

Beetle Outbreaks and Wildfires:

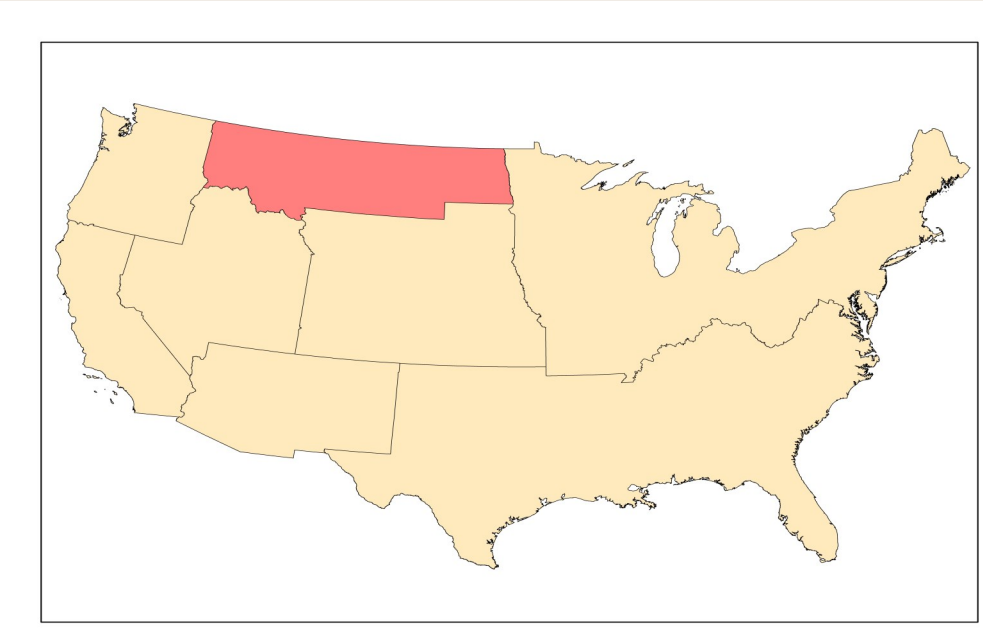
An analysis of Mountain Pine Beetle and Wildfire Distribution in the Northern United States

Introduction:

Since the late 1990’s there has been an explosion of Mountain Pine Beetle (MPB) outbreaks in the Northern United States. The growing population is mainly due to climate change: As temperatures rise, traditionally cold climates that were inhospitable to the Mountain Pine Beetle now becoming vulnerable to this ravenous beetle. Additionally cold snaps, a natural culling mechanism for MPB populations, are becoming more infrequent thereby increasing the duration of severity of outbreaks. As the outbreaks last longer and the beetles find new trees to infest, they kill more trees. Some researchers argue that the dead and dying trees may increase the risk of more frequent and destructive wildfires in the region as the dead and defoliated trees make for good fuel.

Study Area: Northern Administrative Region (R1):

This project maps the damage due to Mountain Pine Beetles outbreaks from 2014-2016 in National Parks in the United States Department of Agriculture (USDA) Northern Administrative Region (as designated by the USDA Forest Service). This project compares the concentration of tree deaths caused by MPB outbreaks in the preceding three years to the areas that experienced wildfires in 2017. The project’s study area is limited to the designated National Parks in the Northern Region.



Research Questions:

The goal of this project is not to compile all the factors that contribute to wildfires, but rather to answer a few basic spatial questions relating to one: Where are MPB outbreaks occurring in the Northern Region during this time period and how intense are they? Have the areas effected by MPB tree death changed over time? If so, how? Where are Wildfires occurring in the same region? Where have wildfire outbreaks significantly increased or decreased from 2013-2017? Are areas with high levels of tree death due to MPB outbreaks more likely to burn in wildfires?

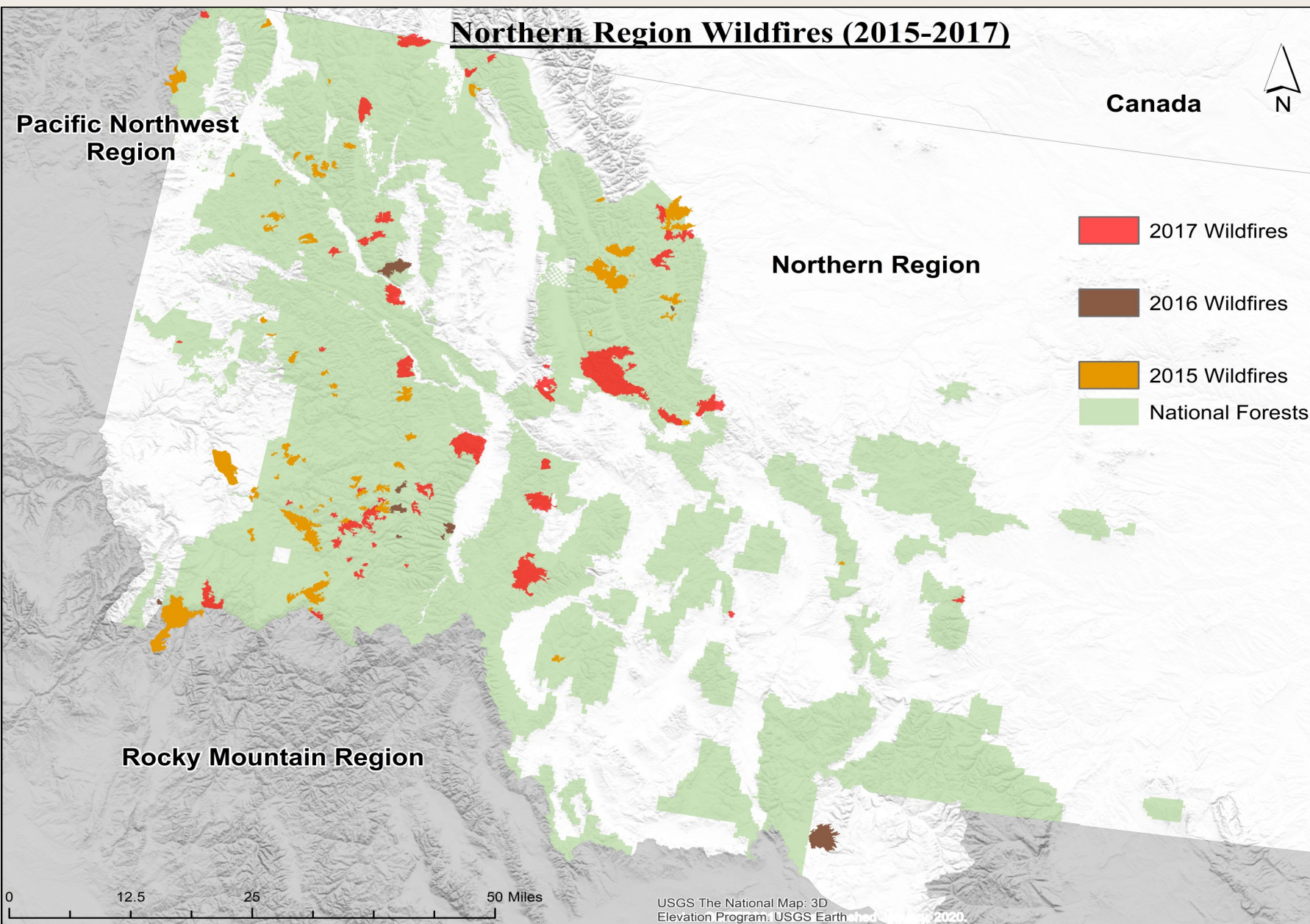
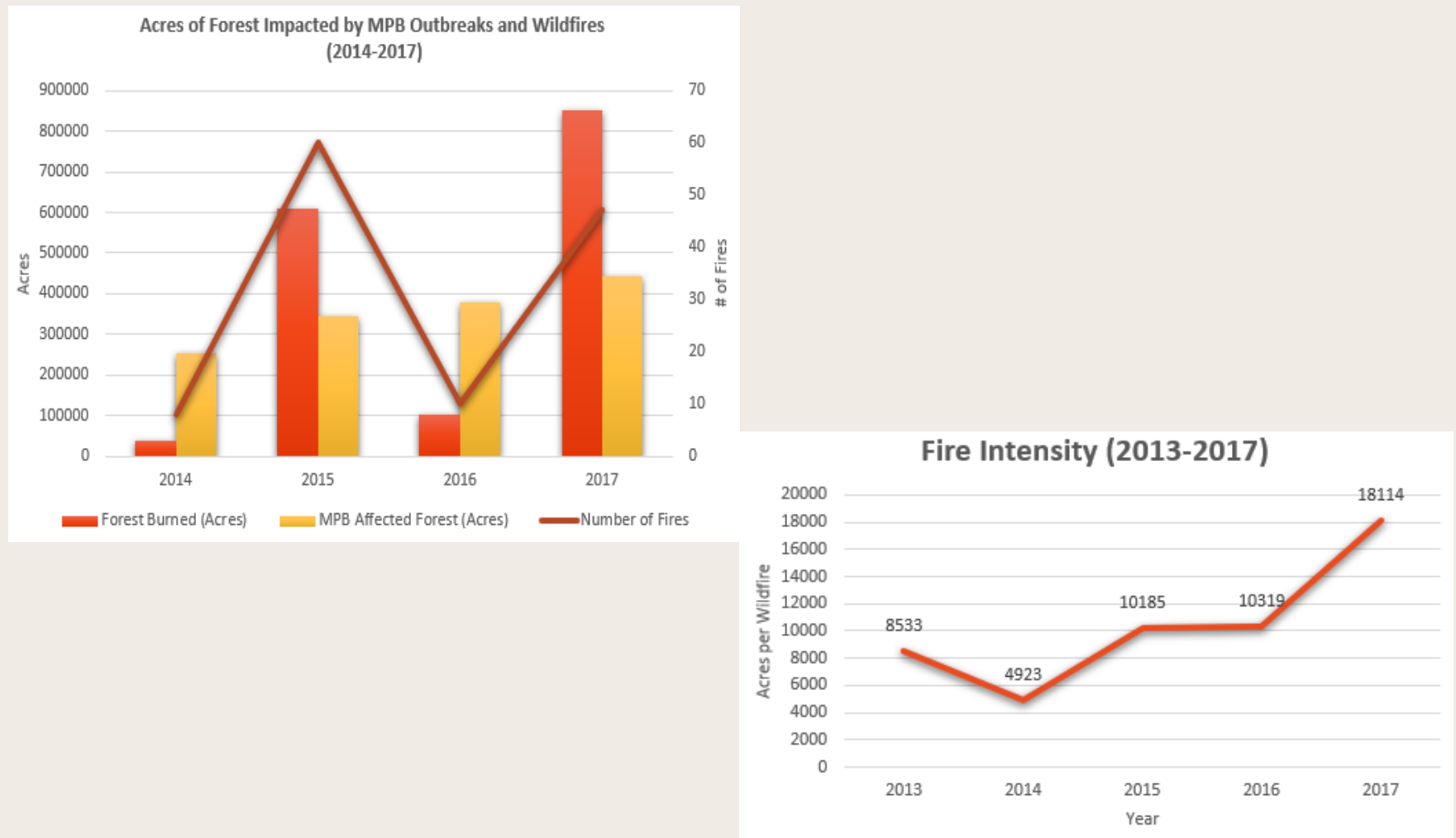
Methodology:

To create my maps, I first converted all of my shapefiles detailing the shapes and areas of MPB outbreaks and wildfires into raster data sets. Then I created a fishnet grid for the entire study area (Northern Region), each pixel in the fishnet grid was 500 by 500 meters. This grid was then tied to the National Forest administrative boundaries shapefile. I then used zonal statistics to summarize my rasterized wildfire and MPB data by the fishnets tied to the National Forests shapefile. This final data set was used to create the following maps and graphics.

The first two graphics are depictions of descriptive data which illustrate the change in the frequency and severity of fires and MPB outbreak areas over time. The first map depicts the forested areas burned by forest fires in the Northern Region from 2014-2017. The second and third maps look at the MPB tree death areas from the three previous years (2014-2016) and compares them to the areas that experienced fire in 2017. A previous study that looked at the Pacific Northwest Region found a correlation between rates of wildfires and severe MPB outbreaks that occurred within 5 years prior.

Results and Limitations

In 2017, the Northern Region composed of northern Idaho, Montana, and parts of North and South Dakota, experienced the worst fire season since 1910 burning over 1 million acres. Not only was there a high number of wildfires in 2017 (47) but the average number of acres burned per fire also increased by almost 8000 acres from the previous year. Areas experiencing tree death due to Mountain Pine Beetles in the Northern Region have been increasing on a yearly basis, averaging just under 70000 acres per year.



There was very little overlap between area that experienced MPB tree death from (2014-2017) and wildfires in 2017. The percentage of the total area **affected by wildfire** in 2017 that also had MPB tree deaths was just 4.57%. Additionally, the percentage of the total area of **MPB tree death** that also experienced a wildfire in 2017 was just %3.69. So although the total area that experienced tree deaths due to MPB outbreaks increased year on year from 2014-2016, there is little correlation between those areas and wildfire areas. The Mountain Pine Beetle data from the USDA forest service was robust but only for the most recent 4 years (2014-2017), and were not the most accurate as they were collected through aerial surveys that covered different areas every year. As a result, the data limited my final analysis. Ideally, I would have included MPB outbreak areas as much as 7 or 8 years before the 2017 fire data so as to get a more robust picture of their relationship.

