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## 3<sup>rd</sup> Annual Congress on

# **Soil, Plant and Water Sciences**

November 11-12, 2019 | Madrid, Spain

### Unsupervised clustering of forest response to drought stress in Zululand region, South Africa

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rought limits the production of plantation forests, notably in the drought-prone Zululand region of South Africa. During the last 40 years, the country has faced a series of severe droughts, however that of 2015 stands out as the most extreme and prolonged. The 2015 drought impaired forest productivity and led to widespread tree mortality in this region, but the identification of tree response to drought stress remains uncertain because of its spatial variability. To address this problem, a method that can capture drought patterns and identify trees with similar reactions to drought stress is desired. This could improve the accuracy of detecting trees suffering from drought stress which is key for forest management planning. In this study, we aimed to evaluate the utility of unsupervised mapping approaches in compartments of Eucalyptus trees with similar drought characteristics based on the Normalized Difference Water Index (NDWI) and to demonstrate the value of cloud-based Google Earth Engine (GEE) resources for rapid landscape drought monitoring. Our results showed that calculating distances between pixels using three different matrices (Random Forest (RF) proximity, Euclidean and Manhattan) can accurately detect similarities within a dataset. The RF proximity matrix produced the best measures, which were clustered using Wards hierarchical clustering to detect drought with the highest overall accuracy of 87.7%, followed by Manhattan (85.9%) and Euclidean similarity measures (79.9%), with user and producer results between 84.2% to 91.2%, 42.8% to 98.2% and 37.2% to 94.7%, respectively. These results confirm the value of the RF proximity matrix and underscore the capability of automatic unsupervised mapping approaches for monitoring drought stress in tree plantations, as well as the value of using GEE for providing cost effective datasets to resource stricken countries.



#### **Recent Publications**

- 1. Xulu S, Peerbhay K, Gebreslasie M, and Ismail R. 2019. Unsupervised clustering of forest response to drought stress in Zululand region, South Africa. Forests, 10, 531.
- 2. Xulu S, Peerbhay K, Gebreslasie M, and Ismail R. 2018. Drought influence on forest plantations in Zululand,

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South Africa, using MODIS time series and climate data. Forests, 9, 528.

3. Peerbhay KY, Mutanga O, Ismail R. 2015. Random forests unsupervised classification: The detection and mapping of Solanum mauritianum infestations in plantation forestry using hyperspectral data. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 8, 3107–3122.

### Biography

Sifiso Xulu is interested in the utility of remote sensing and data science within forestry environments, and the monitoring of natural resources in general. He has published peer-reviewed articles various international journals. His current responsibilities include research, lecturing and training undergraduate and postgraduate students, and interacting with various stakeholders.

Notes: