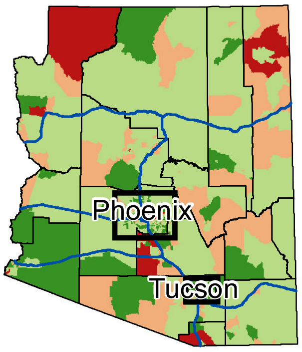
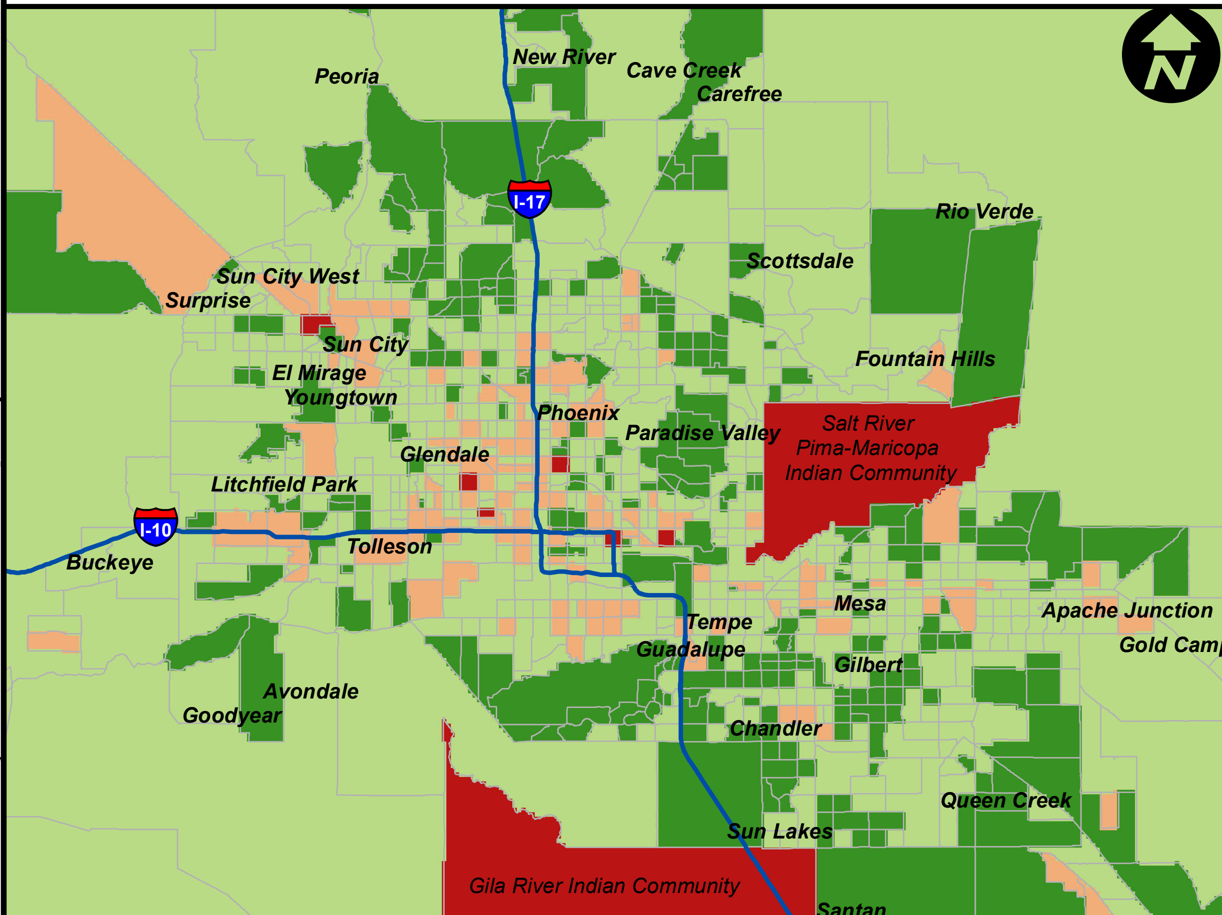
Arizona Department of Health Services

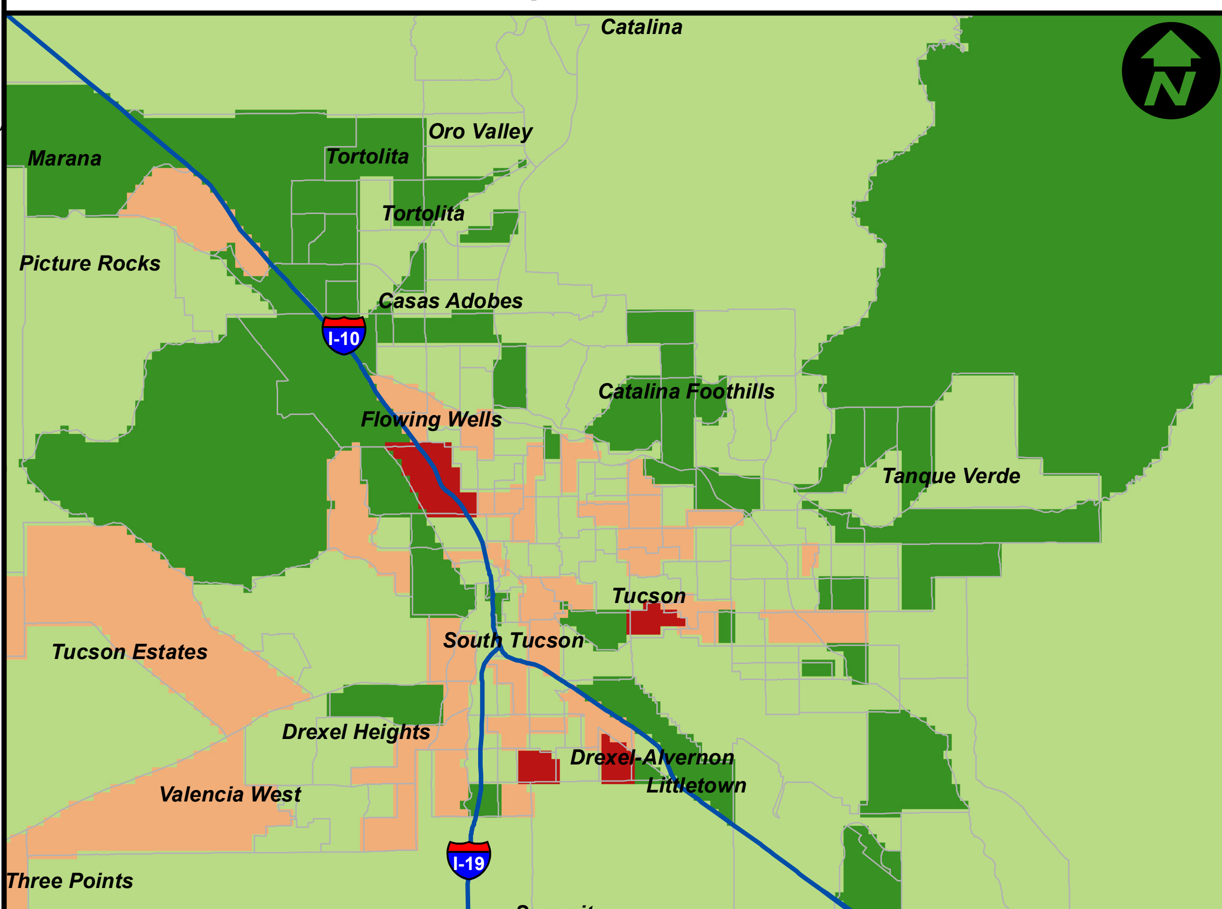
Index of populations vulnerable to extreme heat events in Arizona



Metropolitan Phoenix



Metropolitan Tucson



Social Vulnerability Index

- Low Vulnerability
- Lower- Moderate
- Upper- Moderate
- High Vulnerability

Source: U.S. Census, 2010. Social variables used to calculate vulnerability include: populations under the age of 5; 65 and older; 65 and older who live alone; families whose income is below the poverty line; people whose income is below the poverty line.
Office of Environmental Health.
<www.azdhs.gov/phs/oeh/heat/index.htm>
July 2012.

Social Vulnerability Index Method:

In order to create a composite index that reflects the vulnerability of Arizona's population to extreme heat events, it was necessary to obtain relevant and, more importantly, current demographic and socioeconomic data. The social vulnerability index developed in this study is calculated from five demographic and socioeconomic factors that are well documented in the published literature regarding health-related outcomes during extreme heat events (Vescovi, Rebetez, & Rong, 2005; EPA, 2006; Harlan, Brazel, Prashad, Stefanov, & Larsen, 2006; CCPHIARC, 2007; Ebi & Meehl, 2007; Jenerette, Harlan, Brazel, Jones, Larsen, & Stefanov, 2007; Reid, O'Neill, Gronlund, Brines, Brown, Diez-Roux, & Schwartz, 2009; HC, 2011). Data were obtained for all census tracts in Arizona through the American FactFinder of the US Census (census.gov), and include: 1) the number of children under the age of five; 2) the number of elderly people age 65 and older; 3) the number of elderly people age 65 and older who live alone; 4) the number of families whose income was below the poverty line during the last 12 months*; and 5) the number of people whose income was below the poverty line during the last 12 months*.

Because this social vulnerability index is based on count statistics for census tracts in Arizona, all data were first normalized by the total population of the state of Arizona. Normalization is a technique that effectively standardizes data such that population distributions may be meaningfully compared across geographic areas that are composed of units of varying, or arbitrary, size. After all entries were prepared and normalized, data were joined to a census tract shapefile based on each census tract's unique 10-digit identification code.

Using the "Polygon to Raster" tool in ArcMap 10, all demographic vector shapefiles were converted into raster format. During the conversion process, the "cell center" method was used to assign raster cell values based on the original vector data. In comparison with other techniques, the "cell center" technique assigns each raster cell the value of the vector object that lies at the geographic centroid of the newly created raster cell. Each raster cell has a width and height of 400 meters (1,312.335 feet). This cell size was deemed appropriate for the purposes of this study due to the size of census tracts located within urban areas such as metropolitan Phoenix or Tucson. Census tract boundaries are determined in part by the population of given areas, and because urban areas are typically more densely populated, census tracts located in urban areas of Arizona are often much smaller relative to those that are less urbanized. A cell size of 400 by 400 meters ensured that each census tract was converted into at least two raster cells. If a larger cell size had been specified, multiple census tracts located with the metropolitan Phoenix and Tucson areas would have been represented by a single raster cell, thus reducing heterogeneity and representational accuracy regarding the distribution of social and demographic variables of interest.

After all data were converted to raster files, all social and demographic indicators were reclassified to a uniform scale of 1 – 5 and combined through a weighted overlay procedure. Utilizing simple map algebra, all five raster files representing the social and demographic variables of interest were added on a cell-by-cell basis in order to compute a single, composite vulnerability index. Because this study represents a first attempt at visualizing the distribution of populations vulnerable to extreme heat events, the five social and demographic variables were weighted equally. Therefore, each variable contributed 20-percent to the final social vulnerability index. The resulting vulnerability index incorporates four classifications of vulnerability to extreme heat events: low vulnerability, lower- moderate vulnerability, upper- moderate vulnerability, and high vulnerability.

References:

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* For more information regarding how the Census Bureau measures poverty, please refer to http://www.census.gov/hhes/www/poverty/methods/definitions.html