

Spatial analysis of land cover determinants of malaria incidence in the Ashanti Region, Ghana

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Abstract

Malaria belongs to the infectious diseases with the highest morbidity and mortality worldwide. As a vector-borne disease malaria distribution is strongly influenced by environmental factors. The aim of this study was to investigate the association between malaria risk and different land cover classes by using high-resolution multispectral Ikonos images and Poisson regression analyses. The association of malaria incidence with land cover around 12 villages in the Ashanti Region, Ghana, was assessed in 1,988 children <15 years of age.

The median malaria incidence was 85.7 per 1,000 inhabitants and year (range 28.4-272.7). Swampy areas and banana/plantain production in the proximity of villages were strong predictors of a high malaria incidence. An increase of 10% of swampy area coverage in the 2 km radius around a village led to a 43% higher incidence (relative risk [RR]=1.43, $p<0.001$). Each 10% increase of area with banana/plantain production around a village tripled the risk for malaria (RR=3.25, $p<0.001$). An increase in forested area of 10% was associated with a 47% decrease of malaria incidence (RR=0.53, $p=0.029$).

In a next step, mapping of GPS positions of each household will enable to determine individual risk and to confirm and to improve the validity of the model.

The analyses demonstrate the usefulness of satellite images for the prediction of malaria endemicity. Thus, planning and monitoring of malaria control measures should be assisted by models based on geographic information systems.