

10. VULNERABILITY TO WILDLAND FIRES

Methods

States in the South hold a unique set of urban and environmental characteristics, making the region susceptible to wildfire ignition. An abundance of wildland forest combined with a steady influx of new residents in Florida has created a landscape of urban settlements and infrastructure within or near to forested land across the state. Furthermore, wildfire ignition risk is compounded in Florida by the frequent occurrence of cloud-to-ground lightning (Buckley et al., 2006). With drier and warmer temperatures projected for Florida in the mid-late 21st century, the risk of wildfires is increased, particularly in the spring season through June (Bedel et al., 2013).

To quantify wildfire ignition risk throughout the state, data were obtained from the Florida Division of Forestry. The dataset used for analysis, the Wildland Fire Susceptibility Index (WFSI), represents a subset of the Southern Wildfire Risk Assessment Project, initially produced for the Southern Group of State Foresters in 2006. Spatially, the WFSI is illustrated as a 30x30 m grid with cell values ranging from zero to one representing the likelihood of an acre of land burning if ignited (Buckley et al., 2006). As Buckley et al. (2006) describe, WFSI integrates the probability of an acre igniting and the expected final fire size based on the rate of spread in four weather percentile categories into a single measure of wildland fire susceptibility. The WFSI is comprised of three component data streams: 1) probability of fire occurrence, 2) fire behavior, and 3) fire suppression effectiveness. Figure 66 illustrates the components of the final WFSI model.

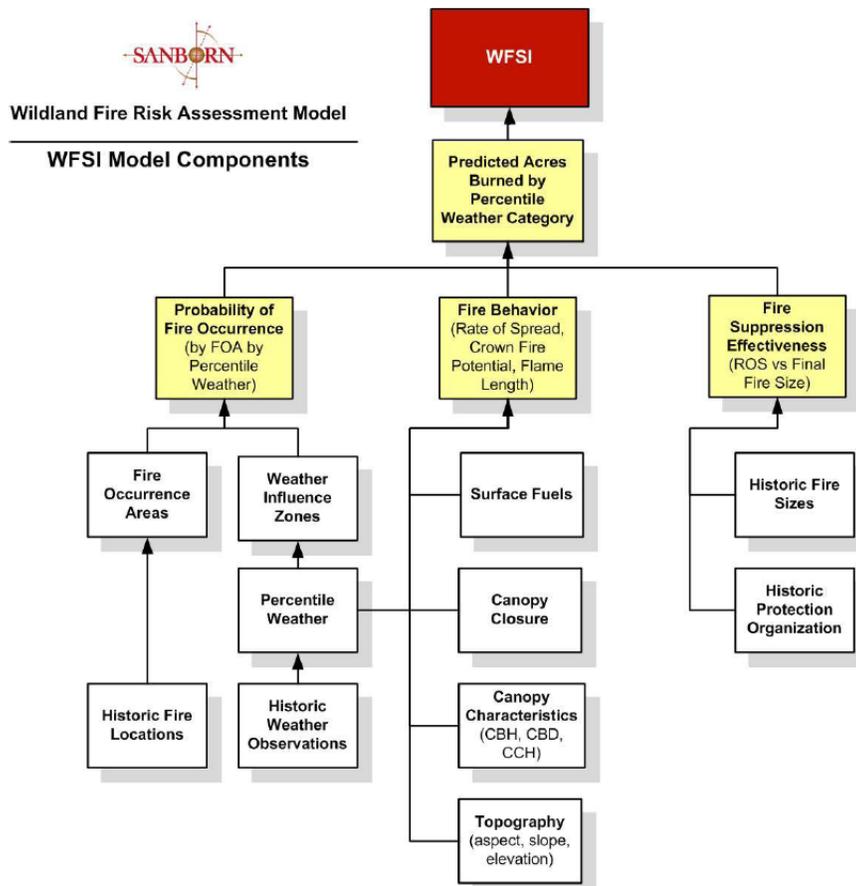


Figure 66: WFSI model components.

Source: Buckley et al., 2006: 41

The WFSI grid was imported into ArcMap for GIS processing. The raster grid was overlaid with Florida census tract boundaries. Wildfire ignition risk for each tract was approximated by extracting the maximum WFSI value inside each tract boundary. Maximum WFSI was selected over the average value because averaging values for each tract resulted in extremely low and misrepresentative values. Using maximum probability of an acre or more burning provides the highest risk faced in any tract in much the same way that tract coincidence with other hazard zones indicates higher risk (Figure 67). Each census tract was then categorized into one of five classes based on the maximum WFSI score coinciding with it using the following equal interval classification scheme so that future changes in risk at the tract-level can be easily seen in comparison to the current risk level:

- Low = Less than 25% probability of an acre or more burning if ignited
- Medium = Between 25% - 50% probability of an acre or more burning if ignited
- High = Between 50%-75% probability of an acre or more burning if ignited
- Extreme = Greater than 75% probability of an acre or more burning if ignited

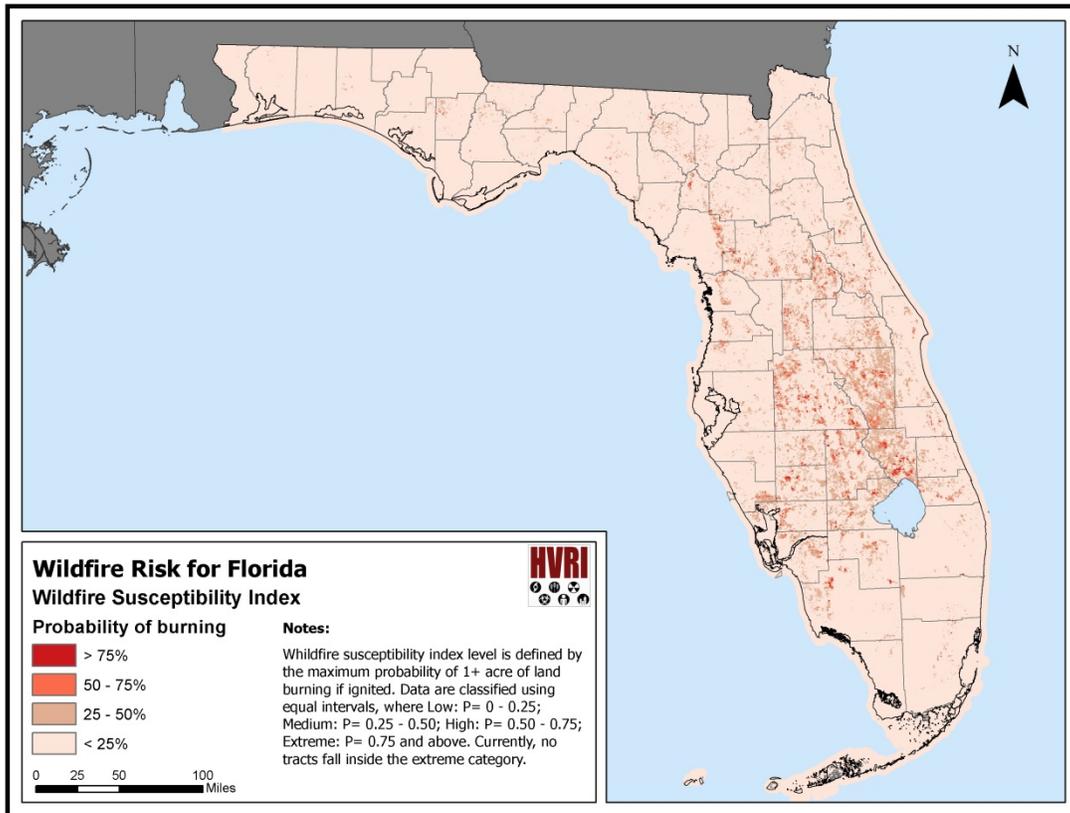


Figure 67: Wildland Fire Susceptibility Index (WFSI) scores for Florida.

State Summary

Wildfire threat is greatest across the central portion of the state where vast fields of livestock and citrus, along with numerous federal, state, and county parks and scenic areas are located (Figure 68). Among the most at-risk counties are Charlotte with 18% of its tracts in a medium threat category, Highlands (15%), Lee (9%), Marion (10%), Osceola (15%), and Polk (19%) (Table 81). There are no counties with census tracts in the extreme wildfire threat category and only two counties (Okeechobee and Polk) with high risk areas, when classifying tracts based on maximum probability of an acre or more burning if ignited. There are, however, many more counties containing populated census tracts characterized by medium wildfire threat. Here, more than 500,000 people live within areas of medium wildfire risk (Table 82).

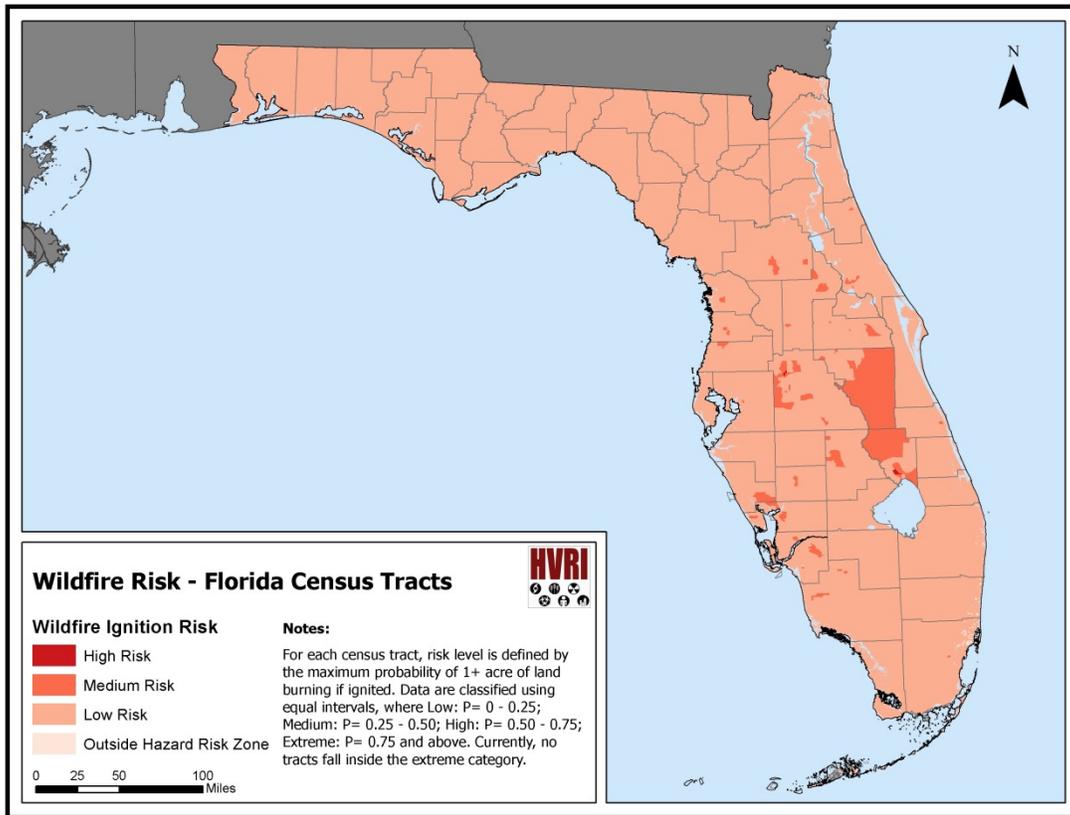


Figure 68: Wildfire ignition risk in Florida.

Table 81: Census tract summary for wildfire risk.

| County Name | Wildfire Hazard Risk | | | | | County Name | Wildfire Hazard Risk | | | | |
|--------------|----------------------|----------------|------------------|------------|--------|--------------------|----------------------|----------------|------------------|---------------|--------------|
| | Extreme (75%) | High (50%-75%) | Medium (25%-50%) | Low (<25%) | Out | | Extreme (75%) | High (50%-75%) | Medium (25%-50%) | Low (<25%) | Out |
| Alachua | - | - | - | 100.00% | - | Lee | - | - | 8.98% | 89.82% | 1.20% |
| Baker | - | - | - | 100.00% | - | Leon | - | - | - | 100.00% | - |
| Bay | - | - | - | 97.73% | 2.27% | Lew | - | - | - | 90.00% | 10.00% |
| Bradford | - | - | - | 100.00% | - | Liberty | - | - | - | 100.00% | - |
| Brevard | - | - | - | 100.00% | - | Madison | - | - | - | 100.00% | - |
| Broward | - | - | - | 96.12% | 3.88% | Manatee | - | - | - | 100.00% | - |
| Calhoun | - | - | - | 100.00% | - | Marion | - | - | 9.52% | 90.48% | - |
| Charlotte | - | - | 17.95% | 79.49% | 2.56% | Martin | - | - | - | 100.00% | - |
| Citrus | - | - | 3.57% | 96.43% | - | Miami-Dade | - | - | 0.19% | 83.82% | 15.99% |
| Clay | - | - | - | 100.00% | - | Monroe | - | - | - | 96.77% | 3.23% |
| Collier | - | - | 5.41% | 93.24% | 1.35% | Nassau | - | - | - | 100.00% | - |
| Columbia | - | - | - | 100.00% | - | Okaloosa | - | - | - | 100.00% | - |
| DeSoto | - | - | 22.22% | 77.78% | - | Okeechobee | - | 9.09% | 63.64% | 27.27% | - |
| Dixie | - | - | - | 100.00% | - | Orange | - | - | 1.45% | 98.55% | - |
| Duval | - | - | - | 100.00% | - | Osceola | - | - | 14.63% | 85.37% | - |
| Escambia | - | - | - | 100.00% | - | Palm Beach | - | - | - | 97.62% | 2.38% |
| Flagler | - | - | 5.00% | 95.00% | - | Pasco | - | - | 1.49% | 97.76% | 0.75% |
| Franklin | - | - | - | 100.00% | - | Pinellas | - | - | - | 99.59% | 0.41% |
| Gadsden | - | - | - | 100.00% | - | Polk | - | 0.65% | 18.83% | 80.52% | - |
| Gilchrist | - | - | - | 100.00% | - | Putnam | - | - | - | 100.00% | - |
| Glades | - | - | - | 75.00% | 25.00% | Santa Rosa | - | - | - | 100.00% | - |
| Gulf | - | - | - | 100.00% | - | Sarasota | - | - | 4.26% | 95.74% | - |
| Hamilton | - | - | - | 100.00% | - | Seminole | - | - | - | 100.00% | - |
| Hardee | - | - | - | 100.00% | - | St. Johns | - | - | - | 100.00% | - |
| Hendry | - | - | - | 100.00% | - | St. Lucie | - | - | - | 100.00% | - |
| Hernando | - | - | 4.44% | 93.33% | 2.22% | Sumter | - | - | - | 100.00% | - |
| Highlands | - | - | 14.81% | 85.19% | - | Suwannee | - | - | - | 100.00% | - |
| Hillsborough | - | - | 0.31% | 99.07% | 0.62% | Taylor | - | - | - | 100.00% | - |
| Holmes | - | - | - | 100.00% | - | Union | - | - | - | 100.00% | - |
| Indian River | - | - | 3.33% | 96.67% | - | Volusia | - | - | 4.39% | 94.74% | 0.88% |
| Jackson | - | - | - | 100.00% | - | Wakulla | - | - | - | 100.00% | - |
| Jefferson | - | - | - | 100.00% | - | Walton | - | - | - | 100.00% | - |
| Lafayette | - | - | - | 100.00% | - | Washington | - | - | - | 100.00% | - |
| Lake | - | - | 5.36% | 94.64% | - | State Total | - | 0.05% | 2.47% | 94.66% | 2.82% |

Table 82: Census tract population summary for wildfire risk.

| County Name | Wildfire Hazard Risk | | | | | County Name | Wildfire Hazard Risk | | | | |
|--------------|----------------------|----------------|------------------|------------|--------|--------------------|----------------------|----------------|------------------|-------------------|----------------|
| | Extreme (75%) | High (50%-75%) | Medium (25%-50%) | Low (<25%) | Out | | Extreme (75%) | High (50%-75%) | Medium (25%-50%) | Low (<25%) | Out |
| Alachua | - | - | - | 247,336 | - | Lee | - | - | 56,200 | 559,452 | 3,102 |
| Baker | - | - | - | 27,115 | - | Leon | - | - | - | 275,487 | - |
| Bay | - | - | - | 168,852 | - | Levy | - | - | - | 40,801 | - |
| Bradford | - | - | - | 28,520 | - | Liberty | - | - | - | 8,365 | - |
| Brevard | - | - | - | 543,369 | - | Madison | - | - | - | 19,224 | - |
| Broward | - | - | - | 1,697,082 | 50,984 | Manatee | - | - | - | 322,833 | - |
| Calhoun | - | - | - | 14,625 | - | Marion | - | - | 38,869 | 292,429 | - |
| Charlotte | - | - | 34,885 | 125,093 | - | Martin | - | - | - | 146,318 | - |
| Citrus | - | - | 6,488 | 134,748 | - | Miami-Dade | - | - | - | 2,141,010 | 352,117 |
| Clay | - | - | - | 190,865 | - | Monroe | - | - | - | 73,090 | - |
| Collier | - | - | 19,622 | 301,898 | - | Nassau | - | - | - | 73,314 | - |
| Columbia | - | - | - | 67,531 | - | Okaloosa | - | - | - | 180,822 | - |
| DeSoto | - | - | 11,592 | 23,270 | - | Okeechobee | - | 4,568 | 23,634 | 11,794 | - |
| Dixie | - | - | - | 16,422 | - | Orange | - | - | 19,504 | 1,126,452 | - |
| Duval | - | - | - | 864,263 | - | Osceola | - | - | 43,025 | 225,660 | - |
| Escambia | - | - | - | 297,619 | - | Palm Beach | - | - | - | 1,295,766 | 23,696 |
| Flagler | - | - | 7,274 | 88,422 | - | Pasco | - | - | 8,869 | 455,828 | - |
| Franklin | - | - | - | 11,549 | - | Pinellas | - | - | - | 916,542 | - |
| Gadsden | - | - | - | 46,389 | - | Polk | - | 3,685 | 113,750 | 484,660 | - |
| Gilchrist | - | - | - | 16,939 | - | Putnam | - | - | - | 74,364 | - |
| Glades | - | - | - | 12,884 | - | Santa Rosa | - | - | - | 151,372 | - |
| Gulf | - | - | - | 15,863 | - | Sarasota | - | - | 53,103 | 326,345 | - |
| Hamilton | - | - | - | 14,799 | - | Seminole | - | - | - | 422,718 | - |
| Hardee | - | - | - | 27,731 | - | St. Johns | - | - | - | 190,039 | - |
| Hendry | - | - | - | 39,140 | - | St. Lucie | - | - | - | 277,789 | - |
| Hernando | - | - | 8,422 | 164,356 | - | Sumter | - | - | - | 87,023 | - |
| Highlands | - | - | 17,281 | 81,505 | - | Suwannee | - | - | - | 41,551 | - |
| Hillsborough | - | - | 5,287 | 1,223,939 | - | Taylor | - | - | - | 22,570 | - |
| Holmes | - | - | - | 19,927 | - | Union | - | - | - | 15,535 | - |
| Indian River | - | - | 5,354 | 132,674 | - | Volusia | - | - | 24,702 | 469,891 | - |
| Jackson | - | - | - | 49,746 | - | Wakulla | - | - | - | 30,776 | - |
| Jefferson | - | - | - | 14,761 | - | Walton | - | - | - | 55,043 | - |
| Lafayette | - | - | - | 8,870 | - | Washington | - | - | - | 24,896 | - |
| Lake | - | - | 8,595 | 288,457 | - | State Total | - | 8,253 | 506,456 | 17,846,318 | 429,899 |

Analyzing Wildfire in Combination with SoVI and MedVI

About Bivariate Classifications

Here, we keep the exposure constant by using the same hazard threat surface but use different vulnerability perspectives (Social and Medical) in bivariate representations to create an easily understood depiction of not only increased threat but also a limited ability to adequately prepare for and respond to these threats. In doing so, we are able to quickly identify three specific geographic areas of interest:

1. Areas where the hazard itself should be the focus of planning and mitigation,
2. Areas where understanding the underlying socioeconomics and demographics would prove to be the most advantageous input point to create positive change, and
3. Areas where a combination of classic hazard mitigation techniques and social mitigation practices should be utilized in order to maximize optimal outcomes.

The following maps utilize a three by three bivariate representation in which one can easily identify areas of limited to elevated SoVI in relation to areas with low to extreme hazard classifications. Places identified in item number one in the preceding list are

shaded in the blue colors and can be understood as locations where hazard susceptibility is higher than SoVI or MedVI. Areas identified in item number two above, indicating where socioeconomics and demographics play an important role, are shaded in the pink/red colors and can be conceived as locations where SoVI or MedVI are greater than physical hazard threats. Places identified in item number three above are shaded either in gray-tones or in a dark burgundy color and can be understood as areas that have equal vulnerability and hazard classification scores.

The pattern of wildfire threats combined with social vulnerability (Figure 69) shows mostly low levels of wildfire threat coupled with medium to high social vulnerability throughout central Florida, especially in Polk, Okeechobee, and Marion Counties. There are no census tracts with high or extreme wildfire threat coupled with high social vulnerability. Only 38 tracts in 13 counties exhibit high social vulnerability coincident with medium wildfire risk, representing 186,000 people (Table 83).

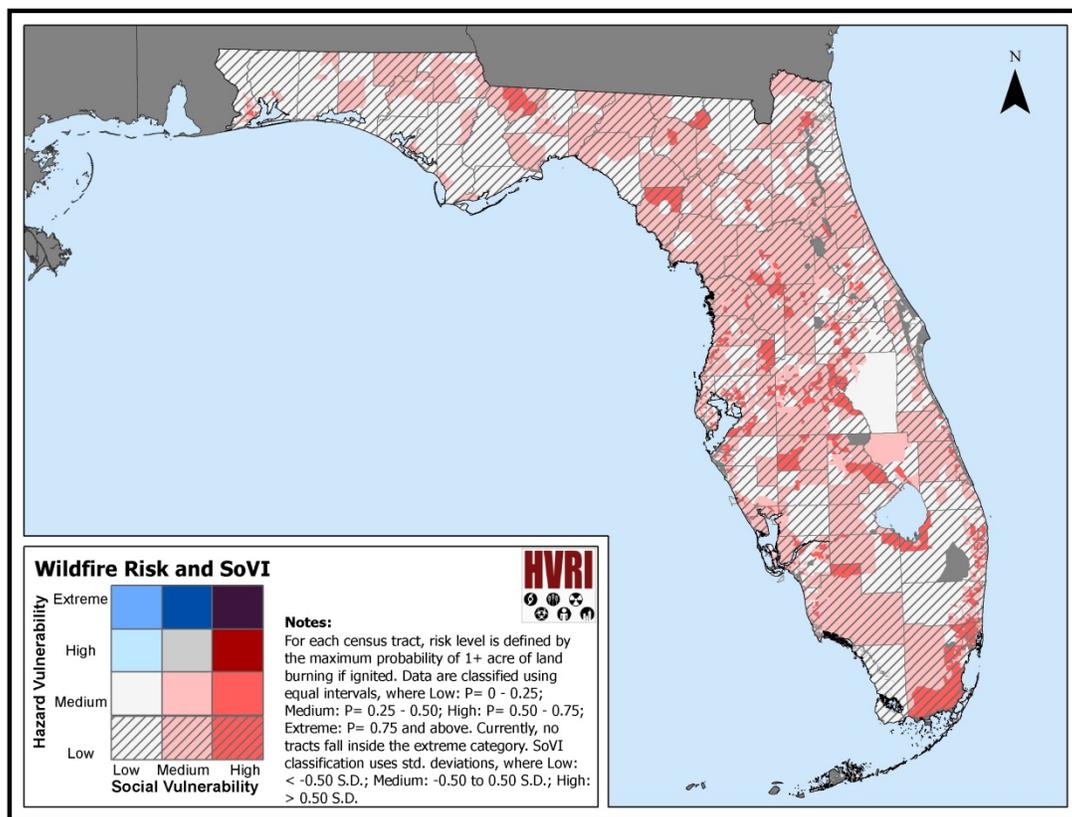


Figure 69: Bivariate representation of SoVI and wildfire risk in Florida.

Table 83: Tract and population summary for counties with high SoVI and medium or greater wildfire risk.

| County Name | Number of Tracts | Total Population of Tracts | County Name | Number of Tracts | Total Population of Tracts | County Name | Number of Tracts | Total Population of Tracts |
|----------------------|------------------|----------------------------|--------------|------------------|----------------------------|--------------|------------------|----------------------------|
| Medium Wildfire Risk | | | | | | | | |
| Charlotte | 3 | 10,175 | Collier | 2 | 9,033 | DeSoto | 2 | 11,592 |
| Hernando | 1 | 3,686 | Hillsborough | 1 | 5,287 | Indian River | 1 | 5,354 |
| Lee | 9 | 39,201 | Marion | 3 | 28,805 | Okeechobee | 3 | 10,116 |
| Orange | 2 | 10,263 | Polk | 9 | 45,762 | Sarasota | 1 | 2,755 |
| Volusia | 1 | 4,055 | | - | - | | - | - |
| State Total | 38 | 186,084 | | - | - | | - | - |

The pattern is quite different when we take into account MedVI. Here, a large portion of Osceola County exhibits medium medical vulnerability coupled with medium wildfire threat (Figure 70). Seminole County, as a whole, does not exhibit as high MedVI or wildfire threat as its neighboring counties. There are, however, more than 300,000 people residing in 72 tracts across 15 counties with both high MedVI and medium to high wildfire threat (Table 84). Included here are 29 tracts in Polk County where more than 100,000 people reside and over an additional 40,000 people across six tracts in Osceola County.

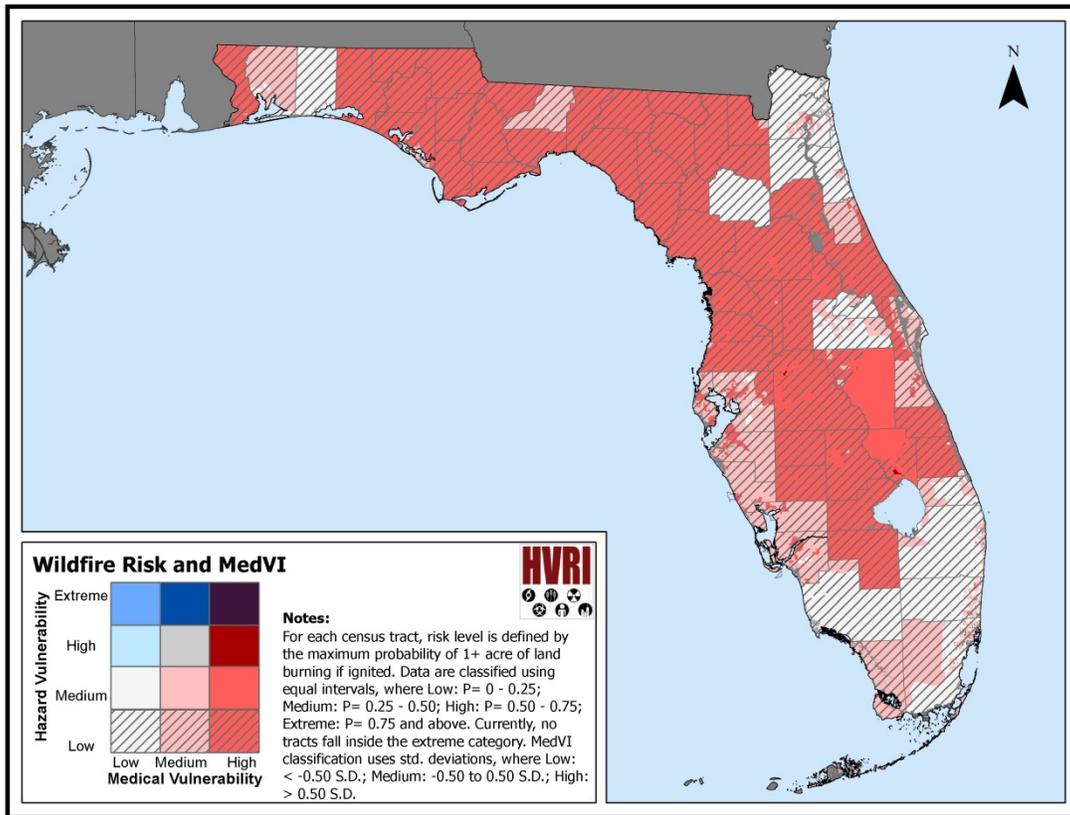


Figure 70: Bivariate representation of MedVI and wildfire risk in Florida.

Table 84: Tract and population summary for counties with high MedVI and medium or greater wildfire risk.

| County Name | Number of Tracts | Total Population of Tracts | County Name | Number of Tracts | Total Population of Tracts | County Name | Number of Tracts | Total Population of Tracts |
|----------------------|------------------|----------------------------|-------------|------------------|----------------------------|--------------|------------------|----------------------------|
| High Wildfire Risk | | | | | | | | |
| Okeechobee | 1 | 4,568 | Polk | 1 | 3,685 | | - | - |
| State Total | 2 | 8,253 | | - | - | | - | - |
| Medium Wildfire Risk | | | | | | | | |
| Charlotte | 1 | 5,498 | Citrus | 1 | 6,488 | DeSoto | 2 | 11,592 |
| Hernando | 2 | 8,422 | Highlands | 4 | 17,281 | Indian River | 1 | 5,354 |
| Lake | 3 | 8,595 | Lee | 5 | 21,194 | Marion | 5 | 38,869 |
| Okeechobee | 7 | 23,634 | Osceola | 6 | 43,025 | Pasco | 2 | 8,869 |
| Polk | 29 | 113,750 | Sarasota | 2 | 12,103 | Volusia | 5 | 24,702 |
| State Total | 75 | 349,376 | | - | - | | - | - |

Bibliography

Bedel, A.P., Mote, T.L., and S.L. Goodrick, 2013. "Climate Change and Associated Fire Potential for the South-eastern United States in the 21st Century." *International Journal of Wildland Fires* no. 22: 1034-1043. doi: 10.1071/WF13018.

Buckley, D., Carlton, D., Krieter, D., and K. Sabourin. 2006. "Southern Wildfire Risk Assessment Project Final Report" Colorado Springs, CO: Sanborn Total Geospatial Solutions, Prepared for Texas Forest Service and Southern Group of State Foresters. Accessed June 9, 2013. Available from http://www.southernwildfirerisk.com/downloads_reports/Sanborn%20-%20Quantifying_Wildland_Fire_Risk_in_South.pdf