AERIAL IMAGERY FOR MONITORING LAND USE IN EAST AFRICAN WETLAND ECOSYSTEMS

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Abstract

Anthropogenic pressure and environmental change processes are key drivers of the recent intensification in the agricultural use of East African wetlands. Land shortage and degradation of upland areas as well as climate change effects turn wetland ecosystems into focal points of production by commercial and traditional users (agro-industries, subsistence farmers, pastoralists), entailing rapid wetland use changes and, in some instances, severe wetland degradation. An ecosystem inventory by surveying and mapping land cover and by monitoring land use changes with remote sensing improves our understanding of change processes in wetlands and will contribute to provide decision support for a sustainable use of wetland ecosystems. However, the spatial resolution of satellite systems is often too coarse to derive land use information at plot-level. In particular, small wetlands often exhibit abrupt transitions into different types of land use and landscape elements. Hence, monitoring of small wetlands requires spatially high-resolution remote sensing data, accounting for the prevailing small-scale diversity in land use. Aerial imaging may provide information of wetland use/change at the required plot-level scale.

An image acquisition over Kenyan wetlands was realized in September 2008, to map land use in selected study areas. Two clusters of test sites were covered in the Laikipia district (between the towns of Rumuruti and Nyahururu) and two in the Nyeri district (close to the towns of Nyeri and Karatina). Outboard of a small plane, a Nikon D-200 with a GPS-link was mounted, doors of the plane were removed and the interval capturing for each flight line was manually controlled. The used camera has a CCD-sensor with 23.6 x 15.8mm with a total amount of pixels of 10.92mio. The image size of 3872 x 2592 pixels and a flight altitude of 670m above ground resulted in a per-picture coverage of about 775 X 520m. A 30% overlap of the images within a flight line was ensured. Where study sites exceeded the maximal ground coverage width of 775m, additional flight lines were realizes with an overlap of 40%. The interval time of the camera resulted from the speed of the plane and the distance between images. According to these settings and requirements, a flight plan was created in a geographic information system.

Within a total flight time of 5.7 hours, 550 images were taken. Due to the fact that the pilot could not precisely navigate at the chosen altitude, the image resolution varied between 0.3 and 0.55m. For preprocessing, images were stitched within flight lines and each flight line was afterwards geo-referenced separately using topographic maps and Landsat- or ASTER-satellite images. A comprehensive data set for the monitoring of wetland use was obtained. It displays land use units at plot-level and is used to discriminate/classify various crops, native plants, open water and infrastructural elements etc. While absolute spatial accuracies of the images - in comparison to their very high spatial resolution – are low due to the low spatial resolution of the reference data, the imagery is suitable to provide high-resolution information about land use patterns in wetlands. The information will be used to derive land use trends and the agricultural suitability of small wetlands of the region.