World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:16, No:07, 2022

Canopy Temperature Acquired from Daytime and Nighttime Aerial Data as an Indicator of Trees' Health Status

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Abstract : The growing number of new cameras, sensors, and research methods allow for a broader application of thermal data in remote sensing vegetation studies. The aim of this research was to check whether it is possible to use thermal infrared data with a spectral range (3.6-4.9 µm) obtained during the day and the night to assess the health condition of selected species of deciduous trees in an urban environment. For this purpose, research was carried out in the city center of Warsaw (Poland) in 2020. During the airborne data acquisition, thermal data, laser scanning, and orthophoto map images were collected. Synchronously with airborne data, ground reference data were obtained for 617 studied species (Acer platanoides, Acer pseudoplatanus, Aesculus hippocastanum, Tilia cordata, and Tilia × euchlora) in different health condition states. The results were as follows: (i) healthy trees are cooler than trees in poor condition and dying both in the daytime and nighttime data; (ii) the difference in the canopy temperatures between healthy and dying trees was 1.06oC of mean value on the nighttime data and 3.28oC of mean value on the daytime data; (iii) condition classes significantly differentiate on both daytime and nighttime thermal data, but only on daytime data all condition classes differed statistically significantly from each other. In conclusion, the aerial thermal data can be considered as an alternative to hyperspectral data, a method of assessing the health condition of trees in an urban environment. Especially data obtained during the day, which can differentiate condition classes better than data obtained at night. The method based on thermal infrared and laser scanning data fusion could be a quick and efficient solution for identifying trees in poor health that should be visually checked in the field.

Keywords : middle wave infrared, thermal imagery, tree discoloration, urban trees
Conference Title : ICUHIAS 2022 : International Conference on Urban Heat Island Adaptation Strategies
Conference Location : Helsinki, Finland
Conference Dates : July 19-20, 2022