Visualising the Australian Wildfires: Comparing Between Day & Night

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IM942

Visualisations Foundations

Graphical Report

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Figure 1

Core visualisation

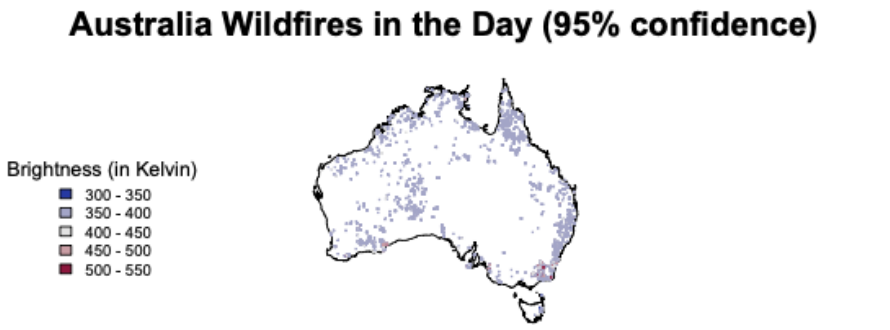


Figure 1a. Distribution of Daytime Wildfires (N = 16204).

Each marker on the map indicates a high-confidence fire (i.e., having at least a 95% probability of being a daytime fire hotspot).

The colour of each marker represents the Brightness temperature (measured in Kelvin).

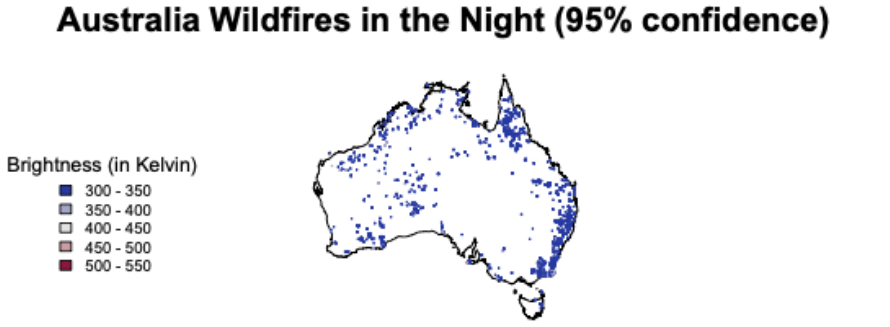


Figure 1b. Distribution of Nighttime Wildfires (N = 16391).

Each marker on the map indicates a high-confidence fire (i.e., having at least a 95% probability of being a nighttime fire hotspot).

The colour of each marker represents the Brightness temperature (measured in Kelvin).

In 2020, Anthony Hearsey went viral for his Instagram post visualising the Australian Wildfires (Figure 2). Hearsay's visualisation was misinterpreted as a satellite image of the wildfires rather than a human-generated data visualisation (Suhardjono et al., 2021). Hearsey's visualisation appeared to focus solely on fire locations, which is beneficial in identifying threat areas. However, it overlooks key information, such as variation in temperature and distribution of fires over time. Therefore, Figures 1a and 1b address these limitations by locating individual fires and highlighting variations in brightness temperature (i.e., temperature of a fire pixel) between day and night in a clear, easily interpretable visualisation. The stakeholders for this visualisation will be firefighters aiming to identify the most impacted and dangerous areas to effectively plan their actions. This report will focus on two key decisions related to these visualisations: using small multiples and applying colour.

Figure 2

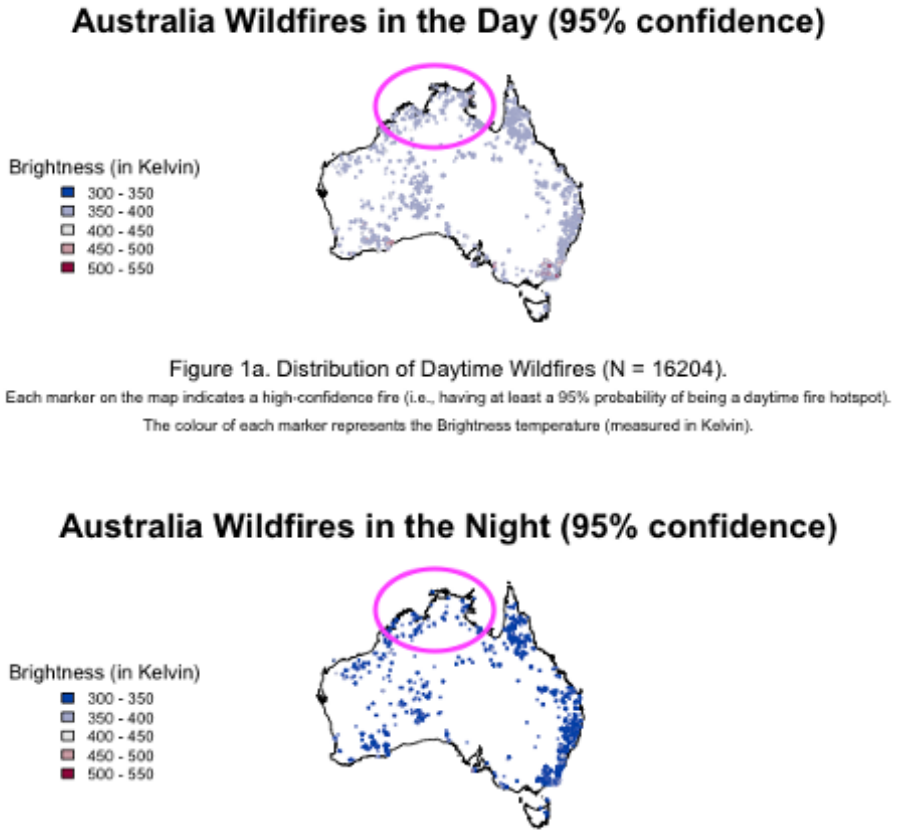
Anthony Hearsey's Visualization of the Fire Hotspots Data in Australia. Taken from Rannard (2020), Misleading maps of Australia fires go viral. https://www.bbc.co.uk/news/blogs-trending-51020564

An artist's visualisation of one month of Australia fire data

Firstly, to ensure the visualisation presented the most pertinent information subsets of the data were created to focus on smaller, more precise data for analysis. For example, both Figures 1a and 1b were based on data from five variables. First, a subset of the dataset was created for high-confidence fires where the ‘Confidence‘ level of an individual fire at a specific location was 95% or higher, ensuring any decisions made by firefighters would be based on the most reliable and accurate data. The resulting dataset was reduced from 93561 observations to 32595 observations. Based on this high-confidence subset, two further subsets were created based on the ‘DayNight‘ variable: one for daytime fires (16204 observations) and one for nighttime fires (16391 observations). For each subset, a map locating each of these high-confidence fires was generated using ‘Latitude‘ and ‘Longitude‘ variables. Each point was coloured based on information from the ‘Brightness‘ variable. By subsetting and using small multiples different contexts of the fires can be provided for the firefighters to keep in mind. Understanding the difference in fires and brightness temperature with regards to the time of day can be beneficial for firefighters in planning where and when they should allocate resources (e.g., manpower, water). For instance, during the day, some areas have a greater concentration of high-confidence fires and at greater temperatures than at night (as shown in Figure 3). Therefore, firefighters may want to dedicate additional resources towards these daytime fires in general and towards these specified areas during the day compared to the night. While the focus was on high-confidence fires due to their higher likelihood of occurrence, it is important to note that even though not visualised, fires with a confidence level below 95% could still be present and therefore firefighters should be aware of this. Nevertheless, subsetting the dataset facilitated a more explicit comparison between the two time periods (i.e., day versus night), enabling the visualisation to focus on more precise information for stakeholders.

Figure 3

Figure 3. Differences in wildfires present between day and night (circled in pink)



Furthermore, each marker representing a potential fire was coloured based on information from another variable. For example, in each visualisation, individual points were assigned to one of five bins representing a range of 'Brightness' temperatures. Assigning specific colours to different brightness ranges allows the visualisation to convey information about multiple variables within one diagram, thereby minimising the risk of the visualisation getting overcrowded with information and potentially challenging to interpret. The use of colour to convey additional information about individual fires was inspired by Strange Sounds (2020), though their visualisation lacked clarity on what the colours was meant to represent (Figure 4). Hence, the current visualisation aims to improve upon this by (a) using an appropriate colour scheme for clear distinction of brightness temperatures (e.g., `diverge_hcl`) and (b) including a legend to clarify the information being conveyed. However, it should be noted that this was not the original idea. Initially, the plan was to create two histograms of brightness temperatures to help firefighters understand the distribution of brightness temperatures and place these histograms beside the maps (Figure 5). While the histograms would help firefighters understand the various fire temperatures, highlighting these temperatures on the map itself would provide a more valuable geographic context for planning, such as deciding what equipment to bring based on fire intensity. Overall, using colour in this visualisation provides clear, sufficient information for stakeholders without overwhelming them with additional visuals.

Figure 4

Figure 4. Inspiration for the use of colour to convey additional information. Taken from Strange Sounds (2020), Australia Fire Map: Week-Long State of Emergency Due to Widespread Extreme Fire Danger Across NSW.

https://strangesounds.org/2020/01/australia-fire-map-updates-news-video.html

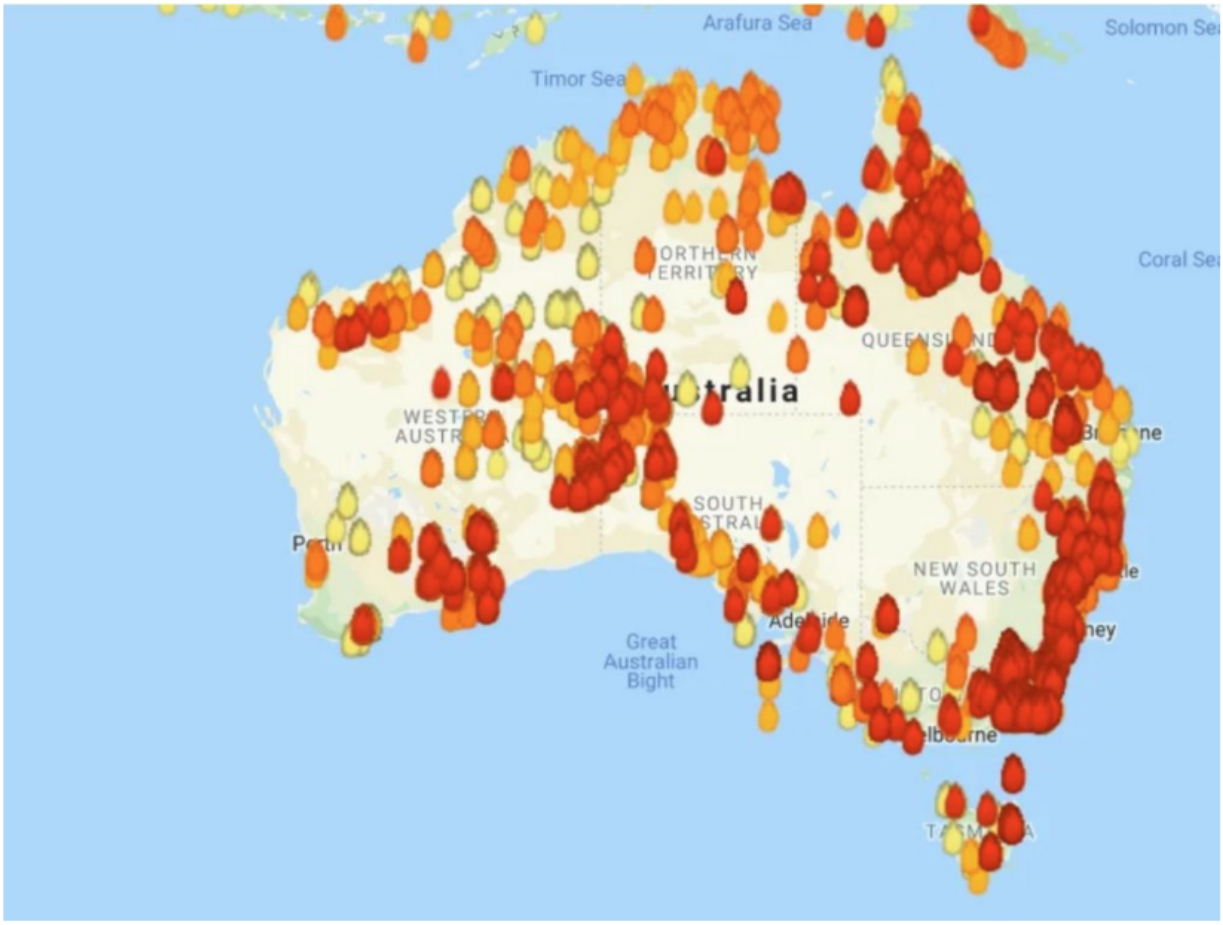


Figure 5

Figure 5. The initial concept was to convey all five variables with maps showing locations of individual high-confidence fires, and histograms depict the associating distribution of brightness temperature.

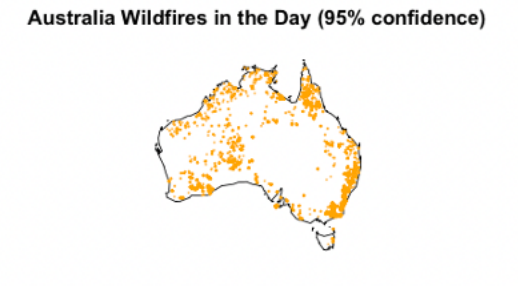


Figure 1a. Distribution of daytime wildfires.
Each orange marker on the map indicates a high-confidence fire (i.e., having at least a 95% probability of being a daytime fire hotspot)

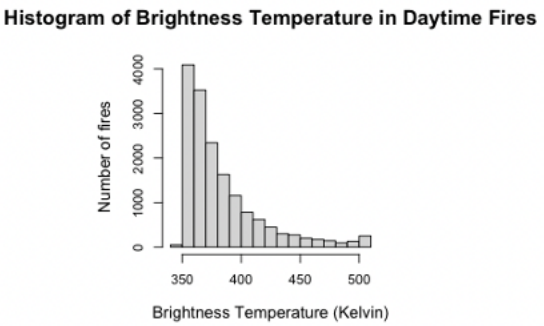


Figure 1b. Distribution of brightness temperature in daytime wildfires.

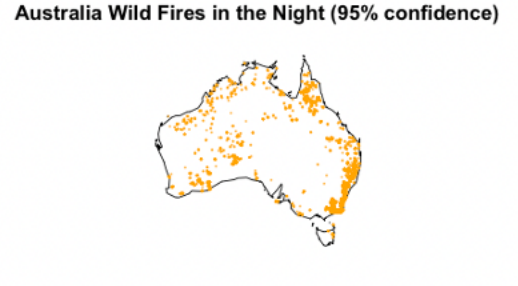


Figure 2a. Distribution of nighttime wildfires.
Each orange marker on the map indicates a high-confidence fire (i.e., having at least a 95% probability of being a nighttime fire hotspot)

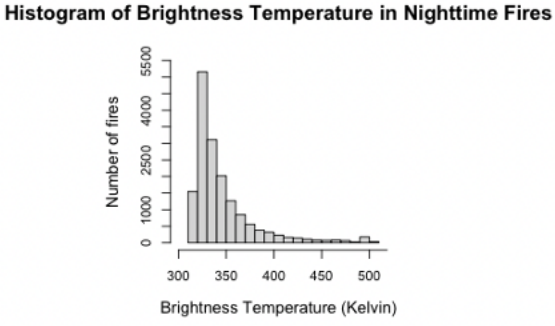


Figure 2b. Distribution of brightness temperature in nighttime wildfires.

To conclude, this visualisation provides key information on high-confidence fires and brightness temperatures, looking to aid firefighters in to identifying threat areas and planning their response based on the geographic and intensity context provided by the core visualisation. In this report, two unique aspects of the visualisation were covered, involving the use of small multiples to emphasise different aspects of the data (i.e., where fires were occurring during the day versus at night) and the use of colours to convey additional information (i.e., brightness temperature) while maintaining the reader's ability to understand the visualisation clearly. While the maps lack detailed precision for pinpointing exact fire locations, they effectively highlight key patterns and variations in fire occurrences and brightness temperatures, which can be supplemented with more detailed tools for operational planning. Nevertheless, the simplicity of Figures 1a and 1b ensures it fulfils its primary purpose of providing an accessible overview of fire patterns and temperature variations to aid strategic decision-making.

References

Rannard, G. (2020). *Misleading maps of Australia fires go viral*. BBC News. https://www.bbc.co.uk/news/blogs-trending-51020564

Strange Sounds. (2020). *Australia fire map: Week-long state of emergency due to widespread extreme fire danger across NSW*. Strange Sounds. https://strangesounds.org/2020/01/australia-fire-map-updates-news-video.html

Suhardjono, L., Oscario, A., Luzar, L., & Sriherlambang, B. (2021). Infographie, data visualization, and the danger of reality distortion: The case study of Australia fire 2020. *IOP Conference Series: Earth and Environmental Science*, *729*(1), 012127. https://doi.org/10.1088/1755-1315/729/1/012127