Mapping and Estimation of Grass Above-ground Biomass (GAB) using Sentinel 2A Satellite Data.

Isa, Muhammad Zumo[1,2,3] and Mazlan Hashim[1,2*]

[1]Geoscience & Digital Earth Centre, (INSTeG), Faculty of Built Environment & Surveying,
[2]Research Institute for Sustainable Environment (RISE),
UniversitiTeknologi Malaysia, 81310 UTM Johor Bahru, Malaysia.

[3]Department of Geoinformatics, Federal Polytechnic, Damaturu, Nigeria

*Emails: isamzumo@gmail.com: mazlanhashim@utm.my

Abstract: Grass Above-ground Biomass (GAB) is one of the important parameters for understanding grassland ecosystem in particular for sustainable management of large grazing area for livestock farming. Previous satellite-based remote sensing (RS) models for mapping and estimation of aboveground biomass have focussed to woody vegetation ranging from vegetated crops to natural shrubs and forests. However, the grass biomass mapping is rarely if ever reported. In this study, the potentiality of satellite RS was explored using sentinel 2A MSI data to derive information for grass biomass and mapping using 3 stepwise approach, namely: (i) in-situ samplings on known grass to form allometric model, (ii) upscaling the allometric model to corresponding satellite data; and (ii) deduction of the upscaled biomass to large area with the satellite data. The study was conducted in the sprawling 3000ha of green *Universiti Teknologi Malaysia* campus, abundant with four dominating grass types. Samples for each of the four-dominant grass types were selected and used as controls and validation. Grass height, stem diameter, leaf area, grass volume, and grass density were measured from the field and laboratory. From the grass allometric analysis, grass height and grass volume were found to be suitable predictors of GAB estimation ($R^2 > 0.881$, $p < 0.001$), respectively. The widely spectral vegetative indices; Normalized Distribution of Vegetation Index (NDVI), Vegetation Index Number (VIN), Normalized Difference Index (NDI) and Ratio Vegetation Index (RVI) derived from the Sentinel-2 MSI data were also analysed for correlation with the measured GAB. Results indicated that VIN has the best fit for modelling grass biomass ($R2 > 0.84$, $p < 0.001$) and validated at accuracy (RMSE) of +-25g with mutually independent test set. It is concluded that grass biomass is potentially be estimated at good accuracy provided the allometric-GAB model could be systematically upscaled to the appropriate satellite spatial resolution as demonstrated above. The application of this GAB to vast unmapped grassland, such as in the African savannah where such information is vital for assisting the migratory livestock farming. Hence, will contribute to attaining the set targets 15.1 and 15.9 of the United Nations (UN) Sustainability Development Goal (SDG) number 15 Life on land.

Keywords: Mapping, Grass, Biomass, Satellite data.