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Monitoring wetland cover changes during the past two decades within the protected areas of the Sudd wetland in South Sudan using MODIS data.

The Sudd wetland, situated along the White Nile in the Republic of South Sudan, is recognized internationally for its unique environmental features. The wetland supports various endangered wildlife species and furthermore provides ecosystem services of high significance to indigenous communities surrounding the area. While monitoring changes within these natural environments usually contributes to their protection, political instabilities within the Republic of South Sudan have made obtaining in-situ data measurements challenging. Therefore, remote sensing technology provides a solution for observing areas otherwise restricted by inaccessibility or regional conflicts.

The aim of this thesis project was to monitor potential wetland vegetation cover changes within the protected areas of the Sudd wetland in March 2000-2020. The wetland vegetation cover was categorized into three vegetational groups, open water, seasonally-flooded grassland, and marsh, using previously reported classification methods of utilizing historical MODIS NDVI imagery data. Possible variations in wetland cover were related to wet season water level changes within the three main water basins sustaining the White Nile, including Lake Victoria, Lake Albert, and Lake Kyoga, in addition to average precipitation surrounding the areas during the preceding years of the obtained NDVI data. Furthermore, frequency and magnitude of armed conflicts associated with herder-pastoralist indigenous communities neighbouring the protected areas was related to the environmental variables.

This thesis project found the water levels of Lake Albert to significantly influence the spatial and temporal variations in wetland vegetation cover extent. Continued elevated water basins levels may have sustained a high value of mean NDVI within the Sudd wetland during years of nationwide droughts. However, the water levels of Lake Victoria and Lake Kyoga in addition to the average precipitation appeared to have no statistically significant association with the mean NDVI and vegetation cover area of the Sudd wetland. This study found the yearly number of reported conflicts to be associated with an elevated mean NDVI, and furthermore to be distributed within larger cities and in proximity to ethnic pastoral boarders. No statistically significant correlation was found between the frequency and magnitude of conflicts and the environmental variables. The analysis further highlighted the spatial variations in vegetation covers between the protected areas of the Sudd wetland, indicating a high natural variability within the areas. In a region expected to receive an increased frequency of climate extremes, the understanding of vegetational responses to hydrological fluctuations merely increases. The usage of satellite remote sensing technology for monitoring variations in wetland vegetation cover have in this thesis project shown to be an effective method for observing large inaccessible areas. Future research should further analyse local vegetational changes within the wetland and their potential hydroclimatic divers.

Keywords: Physical Geography and Ecosystem analysis, MODIS, NDVI, Sudd Wetlands, Wetland Cover Classification, White Nile Hydrology, Armed Herder-Pastoralist Conflict analysis.

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Master degree project 30 credits in Physical Geography and Ecosystem Science 2021 Department of Physical Geography and Ecoystem Science, Lund University. Student thesis series INES nr 548