

CREATING A WATER RISK INDEX TO IMPROVE COMMUNITY RESILIENCE

Lobna El Gammal &
Kelly Klima, CFM PhD

May 4th, 2017

AGENDA

Context

Research Questions & Methods

Results

Conclusions & Future Work

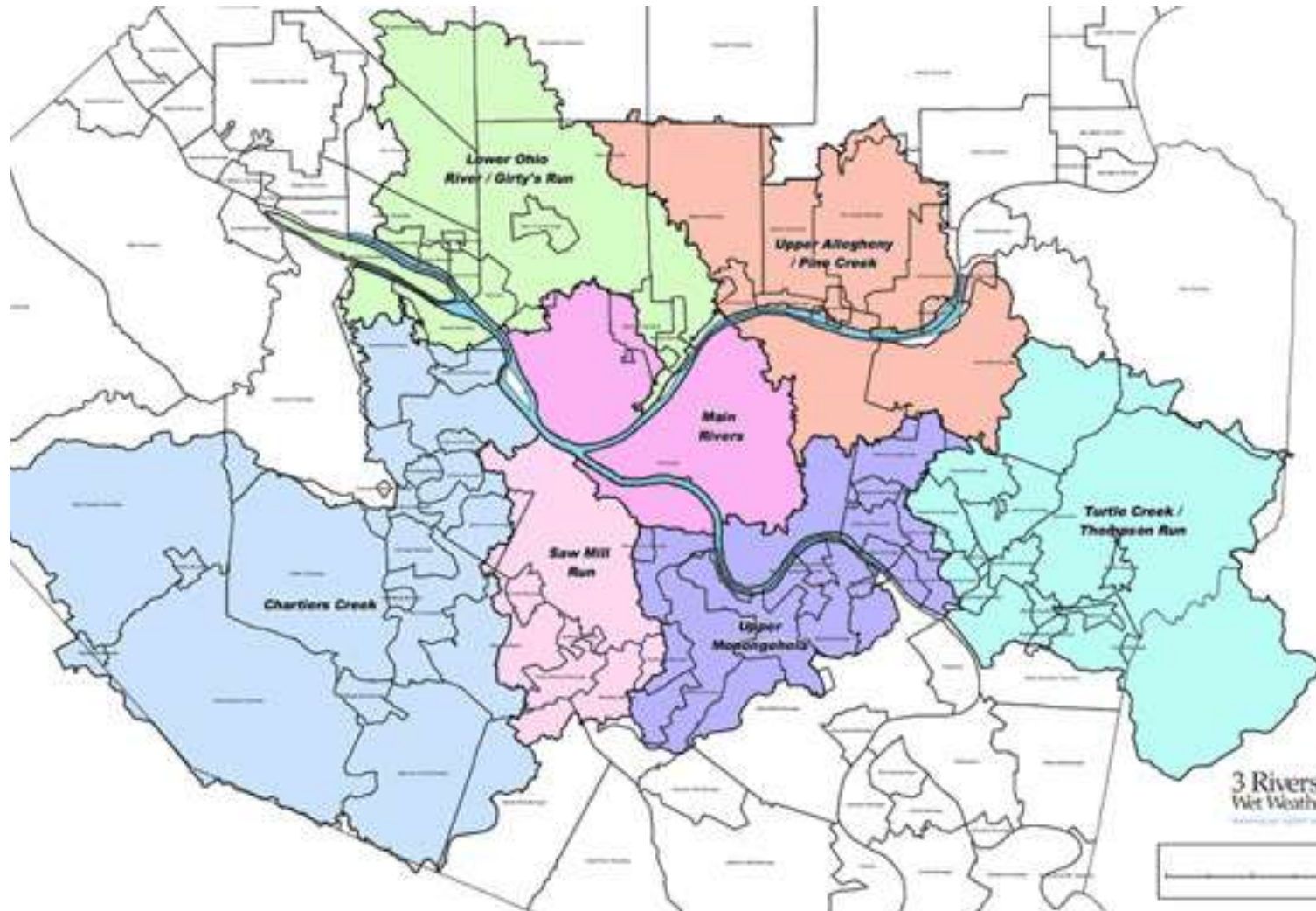


PITTSBURGH HAS EXPERIENCED SEVEN 100-YEAR FLOODS IN THE 20TH CENTURY.



Sources: NOAA & City of Pittsburgh 2

PITTSBURGH'S TOPOGRAPHY YIELDS FLOODING THROUGHOUT THE CITY



CHRONIC FLOODING AFFECTS PEOPLE DISPROPORTIONALLY.



TODAY WE ASK TWO QUESTIONS ON WATER VULNERABILITY

1. How does the literature characterize water vulnerability in a vulnerability index?
2. Where are Pittsburgh's most vulnerable (to water) populations?

1. WE IDENTIFIED 18 SOURCES FOR FLOOD VULNERABILITY INDICES.

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¹Department of Eng

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ABSTRACT: Wi
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Despite expected
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how do these char
assuming the City
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here to search

Sustain. Water Resour. Manag
DOI 10.1007/s40899-016-0051

ORIGINAL ARTICLE

An overview to

Hajar Nasiri¹ · Mohd Jo

Received: 16 October 2015 / A
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Abstract Vulnerability is
management. One of the
vulnerability assessment
between the theoretical co

Nat Hazards (2012) 64:73–105
DOI 10.1007/s11069-012-0234-1

ORIGINAL PAPER

A flood vulnerability index for coastal cities and its use
in assessing climate change impacts

S. F. Balica · N. G. Wright · F. van der Meulen

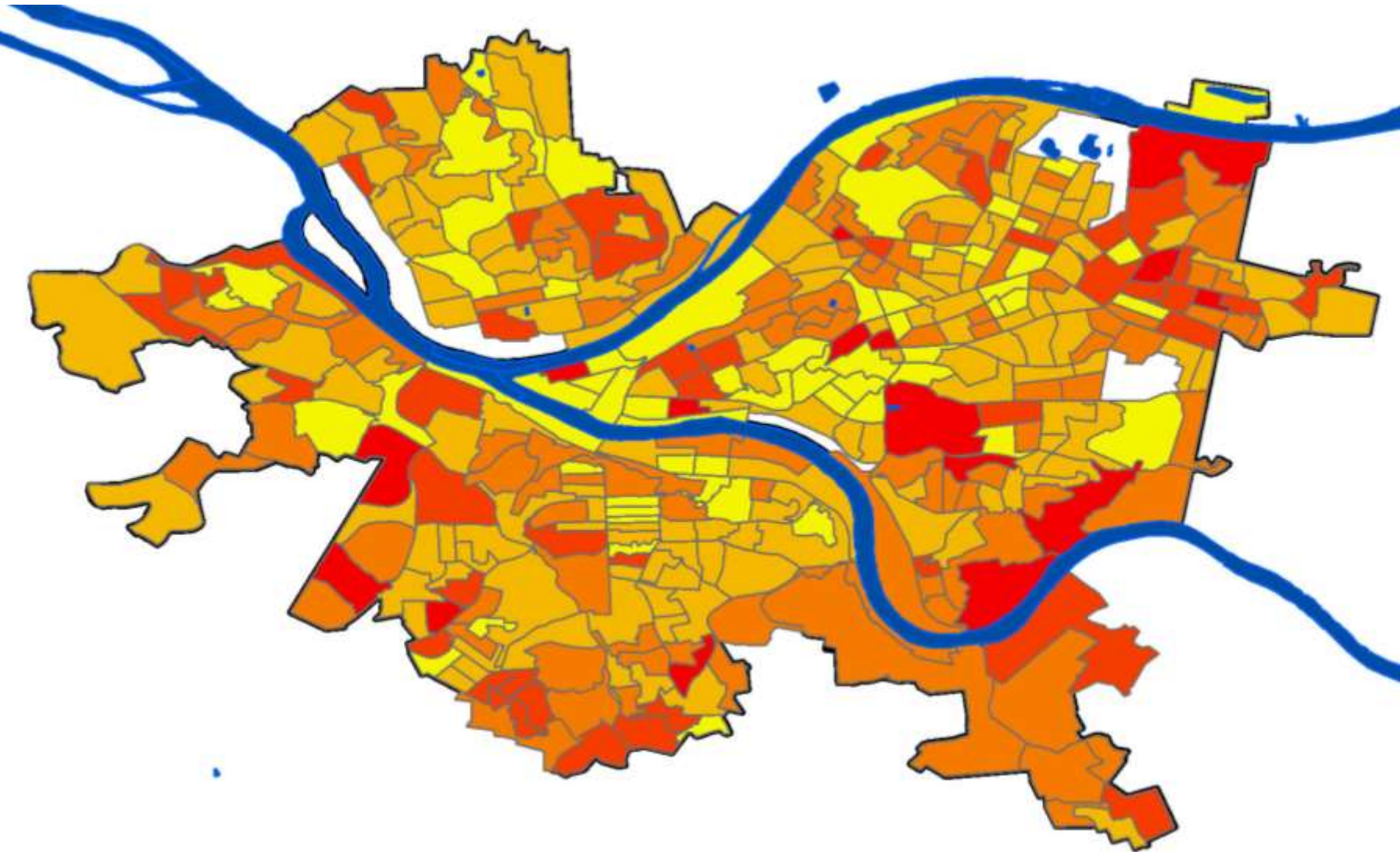
Received: 9 June 2011 / Accepted: 20 May 2012 / Published online: 16 June 2012
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Abstract Worldwide, there is a need to enhance our understanding of vulnerability and
to develop methodologies and tools to assess vulnerability. One of the most important

2. WE USED COMMONLY CITED DATA TO CALCULATE A WATER VULNERABILITY INDEX.

Data	Description	Source
Age, Elderly	% 65 years and older	ACS
Age, Youth	% younger than 14 years old	ACA
Building Density	Ratio area of buildings to area of land (ft ²)	PASDA
Educational Attainment	% without high school degree	ACS
Flooding Risk	% of land within floodway	FEMA
Gender	% female	ACS
Housing, Rented	% of occupied houses rented	ACS
Housing, Vacancy	% of houses vacant	ACS
Race/ethnicity	% Non-white	ACS
Unemployment	% of labor force unemployed	ACS
Wealth	% with annual income below \$25,000	ACS

FOR EXAMPLE, THIS IS PERCENT OVER 65 YEARS OF AGE.

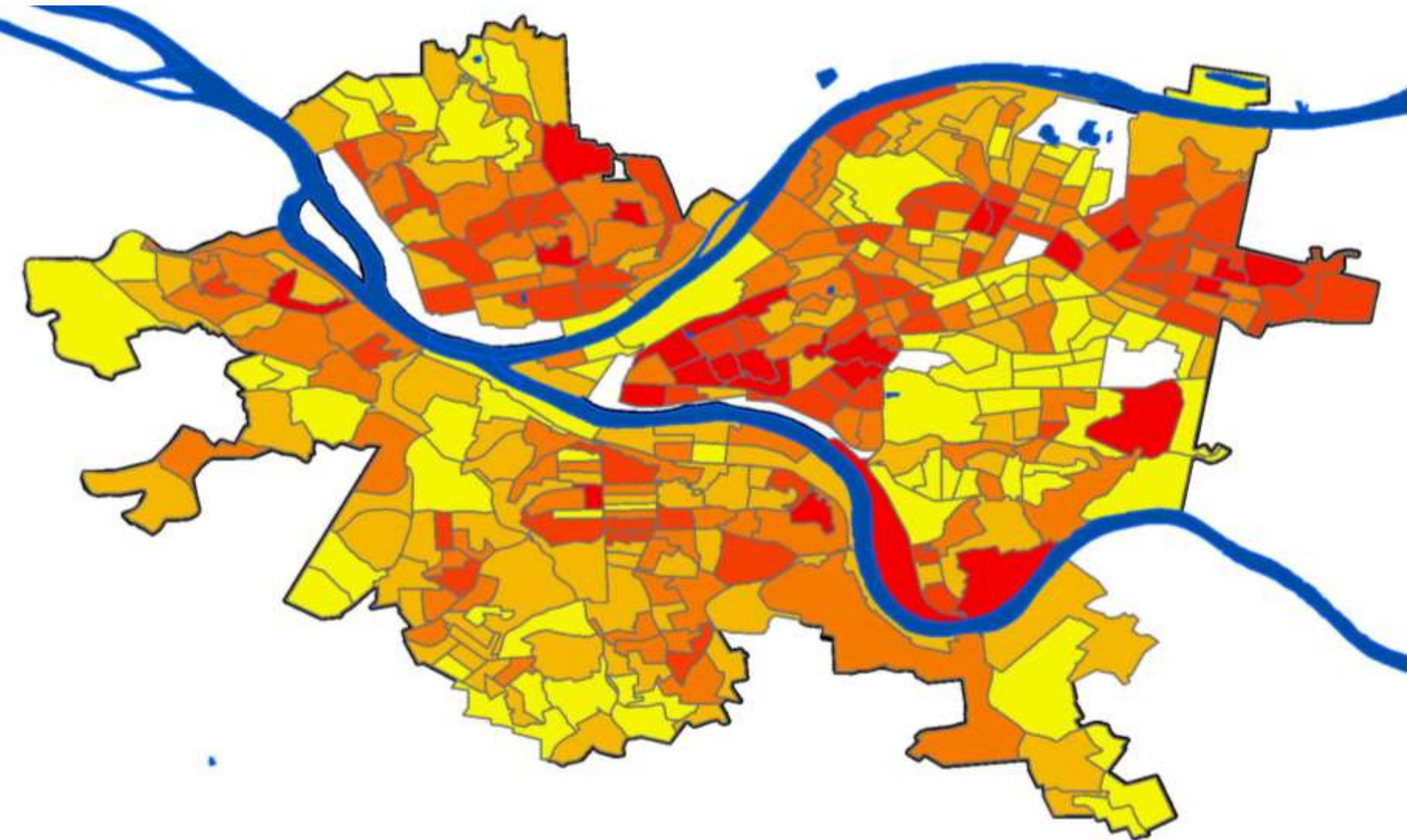


**Less Vulnerable
(Less Elderly)**

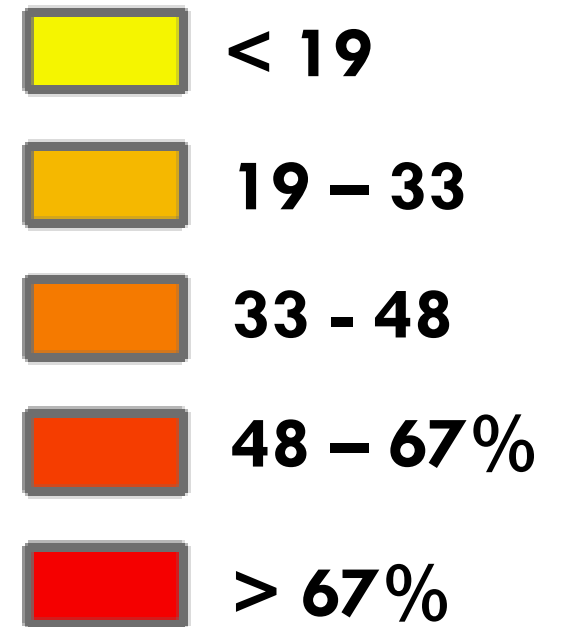


**Most Vulnerable
(More Elderly) 8**

FOR EXAMPLE, HERE IS PERCENT INCOME BELOW \$25K PER YEAR.



**Less Vulnerable
(Richer)**



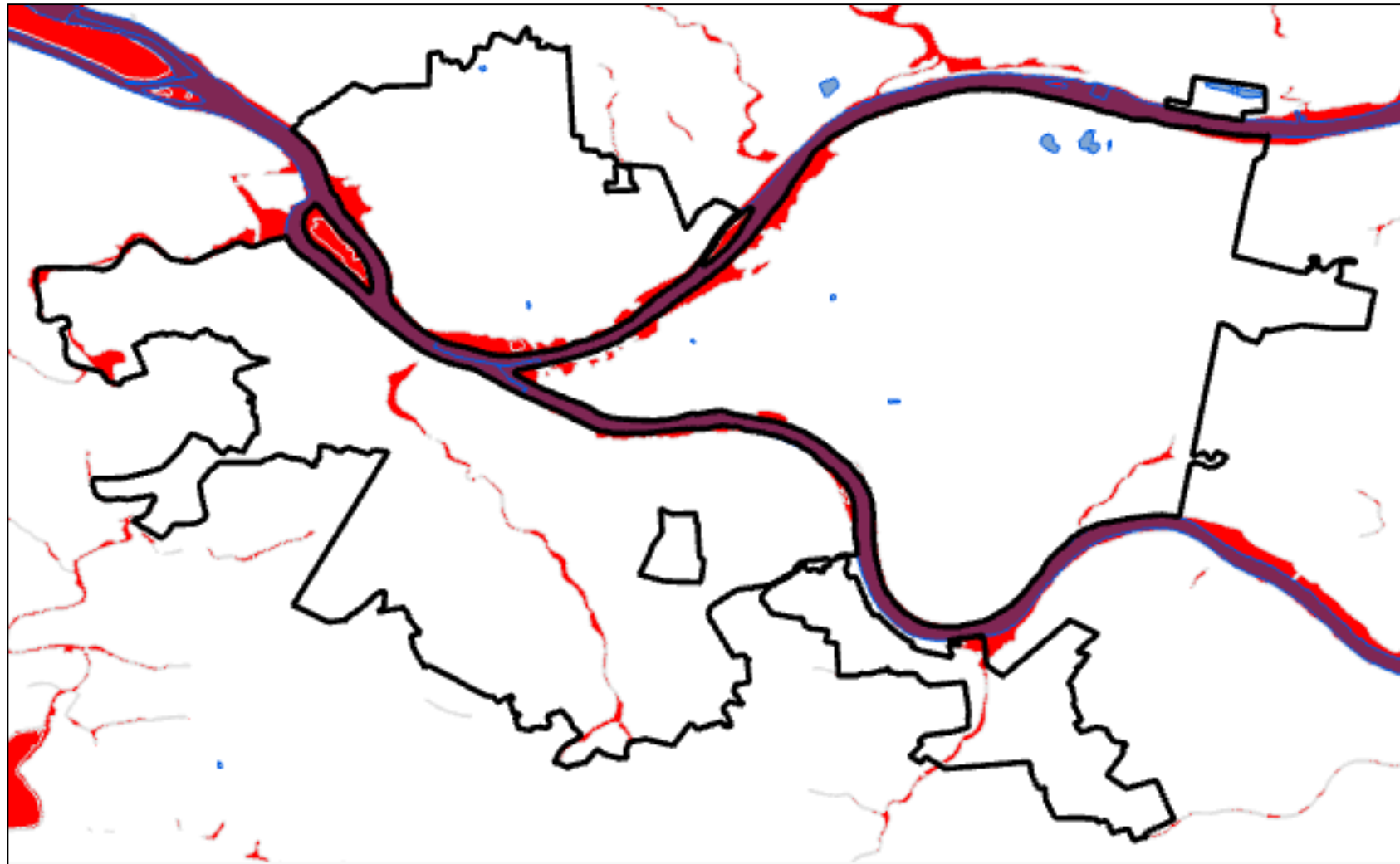
**Most Vulnerable
(Poorer)**

2. USING THESE DATA, WE CREATED AN INDEX FOLLOWING CUTTER ET AL.

1. Multi correlation test
2. Factor analysis (Principal component analysis with varimax rotation)
 - a) Keep factors that explain at least 70% of the variance
 - b) Variables taken to *hang with* a component when loading is above 0.65
3. Calculate vulnerability index
 - a) Convert each factor into a 1 to 6 value as a function of standard deviation from mean
 - b) Average across all factors

RESULTS

1. LITERATURE SHOWS VULNERABILITY IS MORE THAN PROXIMITY TO WATER.



MULTIPLE LITERATURE SAYS THE FOLLOWING INCREASE VULNERABILITY

Economic

Unemployment (3)

Wealth (3)

Economic sector types (2)

Single-sector economy (2)

Infrastructural

Housing occupancy type (3)

Building density (2)

Drainage (2)

Social

Age (6)

Race and/or ethnicity (5)

Educational attainment (4)

Gender (2)

Population growth (2)

Physical

Elevation (2)

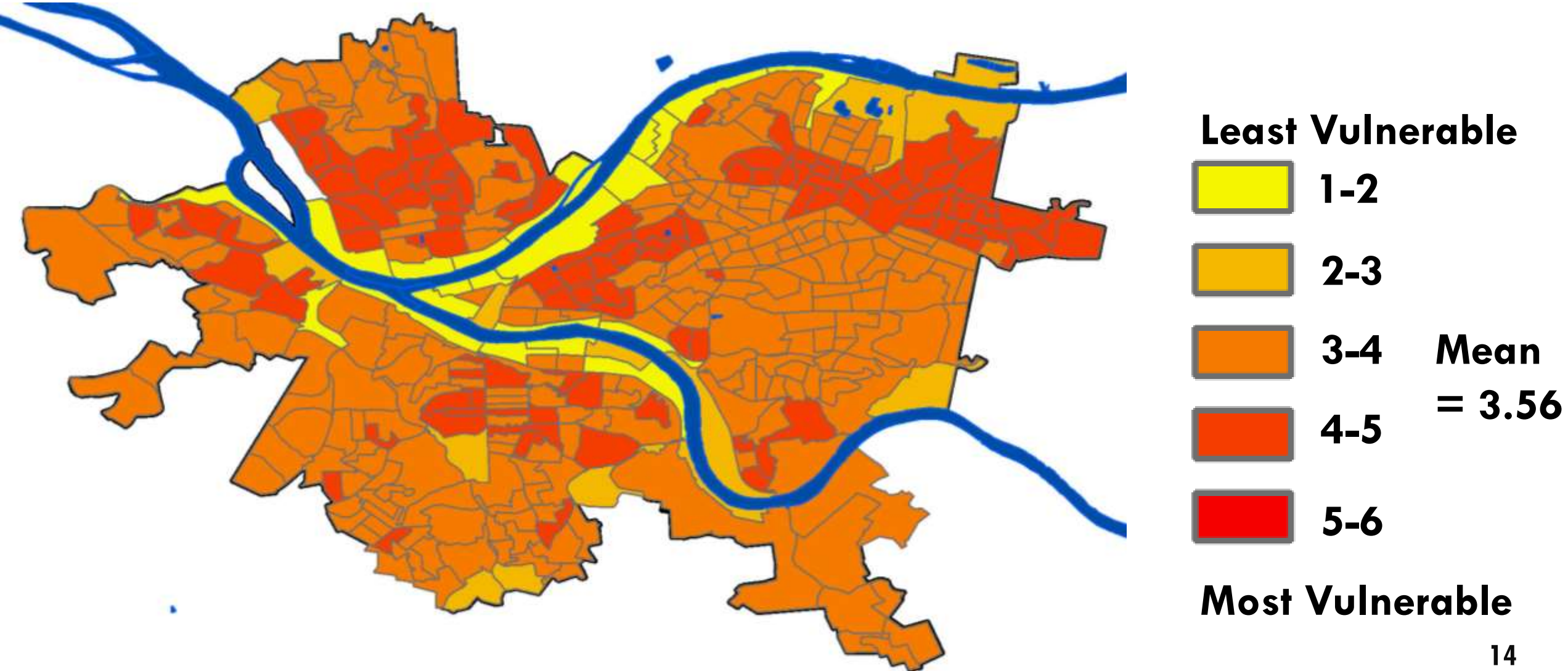
**Note:
Characteristics
in only one
article are not
given here.**

2. FOR PITTSBURGH, 5 COMPONENTS EXPLAIN 74% OF VARIANCE.

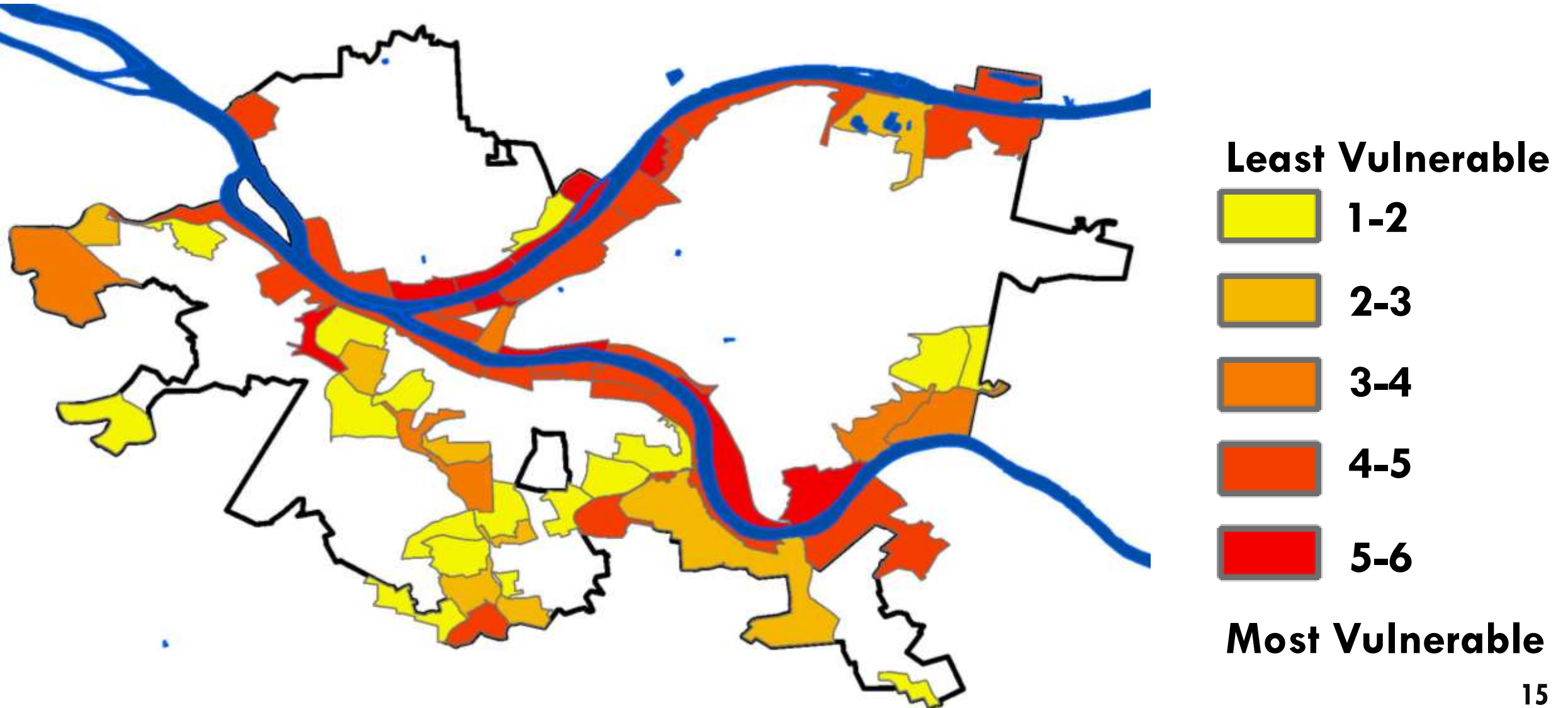
Characteristics that “hang” together for these components:

1	2	3	4	5
Housing, Type	Building density	Age, Youth	Housing, Vacancies	Age, Elderly
Wealth	Educational Attainment	Race		

PITTSBURGH'S MOST VULNERABLE POPULATIONS ARE NOT NEAR WATER.



LOOKING AT JUST THE AREAS IN THE FLOODPLAIN:



FUTURE WORK INCLUDES MORE DATASETS, SUCH AS ELEVATION, OR PERMEABILITY



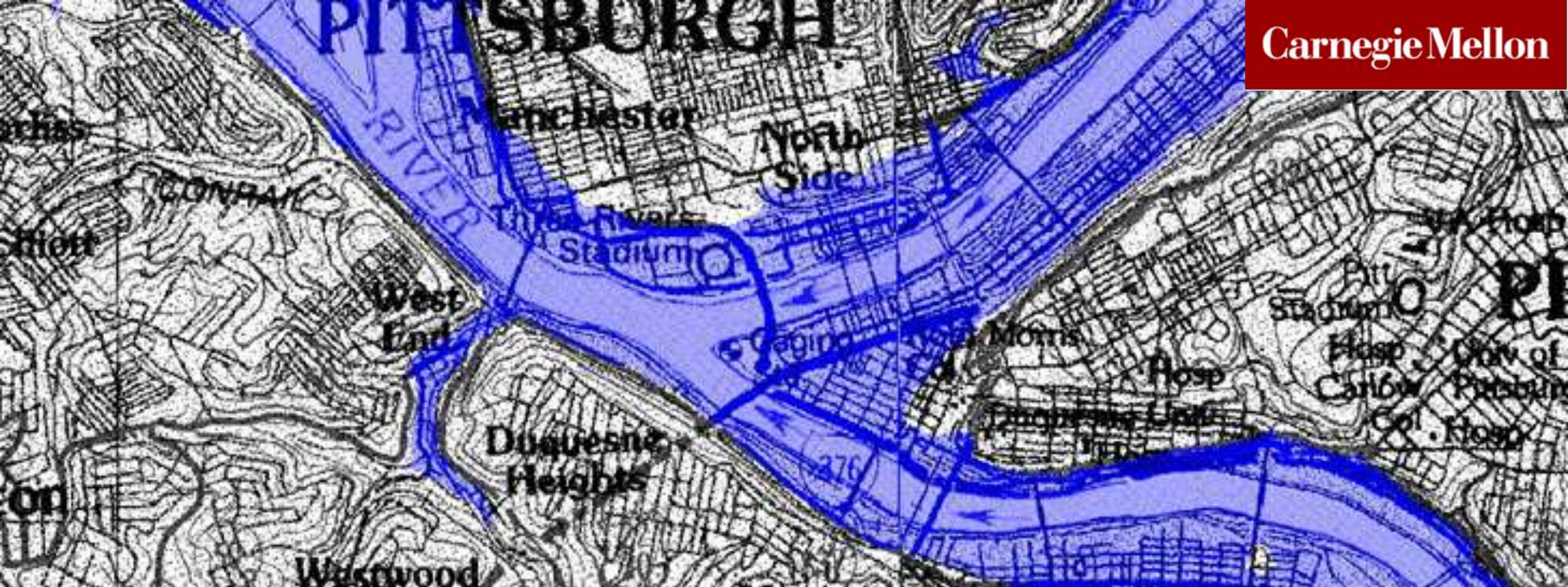
Sources: US Census Bureau, National Weather Service

WHAT DO YOU THINK?

As we continue this project:

- What should we remove?
- What else should be included?
- What needs to be changed?
- What should we do next?





THANK YOU!
QUESTIONS?

lalgamma@andrew.cmu.edu
kklima@andrew.cmu.edu

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