

Assessment of floristic and structural variables of vegetation: the impact of agricultural use in East African wetland ecosystems

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INTRODUCTION

Seasonally and permanently flooded wetlands in East Africa are strongly impacted by human activities. Intensification of **crop production** and long term **misuse** of wetland ecosystems may have **negative effects** on their **functions** and **biodiversity** resulting in a reduction of productivity and provisioning of further ecosystem services. Cost- and time-efficient tools oriented to the **support of decision making** for users and managers are required in order to ensure a **sustainable use of wetlands**. In this regard we aim to design **rapid assessment** methods that may be suitable for East Africa.



Drained wetland for crop production near Kigali, Rwanda



Heavily grazed wetland in Ewaso Narok swamp, Kenya

METHODS

During a survey carried out in 2013 the **vegetation status** of around 200 use units (areas characterized by similar land use type and intensity within randomly selected study tiles) distributed in **Kenya, Rwanda, Tanzania and Uganda** were assessed by means of variables related to the **floristic composition**, plant species diversity and **vegetation structure**. Such variables were selected among those that can be quickly measured or estimated.

The analyzed use units represented the **diversity** of uses from **near-natural vegetation** like stands of papyrus (*Cyperus papyrus*) to **medium-disturbed grazing land** up to **intensively used croplands**.

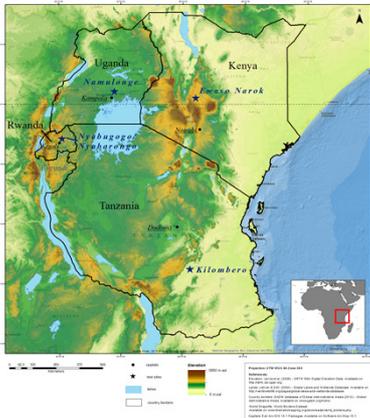
Furthermore, the disturbance intensity was estimated according to the **Wet Health** approach (Kotze et al. 2012, Ecological Indicators 13, 284–293).

List of variables assessed

Land use / land cover
Total vegetation cover
Total dry vegetation cover
Vertical structure (number of layers)
Crop(s)
Cover of crops
Cover of Cyperaceae
Cover of Typhaceae
Cover of Poaceae
Cover of other families
Total cover of monocotyl plants
Total cover of dicotyl plants
Proportion of monocotyl plants
Total cover of annuals
Total cover of perennials
Proportion of annuals
Dominant species and their coverage

STUDY AREA

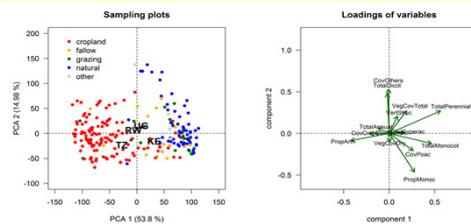
GlobE Wetlands - study area and test sites



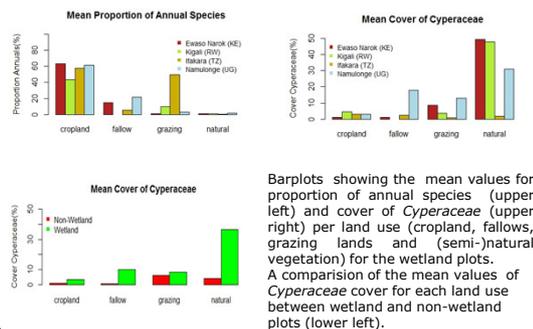
The four focal wetlands:

- Ewaso Narok swamp near Rumuruti, Kenya (KE)
- Wetlands around the Nyabugogo and Nyabarongo rivers near Kigali, Rwanda (RW)
- Kilombero floodplain around Ifakara, Tanzania (TZ)
- Wetlands around Namulonge, Uganda (UG)

RESULTS



Principal Component Analysis of all assessed variables showing the centroids for the localities and the land use for each wetland sampling plot (left) and the loadings of each variable (right)



Barplots showing the mean values for proportion of annual species (upper left) and cover of *Cyperaceae* (upper right) per land use (cropland, fallows, grazing lands and (semi-)natural vegetation) for the wetland plots. A comparison of the mean values of *Cyperaceae* cover for each land use between wetland and non-wetland plots (lower left).

The assessed variables strongly respond to the land use. Component 1 (53,8 %) is mainly an intensity gradient. As expected, **annual species** are within wetlands indicators for **high land use intensity** while perennials dominate in (semi-)natural vegetation. However, due to weed management and seasonal droughts, the total cover of annual species is of lower importance than the **proportion of annuals**. Regarding **perennial species** the **total coverage** is more meaningful.

Coverages of Monocotyledons and Dicotyledons as well as their ratio can help to differentiate between **different** (semi-)natural **vegetation types** rather than between land use intensities.

Surprisingly, the Cover of *Cyperaceae* are of little informative value, according to this ordination. This is likely due to the fact that *Cyperaceae* are rare in the studied part of the Kilombero floodplain (TZ), where natural vegetation consists mainly of Poaceae. In the Kenyan, Rwandan and also the Ugandan site, **Poaceae** are generally more abundant in units of **medium** or past **disturbance** (grazing lands and fallows) while **Cyperaceae** indicate **low land use intensity**. Also, of all assessed variables, *Cyperaceae* show the strongest difference between wetland and surrounding non-wetland plots.

Contrary to the expectations, *Typhaceae* rarely occurred within the study area.

CONCLUSION & OUTLOOK

Preliminary results show that some of the assessed variables can be used for a rapid assessment for the agricultural impact on East African wetland vegetation.

Especially the proportion of annual and the total cover of perennial species are meaningful. *Cyperaceae* can be a valuable indicator for the land use intensity as well as the identification of wetlands on some sites, while it is of no information on other sites.

This study is embedded in the multidisciplinary **GlobE-wetlands project**. A common database for the results of different disciplines is in preparation. Once established, it gives the opportunity for further analysis of these vegetation variables in reference to data from agronomy, hydrology, soil science and socio-economy.

Furthermore, a planned link with the **SWEA-VegDatabase** (GIVD-ID AF-00-006) will allow the application of this assessment to plots surveyed in Kenya and Tanzania.

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