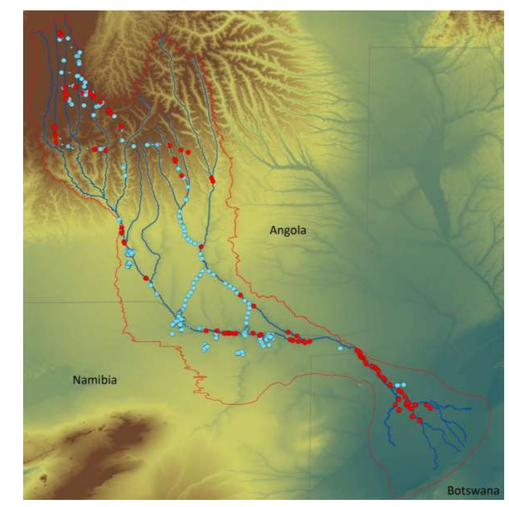
7th biennial conference of the International Biogeography Society, January 8th – 12th, 2015, University of Bayreuth, Germany

Using remotely sensed predictors for SDMs to explain distribution of canopy tree species of Miombo woodlands

Rasmus Revermann[1], Manfred Finckh[1], Marion Stellmes[2], Vera De Cauwer[3], Boris Schröder[4], Jens Oldeland[1]

[1] University of Hamburg, Biodiversity, Ecology and Evolution of Plants, Biocentre Klein Flottbek [2]University of Trier, Department of Remote Sensing
[3]Polytechnic of Namibia, Windhoek, Department of Geospatial Sciences and Technology [4]Technical University Braunschweig, Institute of Geoecology
rasmus.revermann@uni-hamburg.de

INTRODUCTION The Miombo woodlands of Southern and Central Africa have been identified as one of the global tipping points where drastic loss of biodiversity and decline of ecosystem services are likely to occur in the near future. The Future Okavango Project (TFO) uses the Okavango Basin as a study region to investigate future land management options. However, many ecological base line data are missing and therefore we aim to provide current data on the realized distribution of the woody species of the Okavango Basin.

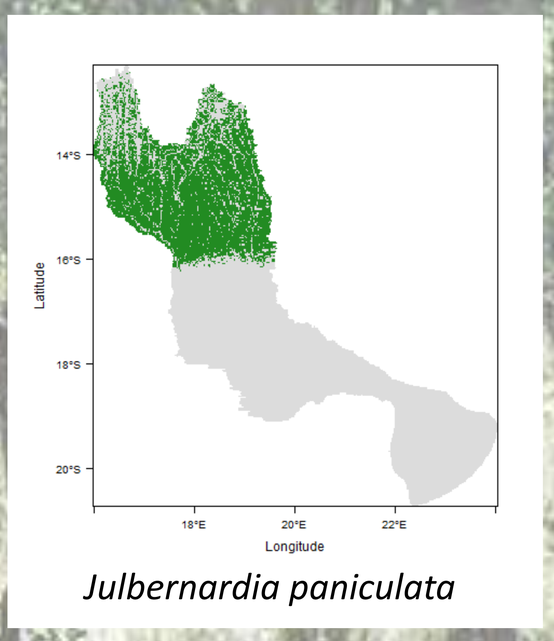


STUDY AREA Okavango Basin

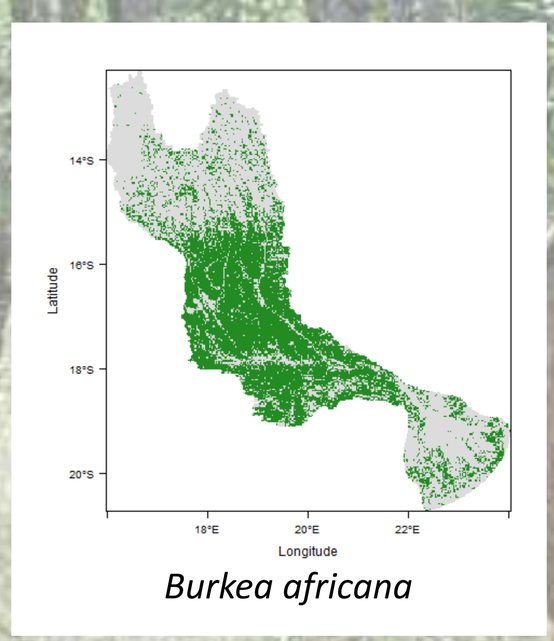
Blue dots: locations of plots

Red dots: additional absences

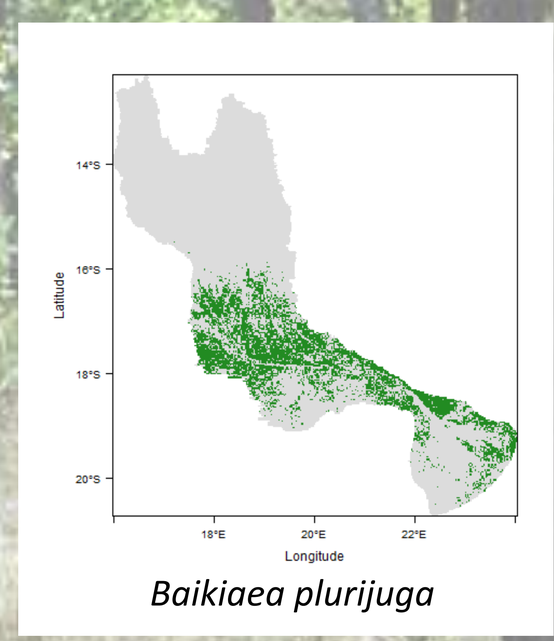
SPECIES DATA was compiled from vegetation mapping campaigns in the years 2012 – 2014 and from a forestry inventory. Plot sizes were 20 x 50 m and circles with a radius of 30 m respectively. Cover data was transformed into presence / absence and additional absence points without woody vegetation such as wetlands were added. In total 535 plots were considered with 134 species. 48 species met the threshold of 30 occurrences to be included in the modelling.



Julbernardia paniculata



Burkea africana



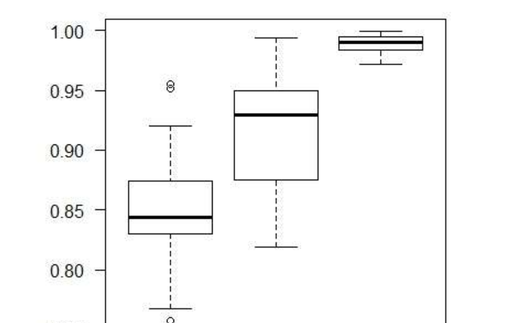
Baikiaea plurijuga

All **PREDICTOR VARIABLES** were up- or downscaled to the resolution of the MODIS data with grid cells of 250 x 250 m. Prior to modelling all predictors were tested for multicollinearity. The following predictors entered the modelling procedure:

Phenological metrics of EVI based on a time series analysis of 12 year of MODIS imagery: *Amplitude*, *Base Value*, *Maximum Fitted Value*, *End of Season*, *Length of Season*, and *NIR*

Bioclimatic data based on ERA-Interim/REMO: *Temperature Seasonality*, *Annual Precipitation*

Topographic attributes derived from SRTM: *Topographic position index*, *Topographic wetness index*, *Topographic rouggedness index*



BOXPLOTS depict results of the cross validation of ensemble models for all species on testing data for three performance criteria: kappa, TSS and AUC

Model algorithms: GLM, GAM, BRT and RF

Model validation: data split 80:20, fivefold cross validation, three performance criteria Cohen's kappa, true skill statistic (TSS) and area under ROC curve (AUC)

Predictions: ensemble forecast for each species for the entire basin as a weighted mean of the predictions of all models with AUC > 0.7

Binary predictions were derived based on the ROC method

Software: all analyses done in R using the libraries biomod2, dismo, raster, vegan

RESULTS All woody species were modelled successfully with good to very good performance and describing a realistic distributional pattern. The Miombo species *sensu strictu* such as *Julbernardia paniculata* or *Brachystegia spiciformis* are restricted to the Angolan Highland. The middle reaches of the Okavango River are covered by *Baikiaea plurijuga* woodlands. At the southern margins of the Basin species of the genus *Acacia* dominate forming the thornbush savanna. Only a few species such as *Burkea africana* occur throughout the entire study area. **Next steps** will be to derive macro-ecological properties such as species richness and functional traits of plant communities based on the entire set of single species models.

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