

Acquisition of RGB and NIR photographs from Unmanned Airborne Vehicles (UAVs) for crop and land use monitoring

Katja Brinkmann, Wolfgang Schaeper, Noromiarilanto Fanambinantsoa & Andreas Buerkert

For more than 50 years, aerial color and color-infrared photography have been used to monitor crop growth, crop health, biotypes, and pest infestations in agricultural fields. The use of Unmanned Airborne Vehicles (UAVs), drones and radio-controlled model aircraft offers an effective, simple, and cheap alternative method to obtain high resolution aerial images compared with conventional satellite imagery. They can be flown at lower altitudes to increase spatial resolution.



Figure 1. Flight mission in Efoetsy with the Paparazzi ground control station (Laptop including software and antenna).



Figure 2. Hexakopter (left) and Mini-Horus (right; Breadth: 1,74 m; length: 1,25 m; weight with payload: 2,07 kg).

For the establishment of detailed land use and cadastral maps and estimation of cassava yield, a small remotely controlled, auto-piloted airplane (Mini Horus® drone, Paparazzi ground control station) was used to deliver high resolution aerial photographs of 3 selected study sites in March 2012 during the peak of vegetation growth. The flight altitude was approx. 300m a.s.l (= 8-10 cm image resolution). A total area of 4000 ha was covered (8500 images).

To georeference and process the images we cooperated with Dr. Peter Selsam (Geoinformatics, University of Jena) and used the applications developed as part of the ANDROMEDA project (Application of Drone-Based Aerial Images - Mosaicking, Geocoding and Data Analysis; Böhm et al. 2008, Reinhold et al. 2008).

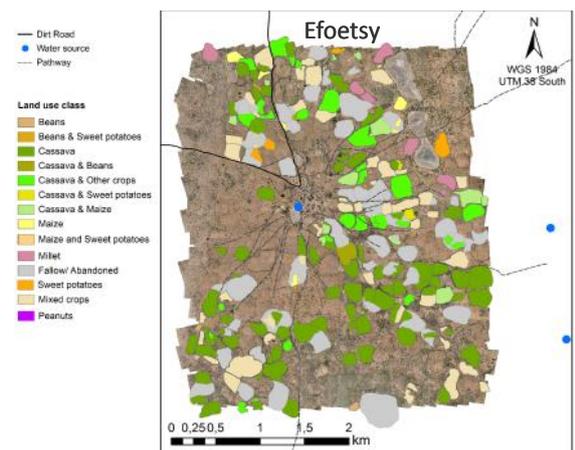
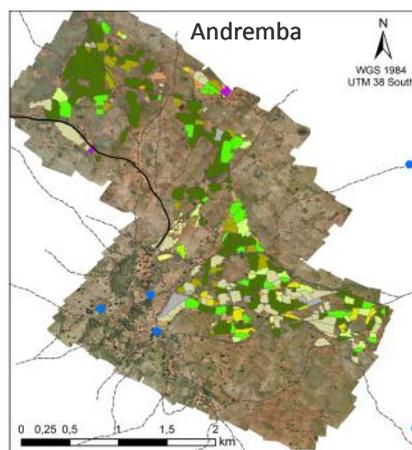
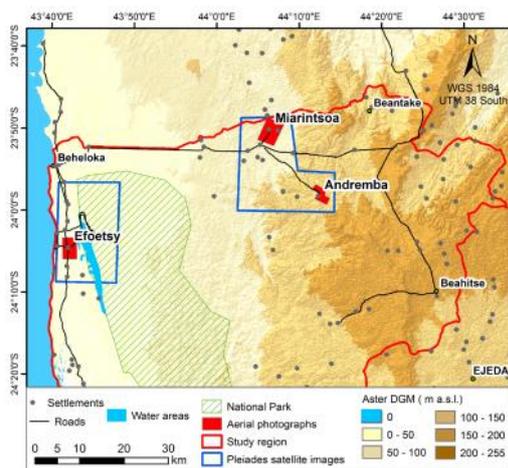
Three Hexakopters (Remote control helicopter equipped with a color digital camera (Panasonic Lumix DMC-GF1) were manufactured at the University of Kassel and are used for Participatory Photo Mapping and for the acquisition of images for experimental plots and sacred forests.



Figure 3. Preparation of the flight: The Mini Horus was equipped with two cameras (RGB), batteries and connected to the autopilot.



Figure 4. Aerial photograph showing the center of a village. The Mini Horus was equipped with two cameras (RGB = Casio Exilim EX-S12; IR = Fuji Finepix F30, NIR-blocking filter removed, IR-Filter 720 nm) resulting in NIR (left) and true colour (right) images.



The resulting digitized maps deliver important base data for the analysis of the land use system and the modelling of land use scenarios. Altogether, 36 crop species (number of varieties = 74) have been identified in the three selected villages, whereby Cassava (*Manihot esculenta* L. Crantz), maize (*Zea mays* L.) and beans (*Vigna unguiculata*) dominate. The spatial extrapolation of ground measurements for cassava yield is based on the plant canopies estimated by object based analysis of aerial photographs.



References

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Authors:

Katja Brinkmann, Wolfgang Schaeper, Noromiarilanto Fanambinantsoa & Andreas Buerkert

Contact:

tropcrops@uni-kassel.de