Australian Bushfires: The Extent of Damage, State-wise

1998481

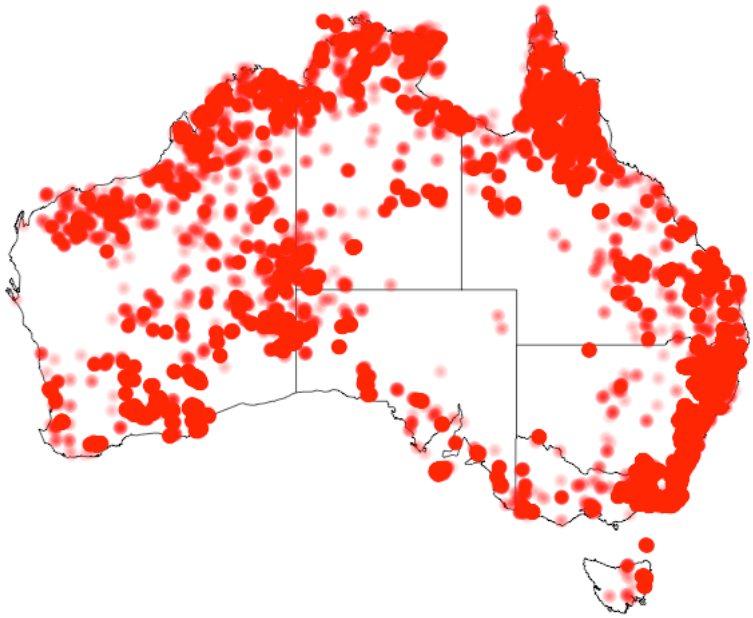

Figure 1.1 Statewise heatmap of Australian Wildfires

Introduction

The devastating bushfires erupted across Australia was one of the worst disasters in the history of Australia. It is not too long ago that the state of New South Wales was finally declared it was officially free of active fires, after literally been on fire for more than 240 days, reported CNN. As per the official records, at least a billion animals were affected, 28 people dead and 3000 homes were destroyed. Although all of Australia was affected, the state of New South Wales was the worst hit, with Sydney's air quality index being reported 11times higher than the hazardous level. It is in this context that I am trying to have a closer look at the Fire Hotspot data released by NASA (NASA, 2020), by visualising them state-wise, to get a sense of the extent of damage in each state.

Approach, Packages and Utilities used:
For coding, R Studio. Among the packages used, maps (), mapdata(), are the main ones. Initially, the idea was to use OZ, a special package with spatial data of Australia, to manipulate the state-wise map and data. The result was a decent looking state-wise visualisation of fires in Australia However, the problem arose as I tried to format and layout the map. The title, scale and other format and layout elements were not visible. My initial response was to try and sort out that problem, but after spending days on it and trying most techniques I learnt from the visualisation from the lab exercises and examples, and internet research I concluded that:

(i) Oz is a really small and useful package, but it is limited in its application. I was convinced that there is a way to plot Oz and use the design strategies that we use with maps (). However, despite my best efforts I could not figure out how and decided to change my approach.

(ii) Most tutorials and resources on the internet use ggplot2 and it seem to be a good enough solution for the problems I have been facing. However, I could not come up with a methodological rationale for its use; for my requirement, ggplot2 will do same things as I can do with maps (), probably with shorter line of codes.

(iii) I tried working with states shapefiles. Was not successful to project the wildfire data to the states data. The "add" function returned error every time.

The purpose and limitations of the visualisation

As mentioned above, the initial aim was to showcase the state-wise impact of the fire. While the visualisation provides a sense of the intensity of the fire, somewhat exaggerated, with by adjusting the alpha and size of the point character, it fails thoroughly as a visualisation. It is not very far from the initial demo map that was produced using the demo code, except for the state boundaries and intensity of the heat. It should also be noted that although the heatmap shows all fires of the entire time period, in reality, not all of them coexisted. In that sense, the map exaggerates the fire.

The visualisation is very limited in terms of its presentation style, it does not have a title, or the names of the states could not be added to the map produced. However, it does manage to get across one point, that the state boundaries and one can see that the intensity of the fire was more in the New South Wales, provided one does know about the states of Australia. It does show that the coastlines are worst affected by the fire.

How could have the visualisation be improved:

i) Activate the visualisation with sufficient annotations, such as title, scale, etc

ii) Either combine all the maps produced in the entire process, could have achieved by merging state boundaries geolocation with that of the geolocation in the NASA data set.

iii) Could have searched for a merged data set, as mentioned above.

iv) The other map that was produced from the spatial data of the shapefile could not be manipulated because of my limited understanding of the spatial data structures.

Technical Difficulties and Tackling them

The most difficult part was to deal with a crashing device all the time, despite working with smaller sample. I did however tackle the problem by plotting directly to png files and pdf files. However, to not be able to see real time what is happening with the data and plot was a huge difficulty and the most frustrating experience of the entire process. Although I was unable to produce the result that I had in mind, I now am familiar with some of the ways in which I can approach data and visualisation and that itself is a rewarding journey.

References:

PDF Graphic Device
https://www.rdocumentation.org/packages/grDevices/versions/3.6.2/topics/pdf
Plot Annotation https://stat.ethz.ch/R-manual/R-devel/library/graphics/html/title.html
Plotting Simple Features, https://cran.r project.org/web/packages/sf/vignettes/sf5.html
R Documentation Graphic Devices,
https://www.rdocumentation.org/packages/grDevices/versions/3.4.1/topics/png
SFML, sf::Color Class Reference https://icwww.epfl.ch/~sam/infosv/doc-sfml/html/classsf_1_1Color.html
Drawing beautiful maps programmatically with R, sf and ggplot2 — Part 2: Layers
https://www.r-spatial.org/r/2018/10/25/ggplot2-sf-2.html
Wildfires, Earth Data https://earthdata.nasa.gov/learn/toolkits/wildfires

Appendix I

```
#(citation)  Australia Wild Fire Data and Demo,
https://moodle.warwick.ac.uk/course/view.php?id=31687


setwd("~/Desktop/CIM UAV/Visualisation/Graphical Report ")
```

```
  library( maps )
  library( mapdata )
  library( sp)
  library(sf)
  library( maptools)
  library( sfsmisc )
  library( raster )
  library( rgeos )
  library( rgdal )
  library( scales )
  library(GISTools)
  library(oz)

## the reason I have so many libraries called, is because I
tried various methods to get the way I wanted it
## I am now afraid to “uncall” it because, I don't want to
take the chance of breaking the code and having to fix it
again
## However, I am aware that the main libraries that I am using
are, "sp", "sf", "oz", "rgdal"
# (citation) Bill Venables and Kurt Hornik (2016). oz: Plot
the Australian Coastline and States. R package version 1.0-21.
# (citation) https://CRAN.R-project.org/package=oz



AuSt <- st_read("Australia_Polygon.shp")

# (citation) Simple Features for R, https://cran.r-
project.org/web/packages/sf/vignettes/sf1.html

st_geometry_type(AuSt)


fia <- read.csv("fire_nrt_M6_96062.csv", sep=",")


fia$acq_date <- as.Date(fia$acq_date, format = "%d/%m/%Y")



summary(fia)
head(fia)

#(citation)  Australia Wild Fire Data and Demo,
https://moodle.warwick.ac.uk/course/view.php?id=31687


head(AuSt)
png(filename = "Rplot%03d.png",
    width = 800, height = 600, units = "px", pointsize = 12,
```

```
    bg = "white",  res = NA)
# R Documentation,
https://www.rdocumentation.org/packages/grDevices/versions/3.4
.1/topics/png

plot(st_geometry(AuSt),col = sf.colors(12, categorical =
TRUE), border = 'grey',
     axes = TRUE)

# citation R Documentation, https://cran.r-
project.org/web/packages/sf/vignettes/sf5.html

title(main="States of Australia", col.main="black")


 oz(states = TRUE)
 # (citation) Bill Venables and Kurt Hornik (2016). oz: Plot
the Australian Coastline and States. R package version 1.0-21.
 # (citation) https://CRAN.R-project.org/package=oz

 heat <- rgb(255,0,0,max=255,alpha=25,names="red1")
  points(fia$longitude, fia$latitude, pch=16, col=heat,cex=
.5)


  heat <- rgb(255,0,0,max=255,alpha=25,names="red1")
  points(fia$longitude, fia$latitude, pch=16, col=heat,cex= 1)


  heat <- rgb(255,0,0,max=255,alpha=25,names="red1")
  points(fia$longitude, fia$latitude, pch=16, col=heat,cex=
1.5)


  heat <- rgb(255,0,0,max=255,alpha=25,names="red1")
  points(fia$longitude, fia$latitude, pch=16, col=heat,cex= 2)

  # inspired from the lab exercises.

  dev.off()
```

Appendix II

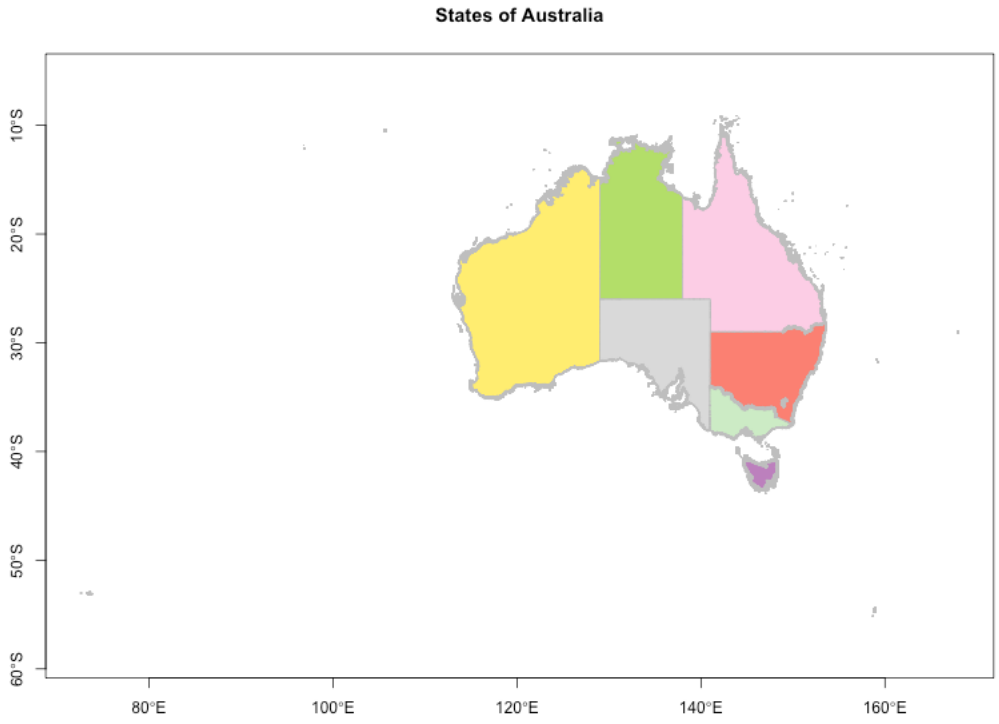

Figure 1.2: States of Australia