Australia Forest Fires 2019/2020

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Introduction and Background

Forest fires ravaged the forested south of Australia in the past dry season and made global headlines. I chose to compare two Landsat tiles of the Australian Alps from last Spring and Summer, i.e. pre and post fire to assess the area of burnt forest. The single selected tile 091 085 covers the southwestern corner of the ACT and the New South Wales/Victoria territory border. To achieve such an analysis, ca. 10 time slices of Landsat 8 imagery were requested from USGS EarthExplorer covering September 2019 and April 2020. Many slices were discarded due to high cloud coverage, smoke, and haze that made classification ambiguous. Selected time slices were 09 September 2019 and 23 January 2020.

Null Hypothesis: *Burnt area is NOT visible and quantifiable*

Analysis

First a Composite Band was generated and based on this the NDVI for highlighting the mountain regions that were impacted by forest fires.

Signatures were trained. Spring still had snow cover in the Alps. The entire tile had relatively strong NDVI values in open land, agriculture fields, and in forested regions. Summer was significantly drier in the open land and agriculture panes. Nevertheless, forests still had high reflectance by photosynthesizing trees. Burnt mountain sides had unique color values that set it apart from dry open land and healthy forests.

For most classes the same training shapes were re-used.

Towns and developments were never segmented and classified since there was too much overlap in color values with dry open land (brown gardens and road shoulders) and snow/clouds (white roofs/reflective metal). Future Machine Learning algorithms that also focus on structures and not only color values may be able to discern these regions better.

A model was built with the Model Builder that takes in the Landsat 8 bands and training sample shapes and outputs Composite Bands, NDVI, and Maximum Likelihood Classification (cell count converted to area). Using this model, other time slices or tiles can be automated given that training shapes and classes are adequate.

Results

No Burnt Forests were visible in September 2019's NDVI, hence no training shapes were used for classifying Burnt Forests and it has to be assumed 0 km^2 were charred.

A total of 6250 km^2 were measured in January 2020 few days to weeks after the forest fires in the selected Landsat 8 imagery.

Conclusions

We can reject the Null Hypothesis: The burnt forest areas of southeast Australia are reliably located using NDVI and quantified using the Maximum Likelihood Classification tool. Future research may include the assessment of recovery of the burnt forests, which includes timing the return of normal NDVI values and spatial progress plant colonization. This proof-of-concept study confirms that classification can be feasible and automated using the Model Builder. Additional work will be selecting tiles and time slices, and creating adequate training shapes and classes.