ONGOING BATTLE: Risk Analysis of Bushfire in Queensland, Australia

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Projection: WGS_1984_World_Mercator

INTRODUCTION

Australia has long been battling with bushfire during the summer season in the southern hemisphere, December to February, when the climate in Australia is dry and hot. This year, the condition of bushfire is extremely severe and unprecedented in many ways. According to 2019-2020 Australian Bushfire (2020), the situation worsened from the beginning of November, while the firefighters were not able to contain all the fires in some areas in Australia until mid-February. During this year's bushfire, more than 11 million hectares of bush, forest, and parks across Australia has burned. Many species, unique and endangered, are facing extinction and the experts concerned that the ecosystem would be difficult to recover. Also, the smoke pollution produced by the bushfire worsens the air quality not only in Australia but also in many other countries due to the monsoon. Queensland, situated in the north-east of the country, would experience bushfire more likely in spring and mid-summer ("Bushfire weather", 2020). Usually, the moister condition and tropical cyclone determine the end of the fire season. This year, the condition was described as 'highly unusual' because of the strong winds, a drier than average condition and a heatwave ("'Unusual' bushfires sweep Australia's north", 2020).

Due to the fact that fire is one of the most important forces at work in the Australian environment, it is hard to prevent the fire completely. There are many factors contributing to the ignition, such as climate, fuel, terrain and historical ignition (Atkinson, Chladil, Janssen & Lucieer, 2010). To be specific, information on fuel conditions and variability is important to this analysis (Miller et. al., 2015). Thus, it is necessary to do a risk analysis, aiming to identify the areas that are subjected to bushfire the most and shift focus to where need to implement actions and facilities to reduce the impact of bushfire.

METHOD

The final bushfire risk analysis included a weighted risk analysis for counties. I used symbology and natural breaks to produce average yearly rainfall (Figure2). For current drought declaration(Figure3), I added a field in attribute table and used field calculation. Then I changed symbol for defined forest area (Figure4) and forest fire danger index (Figure6). Additionally, I used buffer on figure 3 to identify the risk areas outside the forests. Vegetation hazard classes (Figure5) was produced by reclassify 20 categories of land uses into three main categories based on their ability to produce bushfire according to handbook. They will be weighted in the raster calculator: 50% FFDI + 30% forest area + 15% drought declaration + 5% vegetation hazard class. The whole procedure is done by ArcMap 10.7.1.

RESULTS

I found that south-western part of Queensland is more likely to be affected by bushfire during fire season, especially after a dry winter and spring (Figure 1). The same results can be seen in average yearly rainfall (Figure 2), current drought declaration (Figure 3), and Forest Fire Danger Index (Figure 6), which all illustrate that south-western part is the bushfire prone area. In other words, this part experience less than average rainfall, long-time drought and the most suitable weather for ignition of bushfire. However, the state-owned forest (Figure 4) and vegetation hazard classes (Figure 5) show an opposite pattern, with the lowest risk in the south-western part of Queensland.

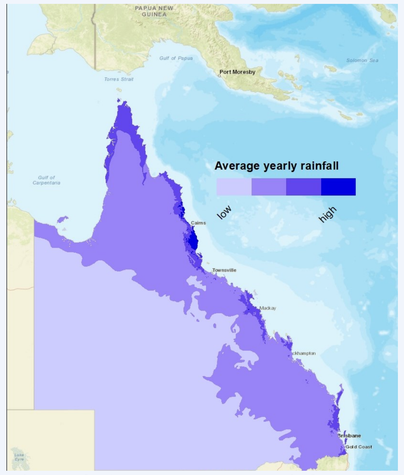


Figure 2 Average Yearly Rainfall Over Past Decades.

The original data were produced by the Department of Natural Resources (2002) from direct measurements compiled from multiple sources, including individual measurements.

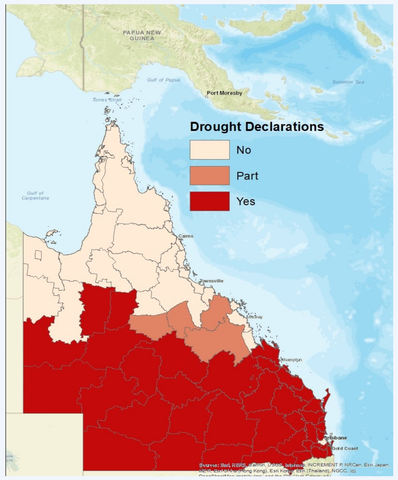


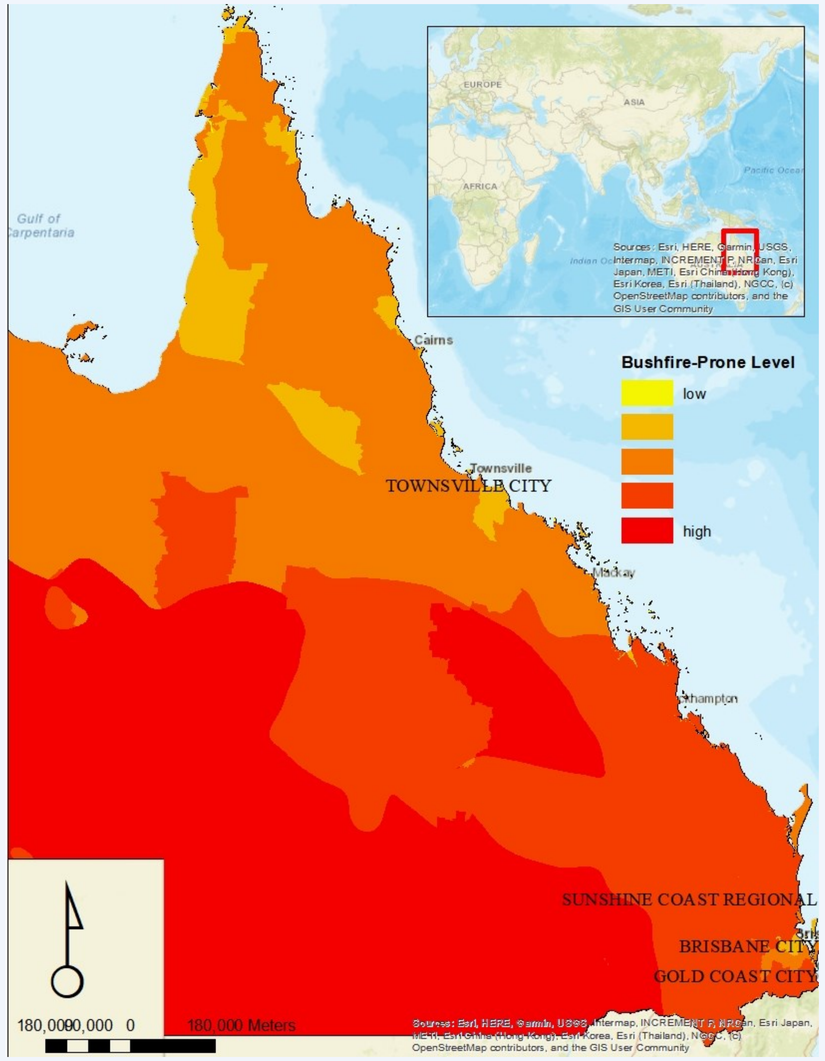
Figure 3 Current Drought Declaration.

The original data were produced by the Minister for Agricultural Industry Development and Fisheries (2015), according to recommendations from Local Drought Committees based on Queensland Government's drought criteria.

Figure 4 Forest Area.

The original data were produced by the Department of Agricultural and Fisheries (2015), identifying the locations of state-owned forests.

Figure 1 Bushfire Prone Area, Queensland, Australia



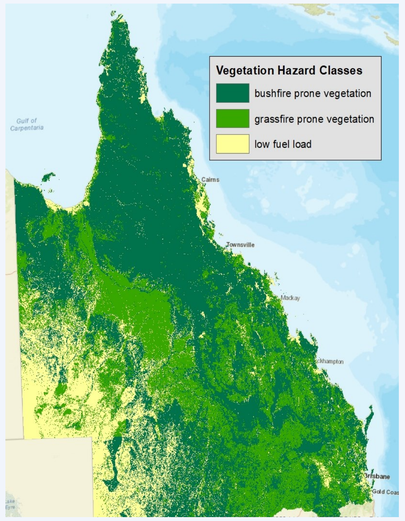


Figure 5 Vegetation Hazard Classes.

The original data were produced by the Queensland Fire and Emergency Services (2015), categorizing vegetation hazard classes based on available state-wide land use and vegetation datasets.

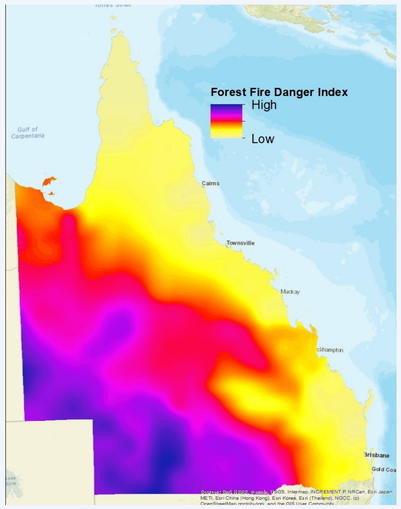


Figure 6 Forest Fire Danger Index (FFDI).

The original data were produced by the Queensland Fire and Emergency Services (2015), calculating FFDI by measurement of rainfall, evaporation, wind speed, temperature and humidity. The higher the number is, the more extreme the whether would be.

CONCLUSION

Overall, people living in south-western part of Queensland should have a survival plan to protect themselves from bushfire during the fire season there. This map (Figure 1) also provides the information for the government to implement efficient fire-suppressing plan ahead of the fire season, trying to make the most of ignition under control.

However, this analysis is not quite consistent with government documentations, because this risk analysis did not take land slope into consideration, which may contribute to become the potential fire-line. Also, this risk assessment only look at the ability for an area to develop bushfire, but exclude the fact that fires happening in south-western Queensland is also easy to suppress.

Considering data sources, Australia is featured in Eacalyptus, the food of Koalas, but I cannot find the exact distribution for each type of trees in Australia. Also, the data I use are quite old-fashioned, which is not quite predictable for current situation.

For future analysis, it is better to consider the land slope and Eacalyptus areas. Also, the size change of eucalyptus forest is also worth noticing. Additionally, taking suppressing into consideration.

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DATA SOURCES

Figure 2: Average yearly rainfall isohyets -1920 to 1969- Queensland, December 2002, Department of Natural Resources, Mines and Energy

Figure 3:Drought declarations - current- Queensland, October 2015, Minister for Agricultural Industry Development and Fisheries

Figure 4:Defined forest area -Forest Products Department of Agriculture and Fisheries - Queensland, January 2015, Department of Agricultural and Fisheries

Figure 5:Bushfire prone area -Queensland series, March 2015, Queensland Fire and Emergency Services

Figure 6:Bushfire prone area -Queensland series, March 2015, Queensland Fire and Emergency Services