Metadata descriptions for the SV viewer:

Social Vulnerability Cluster Analysis

Data used, all data at the census tract level:

Variable	Description	Year, Source
Income	Per capita income	2010, ACS
Black	Percent of population that is Black or African American	2010, Census
Over 65	Percent of population that is over 65 years of age	2010, Census
Unemployed	Percent of civilian labor force 16 and over that is unemployed	2010, Census
Poverty	Percent of population for whom poverty status is established that is living in poverty	2006-2010, ACS
No High School	Percent of population 25 and older with no high school degree or equivalent	2006-2010, ACS
Nursing Homes	Percent of population in nursing homes	2010, Census
Urban	Percent of the population living in urban areas	2010, Census
Female Households	Percent of households with female head, no spouse	2010, Census
Social Security	Percent of households with social security income	2010, Census

Method of analysis:
We conducted a k-means cluster analysis using the "cluster kmeans" command in the Stata software program. All of the variables listed above were standardized to z-scores with zero means and unit variances to avoid any confounding effects that might arise from using variables of different magnitudes in the analysis. We ran the cluster command setting the number of clusters to 30. We repeated the cluster command 500 times using a different set of randomly selected initial values for each run and selected the run with the smallest SSE for this map. For each of the 30 clusters we reviewed each cluster's prototype and made a determination of vulnerability based on the prototype's full characterization. While the clusters are numbered for identification purposes, the numbers themselves have no significance.

Social Vulnerability Index

Data used, all data at the census tract level:

Variable	Description	Year, Source
Income	Per capita income	2010, ACS
Black	Percent of population that is Black or African American	2010, Census
Hispanic	Percent of population that is Hispanic	2010, Census
Native	Percent of population that is Native American	2010, Census
Over 65	Percent of population that is over 65 years of age	2010, Census
Unemployed	Percent of civilian labor force 16 and over that is unemployed	2010, Census
Poverty	Percent of population for whom poverty status is established that is living in poverty	2006-2010, ACS
No High School	Percent of population 25 and older with no high school degree or equivalent	2006-2010, ACS
Nursing Homes	Percent of population in nursing homes	2010, Census
Female Labor Force	Percent of females 16 and over in civilian labor force	2006-2010, ACS
Female Households	Percent of households with female head, no spouse	2010, Census
Social Security	Percent of households with social security income	2010, Census

Method of analysis:

We conducted a principal component analysis (PCA) using the "pca" command in the Stata software program. All of the variables listed above were standardized to z-scores with zero means and unit variances to avoid any confounding effects that might arise from using variables of different magnitudes in the analysis. After conducting the PCA, we retained all of the principal components with an eigenvalue of 1.0 or greater. To facilitate the interpretation of the components, we conducted a Varimax rotation of the six components with a Kaiser normalization. We then determine the directionality of each retained component, that is whether higher values of the component increase the level of social vulnerability (positive directionality) or decrease the level of social vulnerability (negative directionality). Where the directionality of the component was clearly negative, we scaled the component by a factor of -1 before including it in the composite index so that higher values of the scaled component would increase the overall vulnerability index. As is common in the literature, in instances when the effect of the component on vulnerability is ambiguous (as is the case when the different variables that make up the component work in opposite ways), we assume a positive directionality. Each component is then multiplied by the variance it captures from the total input matrix and the weighted components are added together to form the index. To ensure that the index can be compared to other indices, the resulting aggregated values to z-scores with zero means and unit variances. After computing the six component measures for each census tract, we then standardized each variable to z-scores with zero means and unit variances. Each component was then multiplied by the variance it captures from the total input matrix and the weighted components were added together to form the index. To ensure that the index can be compared to other indices, the resulting aggregated values to z-scores with zero means and unit variances.

Hazardous/Toxic Index Score

Data used, all data at the census tract level:

Variable	Description	Source
ACRES	Number of EPA Brownfields grant recipients.	FRS
AFS	Number of stationary sources of air pollution regulated by the EPA, State, and local air pollution agencies.	FRS
CEDS	Number of facilities monitored by the Virginia Department of Environmental Quality's (DEQ) as a source of pollutants.	FRS
CERCLIS	Number of abandoned, inactive, or uncontrolled hazardous waste sites regulated under the Comprehensive Environmental Response, Compensation, and Liability Act.	FRS
EGRID	Number of power plants or other electricity generators.	FRS
ICIS	Number of facilities that are subject to federal compliance and enforcement programs.	FRS
LUST	Number of sites with leaking underground storage tanks.	FRS
NCDB	Number of facilities that are subject to the Federal Insecticide, Fungicide, and Rodenticide Act or the Toxic Substances Control Act.	FRS
NPDES	Number of facilities that have surface water discharge permits issued under the Clean Water Act.	FRS
OIL	Number of facilities with the potential for "Substantial Harm" due to the quantity of oil stored and facility characteristics.	FRS
RADINFO	Number of facilities regulated by EPA for radiation and radioactivity.	FRS
RCRAINFO	Number of facilities that generate, transport, and treat, store, or dispose of hazardous waste.	FRS
TRIS	Number of facilities that are required to report to EPA's Toxics Release Inventory.	FRS
TSCA	Number of facilities that are regulated under the Toxic Substances Control Act.	FRS
HW Generated	Tons of hazardous waste generated.	BRS
HW Managed On-Site	Tons of hazardous waste managed at the site of generation.	BRS
HW Received	Tons of waste received from off-site for management.	BRS
Fugitive Air Releases	Pounds of toxic chemicals released to the air through some means other than a directed air stream.	TRI
Stack Releases	Pounds of toxic chemicals released to the air through a directed air stream (e.g., stack or vent).	TRI
Water Releases	Pounds of toxic chemicals released to bodies of water.	TRI
On-Site Releases	Pounds of toxic chemicals released on-site to any media.	TRI

FRS = EPA's Facility Registry System; BRS = EPA's RCRA Biennial Reporting System; TRI = EPA's Toxic Release Inventory

Method of analysis:

We conducted a principal component analysis (PCA) using the "pca" command in the Stata software program. All of the variables listed above were standardized to z-scores with zero means and unit variances to avoid any confounding effects that might arise

from using variables of different magnitudes in the analysis. After conducting the PCA, we retained all of the principal components with an eigenvalue of 1.0 or greater. To facilitate the interpretation of the components, we conducted a Varimax rotation of the six components with a Kaiser normalization. After computing the six component measures for each census tract, we then standardized each variable to z-scores with zero means and unit variances. Each component was then multiplied by the variance it captures from the total input matrix and the weighted components were added together to form the index. To ensure that the index can be compared to other indices, the resulting aggregated values to z-scores with zero means and unit variances.

Housing Vulnerability Cluster Analysis

Data used, all data at the census tract level:

Variable	**Description**	**Year, Source**
Density	Number of housing units per acre of land	2010 Census
Median Year Built	Median year that housing units in the tract were built	2009-2014 ACS
Homes Lacking Plumbing	Percent of housing units lacking full plumbing facilities (hot and cold running water, a flush toilet, a bathtub or shower, and a sink with a faucet)	2009-2014 ACS
Mobile Homes	Percent of housing units that are mobile homes	2009-2014 ACS
Vacancy	Percent of housing units that are vacant	2010 Census
2nd Homes	Percent of housing units that are vacant because they are not the primary residence	2009-2014 ACS
Owner to Renter Ratio	Ratio of housing units occupied by owners to those occupied by renters	2010, Census
Median Home Value	Median value of homes occupied by owners	2009-2014 ACS
Median Gross Rent	Median gross rent paid by renters	2009-2014 ACS
Median Year Owners Moved In	Median year owners moved into their homes	2009-2014 ACS
Median Year Renters Moved In	Median year renters moved into their homes	2009-2014 ACS
Home Purchase Loans	Number of approved loans for home purchases divided by the number of housing units in the tract	2012-2014 HMDA

Method of analysis:

We conducted a k-means cluster analysis using the "cluster kmeans" command in the Stata software program. All of the variables listed above were standardized to z-scores with zero means and unit variances to avoid any confounding effects that might arise from using variables of different magnitudes in the analysis. We ran the cluster command setting the number of clusters to 30. We repeated the cluster command 500 times using a different set of randomly selected initial values for each run and selected the run with the smallest SSE for this map. For each of the 30 clusters we reviewed each cluster's prototype and made a determination of vulnerability based on the prototype's full characterization. While the clusters are numbered for identification purposes, the numbers themselves have no significance.