



# Mapping floodplains in the continental US for conservation and risk reduction.

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# Risk Reduction & Resilience





# Risk Reduction & Resilience: *The Threats*



Washington 2012



Iowa 2008



# Risk Reduction & Resilience: *Nature based solutions*





# Our Work

Policy



Partnerships



Science & Engineering





# Our Work

Puget Sound, WA



Hamilton City, CA

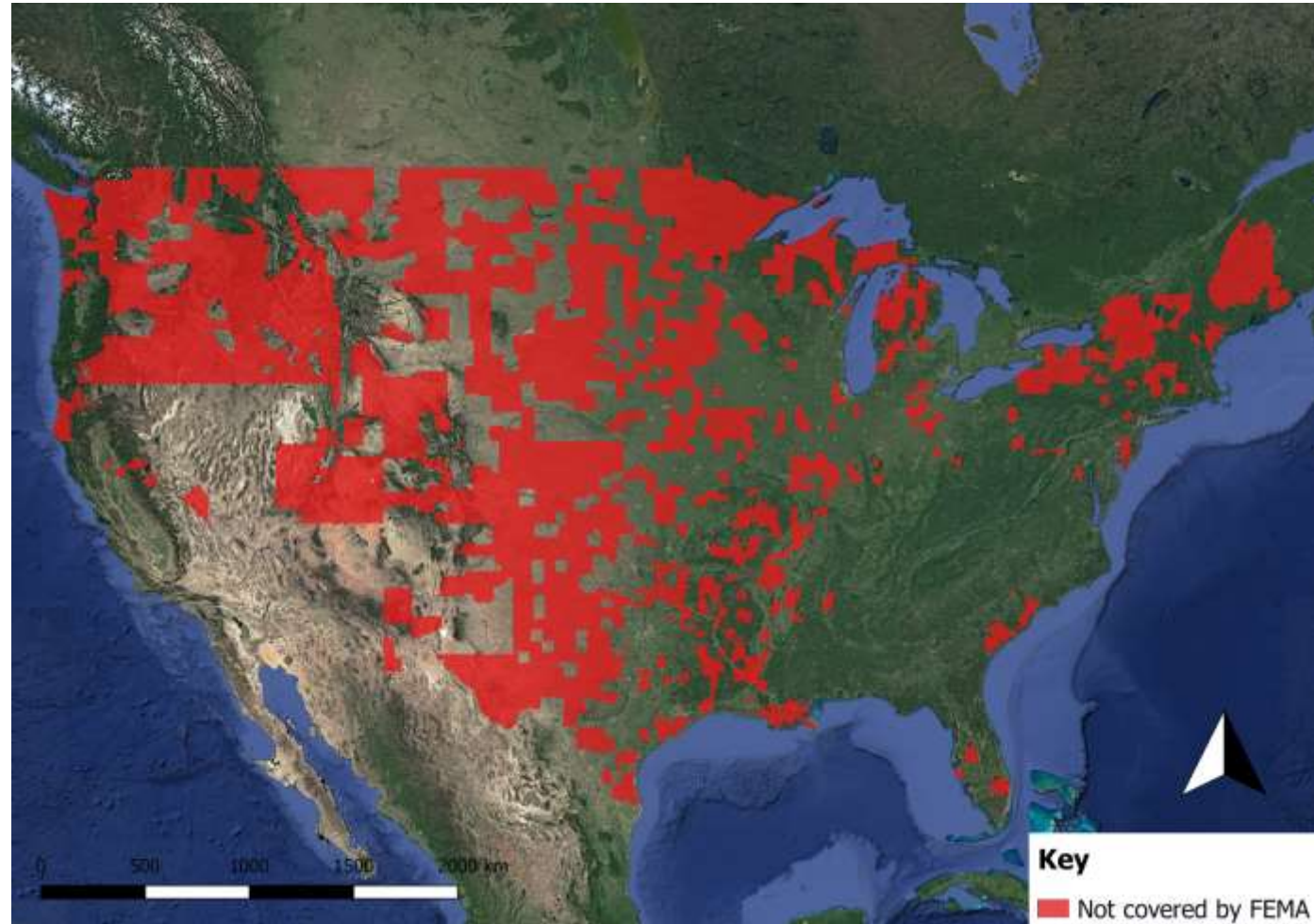


Gulf of Mexico



# Getting to scale

- Fill gaps in existing floodplain data
- Additional flood frequencies
- Inform regional planning & prioritization
- Low-cost alternative to standard flood modeling approaches





# Large-scale flood modeling of continental US

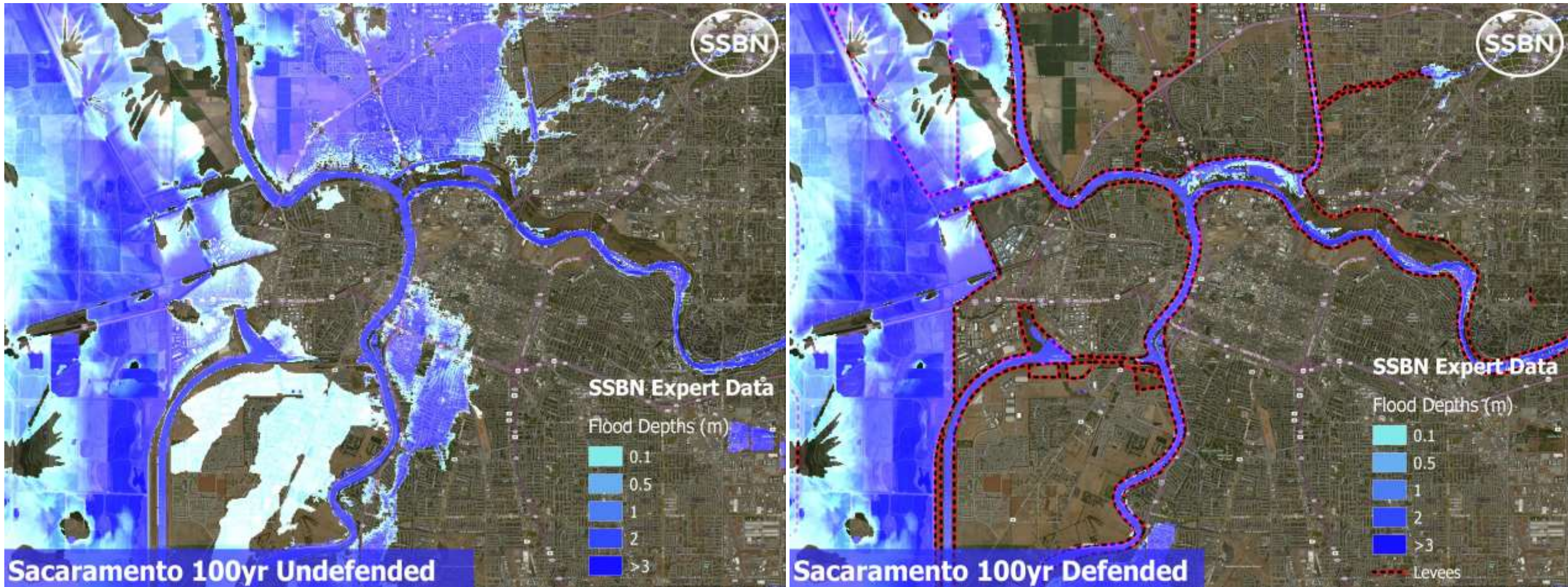
## NEW US model

- 30 m DEM
- LISFLOOD-FP routes flows through channels delineated by HydroSHEDS
- Regionalized flood frequency analysis
- 10 return periods from 5 to 1000 yrs
- Explicit representation of USACE NLD
- Methodology replicated globally with lower quality data (*Sampson et al. 2015*)





# Large-scale flood modeling of continental US



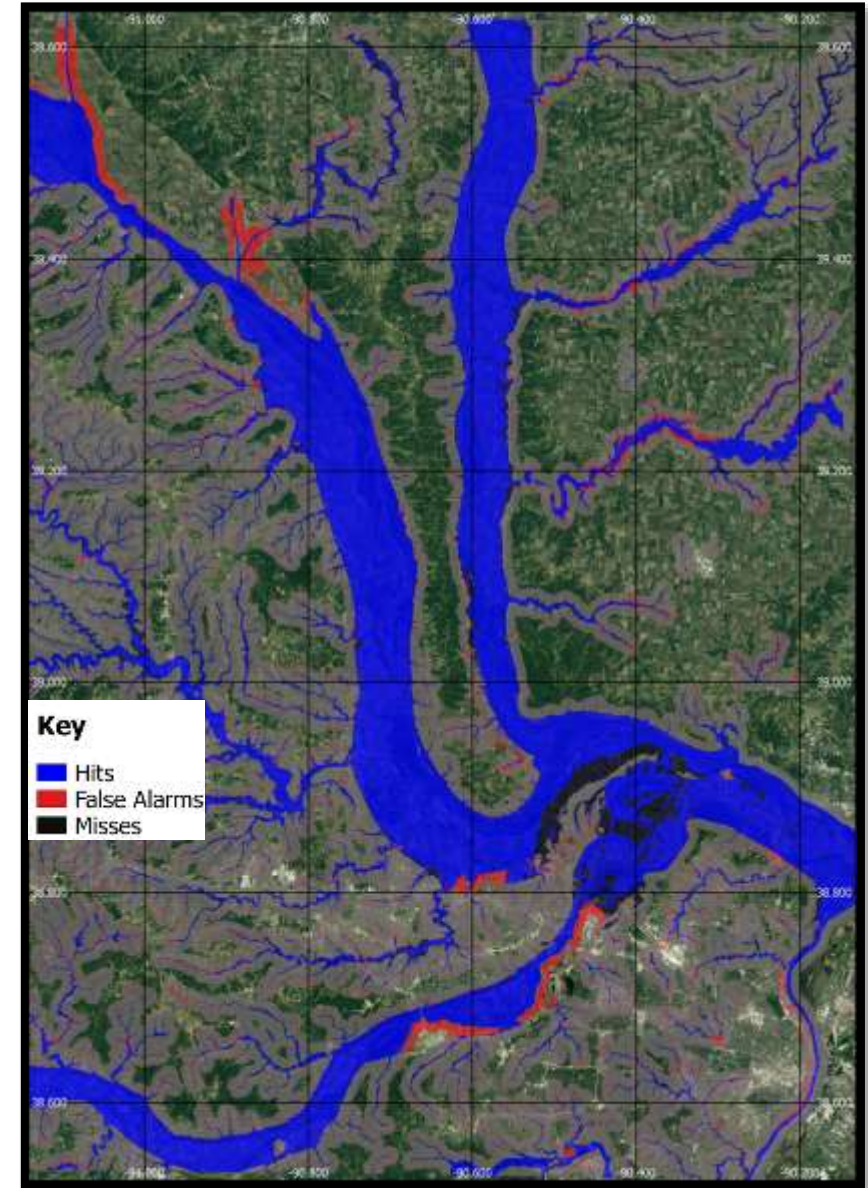


# Large-scale flood modeling: validation

## FEMA Data

- Amalgamation of local studies mapping the 1 in 100 year flood extent
- High level of agreement between FEMA and SSBN:
  - 82% of SFHA captured
  - CSI = 0.55
- performance in dominant climates:
  - Continental:  $H = 78\%$ ,  $C = 0.48$
  - Temperate:  $H = 84\%$ ,  $C = 0.59$
  - Arid:  $H = 73\%$ ,  $C = 0.43$

Wing et al *in review*

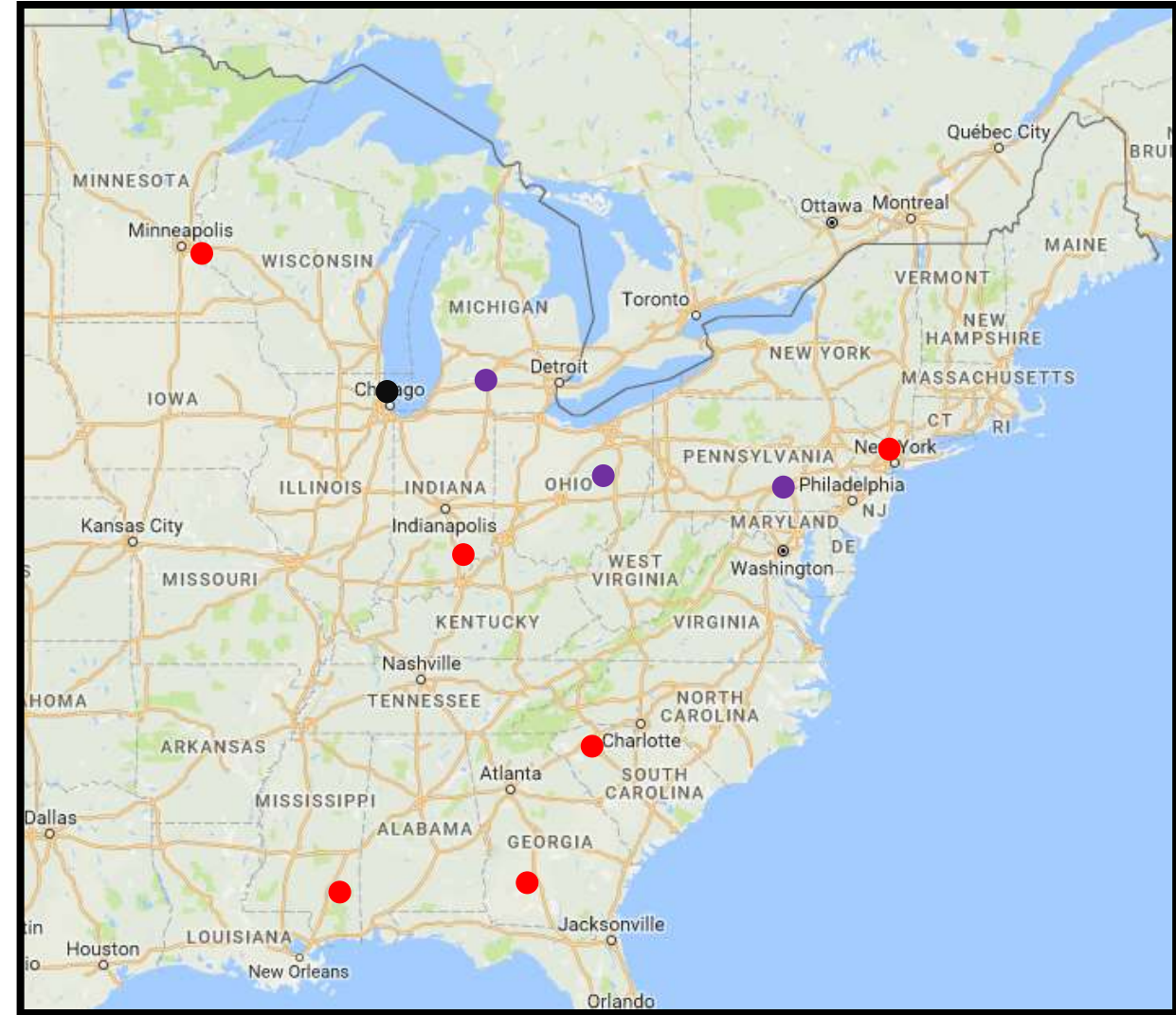




# Large-scale flood modeling: validation

## USGS Data

- 10 highly accurate local studies  
LiDAR DEMs  
surveyed bathymetry  
usually 3m resolution  
calibrated
- Design events with a 100-year recurrence interval selected
- other sites had further data on design events of varying magnitude

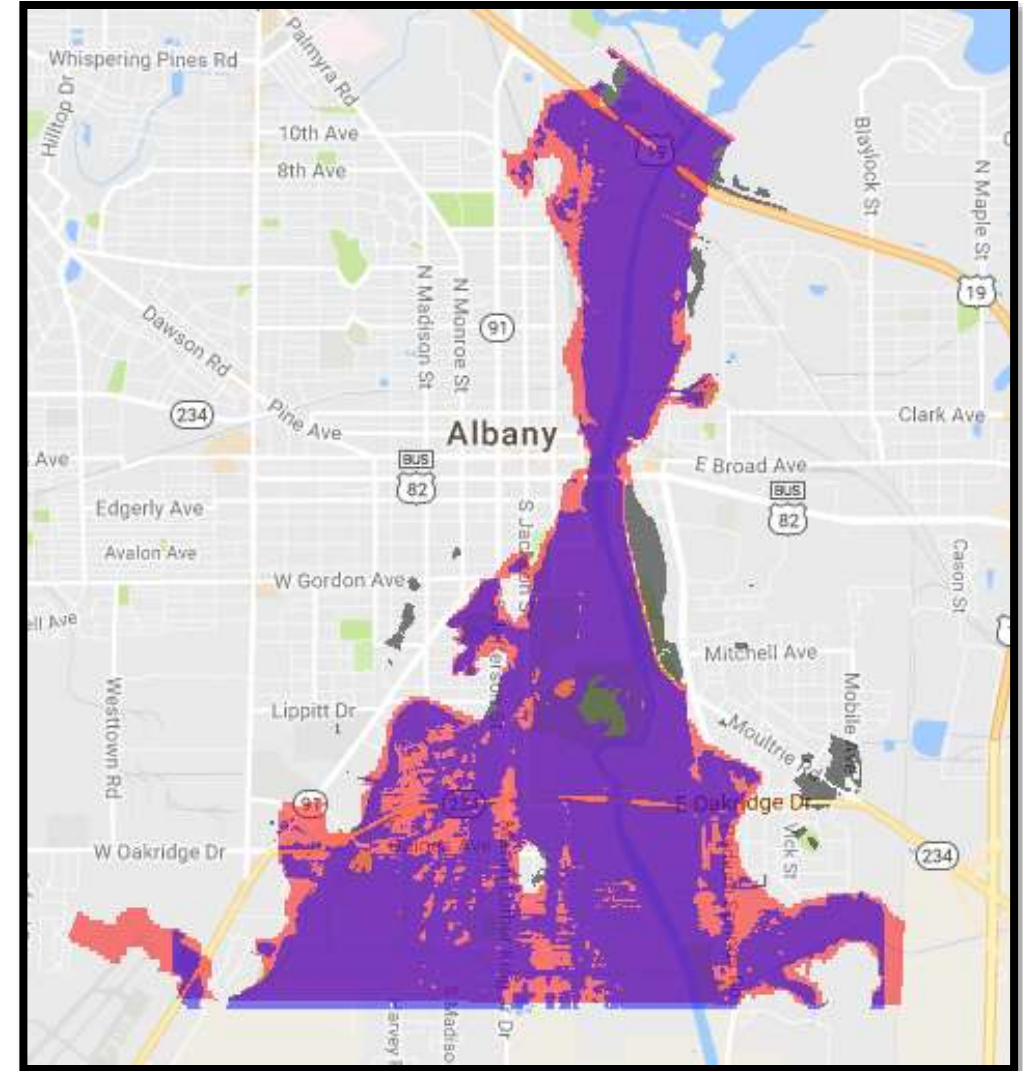




# Large-scale flood modeling: validation

USGS Data: Results (1 in 100)

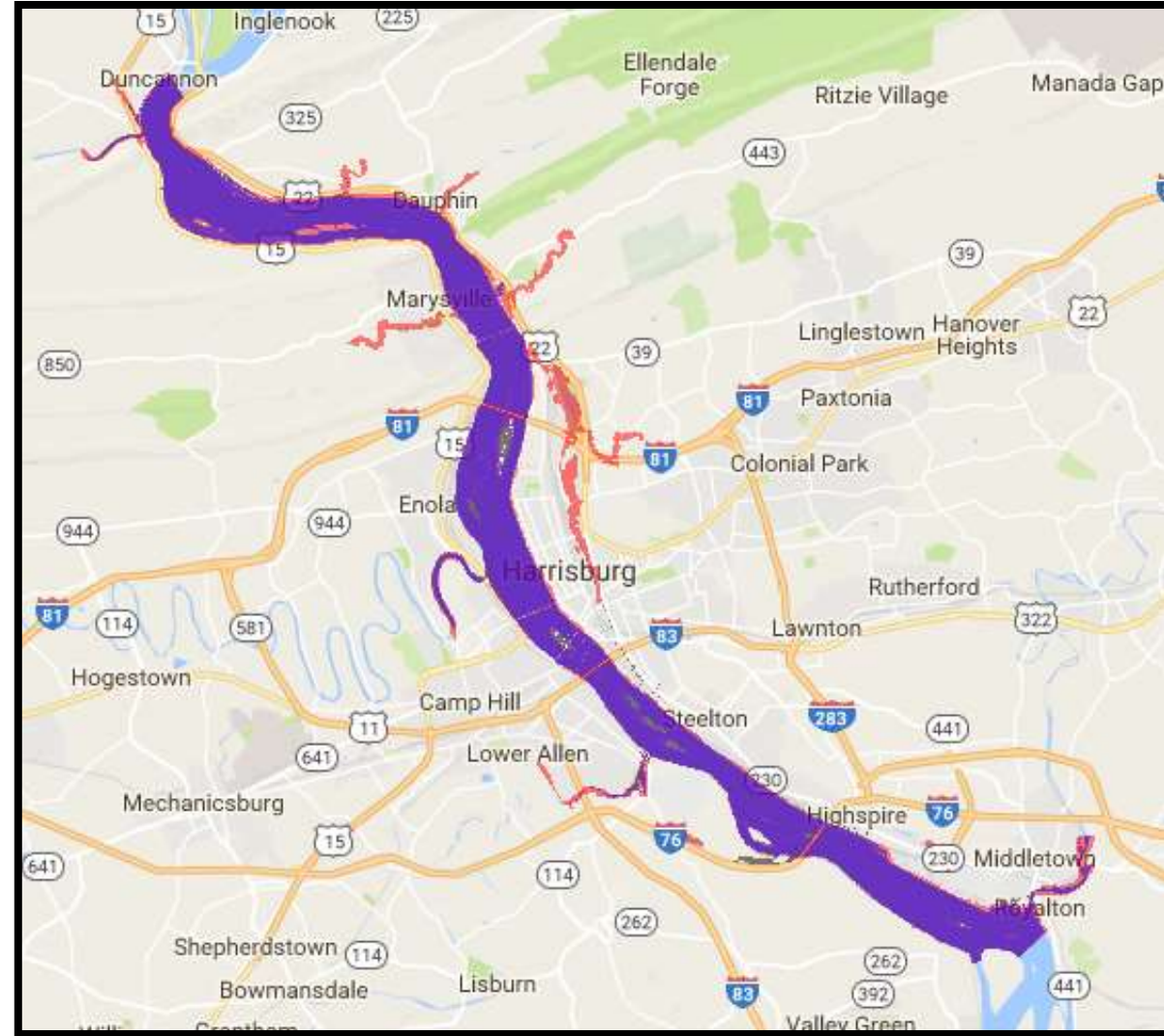
LOCATION	<i>H</i> (%)	CSI
Albany, GA	93	0.76
Columbus, IN	83	0.82
Greenville, SC	100	0.70
Hattiesburg, MS	94	0.90
Minneapolis, MN	91	0.65
Ridgewood, NJ	87	0.83



# Large-scale flood modeling: validation

## USGS Data: Results (1 in X)

LOCATION	<i>H</i> (%)	CSI
Killbuck, OH (1 in 5)	<b>87</b>	<b>0.85</b>
Harrisburg, PA (1 in 10)	<b>96</b>	<b>0.84</b>
Battle Creek, MI (1 in 50)	<b>99</b>	<b>0.54</b>
Lincolnshire, IL (1 in 500)	<b>54</b>	<b>0.53</b>





# Large-scale flood model application

## Quantifying exposure in the continental US:

How many people are at risk?

What lands are exposed to potential flooding?

How might exposure increase with future development?



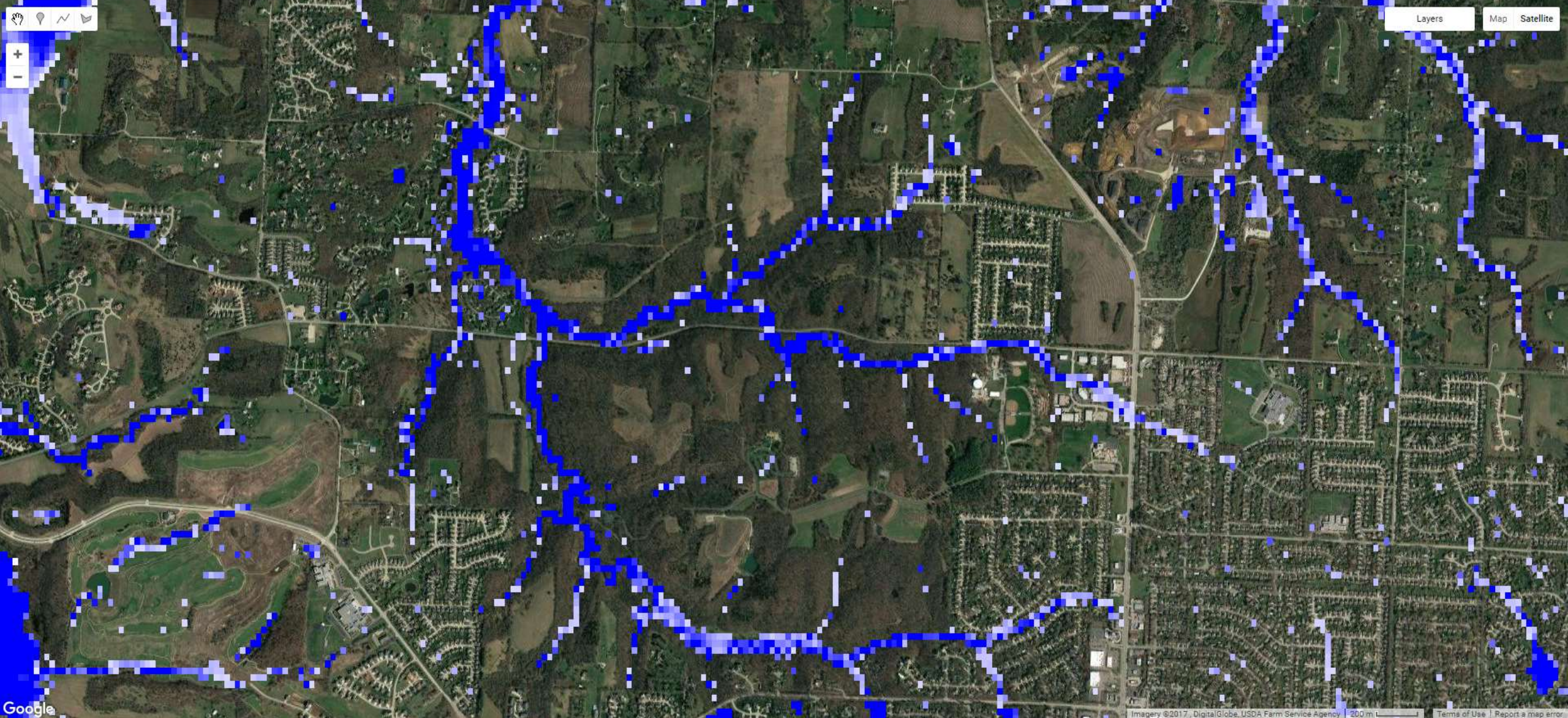




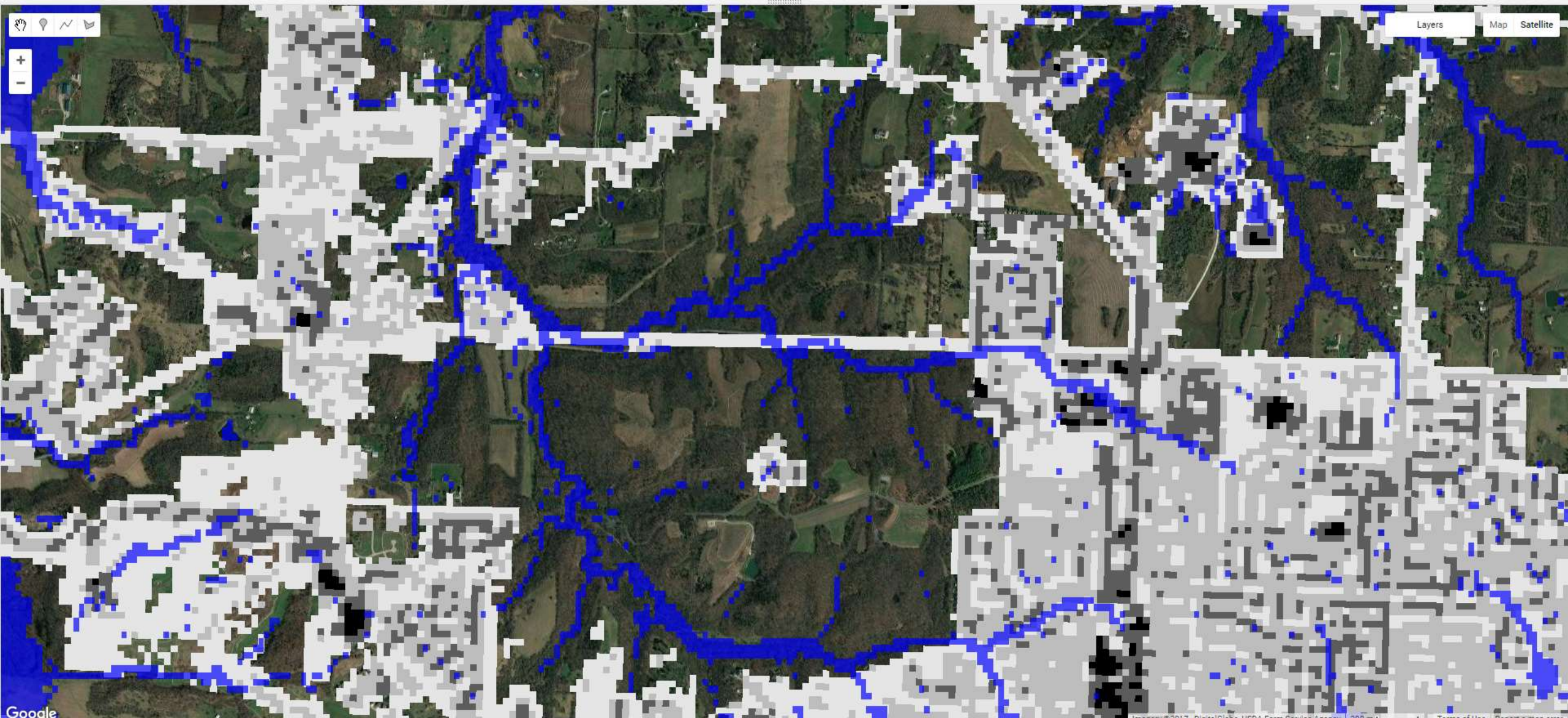
Layers

Map

Satellite







# Quantifying exposure in the continental US

How many people are at risk?

EPA dasymetric population data set

distributes **2010 US census** to 30m pixels based on: census block, land cover, slope

RETURN PERIOD	EXPOSURE (MILLIONS)	EXPOSURE (%)
1 in 5	12.7	4.1
1 in 20	24.7	8.1
<b>1 in 100</b>	<b>40.7</b>	<b>13.3</b>
1 in 500	61.4	20.0
<b>FEMA (1 in 100)</b>	<b>8.3</b>	<b>2.7</b>



# Quantifying exposure in the continental US

What lands are exposed to flooding?

National Land Cover Data Set

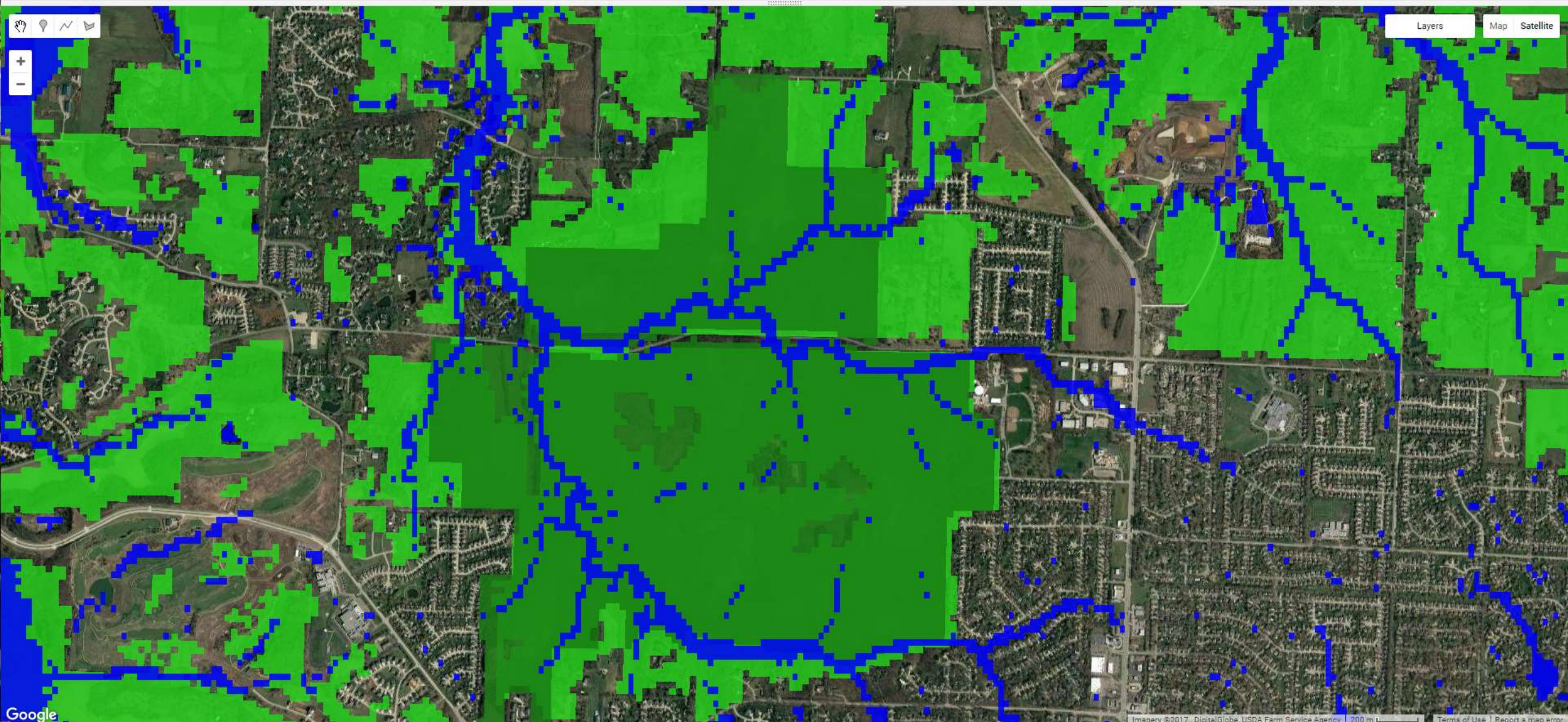
Protected Areas Database of the US

EPA land-use projections & development scenarios

USACE National Structural Inventory





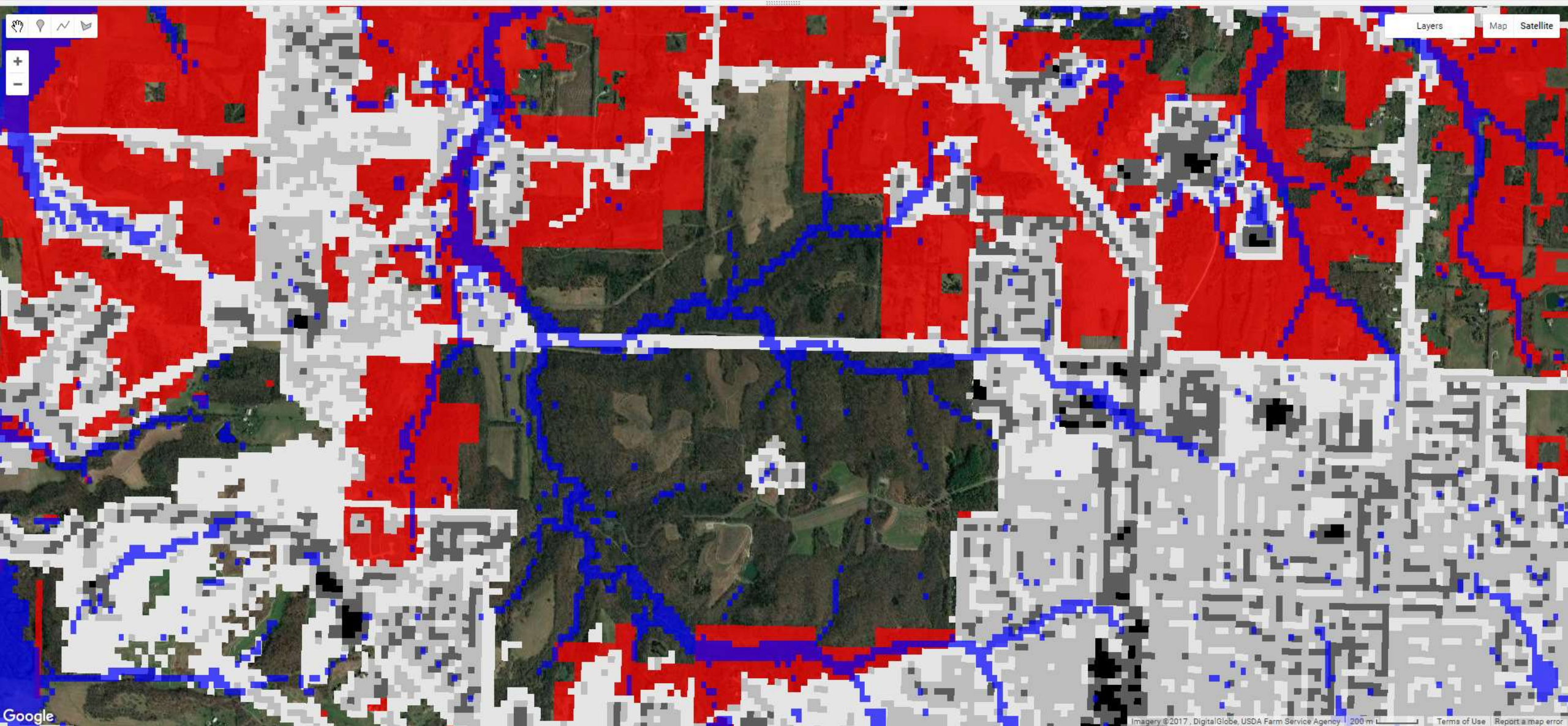




# Quantifying exposure in the continental US

Return period	<u>ALL</u> “natural” LULC classes in the floodplain (area in km <sup>2</sup> )	<u>UNPROTECTED</u> “natural” LULC classes in the floodplain (area in km <sup>2</sup> )
1 in 5	578,738	469,668
1 in 20	845,271	670,990
1 in 100	1,101,945	856,800
1 in 500	1,363,292	1,045,544



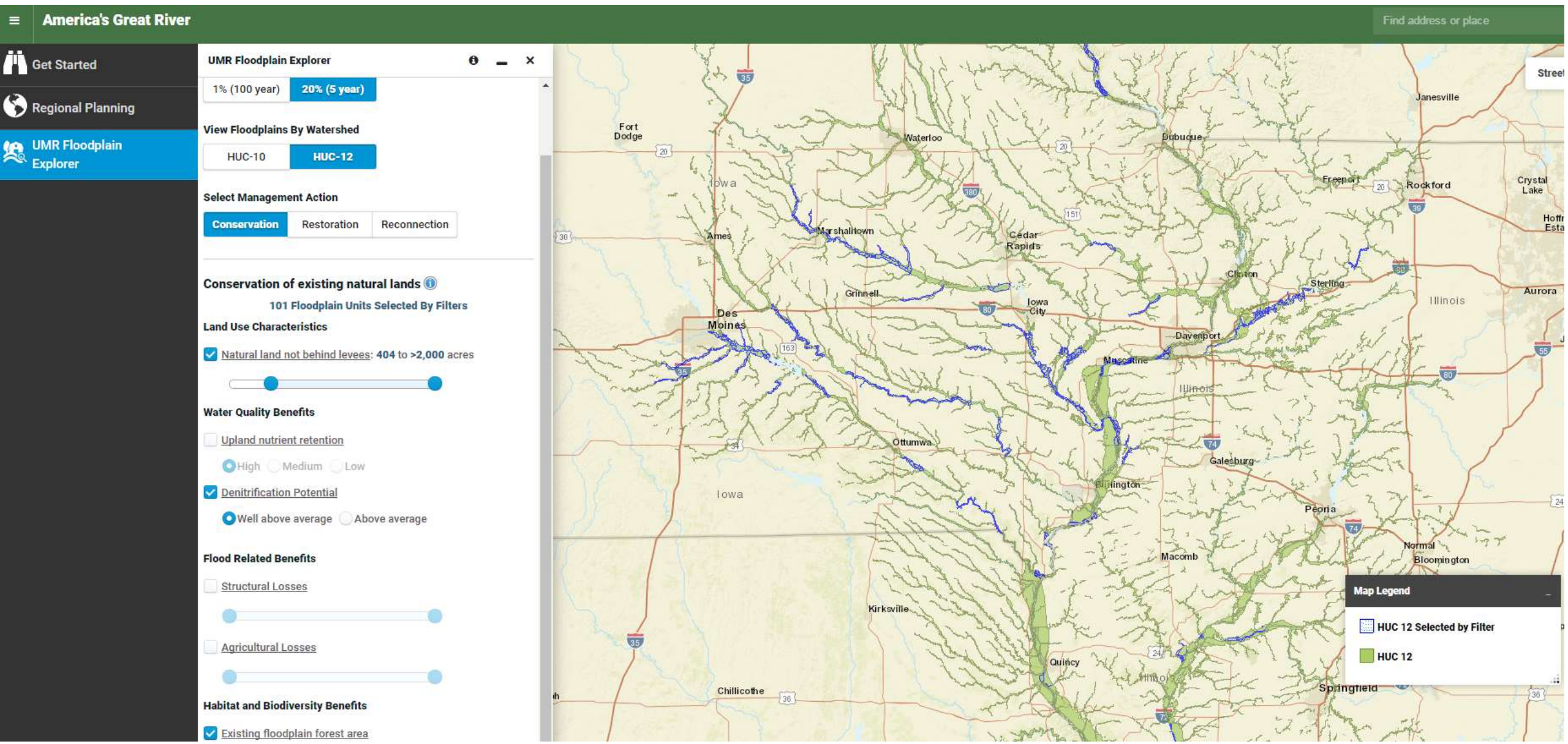


# Quantifying exposure in the continental US

Scenario	Return period	Exposed Developed Area (km <sup>2</sup> )	Assets at risk (trillions of 2017 USD)
SSP2 (Low) 2050	1 in 5	65,632	3.91
	1 in 100	136,202	9.42
SSP5 (High) 2050	1 in 5	75,357	4.24
	1 in 100	155,692	10.28
SSP2 (Low) 2100	1 in 5	74,380	4.28
	1 in 100	155,303	10.47
SSP5 (High) 2100	1 in 5	99,409	5.72
	1 in 100	207,966	14.05



# Freshwater Network Floodplain Explorer







# Questions?

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