Central LNU Complex Fire Severity and Effects on Agriculture Economics
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Introduction:
The Central LNU complex was comprised of numerous fires that spread across Northern California in October of this year. We were primarily interested in the fires that were exactly in the perimeter of Sonoma County, CA which included the Tubbs, Nuns, and Pocket fires which started on October 8th and 9th. The fires spread across an overwhelming amount of acres destroying not only wildland, but also private property. Sonoma county is known for the numerous vineyards that contribute a large percentage of the area's economy. Now that most of the fires have been completely contained we wanted to know the severity of the fires and also more specifically how the agriculture in the area was affected by the fires. We hypothesise that the agriculture was greatly affected by the fires and that it will be costly for the Sonoma county economy. Perhaps this information will be useful for better planning and management strategies to prepare for future incidents. This information can also be useful for economists to predict current and future economic trends for the area.

Methods:
➢ **Digital Data Collection:** To find the data that we needed we searched earth explorer for a pre fire and post fire imagery of Sonoma County. For the pre fire image we used Landsat 8 level 1image taken on September 25, 2017. We decided as a group that the initial post fire image that we were going to use would not meet our resolution needs because of excessive cloud cover. We ended up choosing an earlier Landsat 8 image taken on October 27, 2017 to use as a post fire image. We found a parcel shapefile for the county on the official Sonoma County website. Data for agriculture land cover was found through the NLCD, on the Multi-Resolution Land Characteristics Consortium website. During our data analysis we realized that we needed data on the entirety of the Sonoma complex fires. We found a shapefile of the information through Google Maps.

➢ **Data Analysis:** Once we added the pre and post fire images into ArcMap, the first step was to convert Band 7 of the the pre fire image from raster to float. An extract by mask was done on the converted band from the original raster. The same to steps were done but for band 5 on the original pre fire image. A pre fire NBR was created by using the raster Calculator.
For the post fire image a raster to float conversion and extract by mask were done for the images 7 and 5 bands. A post fire NBR was created again by raster calculator. We created a burn severity image by using the reclassify tool. The burn severity was distorted to to water condition and other resembling land cover types. To get rid of the water distortion we used the NLCD land cover shapefile to extract water pixels by creating a mask. With the raster Calculator we subtracted the water mask from the first burn severity we created. There were still distortion in the severity so we decided to use a shapefile of the Sonoma Complex fires to limit the areas where the burn severity was calculated. The final burn severity was reclassified to the following classes: 1- Unburned, 2- Low severity burn, 3- Moderate severity burn, and 4- High severity burn. To identify areas of agriculture we used the NLCD land cover shapefile by inputting the agriculture land cover codes into the Raster Calculator. We selected only the areas within the Sonoma Complex fire boundaries using the Sonoma Complex shapefile. The area of agriculture was calculated in hectares. An impact raster showing how the fire affected the agriculture

was made by multiplying the burn severity raster with the agriculture raster. Area of the affected agriculture was calculated in hectares, also the proportion of area affected was calculated.

➢ **Cartographic Procedure:** After we created our final maps, we needed to add all of the basic map elements. We made all the levels of severity the same color on each map so they were easier to compare. We added north arrows to each one along with the same scale bar to the bottom. We also added legends to both to show the different types of severity.

Results:

We created two maps, one showing the severity of the burn and one showing where the agriculture was affected by the burn. There were 3 main areas in the county that were affected shown in figure 1 that displayed mostly low to moderate burn severity. We found there was also a low to moderate burn severity on agriculture land shown in figure 2. The amount of land burned was much larger than the amount of agricultural land.

Table 1. Area of land in hectares burned based on agricultural distinction and impact

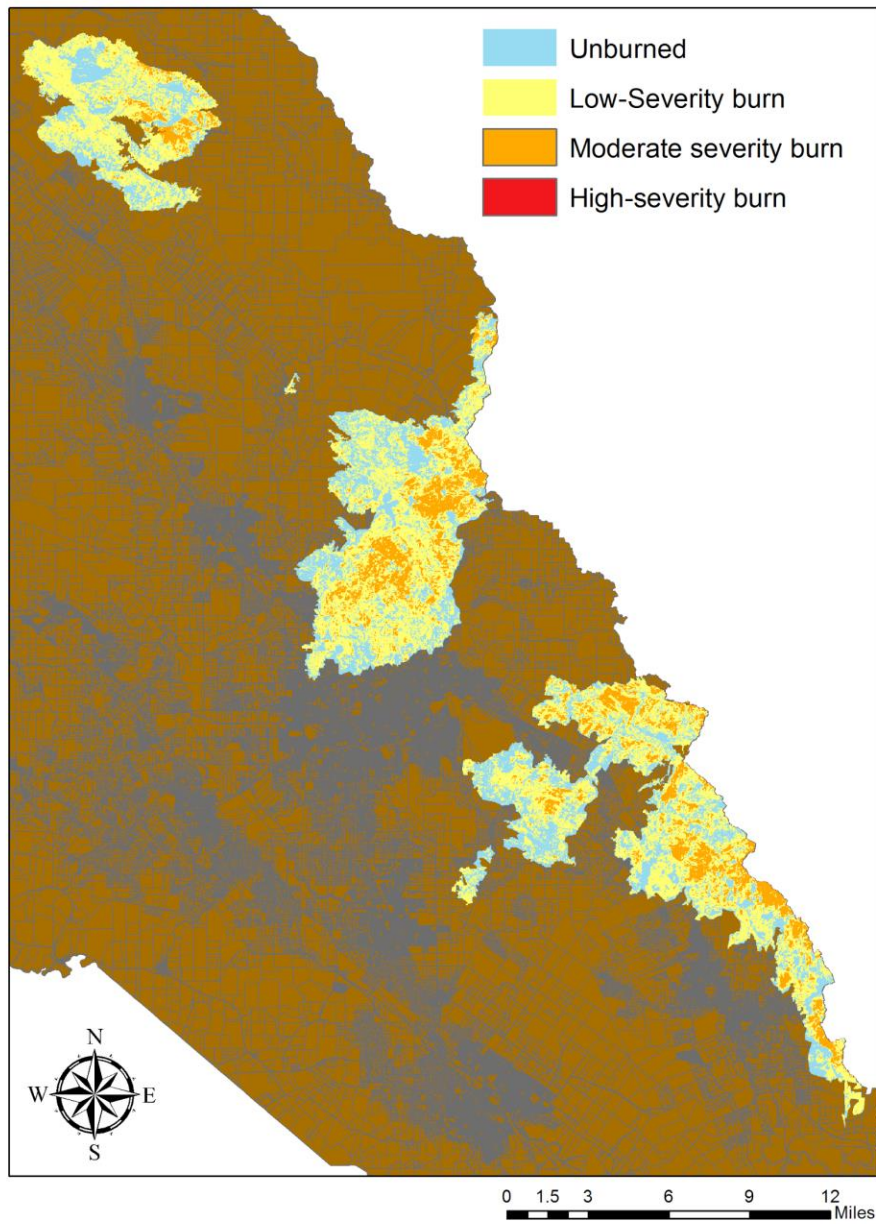| Type of land burned	Low severity hectares	Moderate severity hectares	High severity hectares	Subtotal Area burned
All types	34919.10	5529.69	194.67	40643.46
Agricultural land	335.79	5.85	0.09	341.73

Figure 1. Map showing the burn severity on all types of land.
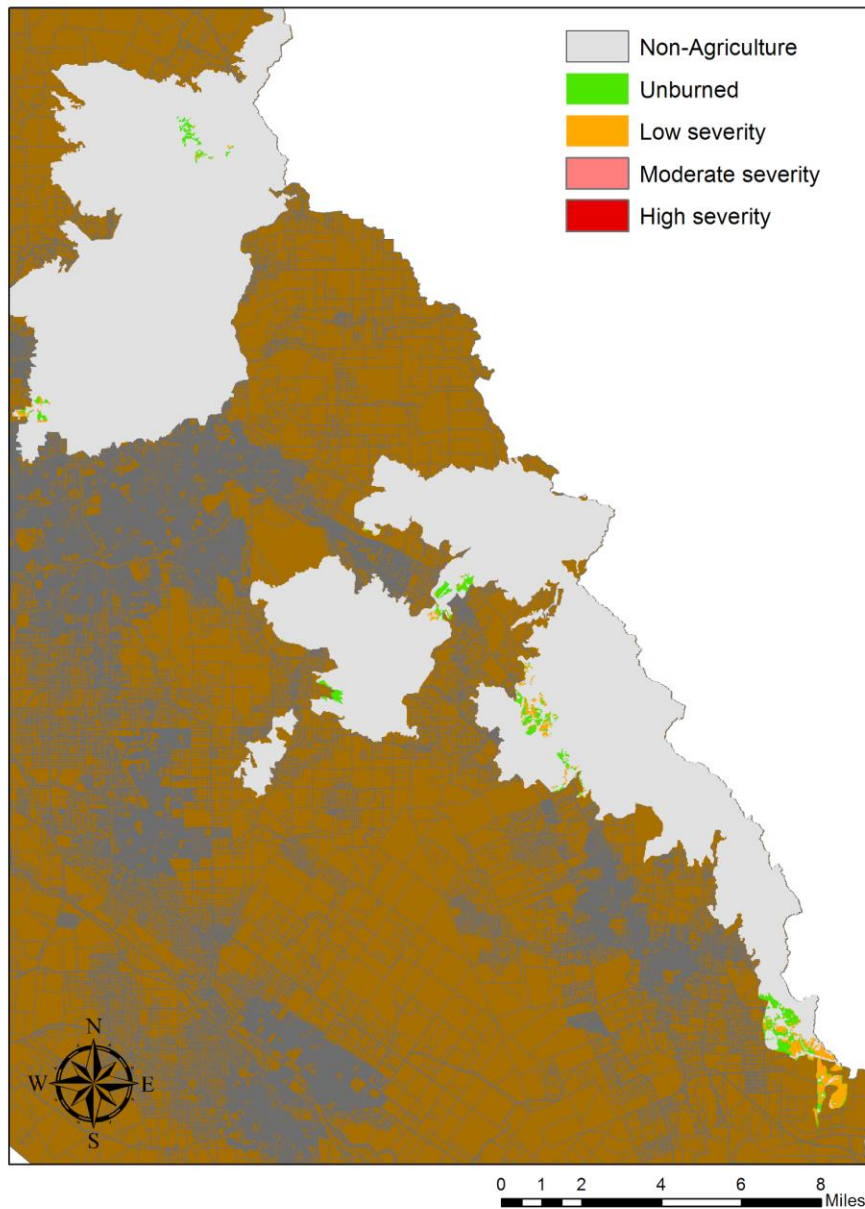
Figure 2. Map showing the burn severity on agricultural land.

Discussion:
Based on the analysis we ran, most of the areas that were burned in the Sonoma County fires had a severity of moderate or lower. The impact the fires had on agricultural areas was relatively minimal compared to non-agricultural areas (Table 1). Although the fires burned more non-agricultural area, the economic impact the fires had on the area can't be ignored. Based on the 2012 Census of Agriculture from Sonoma County, each hectare of farmland is estimated to

produce $2537.77 for crops. This figure puts the average estimate of damage to crops at $867,231.58.

Over the course of our project, we ran into an issue that we needed to resolve. When we initially made our burn severity image, there was still some residual interference from unknown water sources that we needed to take care of. To eliminate these, we used an external source for the fire perimeters and selected only the data within those boundaries.

Though our project only focused on the direct economic impact the fires had on crop values, we can expand our scope for future projects. We could look at the effect it had on businesses, residential areas, or even extrapolating our base economic impact to determine how it may affect the economy of Sonoma County as a whole.

Sources:

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