WILDFIRES: Risk Assessment on Crop Commodities in the US

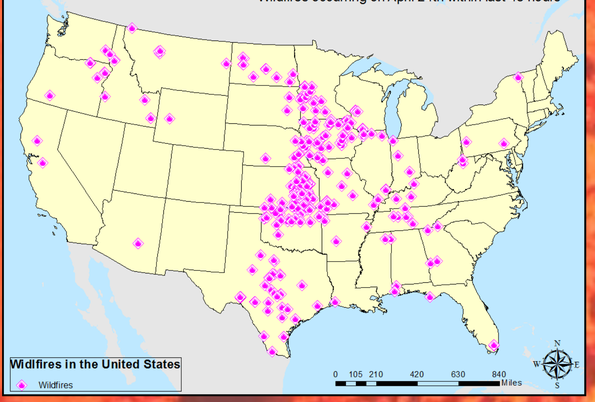
With analysis on two hot spots in Kansas and Washington

Tufts UNIVERSITY

Map 1

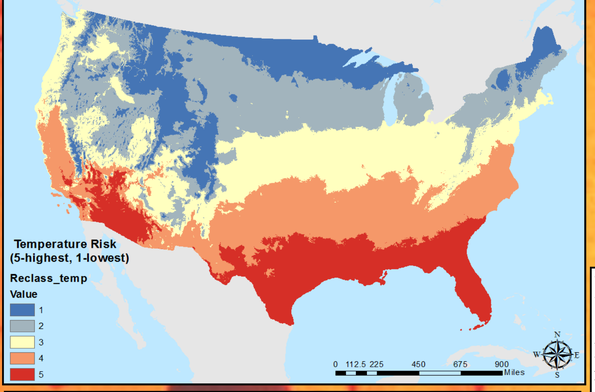
Wildfires in the Uniteds States

Wildfires occurring on April 24th within last 48 hours



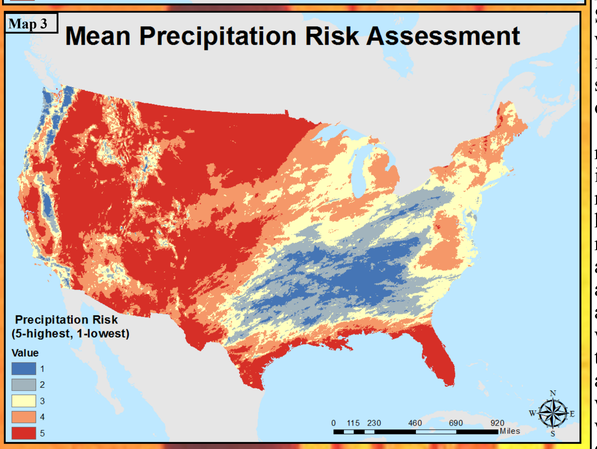
Map 2

Mean Temperature Risk Assessment



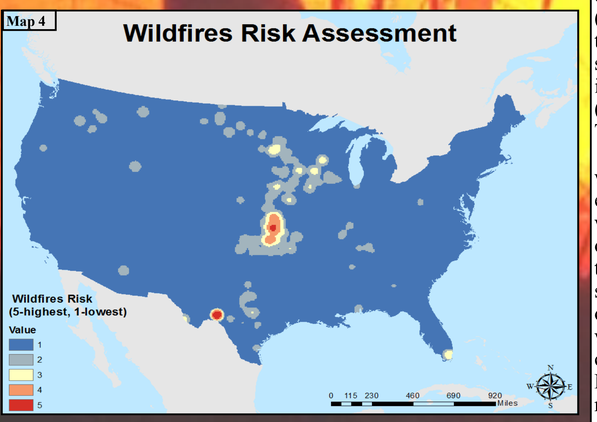
Map 3

Mean Precipitation Risk Assessment



Map 4

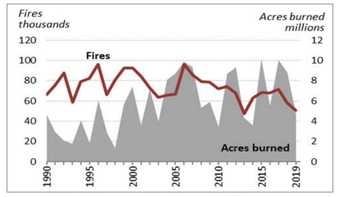
Wildfires Risk Assessment



Introduction:

Climate change has been an increasingly concerning issue that more countries worldwide have felt its adverse effects, effects such as rising sea level, increasing global temperature, and more climate extremes (IPCC, 2018). The United States has also been suffering from climate change, such as the Hurricane Maria sweeping across Puerto Rico in 2017 which led to so many deaths, and enormous wildfires in California in 2019 that made countless people homeless. In this poster, I will focus on one major impact of climate change, wildfires, since the rising temperature enables wildfires to ignite more easily. As it can be seen in Figure 1, in recent years, wildfires have been covering more acreages (Congressional Research Service, 2020). This increase in areas impacted can have a significant influence on agriculture in the US, because wildfires can be extremely destructive of crop commodities. And given the increasing amount of carbon dioxide released into the atmosphere, climate change will only be worsening and more wildfires of larger magnitudes are expected to take place in the near future.

Figure 1. Annual Wildfires and Acres Burned (1990-2019)



Source: National Interagency Fire Center (NIFC).
Note: Data reflect wildland fires and acres burned nationwide, including wildland fires on federal and nonfederal lands.

Given that the US has a large agriculture base, I want to examine which kind of crops is more vulnerable to wildfires. This kind of information will be useful to crop owners and local governments for them to better prepare for future wildfire incidents by taking more proactive actions to lower wildfire risks.

Methodology:

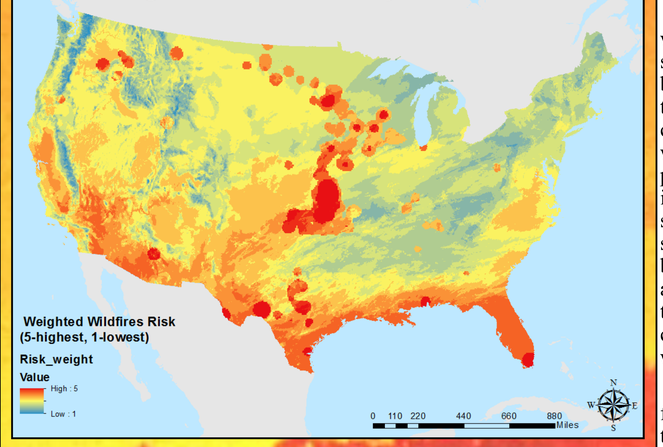
The essential data on wildfire was obtained from the Fire Information for Resource Management System. This website only provides data on the most recent wildfires, and I chose to focus on April 24th within the last 48 hours. Since the data on wildfire location is broken down by continents, the initial wildfire layer encompassed North America as a whole. Since my area of focus is only the mainland United States, I first did *select by attribute* to select out part of the wildfire layer that is within the source layer (the outermost political boundary) of the US (Map 1).

To evaluate the wildfire risk, I need to come up with an overall wildfire risk assessment map. The three factors I utilized to generate this map included a raster layer on the US mean temperature in April. I *reclassified* the raster data based on *natural breaks* on a scale from 1 to 5, with 5 being the highest risk and 1 being the lowest risk. The higher the mean temperature, the more vulnerable the area is to wildfires, so the higher number assigned to that area (Map 2). The second raster layer is mean precipitation (in mm) in April, and I carried out the same *reclassify* process to assign a higher risk factor to areas with little precipitation (Map 3). The third raster data encompassed the wildfire data I discussed in the paragraph above. Not only does the proximity to wildfires matter, but also the numbers of wildfires are important for assessing the risks. As a result, I first used the *kernel density tool* to use the wildfires' variable, brightness, as a proxy to illustrate the intensity of wildfires and to communicate the idea that areas with more wildfires going on have a higher risk. And I *reclassified* the result into the same risk scale (Map 4). So far, I had three raster layers, each with the same risk scale from 1 to 5. I then used the *raster calculator tool* to do a *weighted* vulnerability score. I assigned a higher weight to wildfires because they were the most important factor. I calculated by using the following input formula= (0.6*wildfire risk) + (0.2*mean temperature) + (0.2*mean precipitation). This generated the outcome illustrated in Map 5.

Soon I realized that the data I found on crop commodities from USDA was so mixed that it's impossible to distinguish different crops with naked eyes by looking at the US as a whole. Therefore, I selected two hot spots of wildfires I identified on Map 5, one located in the State of Kansas and the other in the State of Washington. In each of these two hot spots, I selected out ten crops that covered the most acreages. Then, I aligned side by side the map showing the distribution of crops and another map showing the wildfire risks overlapping over the exact same area of crops, so that it can be visualized which crops in these two states are of high vulnerability to wildfires. The crop distribution in Kansas is shown in Map 6.1, and wildfire risk is shown in Map 6.2; crop breakdown in Washington is shown in Map 7.1, and wildfire risk is illustrated in Map 7.2.

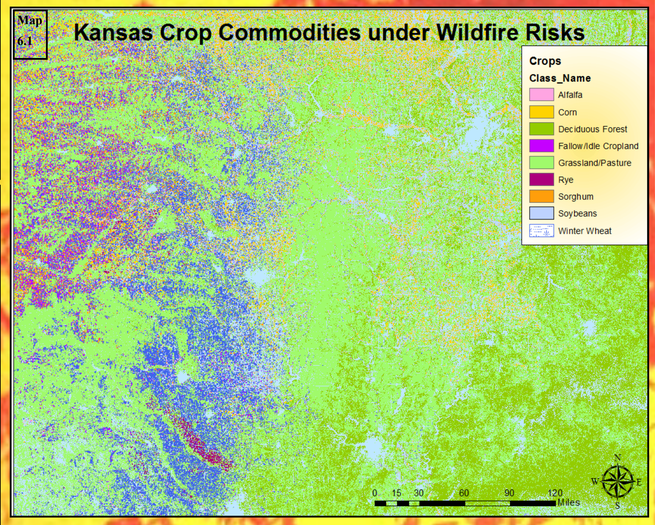
Map 5

Weighted Vulnerability to Wildfires



Map 6.1

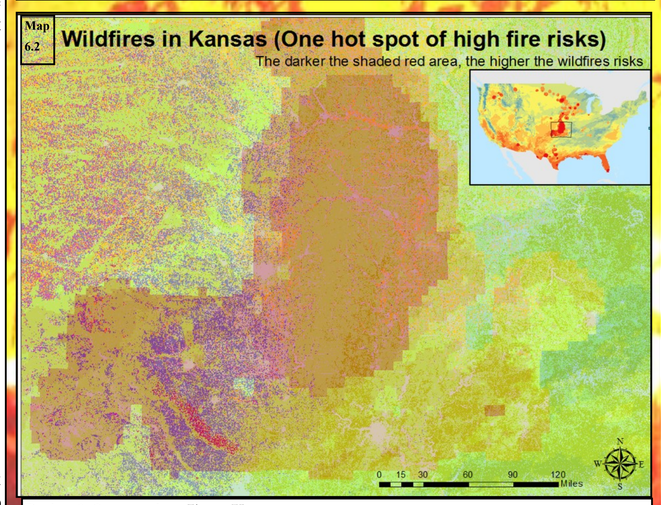
Kansas Crop Commodities under Wildfire Risks



Map 6.2

Wildfires in Kansas (One hot spot of high fire risks)

The darker the shaded red area, the higher the wildfires risks



Design & Cartographer: **Jiayu Xu**

Projection: USA Contiguous Albers Equal Area Conic

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Articles Cited:

IPCC. "Global warming of 1.5 Celsius: Summary for Policymakers." *Intergovernmental Panel on Climate Change*, 2018. Retrieved from https://www.ipcc.ch/sr15/chapter/spm/.

Congressional Research Service. "Wildfire Statistics." *US Congress*, 2020. Retrieved from https://fas.org/sgp/crs/misc/IF10244.pdf .

Data Sources:

CropScape - Cropland Data layer, February 2019, USDA.

Active Fire Data, April 2020, NASA Fire Information for Resource Management System..

Precipitation, April 2020, NOAA Advanced Hydrologic Prediction Service.

United States Annual Temperature Raster, July 2016, USGS.

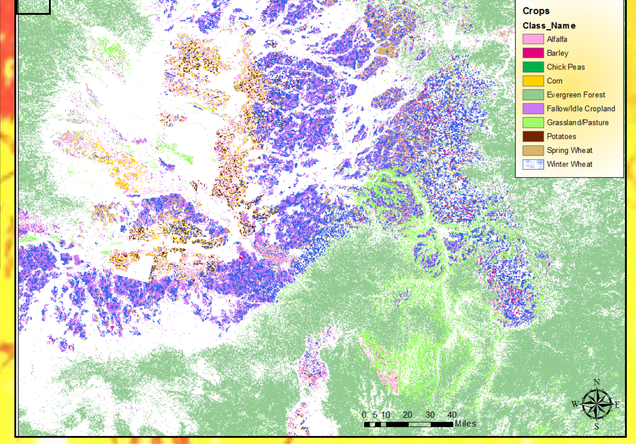
Results and Discussion:

Based on Map 5, it can be clearly seen that the areas of high wildfires risks are mostly concentrated in the Central United States, such as the State of Kansas, or are concentrated along the southern border of US, along with some other sporadic concentrations such as in the State of Washington. For the hot spot in Kansas, the kind of crop commodities that's most adversely impacted is grassland or pasture, which is followed by soybeans in the second place and corn in the third place. For the hot spot in Washington, the crop commodity that's most impacted is fallow or idle cropland, which is followed by barley and spring wheat. Even though my analysis only focused on these two hot spots, I believe the kinds of crops impacted by wildfires in Kansas can be quite representative of the broader central part of the US whose agriculture is mainly composed of these cash crops. Furthermore, given that the map has shown that high wildfire risks are concentrated in the central, I conclude the kinds of crops that are most impacted by wildfires are pasture, soybeans and corn.

One major limitation of my analysis is the inaccuracies which stem from simply relying on visual comparison to find the kinds of crops that are heavily impacted. For example, in Map 6.1, it may be extremely hard to distinguish the mélange of different crops even though I have changed the legend symbology to let each crop have as distinctive color as possible. Another limitation is when I utilized the kernel density tool to indicate the relative intensity or magnitude of wildfires to later reclassify wildfire risk, I used the variable, *brightness*, as a proxy to show the severity of wildfires. That's the best proxy I can find given the limited amount of variables I could choose from in the wildfire dataset.

Map 7.1

Washington Crop Commodities under Wildfire Risks



Map 7.2

Wildfires in Washington (One hot spot of high fire risks)

The darker the shaded red area, the higher the wildfires risks