

Assessing social vulnerability to the risk of flooding in Dane County, Wisconsin

TENG HEONG NG

Professional project | May 2017 | Review Committee: Asligh Gocmen | Kurt Paulsen
Department of Urban and Regional Planning | University of Wisconsin-Madison

1 EXECUTIVE SUMMARY

The risk of flooding in Dane county presents a constant threat to the economic, social, and environmental stability of the communities. Utilizing my hazard planning knowledge, statistical skill, and GIS mapping technique, I assessed social vulnerability to the risk of flooding in Dane county, WI. I modified an existing Social Vulnerability Index (SoVI) to

incorporate 100-year floodplain map and formed a new model called Social Vulnerability to Flood Index (SoV2FI). A map created using SoV2FI can potentially assist the government and the communities of Dane county in Wisconsin to identify areas that require extra attention in hazard planning and mitigation.

2 OBJECTIVES

I seek to enhance community resiliency towards natural hazards by assessing the geographic distribution of social vulnerabilities to the risk of flooding in Dane county, WI.

3 DEFINITIONS



natural hazards
noun
Natural disaster such as hurricane, drought, flood, or forest fire.
(John Randolph 2004)



flood
noun
An inundation of a normally dried area due to rainstorm, tidal waves, snowmelts, or dam failures.
(NOAA National Severe Storms Laboratory 2017)

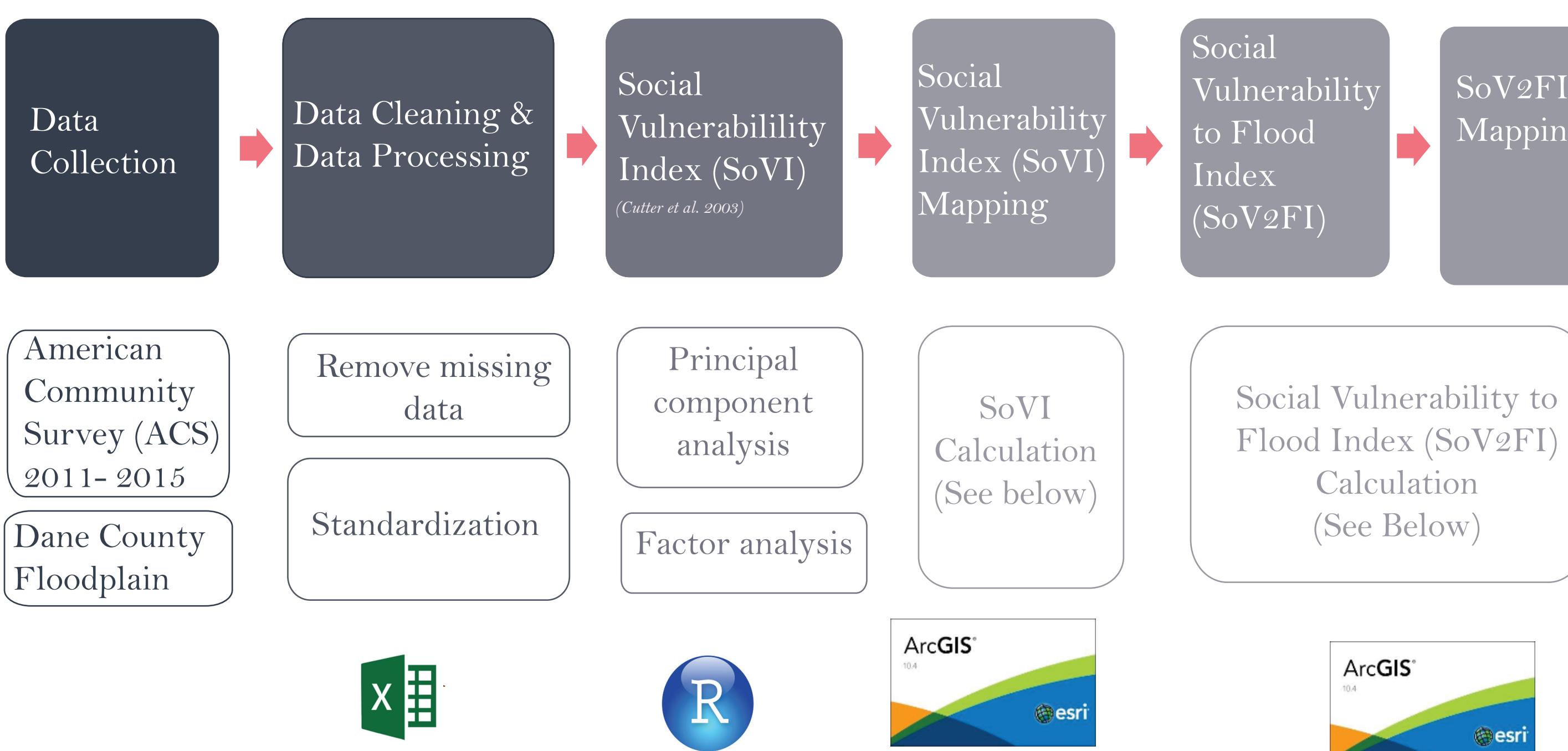


vulnerability
noun
Unprotected nature of property, people, or natural resource to the risk of hazards.
(John Randolph 2004)



hazards mitigation
noun
An effort to reduce loss of life and property by lessening the impact of disasters.
(John Randolph 2004)

5 METHODOLOGY



R script for SoVI Calculation

```
## Professional Project: Assessing Social Vulnerability to Floods in Dane County, WI
## Load data
mydata<- read.csv ("C:/Users/Teng Heong/Desktop/pplog/data_std.csv")
attach (mydata)
## Define variables
POPNS, QBLACK, QASIAN, QNATAM, QHISP, QFEMALE,
MEDINC, QACEDEF, QPM, QHICDEP, QSSBL, QPERC, QPOWTY,
QPHL, QUSCCHU, QRENTER, QMOHO, QSEL, QEDUL, QCVLUN,
QSPNEEDS, QNOAUTQ, QFEMBLR, QEXTRACT, QNOLTH, QSERV
```

Principal Component Analysis

pcat <- prcomp (X, scores = TRUE, cor = TRUE)

Summary of PCA

summary (pcat)

Scree plot of eigenvalues

jpeg ("screeplot.jpg")

plot (pcat)

graphics.off ()

jpeg ("ScreePlot.jpg")

screeplot (pcat, type="line", main="Scree Plot")

graphics.off ()

Conduct factor analysis using varimax rotation

sink ("faz.csv")

Social Vulnerability Index (SoVI) i

$$= \text{Factor 1 } X \text{ variable } i + \\ + \text{Factor 2 } X \text{ variable } i + \\ \dots + \text{Factor 7 } X \text{ variable } i$$

$i = \text{blockgroup 1 to blockgroup 308}$

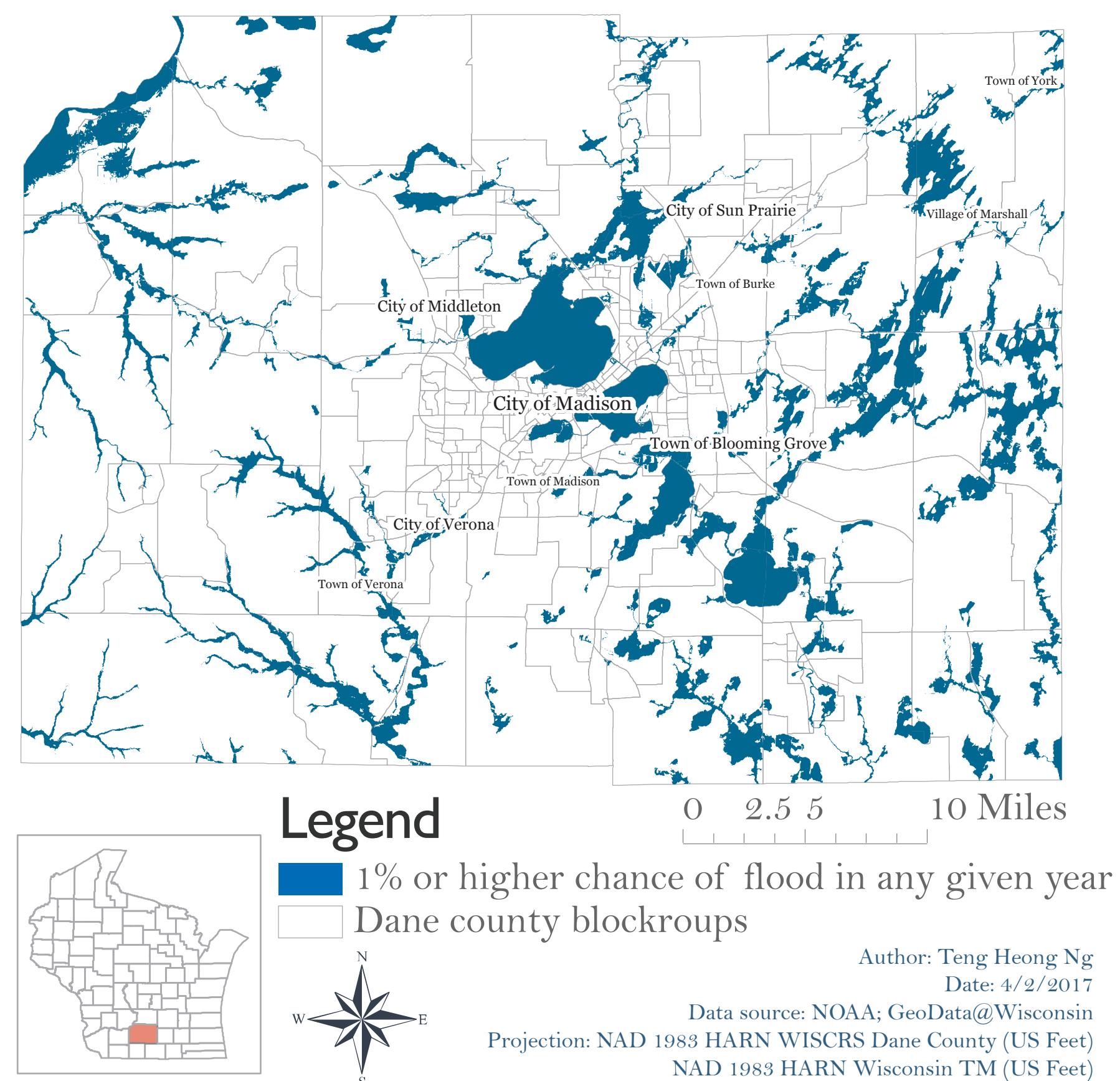
Social Vulnerability to Flood Index (SoV2FI)

$$= \text{Social vulnerability Index (SoVI)} X$$

Flood density by blockgroup area

4 LITERATURE REVIEW

100-year floodplain in Dane County, WI



100-year floodplain

noun
A flood that statistically has a 1-percent or higher chance of occurring in any given year.
(FEMA n.d.)

Flood in Dane County, WI

7 out of 23

federal declared flood events in Wisconsin happened in Dane County, WI.
(Government of Dane County Emergency Management 2009)

\$65 million of estimated private, public, and agricultural damages.
(Government of Dane County Emergency Management 2009)

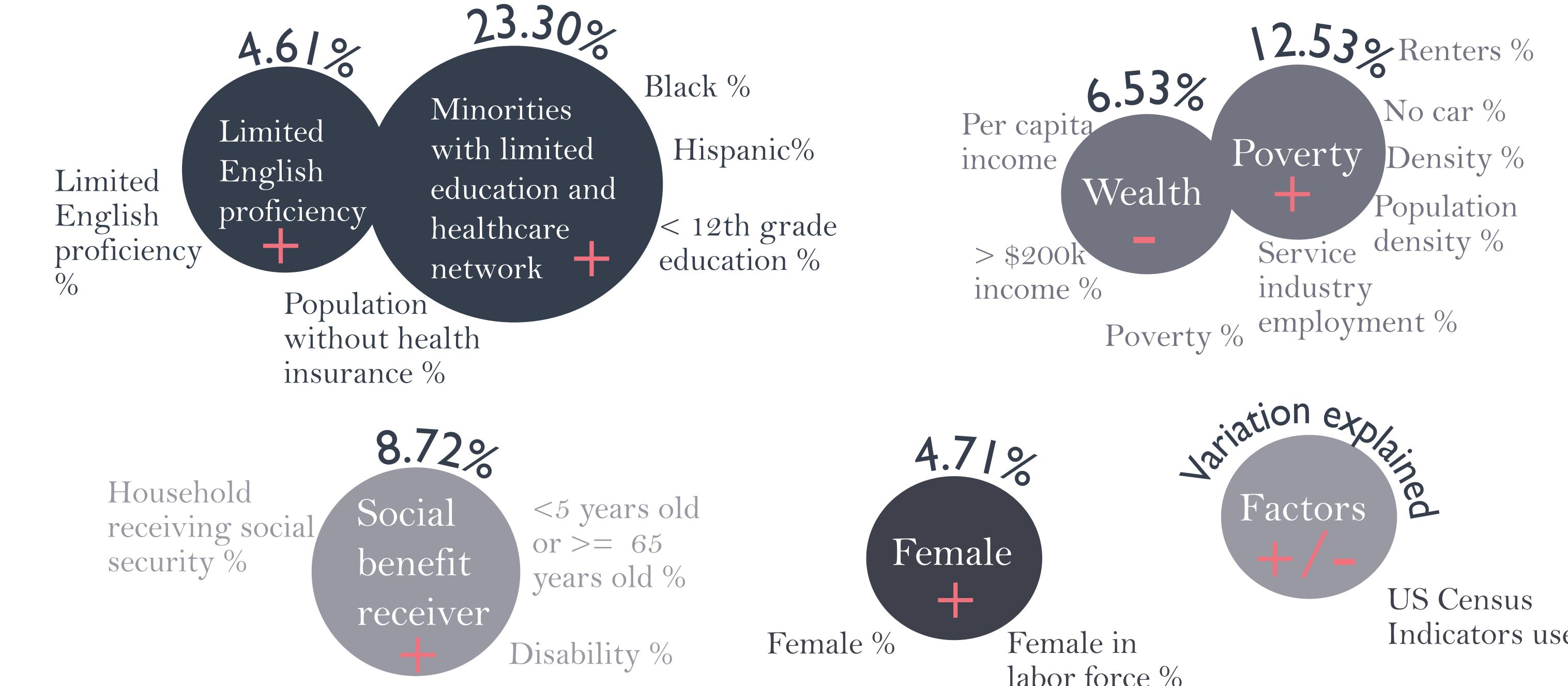
156.62 sq. mi. or 13% of Dane County, WI is categorized as 100-year floodplain.
(Weathergen. 2017)

80 flood incidents from 1844 to 2014.
(Weathergen. 2017)

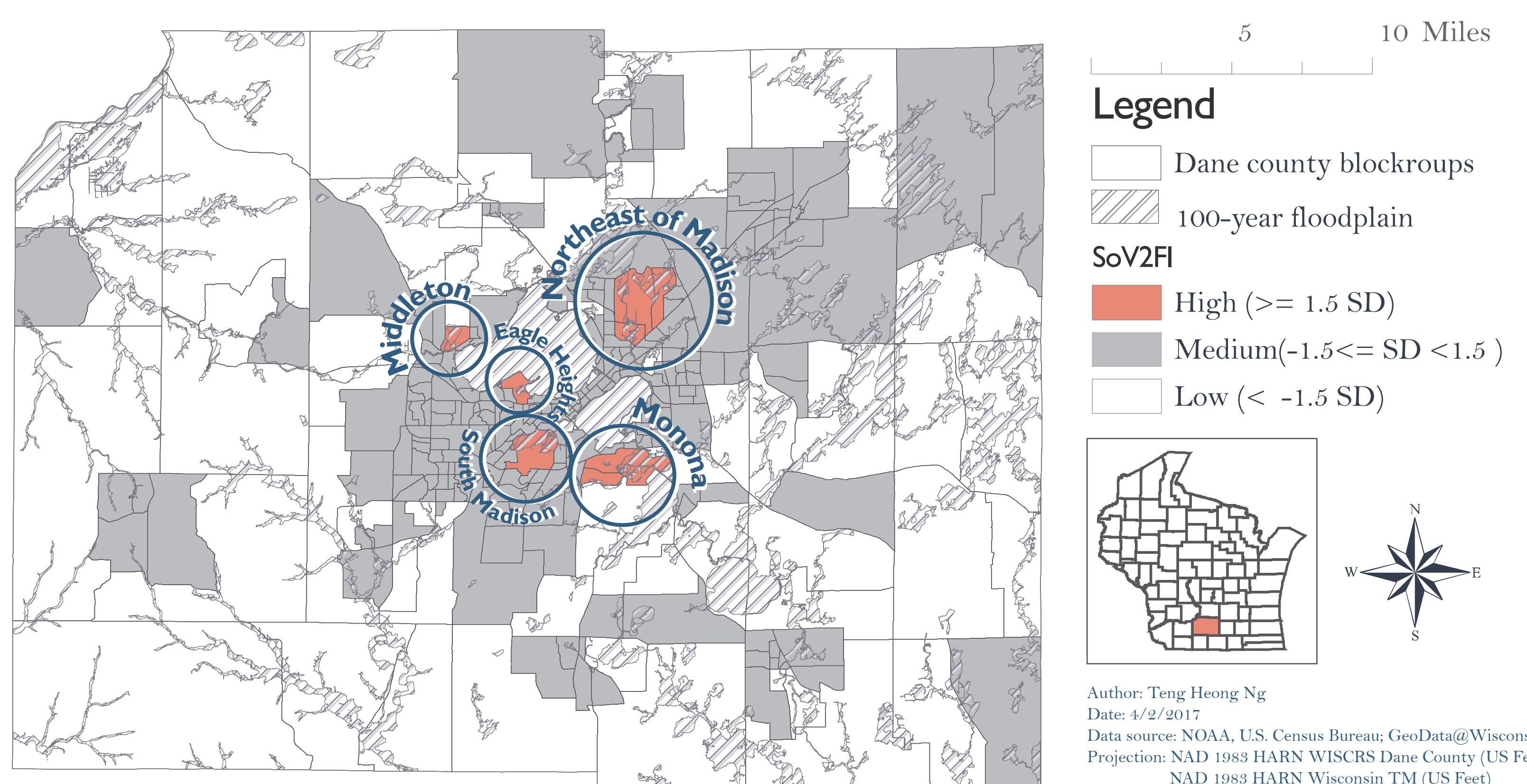
2nd most frequent in flood events in Wisconsin.
(Weathergen. 2017)

6 RESULTS

Factors influencing SoVI in Dane County, WI



Social Vulnerability to Flood Index (SoV2FI) of Dane County, Wisconsin

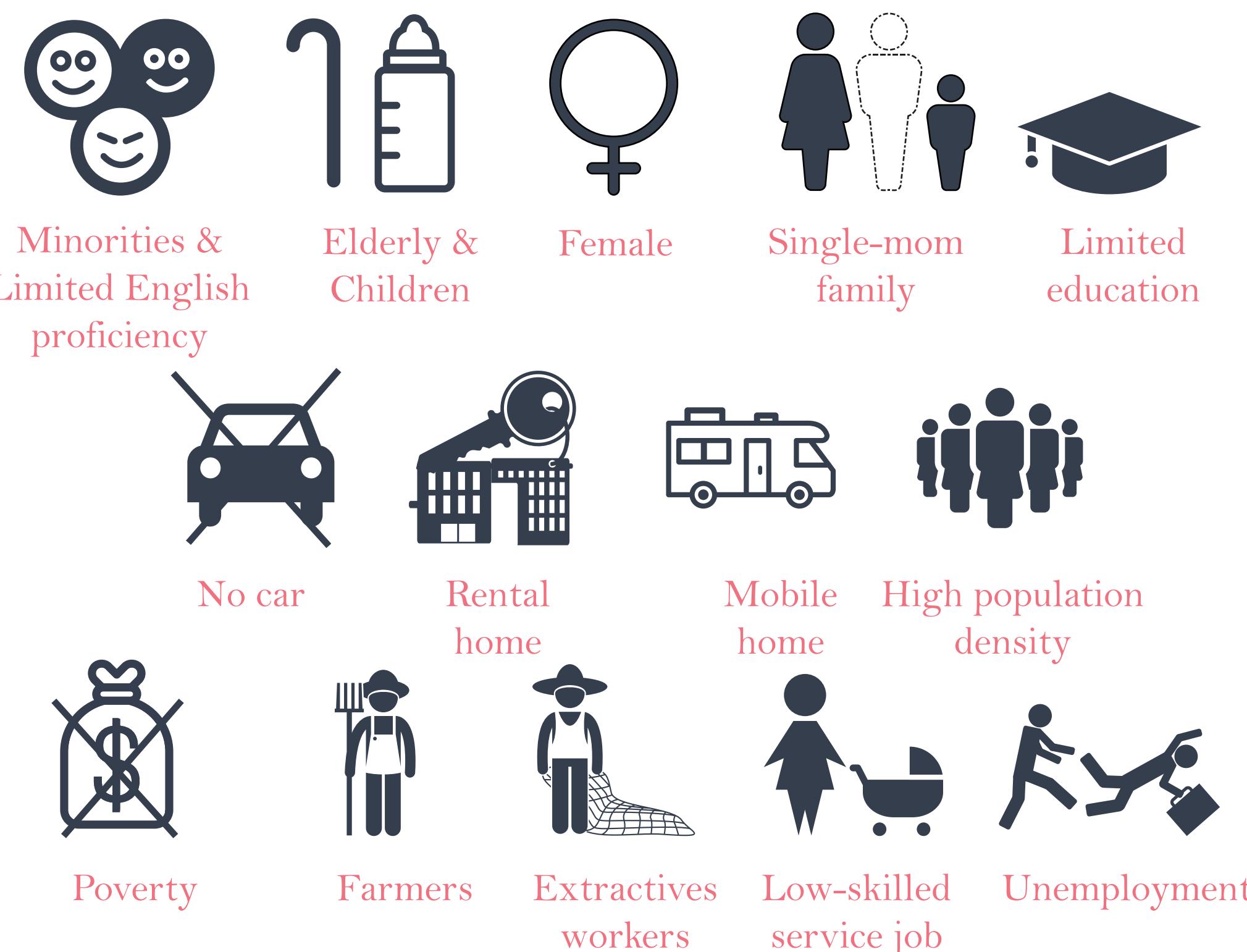


Social vulnerability to hazards

The ability of an individual or a community to forecast, handle, response, and recuperate from the consequences of natural hazards can fluctuate according to their location and unique physical, social, and economics conditions

(Cutler et al 2003; Wisner et al 2011; Vale 2014).

Factors contribute to social vulnerability to natural hazards



7 LIMITATIONS

1) No intersection between the social vulnerable group with the 100-year flood plain within the high SoV2FI blockgroup

2) Different weight on the SoVI will produce different results, in this study, I used equal weight.

3) Verification is need to check the accuracy of the results.

8 CONCLUSIONS & RECOMMENDATIONS

1) SoV2FI can help local authorities to identify location of residents that are socially vulnerable to flood.

2) The information is useful for Dane County Department of Emergency Management to align disaster management policy and allocate resources to the neglected communities.

3) Receive feedback from the local authorities as well as the communities to verify the accuracy of the map.

4) Create a user-friendly tool that allows planners or communities to calculate SoV2FI, generate report, and share the information instantaneously through

9 REFERENCES

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