Monitoring of land use/land cover dynamics using satellite data in Ngorongoro Conservation Area, Tanzania

（衛星画像データを用いたタンザニア，ンゴロンゴロ自然保護区における土地利用・土地被覆変化のモニタリング）

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The Ngorongoro Conservation Area (NCA) is a world renowned biodiversity hotspot, which supports the large number of wildlife species in East African semi-arid savannah. The NCA is a unique place, where multiple goals prevail including wildlife conservation, tourism and sustainable human livelihood of Maasai pastoralists. However, steady increase of population of the Maasai residents, through endogenous and immigration and climatic conditions are the main stressors to the integrity of the conservation status of the NCA. The aim of this research is to assess the magnitude and trend of land cover changes in the NCA from 2000 to 2017 based on MODIS-EVI (Enhanced Vegetation Index) time-series data.

MODIS-EVI 16-day 250 m satellite imageries from 2000 to 2017 were analyzed in R software. The maximum values of MODIS-EVI were used to detect dynamics of vegetation cover in two land covers; (1) forest, which was restricted for any consumptive land use and (2) grassland, which was used as grazing area for livestock. The changes in land cover were detected from the annual mean of total images of each year. The changes detected were validated by the field observation in 2017. The seasonality of vegetation indices was further studied based on climatic condition using precipitation and temperature data of the study area under the period of monitoring.

The time series analysis of land cover showed high seasonality and annual variability in grassland and weak seasonality in forest which was influenced by availability of precipitation. The grassland cover showed a decreasing trend under the monitoring time. The forest cover remained almost unchanged throughout the monitoring period. The precipitation showed a decreasing trend while temperature trend indicated warmer conditions which led to decline in amount of grassland in addition to the increased livestock grazing activities.

This study revealed that from 2000 to 2017, the NCA’s land cover has been influenced by climatic factors and human activities. The grassland cover is the most vulnerable due to decreased precipitation and the increased number of livestock. Further research is necessary to conduct in-depth investigation on proper adaptation measures for sustainability.