Resurrecting Fire Lookout Towers in the Los Padres National Forest

Scope

The purpose of this project is to determine whether or not early wildfire detection could benefit from bringing back the use of fire lookout towers. The area of study is limited to the Los Padres National Forest in the southern California counties of San Luis Obispo, Santa Barbara, and Ventura. The focus has been made on this area specifically in light of several recent devastating fires. Supporting maps include a viewshed analysis of currently standing fire lookout towers, fire threat areas overlayed with the fire lookout tower viewshed, a viewshed analysis map of all previously known fire lookout towers in the area of study, and comparison maps of wildfires from 1920-1989 and wildfires from 1990-2017. The dates of comparison are based on general years when fire lookout towers were in widespread use (beginning in the 1920's) and when they stopped being used (last tower used in Los Padres National Forest was 1990). A 3-D ArcScene map of the last standing tower locations in the Los Padres National Forest is also included to give the viewer height/distance perspective.

Methodology

In order to determine how much visibility coverage is provided by the still standing fire lookout towers, a viewshed analysis was performed. This included downloading the five appropriate DEM files for the area of study and performing a "mosaic to new raster" to combine them into one DEM. I then performed a raster projection to UTM Zone 11N, to change measurements to meters and appropriate for southern California. Fire lookout tower points were created from a CV file that provided latitude and longitude for each location. Each tower generally sits on either a 3.048m (10ft) base or a 6.096m (20ft) base. This information was either found on the tower's national historic landmark data site or determined from images. I then added the base height (ground to floor) plus the average height of an adult, 1.778m (5ft 10in) to get the final height (OFFSETA). The range of view (RADIUS2) was calculated by how far, on average, one could see on a clear day with binoculars and was entered as 64,374m (40 miles). Obviously this variable could change depending on several factors such as smog, eyesight of person, and strength of binoculars. All other variables in controlling the visibility analysis were left in default. The viewshed analysis was performed, followed by an "extract by mask" to find the viewshed for are area of study only. Finally, a zonal tabulation was performed to determine how much of the area of study was within visibility of the fire lookout towers. I also chose to classify the towers by status or grade so that, financially, one could see how realistic and cost effective it would be to bring back the use of each or any of the towers.

I chose to show the lookout tower viewshed map over top of a fire threat raster to visualize how much of the most threatened areas could be under visibility, should the towers be returned to use.

For the past and present towers map, the same viewshed analysis method was repeated with the additional, formerly standing, fire towers. However, it was much harder to find information on the tower base heights, so if no data was available it was set to 0 and only the height of an average person was taken into account. I simply classified these towers as former (non-existent) and remaining (still standing). This was to show how much more visibility existed

and could be re-gained if it's proven that wildfire prevention could benefit from the rebuilding of these towers.

Fire lookout tower use began in the 1920's and surged through the decades. Many towers were rebuilt in the 1960's and continued to be used through the 1980's. Only one fire lookout tower was being used in the Los Padres National Forest in 1990, the final year it was staffed. I chose to include the 1990 date with the "non-use" dates since it was the only tower in use. I thought it would be worthwhile to look at past wildfire activity and compare the numbers from during and after lookout tower use to determine effectiveness. I calculated both the number of wildfires that occurred and the number of acres burned during each time frame.

Results

The zonal tabulation for the viewshed analysis of the still standing fire lookout towers found that 26% of the area of study is visible (74% not visible). The zonal tabulation for the viewshed analysis of fire lookout towers, past and present, found that 47% of the area of study is visible (53% not visible). Neither analysis took into account the possibility of observational obstructions, such as buildings or radio towers. Most of the area of concern involves wilderness areas where little to no obstruction should exist.

The past wildfires comparison maps shows that 658 wildfires occurred from 1920 to 1989, burning approximately 2,304,930 GIS calculated acres. From 1990 to 2017, 588 wildfires have occurred, burning 1,466,400 GIS calculate acres. If you break it down by year, the period where lookout towers are no longer used has seen almost double the number of wildfires than the 69 years where towers were mostly used. We could also determine that more acreage is burning per year since 1990 than previously.

Drought, natural ecology, and population growth are just some of the factors that contribute to increased wildfire activity in recent decades. It is hard to say whether or not the decline in the use of fire lookout towers have contributed to this increase, as they have been replaced with lower cost, higher-tech methods, like planes and drones. Several of the still standing lookout towers, particularly those in Ventura and Santa Barbara County, have visibility in some of the highest fire threat areas and one could argue that with constant eyes on the ground, those areas could greatly benefit from early wildfire detection. The difficult decision comes from whether or not the costs to resurrect, maintain, and staff these towers is worth the benefit of possible early detection.

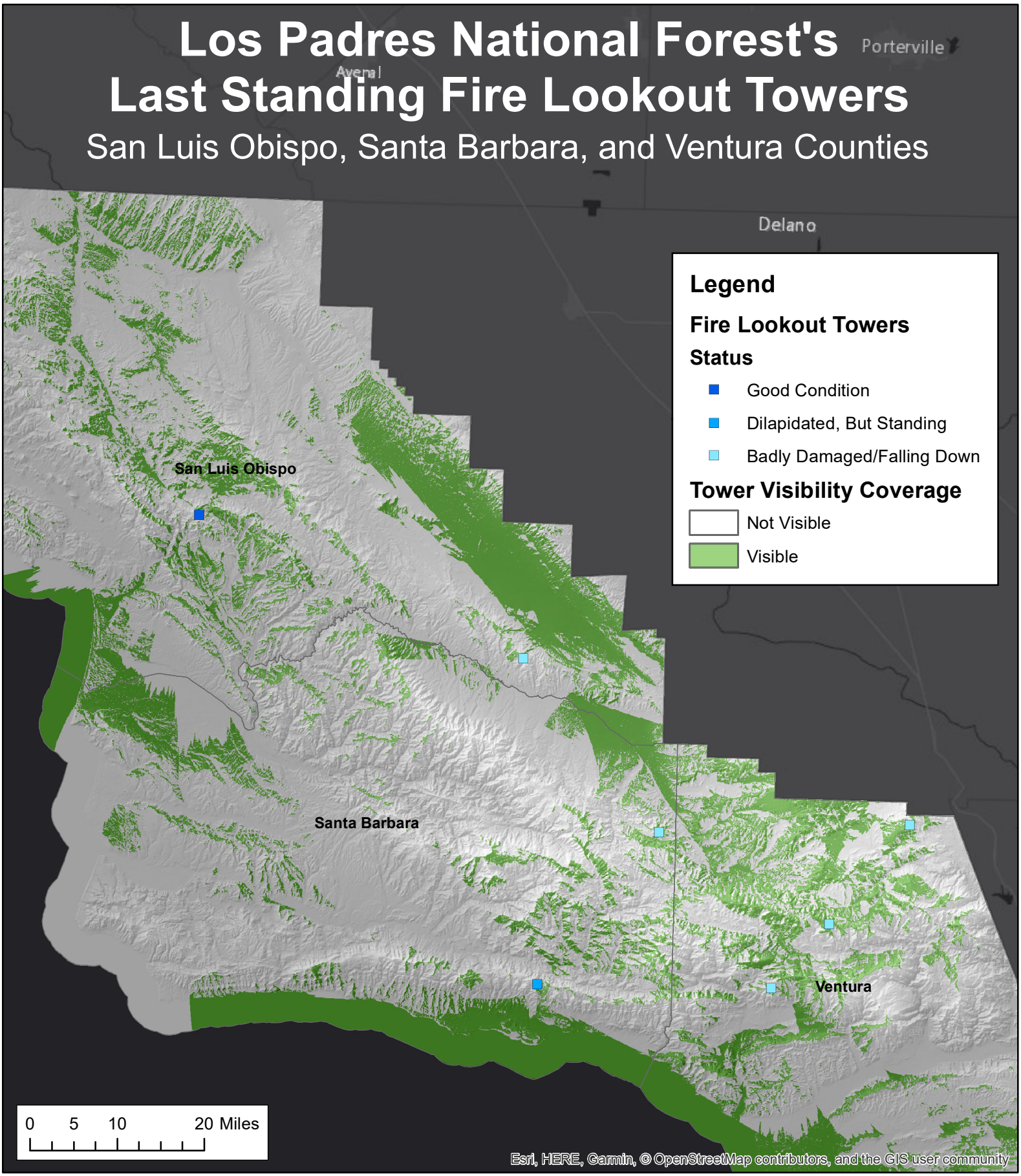
Sources & Related Articles

http://www.peakbagging.com/Peak%20Lists/CA_Lookout1.html
https://earthexplorer.usgs.gov
http://frap.fire.ca.gov
https://data.ca.gov

http://articles.latimes.com/1990-09-16/local/me-974_1_fire-lookout
https://lpfw.org/fire/

Los Padres National Forest's Last Standing Fire Lookout Towers

San Luis Obispo, Santa Barbara, and Ventura Counties



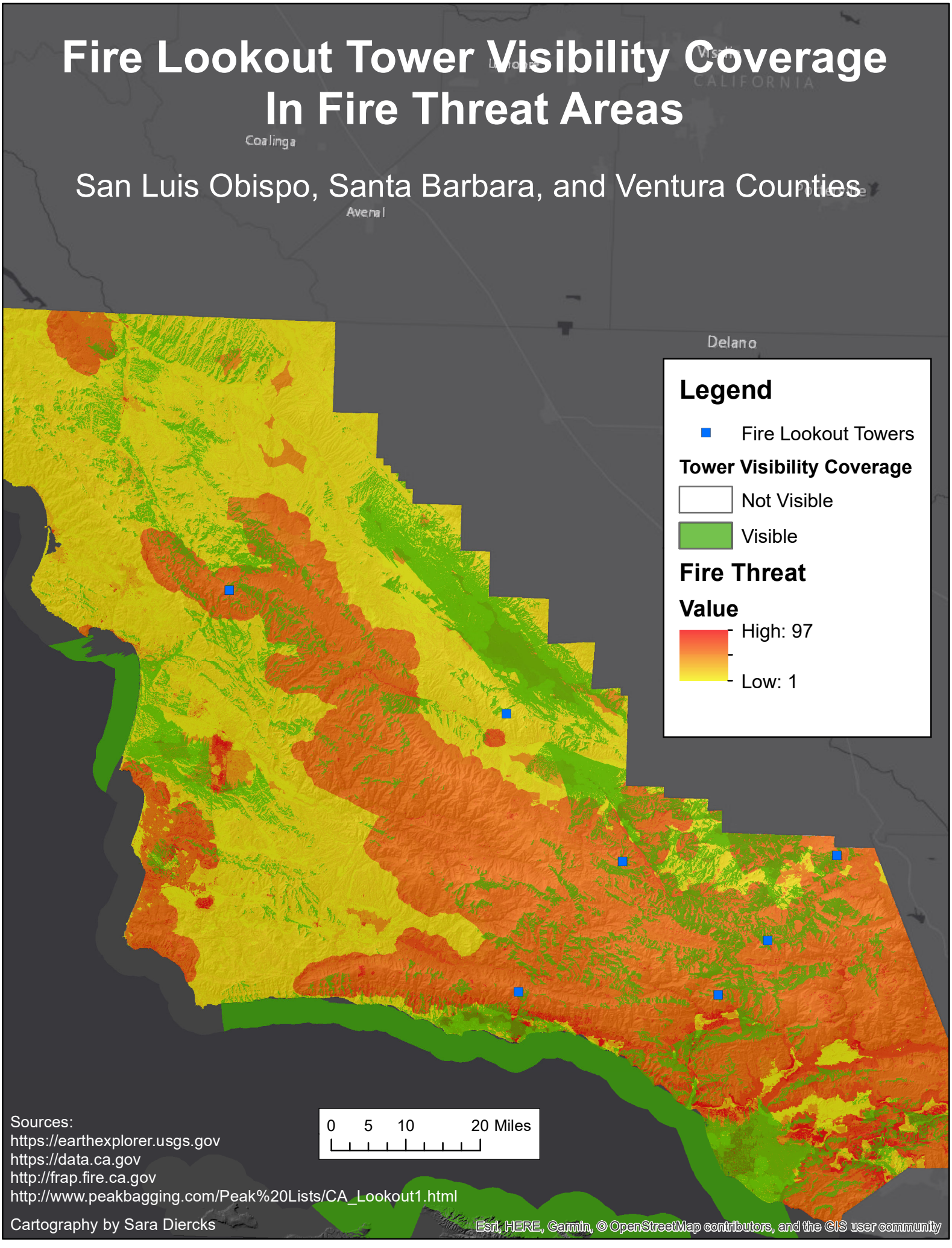
26% Visibility Coverage Provided by Lookout Towers

Sources:
https://earthexplorer.usgs.gov
https://data.ca.gov
http://www.peakbagging.com/Peak%20Lists/CA_Lookout1.html

Cartography by Sara Diercks

Fire Lookout Tower Visibility Coverage In Fire Threat Areas

San Luis Obispo, Santa Barbara, and Ventura Counties



Sources:
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Los Padres National Forest's Fire Lookout Towers, Past & Present

San Luis Obispo, Santa Barbara, and Ventura Counties

47% Visibility Coverage Provided by Lookout Towers

Sources:
https://earthexplorer.usgs.gov
https://data.ca.gov
http://www.peakbagging.com/Peak%20Lists/CA_Lookout1.html

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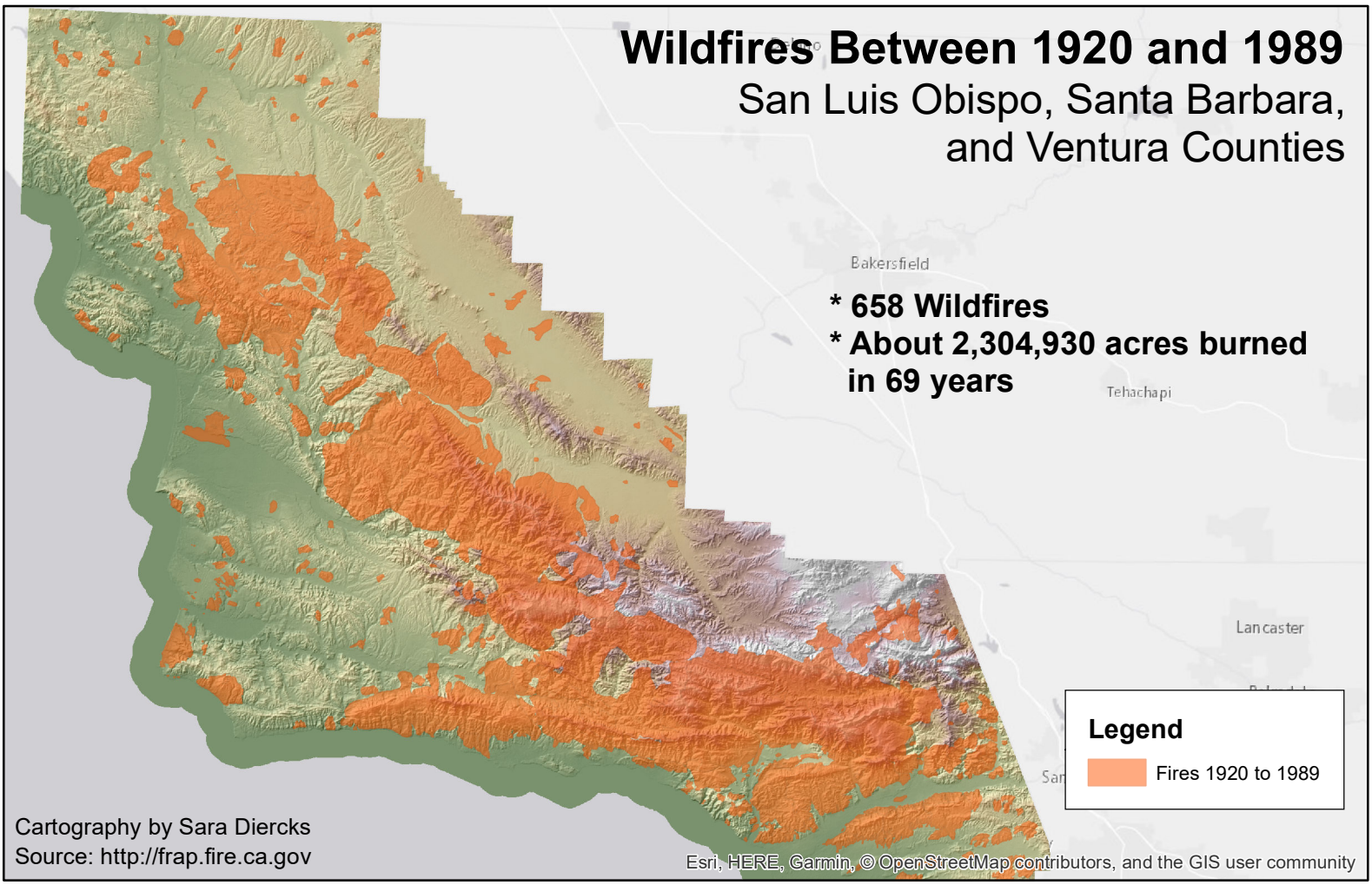
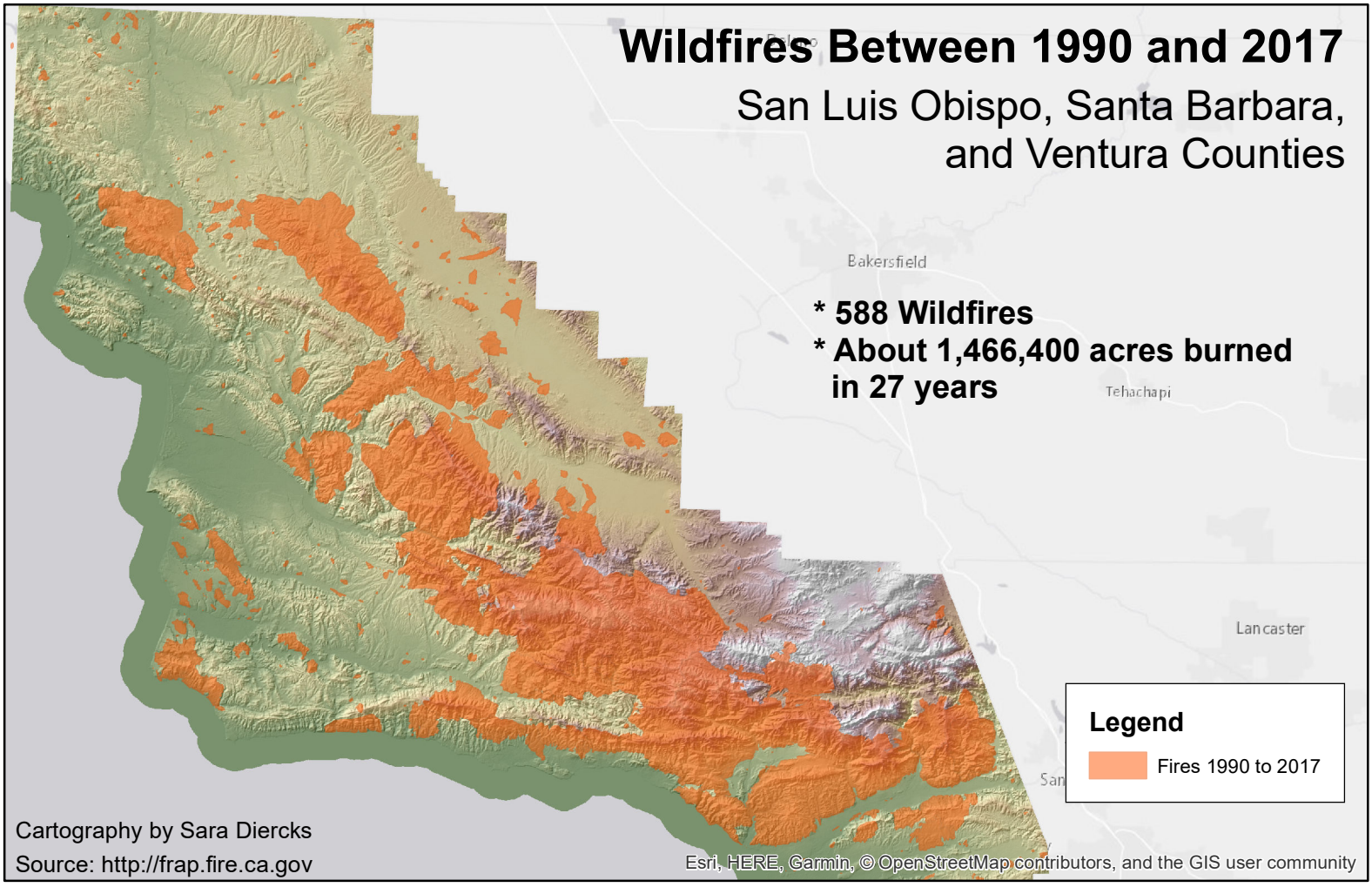

Wildfires Between 1920 and 1989
San Luis Obispo, Santa Barbara, and Ventura Counties
* 658 Wildfires
* About 2,304,930 acres burned in 69 years
Bakersfield
Tehachapi
Lancaster
Legend
Fires 1920 to 1989
Cartography by Sara Diercks
Source: http://frap.fire.ca.gov
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community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