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Simulating the radiative transfer budget of the Amboseli National Park (Kenya) to support vegetation monitoring using remote sensing

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MOSAIC is a European project using Open Science to address Planetary Health challenges by co-designing information ecosystems with local stakeholders. One study area is the cross-border rangelands of southern Kenya and northern Tanzania, where Maasai pastoralists face increasing drought, overgrazing, and loss of habitat diversity. In Amboseli National Park, woodland and bushland have declined while grasslands and swamps expanded over the past five decades, affecting wildlife and pastoral livelihoods.
The African Conservation Center combines aerial surveys, plot measurements, and the Normalized Difference Vegetation Index (NDVI) computed by NASA's MODIS to monitor grazing pressure and total biomass. However, NDVI is least sensitive to living plant biomass during severe droughts, is strongly influenced by soil background, and empirical biomass relationships are difficult to transfer across space and time. The lack of long-term field measurements against which to calibrate remotely-sensed indices remains an essential limitation.
Radiative transfer (RT) modeling simulates the propagation of radiation with all physical mechanisms that lead to remote sensing (RS) acquisitions. It is thus a powerful tool to tackle the latter challenges. Using the DART model, this study aims at quantifying the effect of above-ground biomass (AGB), leaf chlorophyll content, soil type and spatial resolution of RS acquisitions on NDVI values across Amboseli National Park's 8 main habitats. The methodological objective is to calibrate DART for the Amboseli landscape. Work will focus on compiling instrumental, optical, structural, and geometric parameters through literature review and targeted field measurements. Preliminary results suggest AGB loss and vegetation dryness are processes that can be differentiated by comparing distribution of NDVI values over time, (2) spatial resolution affects the discriminative power of the approach, (3) soil type has a significant influence on the mode of the distribution, even under dense forest canopy.
The final goal is to both develop operational indicators to support local decision-making as well as a transferable and replicable approach, in the spirit of the MOSAIC project.