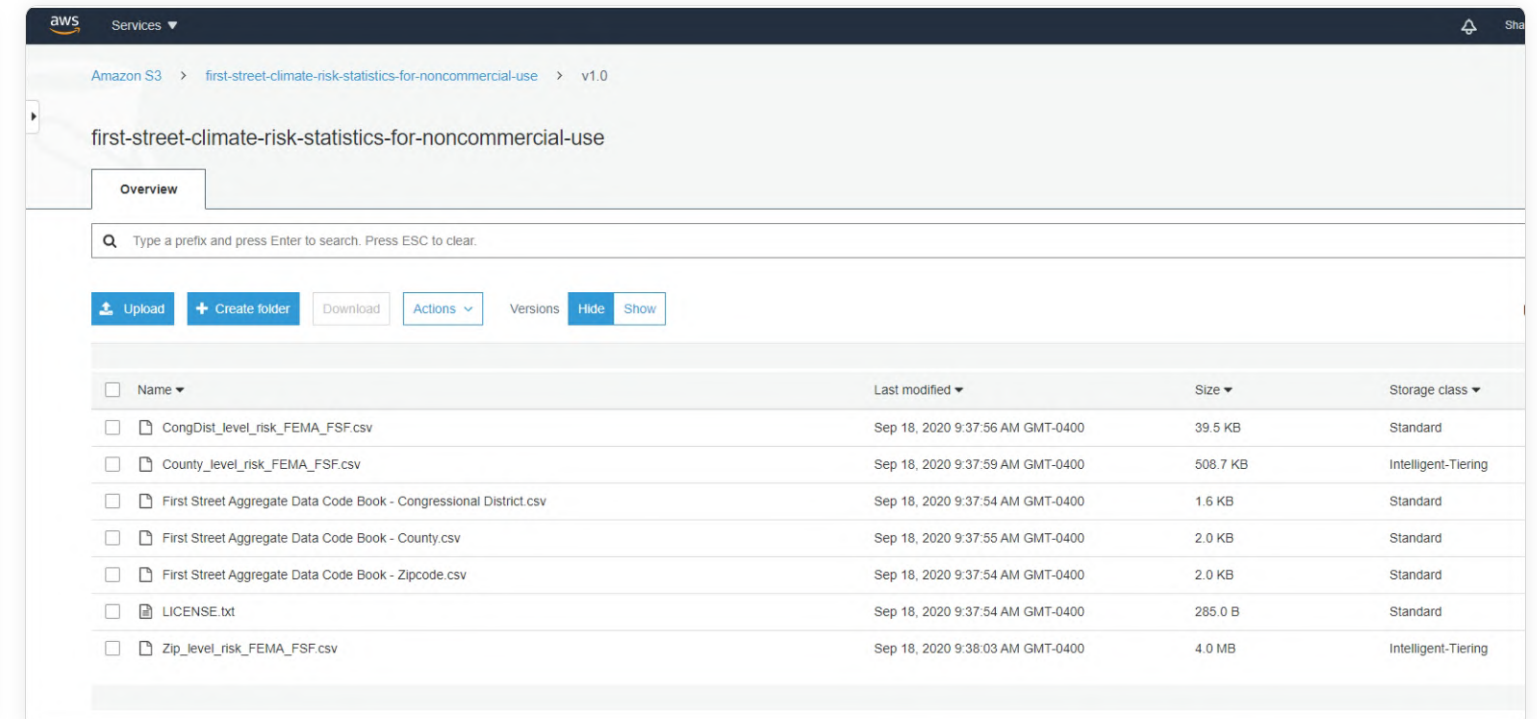
Step 1 & 2
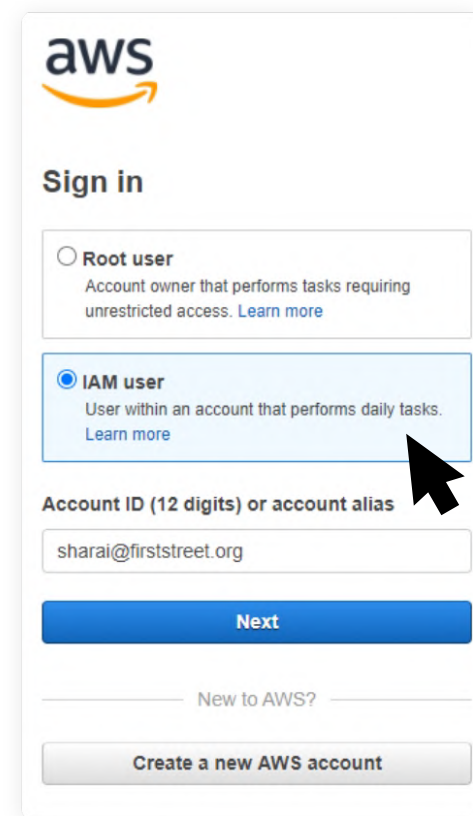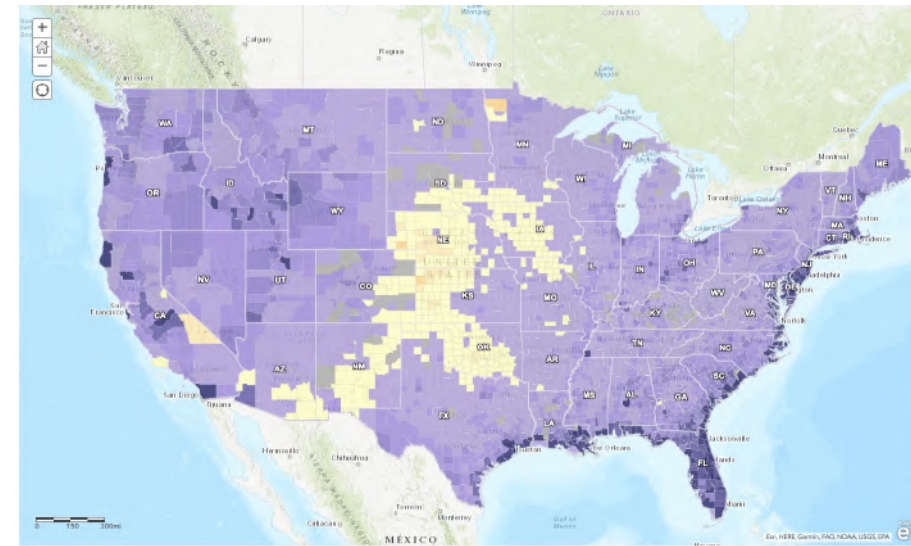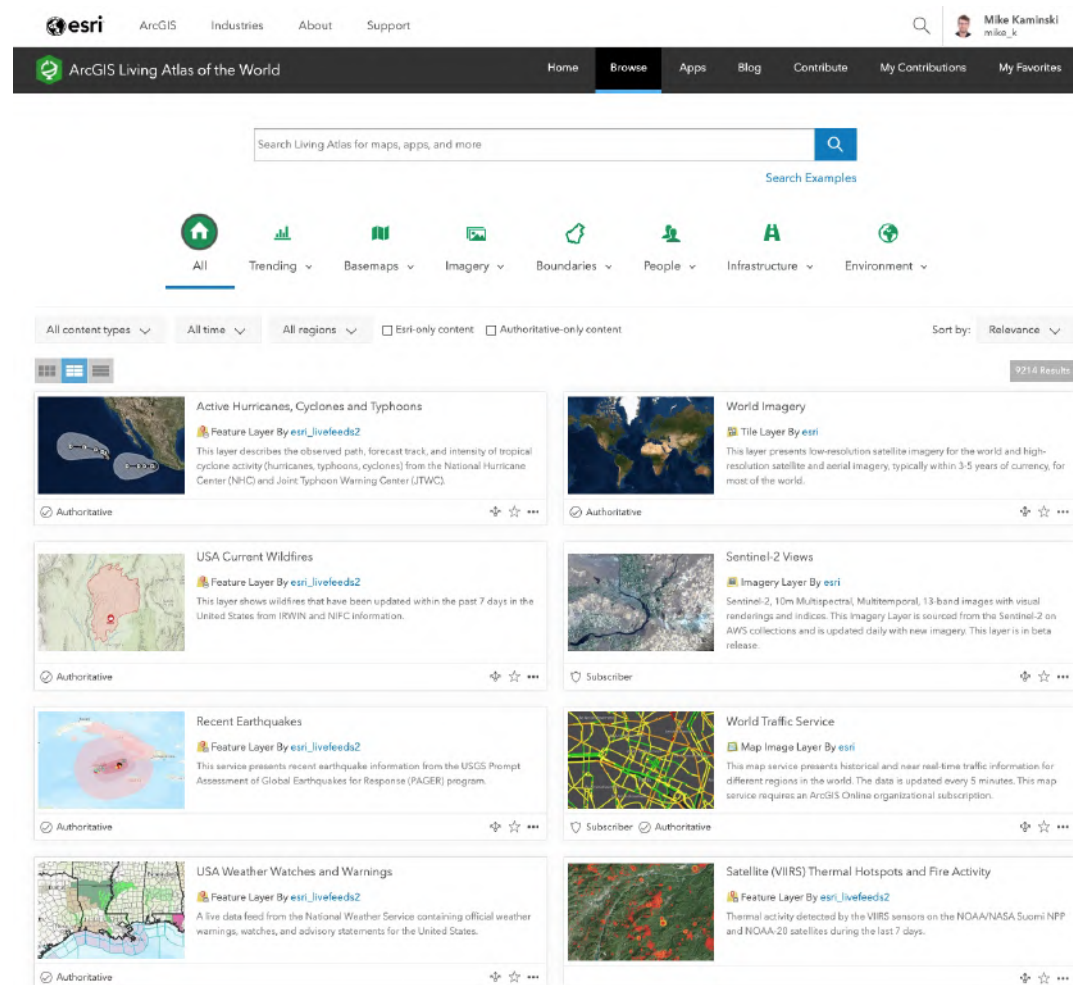
Step 3
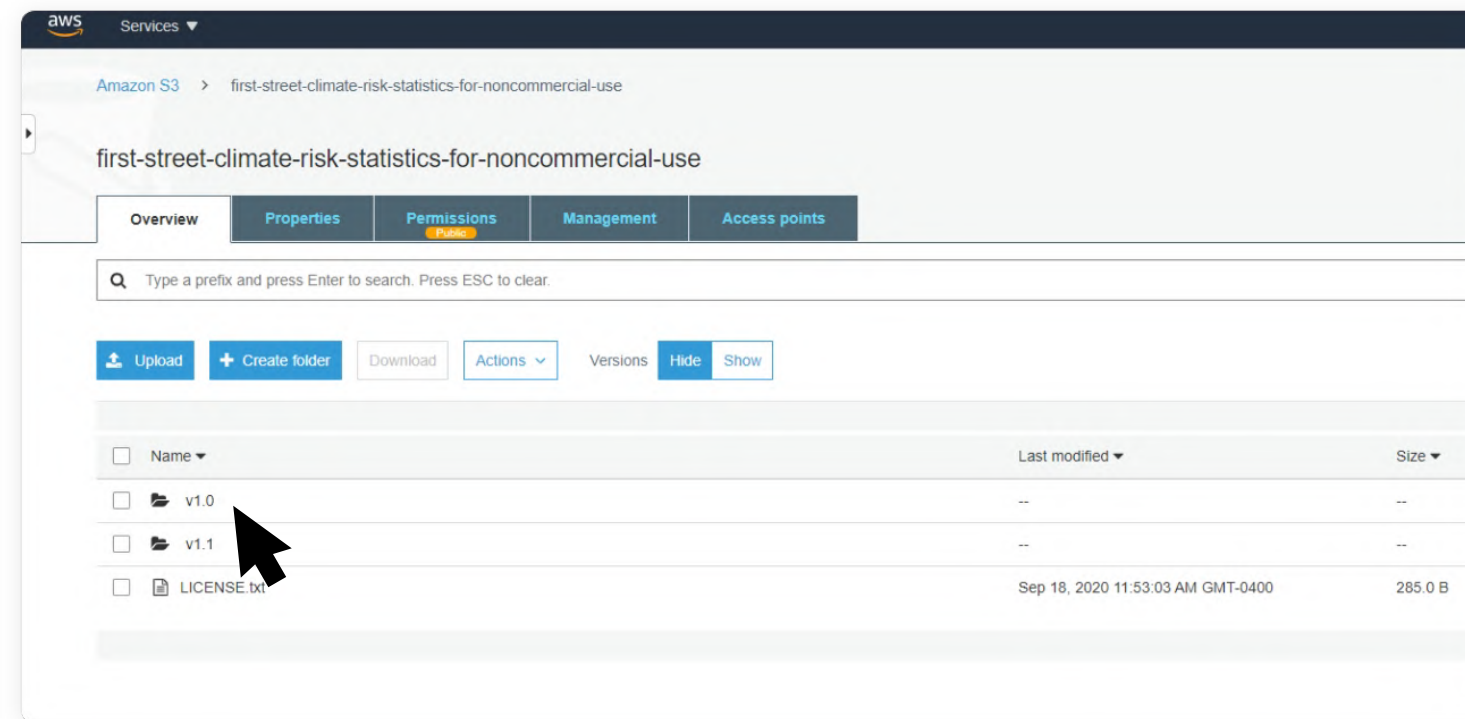
Step 4

ESRI Living Atlas of the World

Flood risk summary statistics available on Living Atlas

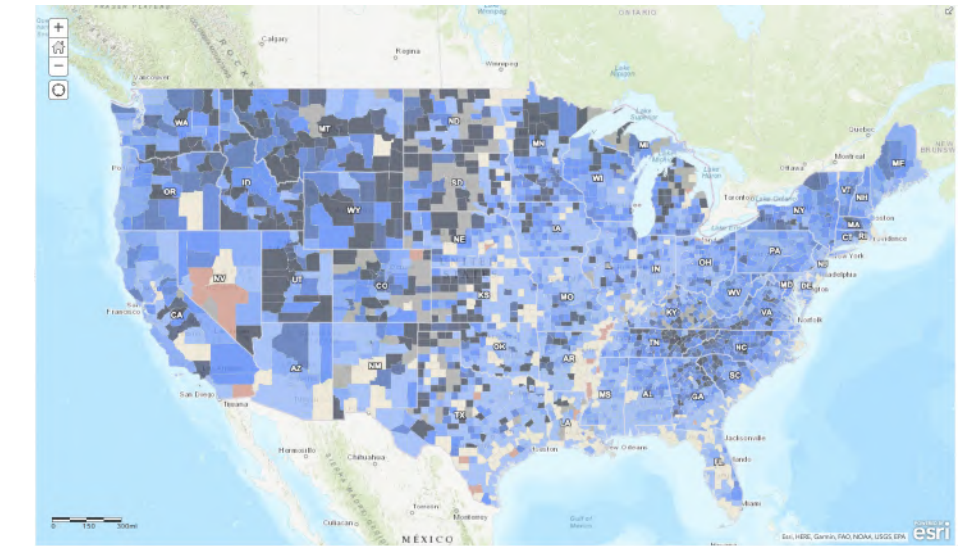ESRI platform for hosting expertly curated and authoritative spatial data layers

Data layers already symbolized to instantly visualize meaning

Accessible across all ESRI products

- Further symbolize, run analyses, download, etc.

Full dataset

FEMA comparison data bundle
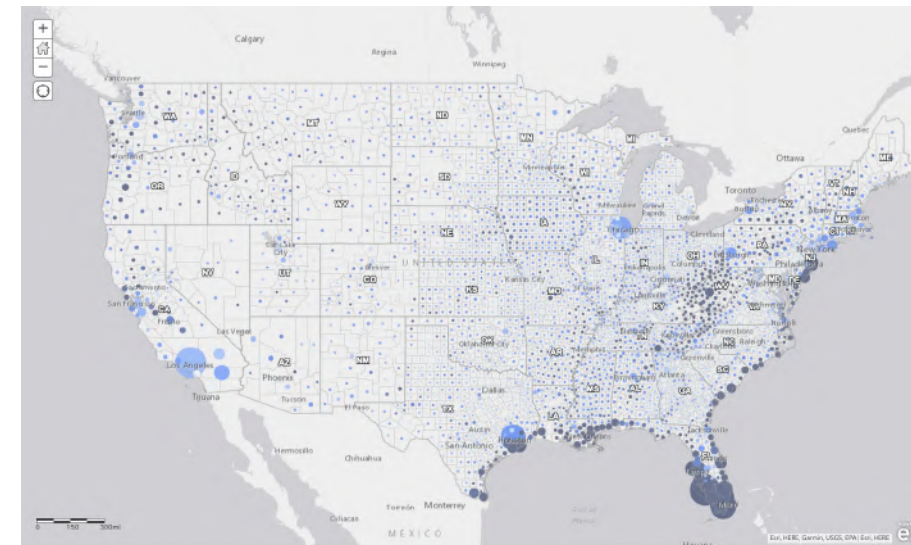
Modeled return periods data bundle
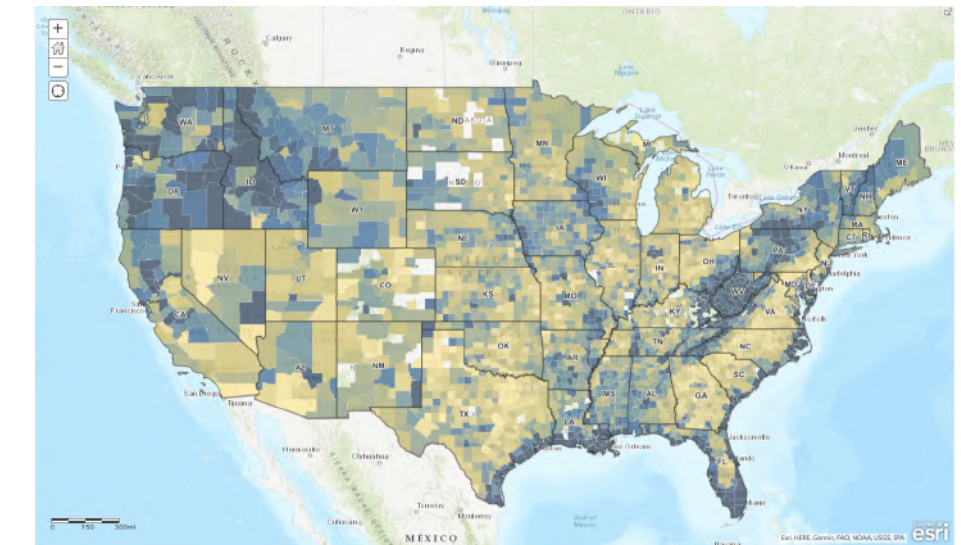
Flood Factor risk scores data bundle

River flood near Beaumont, TX

Paid data access

Available Data

Property-Level Flood Risk Statistics

- Access any property's Flood Factor®, risk summary, and how risks are evolving over time due to environmental changes
- Includes flood projections through 2051 for 5 return periods and 3 depth thresholds with ranges for uncertainty
- Risk information from modeled historic events
- Degree of protection from adaptation
- See data dictionary page for further details and sample data

Map Hazard Layers

- 3 meter resolution
- Historic storm extents, present risk, and risk in 30 years
- Available at the 2, 5, 20, 100, and 500-year return periods
- See data dictionary page for further details and sample data

Commercial AAL Data Reports

- Custom vulnerability reports
- Include
  - Depth of flooding
  - Structural damages in repair costs
  - Downtime in days closed
- Estimates available for the 2, 5, 20, 100, & 500-year return periods, and for the year 2021 & 2051
- See data dictionary page for further details and sample data

Map Hazard Layers

Property-Level Statistics
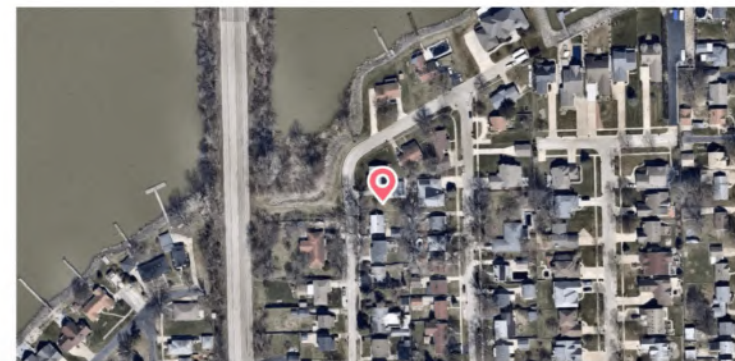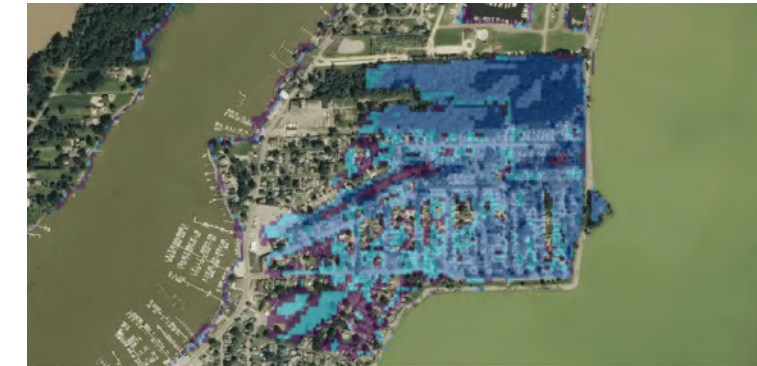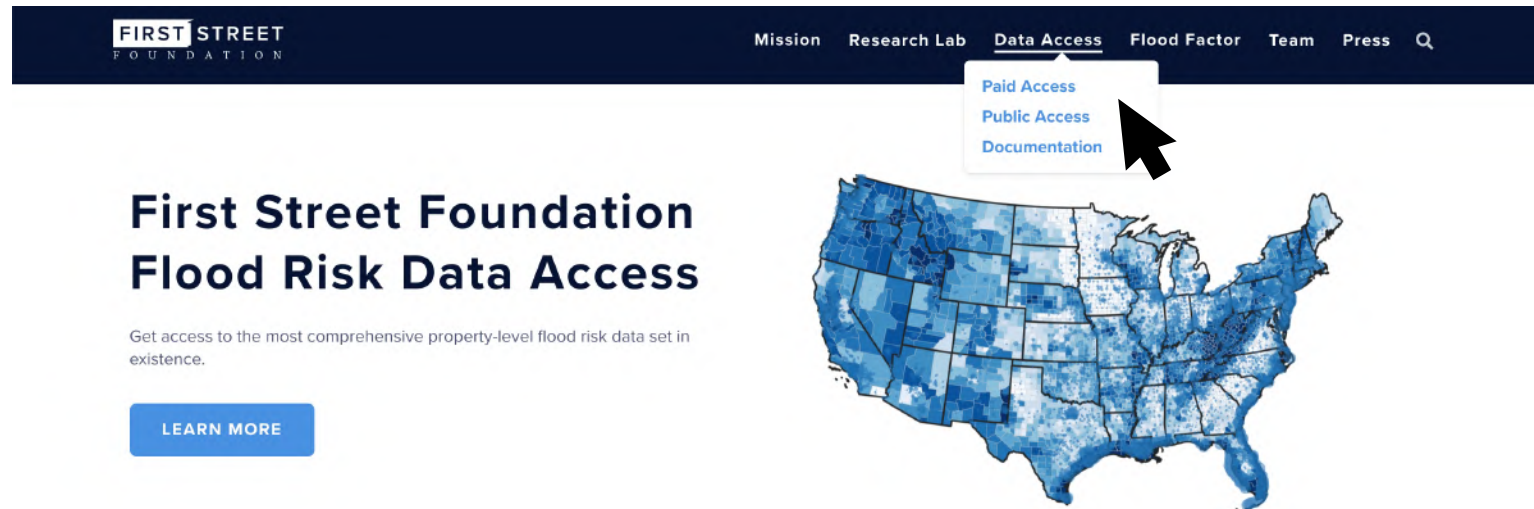

Commercial AAL Data Reports

Using Our Data Access Page

1. Visit firststreet.org and navigate to our Paid Data Access page
2. Fill out pricing calculator for State or County of interest
3. Click request data and complete the data purchase request form
4. For a national dataset or custom partnership, follow link at bottom of page and submit a proposal

Step 1

Modeled return periods data bundle

Step 2-4
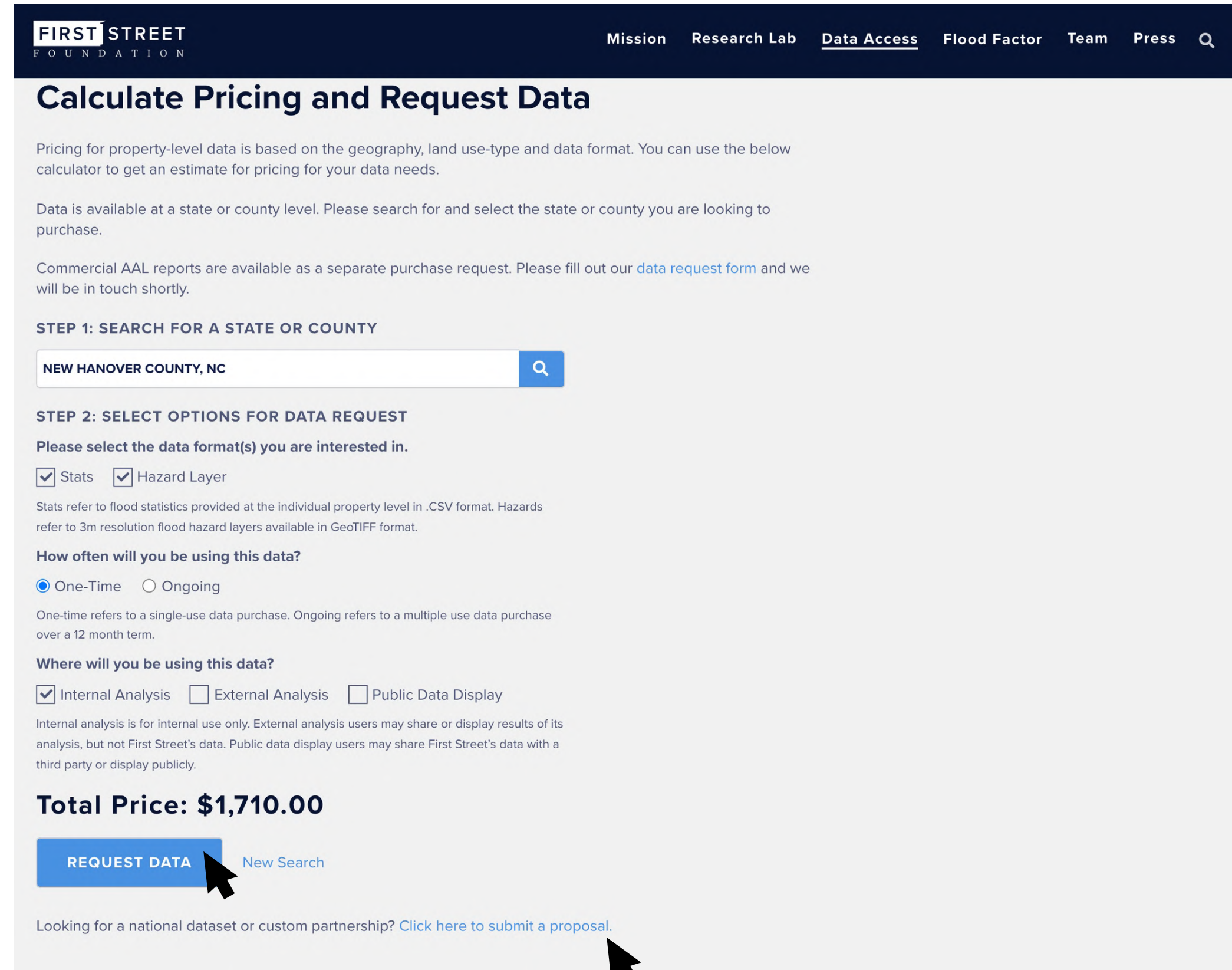
Thank you

contact: datashare@firststreet.org