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“Reconcile land system changes
with planetary health”

Importance of plant phenology and implications of agricultural expansion for beetle diversity in a Kenyan highland floodplain

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Abstract

Wetland ecosystems in East Africa represent biodiversity hotspots that are increasingly threatened by the effects of land use intensification and climate variability. Invertebrates such as beetles are of high ecological importance, e.g. for pollination, nutrient cycling, and soil health. However, their diversity and population dynamics, and their response to land use and land cover changes, are severely understudied in these wetlands.

Our study therefore asks: (1) How do hydrological conditions and land use regimes in a tropical highland floodplain influence abundance, composition, and diversity of beetles? (2) Which role do seasonal variations in vegetation phenology hereby play?

The study has been conducted in Ewaso Narok swamp, a highland floodplain in Laikipia, Kenya. A semi-arid savannah climate with distinct wet and dry seasons creating a high spatial and temporal variability of water levels and vegetation, complemented by a variety of land uses.

To capture these diverse conditions, 42 sampling plots were stratified along gradients of hydrology (never, seasonally, and permanently submerged) and land use intensity (pristine, grazing land, fallow, and cropland). During six field visits in 2015 and 2016, ground-living and canopy dwelling beetles were sampled using pitfall traps and sweep nets, respectively. Additionally, data on vegetation including phenological stages (budding, flowering, and fruiting) were collected for each sampling plot. We analysed spatial and temporal variation of diversity metrics, functional groups as well as individual species of beetles.

The sampling date was the key determiner of beetle abundance, and composition. The different sampling dates reflect the phenological stages of vegetation. While some species were recorded at all sampling dates, others were restricted specific phenological stages. Particularly the abundance of flower buds favoured many beetle species. Vegetation, and the abundance of buds, flowers, and fruits, did not only differ between dates, but also between land uses and hydrological zones. Beetle species composition could however rarely be linked to specific land uses or hydrological zones, likely due to the landscape's heterogenic structure and the mobility of the beetles. However, with ongoing agricultural expansion, this might change, and therefore it is crucial to monitor current beetle diversity and counteract potential losses in tropical wetlands.

Keywords: Agricultural expansion, beetle diversity, Ewaso Narok, floodplain wetland, land use, plant phenology, vegetation

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