Edaphic grassland and wooded grasslands in eastern Africa

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Objective

Better and more consistent separation of edaphic grassland on drainage-impeded or seasonally flooded soils (g) and Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (wd).

Description

On the previous version of the VECEA potential natural vegetation (PNV) map, there were considerable inconsistencies in the mapping of the edaphic grassland on drainage-impeded or seasonally flooded soils (g – henceforward referred to as edaphic grasslands) and Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (henceforward referred to as edaphic wooded grasslands). The reason was that the original national vegetation maps and the accompanying documentation were often not conclusive as to the physiognomic characteristics of these areas. This was also the reason that *edaphic wooded grassland* were loosely described as *edaphic grassland with scattered woody species* and *edaphic grassland* as *edaphic grassland without scattered woody species*.

As a consequence, in some areas the classification of the edaphic grasslands may be better described by the physiognomic classification system use by White (1983), in which all vegetation with a woody cover < 10% are considered grasslands. For other areas the classification may have followed more closely the definition of grasslands by Pratt et al. (1966), viz., grasslands are lands that are dominated by grasses and occasionally other herbs and with a woody canopy cover that does not exceed 2%.

Examining the distribution of the edahpic grasslands moreover showed that in many of these areas there is a clear canopy of woody vegetation with a coverage exceeding even the above-mentioned 10% threshold. On the other hand, areas classified as edaphic wooded grasslands showed no sign of wooded vegetation cover. In the second case, human activities may have led to the disappearance of the woody cover so no strong conclusions can be drawn from these observations without information on the past and current land use in these areas. A woody coverage on the other hand is fairly strong evidence that these areas can maintain a wooded grassland community (plantations are assumed to be rare in these areas, but this is still something that need to be checked).

Methods

As a first (intermediate) step to solve the problems outlined above, we reclassified all edaphic grasslands based on the actual woody vegetation coverage. As threshold value separating edaphic grasslands and edaphic wooded grasslands, we used the same criteria as used by White (1983), viz. areas with 10% or more woody vegetation coverage where (re-)classified as edaphic wooded grasslands.

For the woody vegetation cover, we used the average woody vegetation cover estimates by the MODIS Vegetation Continuous Fields collection (version 5) [1]. The product is derived from all seven bands of the MODerate-resolution Imaging Spectroradiometer (MODIS) sensor onboard NASA's Terra satellite. The estimates, available for the years 2000-2010, come at a resolution of 7.5 arc seconds (approximately 250 meter at the equator). For our product, we used the average over the 2000-2010 period (henceforward referred to as MODIS tree cover layer).

It should be noted that this data set estimates the proportional tree cover, i.e., all woody vegetation with a height of 5 meter or above. Especially in the more arid regions, the woody component of the wooded grassland communities will normally consist of bushes and scrubs. Our estimates may therefore still considerably underestimate the extent of this wooded grassland community.

From the VECEA PNV map version 1.1 we extracted all areas classified as edaphic grassland on drainage-impeded or seasonally flooded soils (g), or compound vegetation types with edaphic grasslands and wooded grassland on drainage-impeded or seasonally flooded soils (g/wd). We overlaid this layer with the MODIS tree cover layer and reclassified all areas with a estimated tree cover > 10% as *wd* and the remaining areas as *g*.

Results

The result is shows in Figure 1. It shows that there was a strong bias in how edaphic vegetation types were classified, with no edaphic wooded grasslands in Tanzania (the small area in the northern Serengeti was classified based on modelling). In total 41083 km2 (1.1% of the region) was classified as edaphic wooded grasslands. After the reclassification described above this was 69485 km2 (1.8% of the region).

Note that we excluded the dambo grasslands / swamps in Zambia. Due to some shifts in the location of the dambo's, a reliable estimates of tree cover in those areas is not possible. Inspection of the dambos on Google Earth revealed that many but not all dambos (taken into account a shift in their location) seem to consist of grasslands, albeit often less wide than mapped on our PNV map.

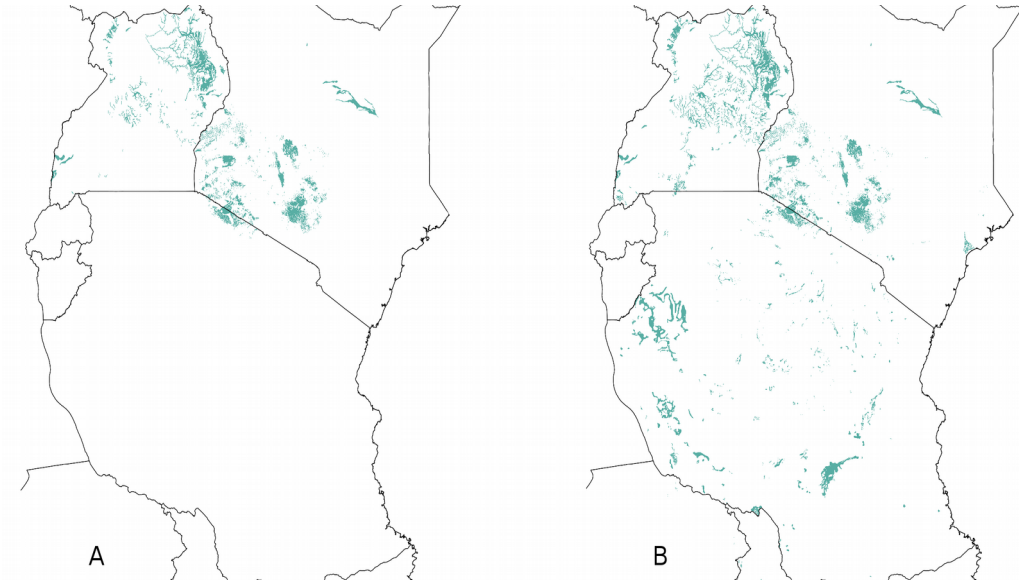

Figure 1. The distribution of Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (wd) (A) as mapped on the potential natural vegetation map of eastern Africa version 1.1 and (B) the estimated distribution of this vegetation type if all edaphic grasslands are included that have a tree cover of 10%, based on the average of the estimated tree cover for the years 2000-2010 from the MODIS VCF tree cover data layer [1].

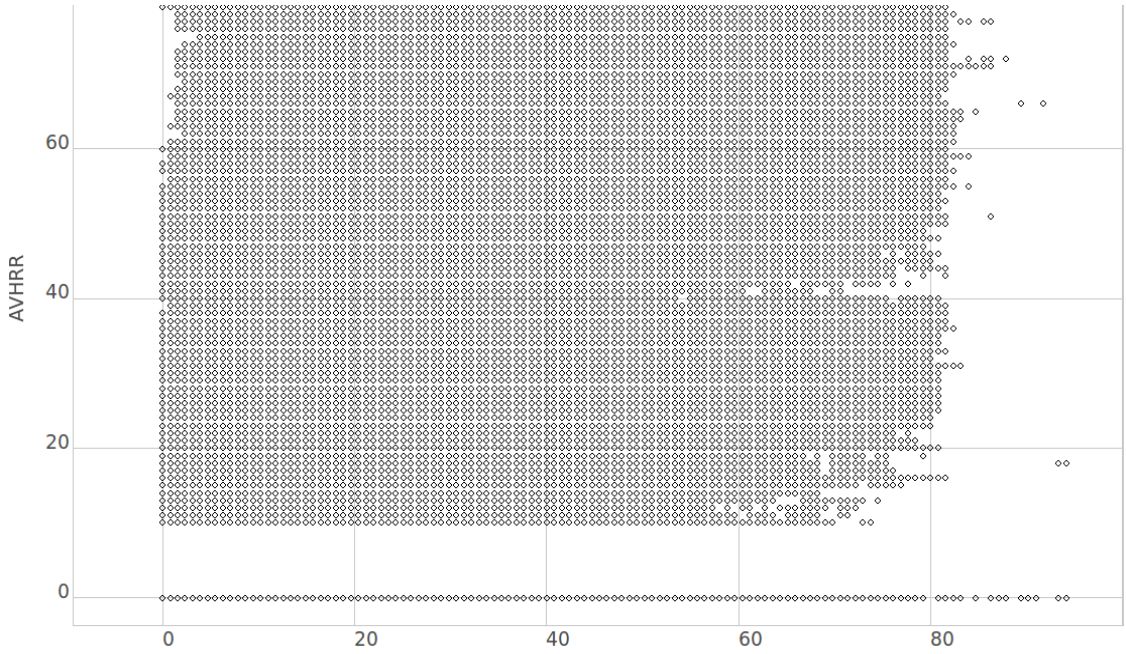

Figure 2. The estimation percentage tree cover in eastern Africa based on the MODIS VCF and AVHRR VCF satellite images. We used the MODIS data for 2000, while the AVHRR data is from 1992-1993.

Validation

Validation has not been carried out yet. A quick comparison of the tree cover estimates in eastern Africa based on the MODIS and AVHRR data shows that there is reason to be cautious with tree cover estimates based on automatic classification of satellite images (Figure 2). As a measure of confidence / accuracy of the estimates, we are therefore planning to carry out the reclassification based on different (satellite based) data sets such as tree cover estimates based on LandSat images [2] and a visual examination on Google Earth of the vegetation cover in X randomly selected points across the region.

When new information or data becomes available about the distribution of these vegetation types, we will explore the possibility to incorporate those in the VECEA map. If you have information or data that can help us to improve the map, please contact us on http://vegetationmap4africa.org.

References

[1] DiMiceli, C.M., M.L. Carroll, R.A. Sohlberg, C. Huang, M.C. Hansen, and J.R.G. Townshend (2011), Annual Global Automated MODIS Vegetation Continuous Fields (MOD44B) at 250 m Spatial Resolution for Data Years Beginning Day 65, 2000 - 2010, Collection 5 Percent Tree Cover, University of Maryland, College Park, MD, USA.

[2] Sexton, J. O., Song, X.-P., Feng, M., Noojipady, P., Anand, A., Huang, C., Kim, D.-H., Collins, K.M., Channan, S., DiMiceli, C., Townshend, J.R.G. (2013). Global, 30-m resolution continuous fields of tree cover: Landsat-based rescaling of MODIS Vegetation Continuous Fields with lidar-based estimates of error. International Journal of Digital Earth, 130321031236007. doi:10.1080/17538947.2013.786146.

[3] DeFries, R., M. Hansen, J.R.G. Townshend, A.C. Janetos, and T.R. Loveland (2000), 1 Kilometer Tree Cover Continuous Fields, 1.0, Department of Geography, University of Maryland, College Park, Maryland, 1992-1993.