Increasing Temperatures in Urban Environments: Identifying At-Risk Areas with Remote Sensing

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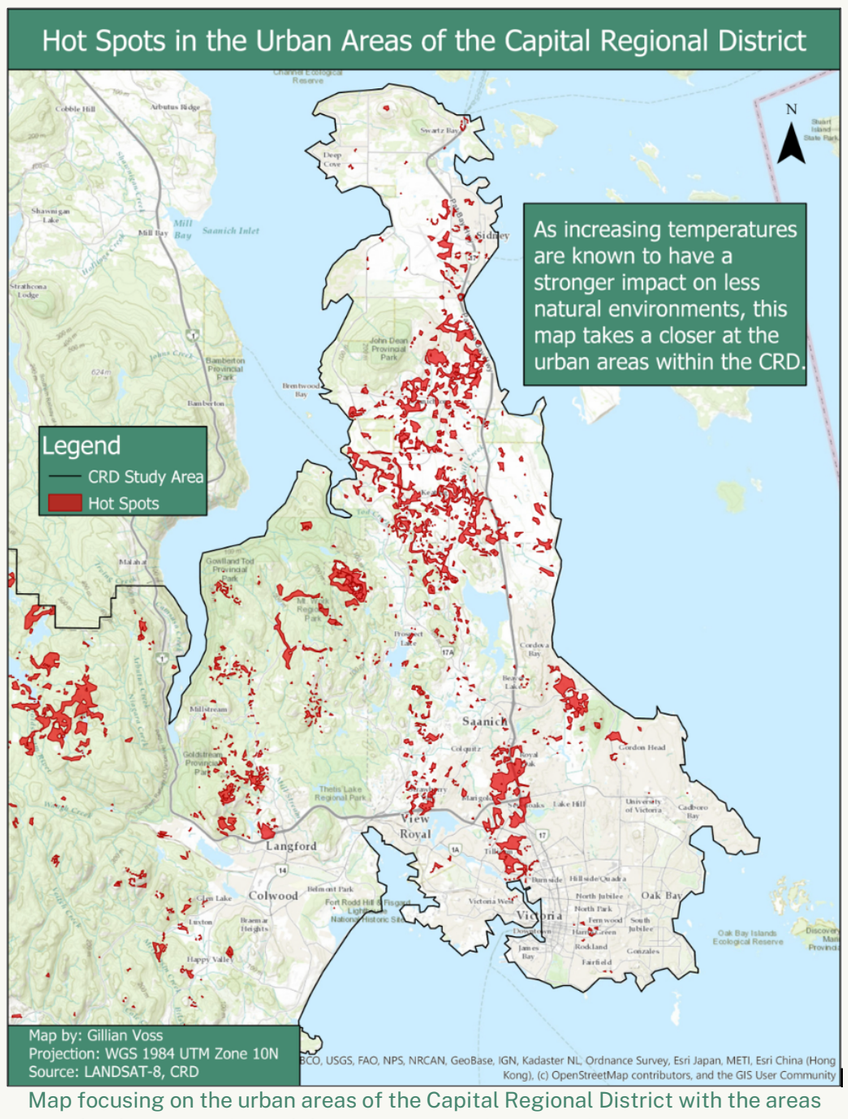


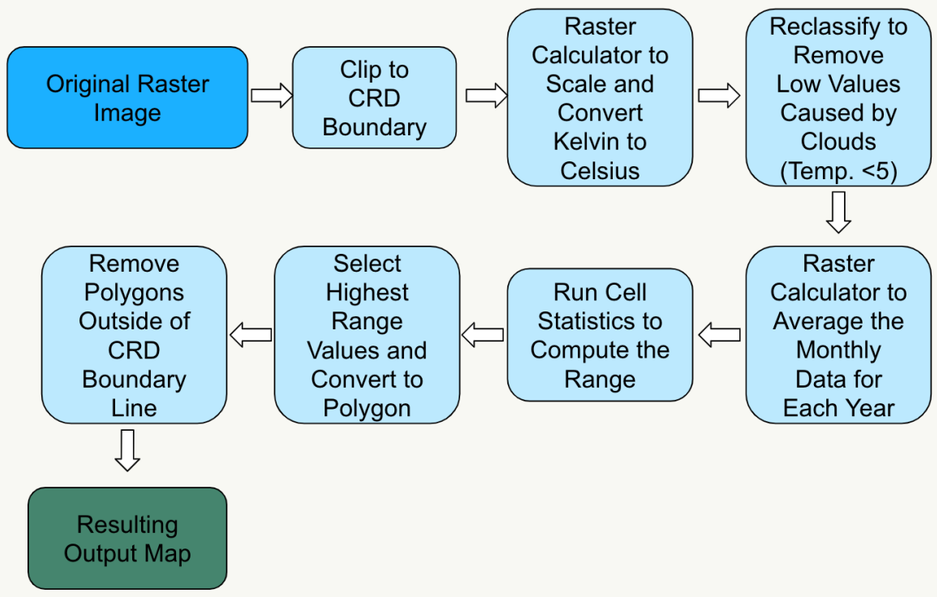
Map focusing on the urban areas of the Capital Regional District with the areas that have experienced the most extreme increases in average summer temperatures from 2018 to 2021, highlighted in red.

OBJECTIVE

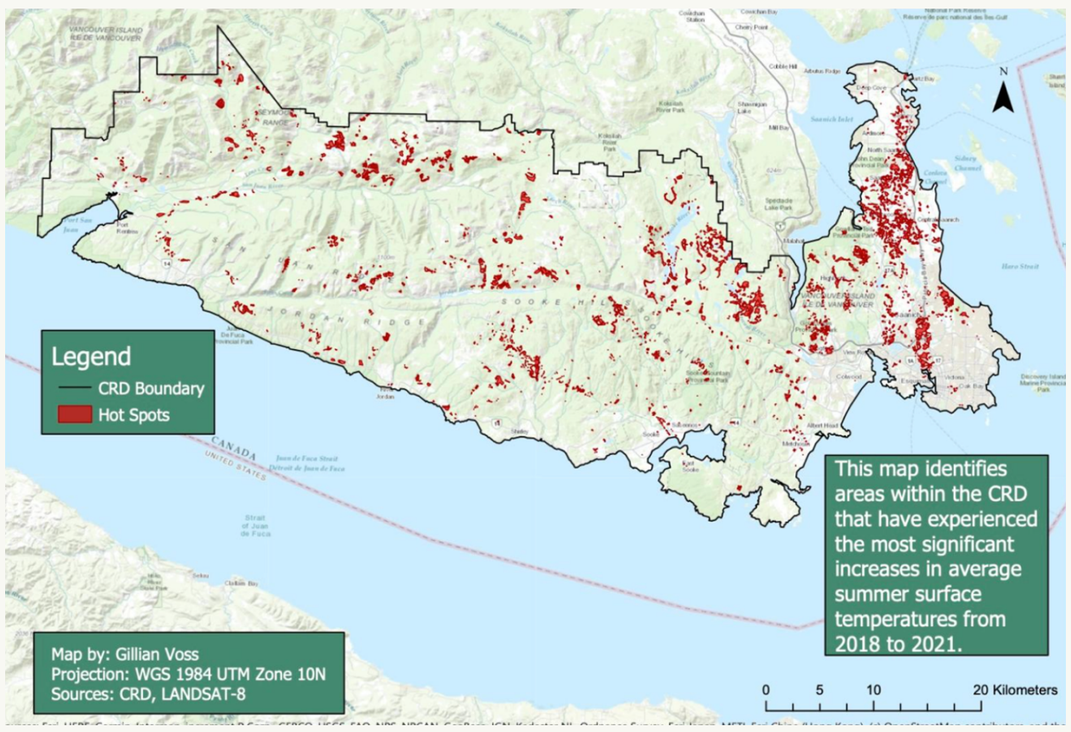
This study focuses on the Capital Regional District on the southern tip of Vancouver Island. **The purpose of this research was to identify areas within the Capital Regional District, that would likely be the most strongly affected by rising temperatures as a result of global climate change.** The Urban Heat Island effect is well documented and it was expected that this study would provide further support for this phenomenon. Ideally, the results of this study will provide additional insight as to what factors contribute most heavily to an area being more or less vulnerable to extreme heat.

METHODOLOGY

This study compares LANDSAT-8 imagery of the CRD containing surface temperature data from the summer months of 2018 to 2021. These temperature values were scaled and converted from Kelvin to Celsius prior to analysis using the Raster Calculator. A low value indicated that the temperature was from a cloud rather than the actual ground so any value below 5C was removed. The values for the summer months were averaged for each year using the Raster Calculator tool in ArcPro.



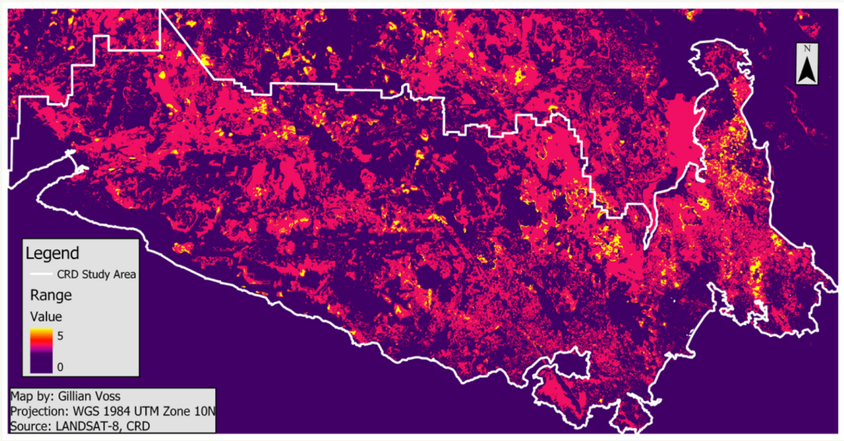
The Cell Statistics function was then used to determine the range in values over the four years for each pixel in the raster. The areas with the highest range were selected and turned into polygons so they could be mapped for the final output. Two output maps were created: one of the entire CRD and one that provided a closer look at the urban centre of the CRD so that factors affecting susceptibility to extreme heat could be better identified.



Map of the Capital Regional District with the areas that have experienced the most extreme increases in average summer temperatures from 2018 to 2021, highlighted in red.

RESULTS

As expected, a vast majority of the hotspots within the CRD were located in the urban core. Results also suggested that both **proximity to the ocean and to major road networks** also played a factor, with areas on the coast experiencing less dramatic temperature increases and areas on major roads experiencing more dramatic temperature increases.



Map of the range in average summer temperature classification values from 2018-2021

CONCLUSION

Overall, this study helped to identify potential influencing factors that make areas within an urban environment high risk for extreme heat. It also outlined a streamlined process for identifying at-risk areas using open source data (LANDSAT imagery). Future studies could consider looking more closely at the impact of proximity to road networks and bodies of water.

RELATED LITERATURE

Aniello, C., Morgan, K., Busbey, A., & Newland, L. (1995). Mapping micro-urban Heat Islands using Landsat TM and a GIS. Computers & Geosciences, 21(8), 965–969. https://doi.org/10.1016/0098-3004(95)00033-5

Garzón, J., Molina, I., Velasco, J., & Calabia, A. (2021). A remote sensing approach for surface urban heat island modeling in a tropical Colombian city using regression analysis and machine learning algorithms. Remote Sensing, 13(21), 4256. https://doi.org/10.3390/rs13214256

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