Use of Remote Sensing Data to Assess Crop Yields and Food Security on the Mahafaly Plateau in SW Madagascar

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The rainfed, subsistence-oriented slash-and-burn agriculture on the Mahafaly Plateau is limited by the availability of water and nutrients throughout the year and is regularly faced with natural hazards such as drought events, cyclones and locust infestation. Consequently, food insecurity affects more than 68 % of the households and information on local food production and agricultural vulnerability are urgently needed. Our study, therefore, aims to develop GIS-based methods in combination with socio-economic data to assess food security at the household and field level.

High resolution aerial photographs and field inventory data of different years were used to establish detailed land use and cadastral maps and to analyse the land use dynamics for three selected villages. To assess crop yields, the following reference data for cassava and maize were collected on 10 fields per village over a period of two years: GPS location, crown cover, total plant height, aboveground (leaves and sticks) and belowground biomass (tubers) of cassava (n=80); Height, corn- and leaf biomass of individual maize plants (n=50). Additionally, the yield and plant cover of supplementary crops (beans, sweet potatoes and millet) was measured (n=10).

The most important staples on the Mahafaly plateau are cassava (*Manihot esculenta* L. Crantz) and maize (*Zea mays* L.), followed by beans (*Vigna unguiculata* L.) as a vegetable. Cassava occupies 77 % of the fields on the plateau and 55 % of the fields in coastal areas.

Based on aerial photographs the cover of individual cassava plants and total maize cover was calculated for all fields using object based image classification. Aboveground (R^2=0.70) and belowground (R^2=0.51) biomass of cassava strongly correlated with plant cover and the resulting regression formulas are used to extrapolate crop yields. The crop yields of the labour intensive, low-input agriculture are relatively low (2–5 t DM ha^{-1} for cassava), but the high diversity of cultivated crop species (n=36) with more than 70 varieties reduces vulnerability to natural hazards. Our results will be combined with socio-economic base data from household surveys to identify and assess household-level food security and food insecurity coping strategies.

Keywords: Biomass, cassava, food security, object based classification

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