9th international Meeting on Vegetation Databases: Vegetation Databases and Climate Change, Hamburg, 24- 26 February 2010

Modelling plant species and trait response curves along grazing gradients in central Namibia

Presented by:
Magdalena Pellowski

Magdalena Pellowski[1,3], Dirk Wesuls[1,4], Jürgen Dengler[1,5], Sigrid Suchrow[1,6], Jens Oldeland[1,7], Florian Jansen[2,8]

[1]Biodiversity, Evolution and Ecology of Plants, Biocentre Klein Flottbek and Botanical Garden, University of Hamburg, Ohnhorststr. 18, 22609 Hamburg, Germany
[2]Institute of Botany and Landscape Ecology, Ernst-Moritz-Arndt-University, Grimmer Str. 88, 17487 Greifswald, Germany
[3]magda_pellowski@web.de; [4]dirk.wesuls@yahoo.de; [5]dengler@botanik.uni-hamburg.de;
[6]ssuchrow@botanik.uni-hamburg.de; [7]oldeland@botanik.uni-hamburg.de; [8]jansen@uni-greifswald.de

Federal Ministry of Education and Research

Aim of the study

We analyzed the distribution of plant species and plant functional traits along grazing gradients on different spatial scales, i.e. gradients of different lenghts. We wanted to detect consistent grazing responses of plant species and functional traits, which, in turn, could be used as indicators for a certain level of grazing pressure.

Study area & Methods

The study area is located in the semi-arid open shrub savanna of central Namibia (average annual rainfall ~ 250 mm). On seven farms, we investigated the distribution of plant species and plant functional traits along grazing gradients using Huisman-Olff-Fresco (HOF) modelling – a set of hierarchical regression models. Plant species response was assessed along piosphere transects (zones around livestock watering points) on different spatial scales: we compared the responses along short transects (150 m) with small inter-sample distances and long transects (1500 m) with greater spacing between samples (**Fig. 1**). Further, the total cover of plants was modelled along both transect lengths. The responses of the traits life form, life cycle and growth form were modelled along the short transects. We calculated optima values and niche range for single species and traits. Additionally, we collected soil data (pH and electrical conductivity).

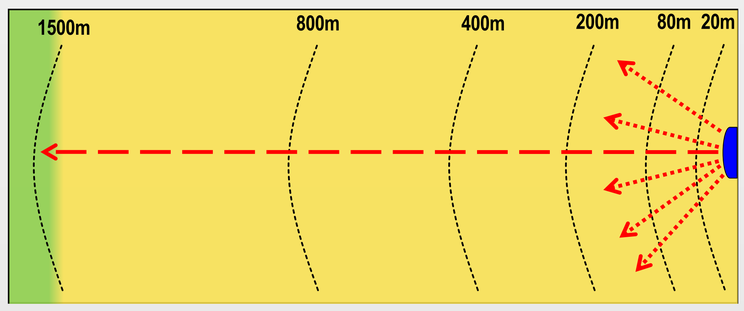

Fig. 1: Sampling design and distances from watering (blue). Long red arrow: Long transect with large inter-sample distances. Small red arrows: short transects with small inter-sample distances.

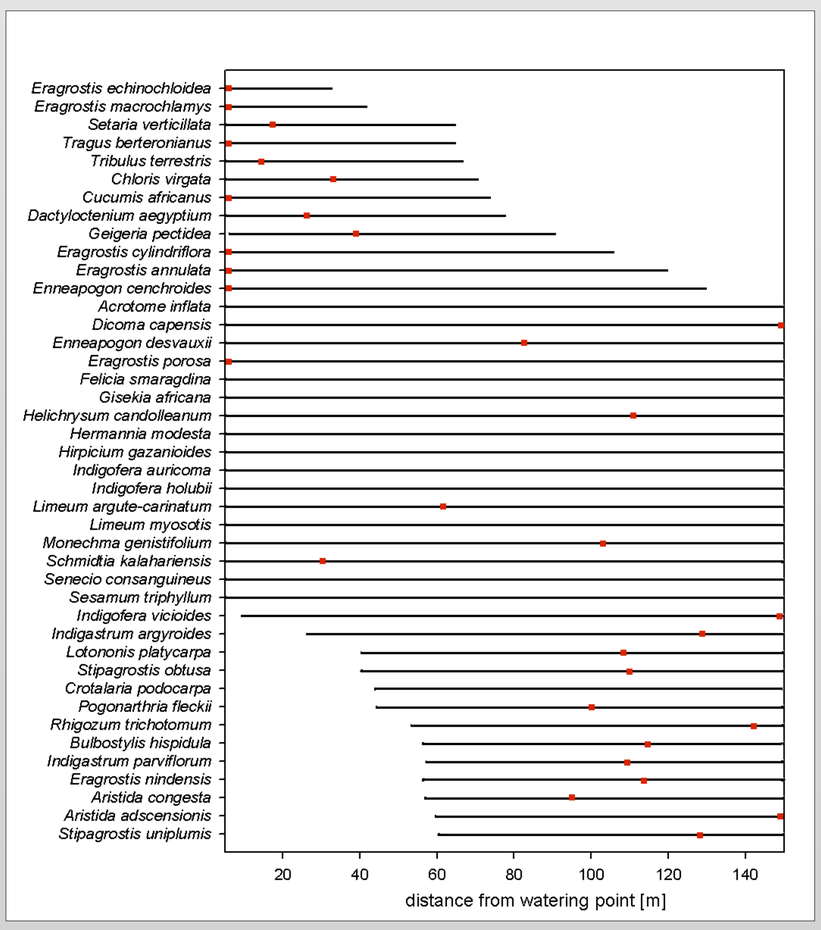

Fig. 2: Range (80% of occurence) and optima (red dot) of the 37 most frequent species along the short transects.

Results

The pH value and the electrical conductivity decreased with increasing distance from watering points. Total species cover of vascular plants decreased with higher grazing pressure. Most species showed a stronger response to grazing along the short transects compared to the long transects. Along the short transects, 12 species decreased while ten species increased with increasing distance from the watering point (**Fig. 2**). Along the long transects, four species decreased while nine increased with increasing distance from the watering point. 25 of the 27 most frequent species presented consistent response curves regarding the different spatial scales. The area of major disturbance was dominated by annual species (**Fig. 3**). Woody perennial species increased in cover with increasing distance. Geophytes and therophytes were frequent around the watering point, whereas chamaephytes and phanerophytes avoided this highly disturbed area (**Fig. 3**).

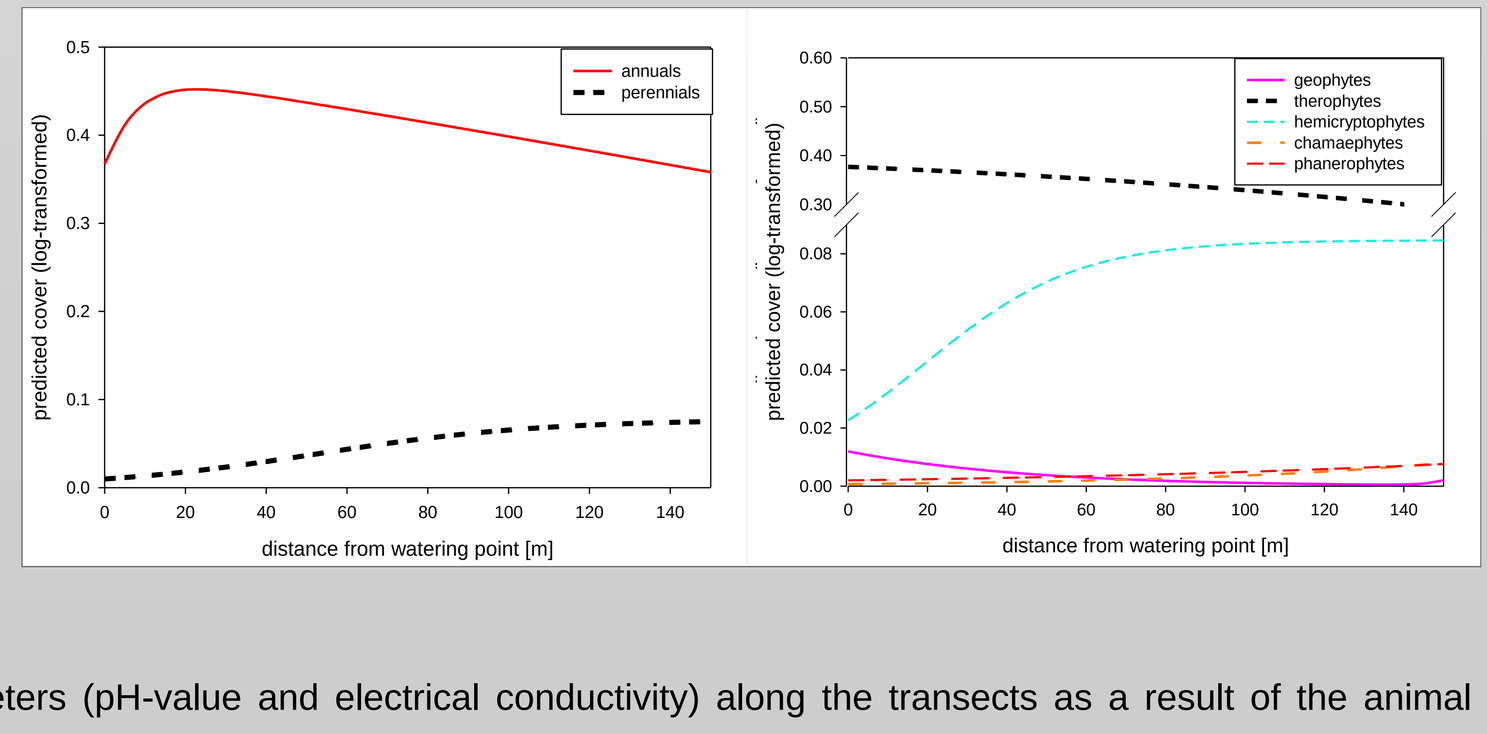

Fig. 3: Best HOF models (according to Akaike weights) based on the cover of the traits life forms and life cycle (the difference between the curves of annuals and therophytes is due to the exclusion of „weak perennials“ in the first case).

Conclusions

We interpret the changes in soil chemical parameters (pH-value and electrical conductivity) along the transects as a result of the animal impact in the vicinity of watering points. The hierarchical response curves applied on gradients of different lengths can be used for the reliable identification of indicator species. The plant functional traits life cycle and life form show characteristic responses and indicate vegetation changes resulting from shifts in disturbance regime. If information on disturbance is included in vegetation databases covering larger geographical scales, the methodology applied here may be used to assign disturbance indicator values for species and plant functional traits.