

Land use/ cover mapping of the dry and wet season of Kikuletwa catchment using GIS and remote sensing techniques

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Management of water resources has become complicated due to lack of reliable information on the water uses of different sectors. The quantification of water consumption has been concentrated to modified and cultivated areas, but often lacks a correct representation of agricultural water management practices (crop rotations, drip irrigation) while leaving out the water consumption from natural ecosystems (forest, barren land, grazed grassland and shrubland or thickets). A detailed land use map can help water resources scientists and managers to better quantify the water uses by these ecosystems. However, most of the time the hydrological seasons are not considered in developing the land use maps. The objective of this study was to develop a land use maps for the two main seasons (dry and wet season) of the semi-arid Kikuletwa catchment, Tanzania. Three Landsat 8 images of March, August and November 2016 were obtained and cloud masked. Ground truthing points and questionnaire surveys regarding cropping system were collected during the month of August 2016. Unsupervised and supervised techniques in ArcMap and ground truthing point with the aid of cropping calendar was used to classify the three images. About 20 land use/land cover classes were obtained. The dry season images seem to have higher accuracy than the wet season images having Maximum NDVI of 0.6. The results showed a clear difference of how the land is being used in the dry and wet seasons. The image obtained on March representing the wet season showed 74% of the total cultivated land is rainfed with supplemental irrigation while 60% of the cultivated land is irrigated in the dry seasons. Additionally, the results show differences in land size of the natural ecosystems like grazed grassland. The total grazed grassland for the dry month of August was 5.3% of the total catchment area while that of November was 5.1%. The change seen during the dry seasons between the month of August and November is due to continual grass consumed by livestock, which turned 0.2% of the area into the bare land and sparse vegetation. However, from the start of the rainfall seasons the area is left ungrazed, hence the land use map for the month of March shows 6.2% of the total catchment area is grassland. This detailed land use map information is useful to quantify annual water depletion of the catchment considering two distinct seasons.

Keyword: water consumption, Land use/cover, natural ecosystem, dry and wet seasons