SB 762 Wildfire Risk Mapping

Identifying Socially Vulnerable Communities in Oregon

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Lionshead Fire, Warm Springs Oregon, September 2020.

Why look at human communities?

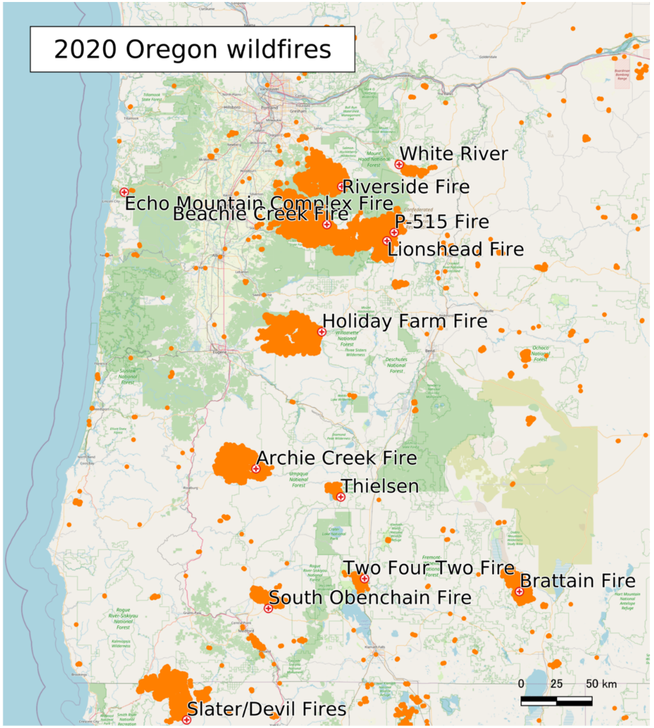

Figure 1. MODIS Active Fire Detections for CONUS (2020), Geospatial Technology and Applications Center, U.S. Forest Service, USDA

- Human alterations of the landscape and shifts in climate have increased wildfire frequency, severity and season length. [1]
- Expansion of human communities into forested landscape (WUI) is putting more lives and homes at risk. [2]
- **Not all communities are equally equipped** to prevent, respond to and recover from environmental hazards. [3]
- *This work is in conjunction with and informed by a research collaboration with USDA Forest Service Pacific Northwest Research Station.*

1 Cattau et al., 2020, Prestemon et al., 2013. 2 Radeloff et al., 2018. 3 Cutter et al., 2003, Coughland et al., 2019

The Social Side of Wildfire Risk

Wildfire risk is a function of an area's physical climate and geography as well as the **social factors of a community**.

Social vulnerability or adaptive capacity here refers to the **social, economic and cultural attributes that can limit access to resources**, making some communities more vulnerable and exacerbating the impacts of wildfire.

Wildfire Vulnerability Framework illustrates community vulnerability as a function of both the physical wildfire risk and the adaptive capacity of a community.[1]

1 Davies et al., 2018

SB 762 - Wildfire Risk Map - Intent

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Directs Board of Forestry to oversee development of a comprehensive statewide map of wildfire risk that:

- Includes wildfire risk classes (extreme, high, moderate, low and no risk)...
- Includes boundaries of the wildland-urban interface (as defined in ORS 477.015)
- **Identifies socially and economically vulnerable communities**

Includes provisions to support socially vulnerable communities:

- Specifically prioritizing support to **socially and economically vulnerable communities**, persons with limited proficiency in English and persons of lower income.
- YCC grants to be awarded **equitably by identifying and supporting populations with greater vulnerability**.

Decision points

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- **One map or two?**
  - Depends on the *intended* use of the social vulnerability index (SVI) map.
    - Can provide a single map with SVI at the smallest unit or SVI for a whole community.
      - one map: less confusion when applied;
      - two maps: can provide both the smallest unit (better for targeting specific households) AND one that provides a better summary for targeting specific communities. Potentially challenging if agencies are unclear about which maps to use and/or if maps show differing SVI for the same area at different scales.

- **What geographic unit?**
  - Trade offs between level of detail and accuracy of data

Census Geographies

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Deciding on the geographic scale of the map is an important aspect of quantifying and mapping social vulnerability.

Census geographies can pose challenges, especially when trying to represent small, rural populations.

Block Groups, groups of census blocks, are the smallest unit for which most social and economic summary statistics are available.

Possible mapping units

Census geography	Pros	Cons
County - Main political and administrative divisions of states	Very stable More data available	Much larger than community Too coarse to identify SVI
Census tracts - Small, *relatively* permanent statistical subdivisions of a county. Average ~4,000 inhabitants	Relatively well-known Relatively stable	Variable in size (rural to urban) Multiple tracts in a community sometimes
County Subdivisions - Areas of concentrated population, no minimum; must have suitable and distinguishable features for a visible boundary.	Better representation of communities Most data available at this level	Less specificity in more populated areas Less well-known that other types
Place - A concentration of population, must have a name and be legally recognized (incorporated) or recognized by the census (designated). Needs to meet a minimum population count (150).	Represents larger/urban communities well	Doesn't encompass all settlement Does not represent rural communities
Zip code tabulation areas (ZCTA) - Created for purpose of mail delivery and adjusted to a census equivalent	Well-known	Does not relate to other census geography Does not represent communities Problematic data
Block Groups - Divisions of census tracts. Contain between ~600 to 3,000 people.	Gives most detailed picture of vulnerability	Some limitations to data availability Data at this level is the least reliable Does not represent community
Block group aggregations up to the level of "community" (manual)	Better representation of community	Needs to be manually created Not as easily replicable

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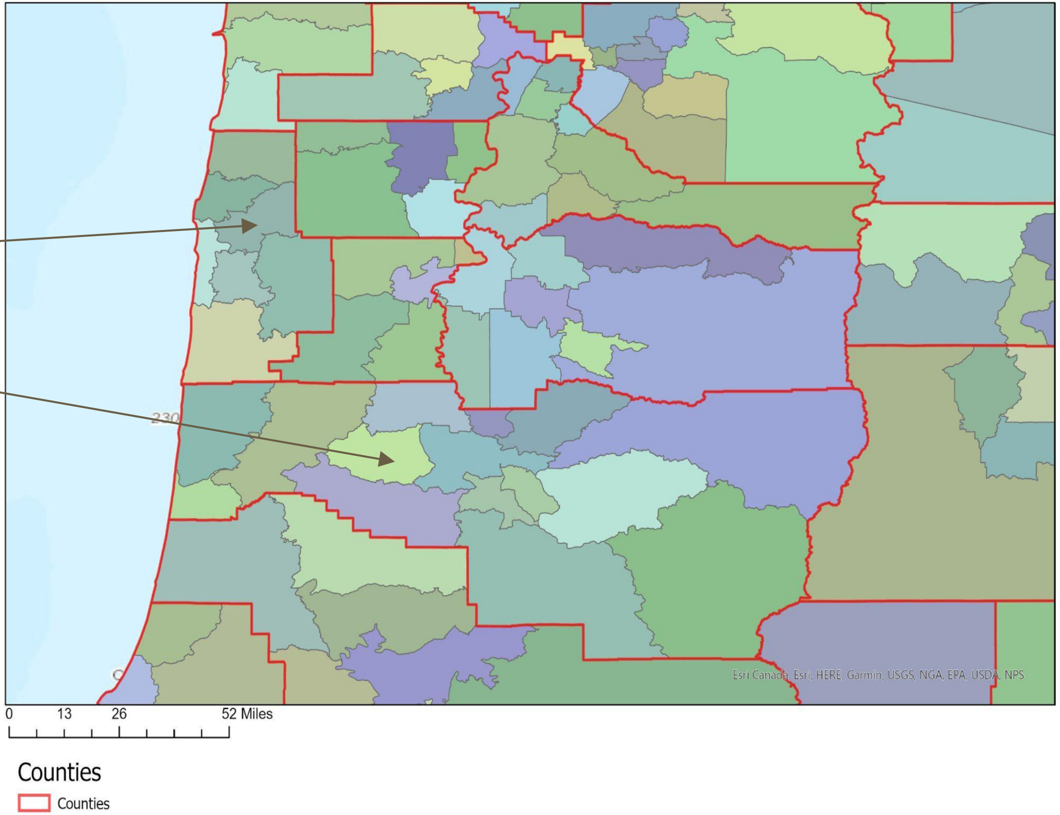
County Subdivisions vs Counties

County Subdivisions (CCDs) as solid color with county boundaries outlines in red.

Lincoln County has 7 county subdivisions; Lane County has 15 county subdivisions.

Reminder: CCDs are areas of concentrated population, no minimum population; must have suitable and distinguishable features for a visible boundary



Tracts vs County Subdivisions

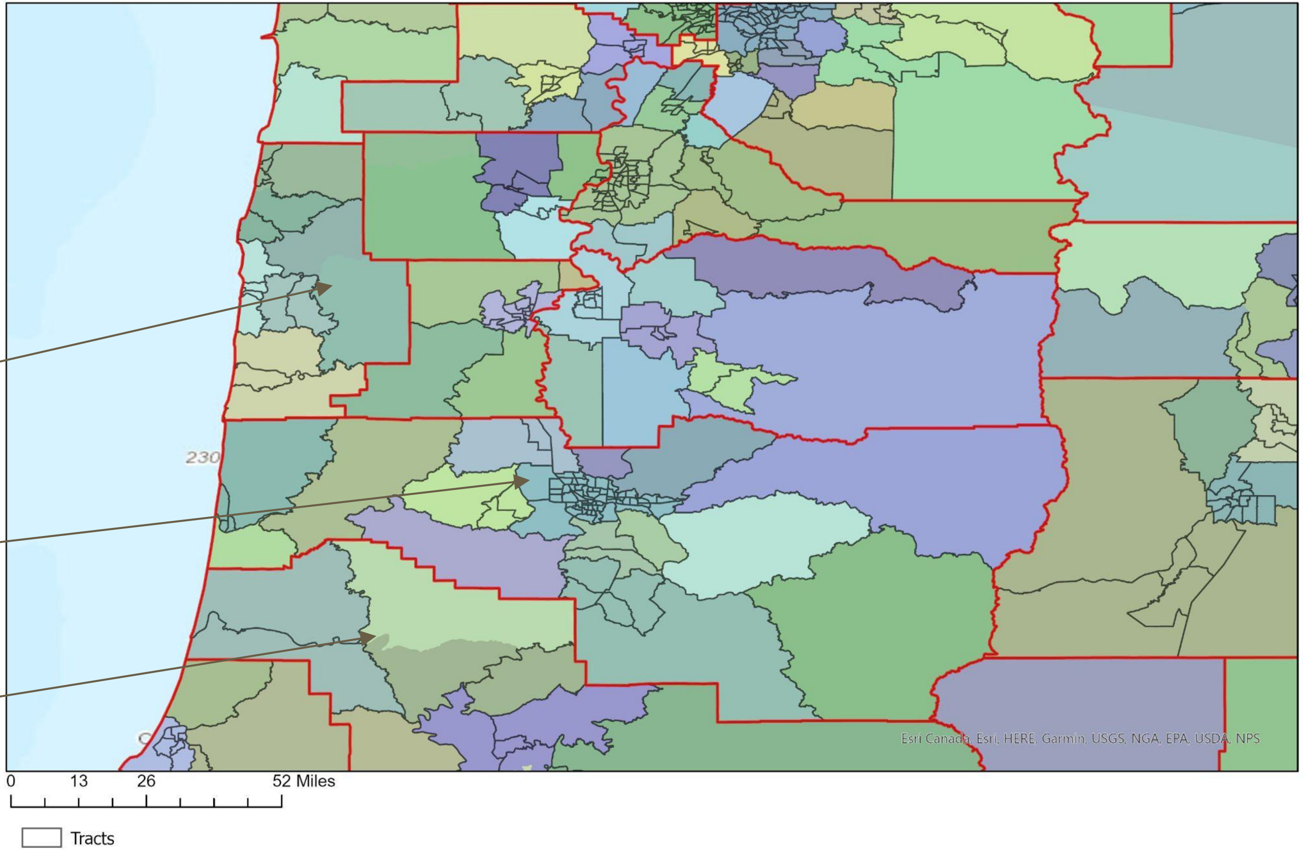
County Subdivisions in solid colors, Tracts in grey, County boundaries in red

Reminder: Tracts are divided so they all have ~4,000 people.

Sometimes, tracts are larger (rural areas)

Sometimes, tracts are smaller (urban areas)

Sometimes they are just a different configuration

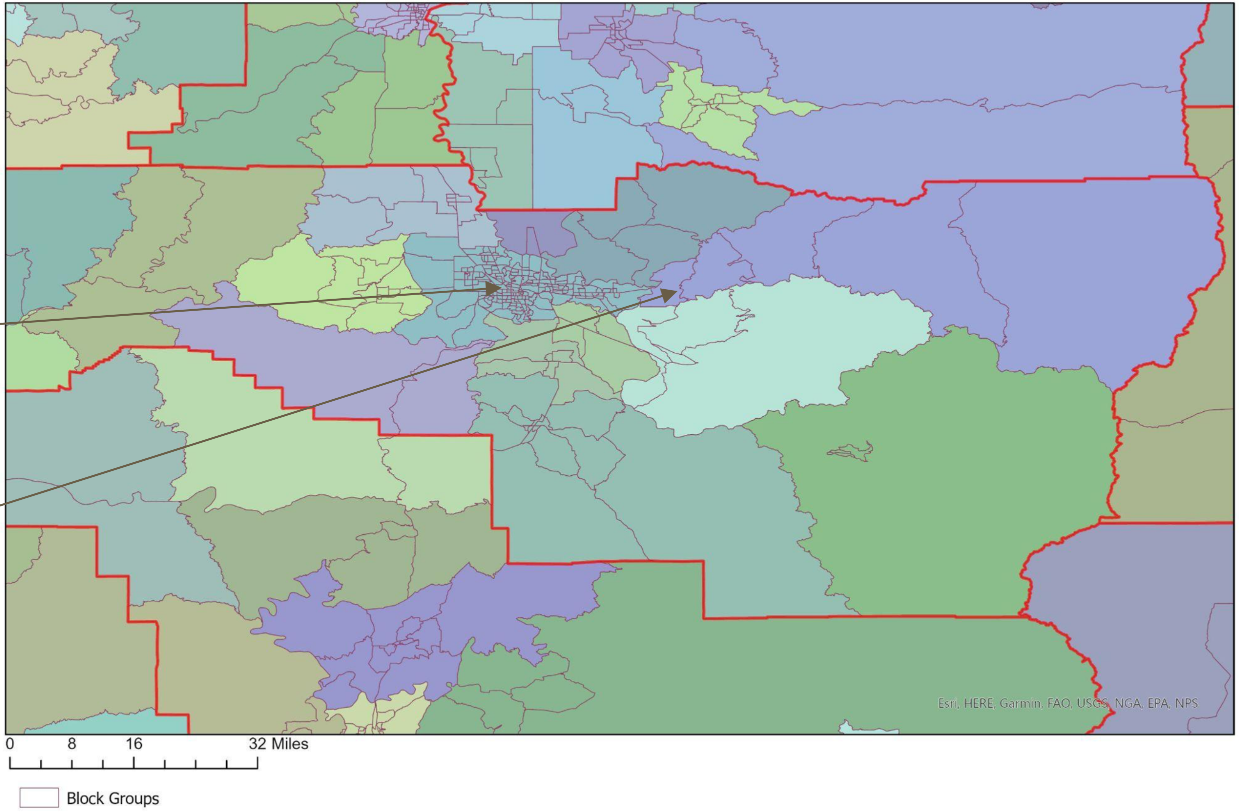


Block Group vs County Subdivisions

Reminder: Block Groups are divisions of census tracts that contain between ~600 to 3,000 people.

Are very small in urban areas (Eugene)

Block groups provide more differentiation in rural areas (Outskirts of Eugene, Cascade foothills).



Data Source: American Community Survey

Unlike the Decennial Census, which is mainly to provide counts of people for the purpose of congressional apportionment, the American Community Survey (ACS) exists mainly to measure **the changing social and economic characteristics of the U.S. population**— education, housing, jobs, etc. Was designed to replace the "long form" census questions at an increased frequency of release.

Sample: ~ 1 in 12 US households in a rolling panel; for rural areas, 5 years of survey data are combined for each release (*e.g., ACS 2020 data will be an aggregate of information collected in 2016 through 2020*)

Methods:

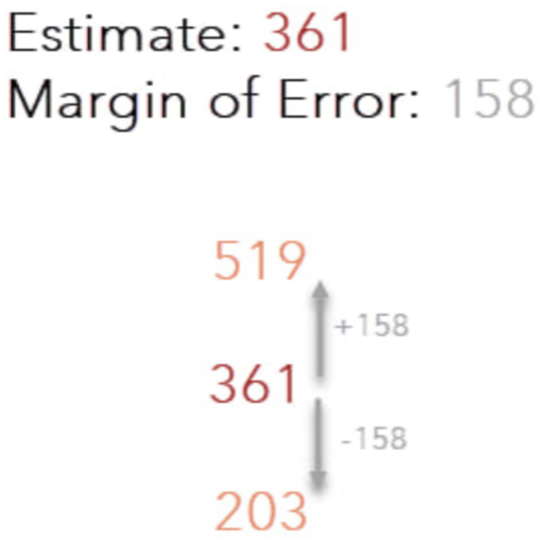
- Uses a **"current residence";** includes people who will be staying in a residence for 2+ months. Data describe the characteristics nearly every day over the full calendar year.
- Utilizes mail-out/ mail-back questionnaires, internet response, telephone, and in-person visits.
- In ACS 2017, **only 1 in 3 nonrespondents were followed up** with for an in person interview.

Data Reliability

The ACS takes a sample of the population and gives sample ***estimates*** of the characteristics of the whole population.

Margins of error are an indicator of the reliability of the estimate, they are the upper- and lower-bound of a range that the Census has given us. The estimate is simply the midpoint of that range or "confidence interval."

In general, the confidence interval gets larger as your population gets smaller *(this is why data gets less reliable as you use smaller levels of geography).*[1]



Example of estimate, margin of error, and confidence interval. [2]

1 American Community Survey General Handbook. Understanding error and determining statistical significant. https://www.census.gov/content/dam/Census/library/publications/2018/acs/acs_general_handbook_2018_ch07.pdf

2 ArcGIS Blog. The Census Bureau Gives You Margins of Error, We Help You Map Them. https://www.esri.com/arcgis-blog/products/arcgis-online/mapping/the-census-bureau-gives-you-margins-of-error-we-help-you-map-them/

Measuring Reliability

Coefficients of Variance (CVs) are a standardized indicator of the reliability of an estimate.

The lower the CV, the more reliable the data. There are no hard-and-fast rules for setting acceptable thresholds of reliability.

What is a good CV?

The cut-off depends on the application of the data –

Environmental Systems Research Institute, the makers of ArcGIS, in its own use of ACS, uses the following reliability thresholds[1]:

- **High Reliability:** Estimates with **CVs less than or equal to 12** - sampling error is small relative to the estimate and the estimate is reasonably reliable
- **Medium Reliability:** Estimates with CVs between **12 and 40** - use with caution
- **Low Reliability:** Estimates with large **CVs over 40** - sampling error is large relative to the estimate. The estimate here is considered very unreliable.

1 Tufts GIS https://sites.tufts.edu/gis/files/2013/11/Amercian-Community-Survey_Margin-of-error-tutorial.pdf

Deriving Sampling Error Measures From Published MOE

Margin Error (MOE) for Alternate Confidence Levels

$$MOE_{95} = \frac{1.960}{1.645} MOE_{ACS}$$

$$MOE_{99} = \frac{2.576}{1.645} MOE_{ACS}$$

Standard Error (SE)

$$SE = \frac{MOE_{ACS}}{1.645}$$

Confidence Interval (CI)

$$CI_{CL} = \left(\hat{X} - MOE_{CL}, \hat{X} + MOE_{CL}\right)$$

Coefficient of Variation (CV)

$$CV = \frac{SE}{\hat{X}} \times 100$$

American Community Survey General User Handbook (2018). https://www.census.gov/content/dam/Census/library/publications/2018/acs/acs_general_handbook_2018_ch07.pdf

Data Reliability at Different Geographic Scales

Geography	Total number in Oregon	Range of calculated Coefficients of Variance	% of units w/ CV > 100
County	36	2 - 23%	0%
County Subdivisions	212	2 - 88%	1.8%
Tracts	834	10 - 66%	1.2%
Block Groups	2634	13 - 99%	6.7%

Comparison of reliability of the **population in poverty** estimate for different census geographies using ACS 5 year estimates for 2015-2019.

MOE (margin of error) - provided with ACS data for each estimate

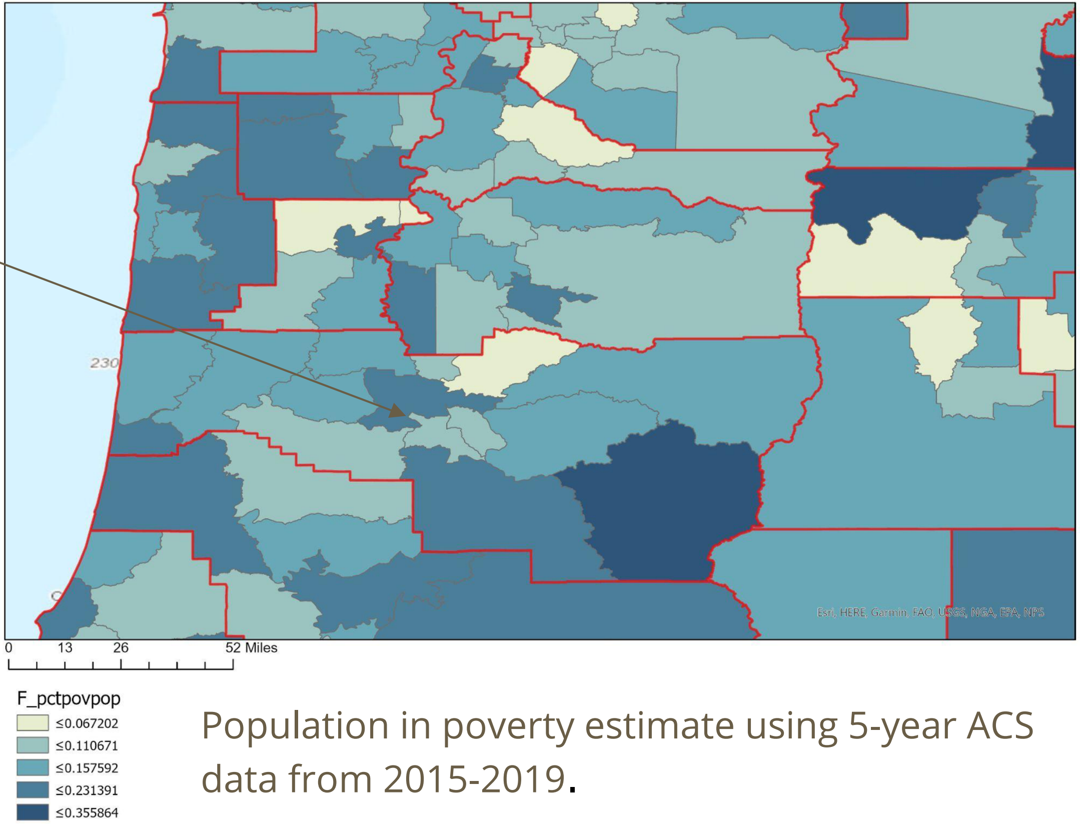
Standard Error = margin of error for population in poverty/1.645

Coefficient of Variance = SE/estimate of population in poverty

% of units with CV > 100: driven by instances where **MOE > Estimate,** indicating VERY low reliability of the data.

Poverty by County Subdivision

Multiple areas in Lane County with very different poverty levels (county boundaries in red)

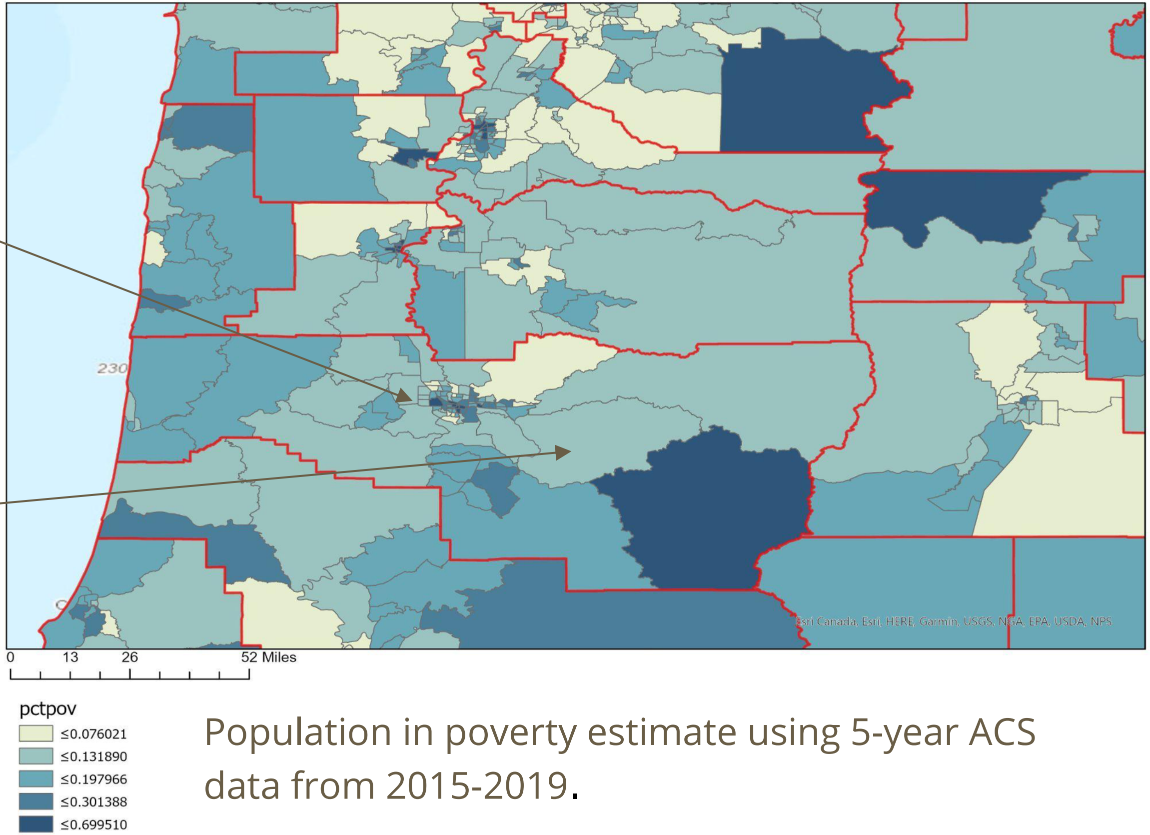


Population in poverty estimate using 5-year ACS data from 2015-2019.

Poverty by Tract

Lots of tracts within the Eugene-Springfield area with very different levels of poverty reported....

Eastern part of the county are about the same size as their respective county subdivisions w/ similar poverty measures reported



Population in poverty estimate using 5-year ACS data from 2015-2019.

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Poverty by Block Group

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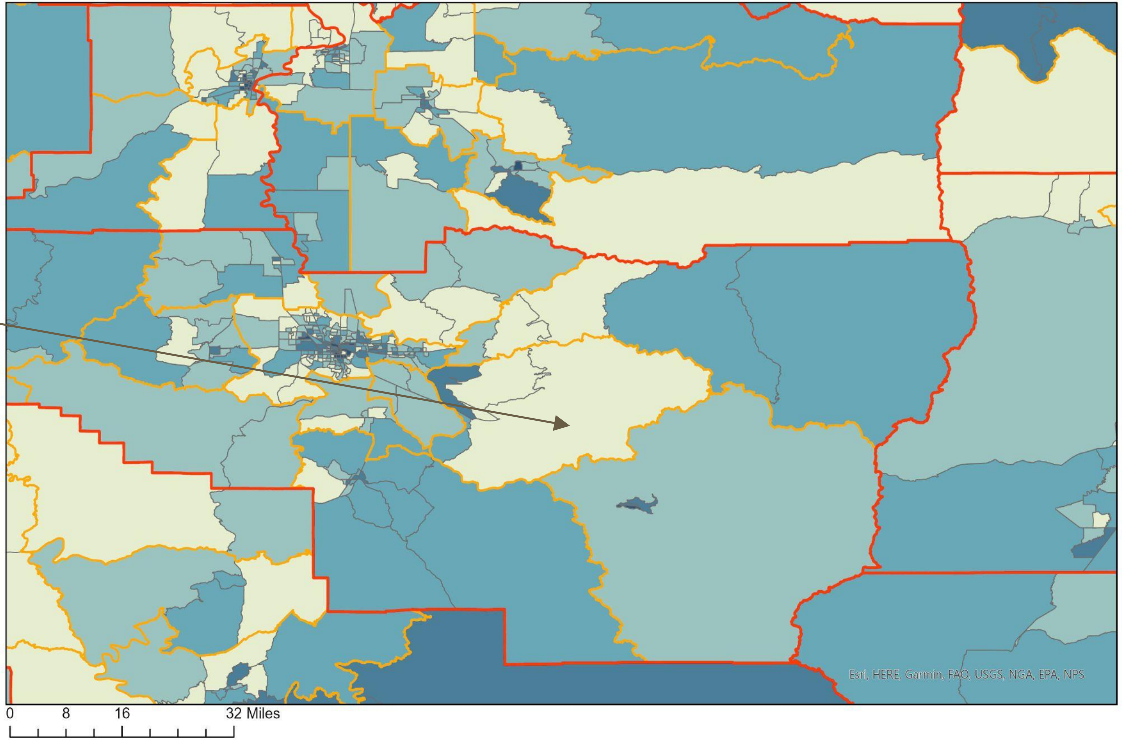
Eastern part of the County is now split into many block groups, sometimes with varying poverty rates



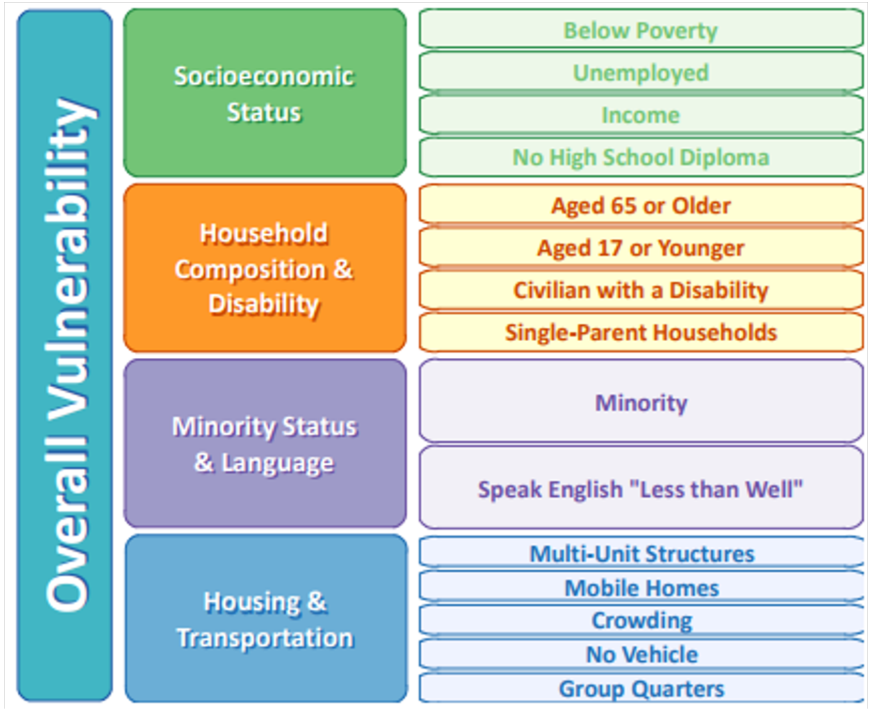
Population in poverty estimate using 5-year ACS data from 2015-2019.

Social Vulnerability Index

Social vulnerability is commonly used by agencies and proxied for using a Social Vulnerability Index (SVI).

SVI is quantified through population demographic data that are indicators of social status and access to resources.

The CDC has developed a SVI that has been widely adopted by agencies and others[1].



Social Vulnerability Index developed by the Centers for Disease Control, using American Community Survey data.

1 Coughland et al., 2019; Cutter, Boruff, and Shirley, 2003

Ranking & Mapping SVI

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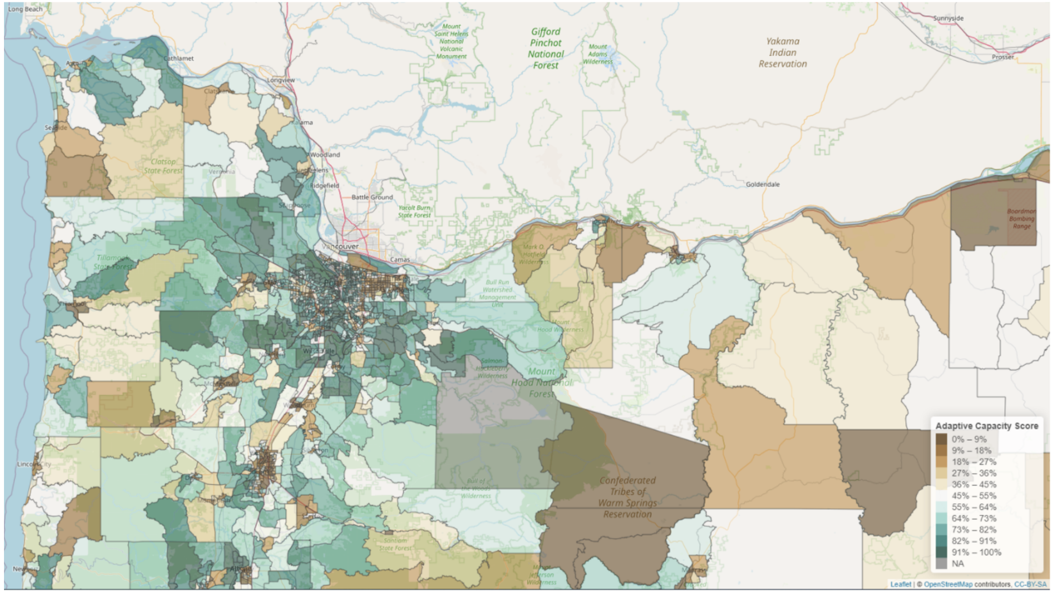
Each socioeconomic indicator is ranked for each community as compared to all communities.

Then, the sum for each of the ranks for a community is taken.

These summed values are ordered and an overall percentile ranking is calculated that represents the final SVI for a given geography.

SVI is then mapped using geospatial information systems to produce a map layer that can be tied to other map layers and displayed in the Oregon Explorer.



Example of an SVI calculated at the block group level for Oregon (Holmes, 2020).

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- **What geographic unit?**
  - Trade offs between level of detail and accuracy of data
  - May have to adjust indicators included in SVI based on available data

Timeline

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- Ongoing: communicate and coordinate with other agency efforts.
- Winter 2022: Gather socioeconomic data - 2020 ACS/Census data (~~release date Dec 2021~~).
  NEW RELEASE DATE: March 2022
- Spring 2022: Calculate SVI; Rank and map for all communities in Oregon.
- Spring 2022: Integrate with Oregon Wildfire Explorer Interface and map of biophysical wildfire risk.

For more information

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