Seronga - Vegetation

At the Seronga core sites two major vegetation units are encountered, being determined by small differences in topography alone. On the one hand, there are extensive woodlands covering vast areas of the hinterland. These woodlands belong to the Zambezian *Baikiaea* woodlands according to Olson et al. (2001) and tend to be situated at the transition zone to the Zambezian Mopane woodlands. On the other hand, there is the Panhandle and the Okavango Delta comprising the lower lying areas that are seasonally flooded or permanently inundated. In this part, vegetation composition is strongly governed by microtopography and very small differences in altitude cause important difference in the flooding duration. Thus, a mosaic is formed consisting of channels with permanent open water, extensive areas covered by reeds, and grasslands flooded for short periods of the year only. In the following description, the vegetation units depicted in the land cover map (Schneibel et al. 2013) are discussed:

Mixed woodlands (including dominant stands of *Colophospermum mopane*): Areas with clay and hence nutrient-rich soils usually support a vegetation of tall *Colophospermum mopane* woodlands with sparse undergrowth. Mopane forms almost pure stands. These woodlands are characteristic of the area east of the Delta (Fig. 2).

Thornbush savannah (sparse): This vegetation unit stretches along the Panhandle and represents various stages of degraded woodlands and fallows dominated by spinous shrubs, e.g. *Dichrostachys cinerea*, *Acacia nigrescens*, *A. fleckii*, *A. tortilis*, *A. erioloba* as well as *Searsia tenuinervis*, and *Grewia* spp. (Fig. 3).

Low woodlands (with *Colophospermum mopane*; medium dense): This woody vegetation is dominated by *Colophospermum mopane*, but it reaches only shrub height of 2 m and sometimes it is referred to as "hedged Mopane". Several explanations have been proposed for the existence of this growth form. One suggestion is that it is maintained at shrub level by elephants. In different areas, the shrub form can be attributable to frost, and also to edaphic factors such as the presence of hard-pan layers in the soil, or to a high soil content of montmorillonitic clays which swell and contract and interfere with root development. Another possible explanation that has been put forward is fire. However, all of these factors may operate together in various combinations (Fig. 4).

Mixed *Burkea* woodlands (with *Terminalia sericea*; sparse): This vegetation unit covers large areas of the Kalahari Sandveld. It is dominated by *Terminalia sericea*, *Baphia massaiensis*, *Dichrostachys cinerea*, *Acacia ataxacantha*, *Philenoptera nelsii* and occasionally includes large *Baikiaea plurijuga* trees. However, the average canopy height reaches only a few metres. In the rainy season, there is a rich herbaceous vegetation with many species belonging to the Acanthaceae, Convolvulaceae and Fabaceae (Fig. 5).

Gallery forest: This is in most cases a narrow linear vegetation unit and not detectable by the spatial resolution of Landsat. It represents the transition zone from the floodplain to the dry Sandveld forming a small fringe of tall, woody

Table 1: Vegetation of the dry woodlands of the Seronga core site in numbers: sampling size and biodiversity indices. Note that only dry woodlands have been sampled and that plot numbers are low.

Ecoregion	Zambezian *Baikiaea* woodlands and Zambezian flooded grasslands
Sampling period	March 2012
1,000 m² plots sampled	7
100 m² plots sampled	6
Vegetation unit (MODIS classification)	Mixed *Burkea* woodland (with *Terminalia sericea*); mixed woodlands (including *Colophospermum mopane*); *Baikiaea-Burkea* woodlands (open and medium dense); seasonally flooded grasslands and reed beds
Dominant families (cover)	Fabaceae, Combretaceae, Acanthaceae, Poaceae
Dominant families (richness)	Fabaceae, Convolvulaceae, Poaceae, Lamiaceae
Species richness (1,000 m²)	43 (23 - 56)
Species richness (100 m²)	29.5 (20 - 37)
Evenness (J') (1,000 m²)	0.488 (0.167 - 0.635)
Evenness (J') (100 m²)	0.452 (0.265 - 0.644)
Simpson index (D_{SI}) (1,000 m²)	0.769 (0.205 - 0.861)
Simpson index (D_{SI}) (100 m²)	0.681 (0.395 - 0.846)

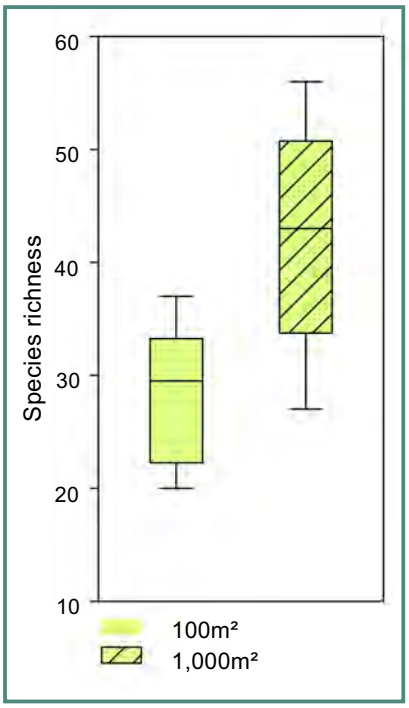

Fig. 1: Species richness of the dry woodlands of the Seronga core site. Values are shown for vegetation plots sized 100 m² and 1000 m². Note that sample sizes are small compared to the Angolan core sites.

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vegetation; here species occur that do not tolerate prolonged flooding but require a higher soil moisture content or shallow ground water. Typical species include *Diospyrus mespiliformis*, *Acacia nigrescens*, *Combretum imberbe* or *Kigelia africana* (Sausage Tree).

Open water and channels: Large emergent reeds such as *Cyperus papyrus, Phragmites* spp. and the floating-stemmed grass *Vossia cuspidata* line channel banks and lagoon margins in dense stands, which open up with increasing distance from the channel (Fig. 7).

Reed beds: Perennially flooded areas in proximity to the main channels have a mixed community of tall emergents such as *Cyperus papyrus*, *Phragmites* spp., and *Cladium mariscus*; with increasing distance from the channels, declining nutrient levels support a progressively sparser community of floating-leaved (e.g. *Nymphaea lotus*) and submerged aquatic macrophytes with sparse emergents. Flood duration here usually exceeds eight months (Fig. 7).

Sedge-dominated marshes (flooded seasonally, densely vegetated): Here, the characteristic plants are mainly sedges (*Eleocharis dulcis*, *Cyperus articulatus*) and aquatic grasses such as *Leersia hexandra* and *Oryza longistaminata*. Herbs are water-tolerant perennials such as *Ludwigia stolonifera* and *Persicaria limbatum*. Mean duration of flooding here is 5-8 months.

Grass-dominated marshes (flooded seasonally, medium densely vegetated): In these less frequently inundated floodplains, the dominance changes from sedges to grasses. In those portions flooded for longer time periods, an important grass is *Panicum repens* which is rhizomatous and can withstand intense grazing provided it is protected for some part of the year by flooding. Dominant species where flooding is shorter include the grasses *Eragrostis lappula* and *Setaria sphacelata*, and the sedge *Cyperus sphaerospermus*. There is also frequently a scattering of the diminutive annual sedge *Abildgaardia hispidula*. These grasslands seldom have any woody seedlings or saplings. Flood duration is 1-5 months (Fig. 8).

Wet grasslands (flooded seasonally, sparsely vegetated): This unit is occasionally flooded and is dominated by grasses. The sparse vegetation may reflect rising flood waters or heavy grazing pressure, or both.

Biodiversity in and around Seronga

The occurrence of a wide range of habitats ranging from permanent wetlands to dry woodlands on nutrient poor sands results in a stunning diversity of vascular plants (Ramberg et al. 2006). However, some habitats are dominated by just a handful of species such as the permanently flooded areas of the Delta. The richest flora is to be found on dry or only occasionally flooded areas in close proximity to the wetlands (Mendelsohn et al. 2010). Although fewer species occur in the dry woodlands in the hinterland, they display a higher species richness than, for example, the Caiundo core site. However, they have a lower evenness (Fig. 1, Tab. 1, note the small sample size). This may be due to their position in the transition zone from Mopane to *Baikiaea* woodlands, or due to high heterogeneity of abiotic conditions.

For details on the applied methods and study design please refer to the Electronic Appendix.

Fig. 2: Mixed Woodland with *Colophospermum mopane*; medium dense (photo: R. Revermann).

Fig. 3: Thornbush Savannah (sparse) with *Acacia* spp. and *Dichrostachys cinerea* along the Panhandle and intensively used areas close to the villages (photo: R. Revermann).

Fig. 4: Low Woodland with *Colophospermum mopane* (photo: R. Revermann).

Fig. 5: Mixed *Burkea* Woodlands with *Terminalia sericea* (photo: R. Revermann).

Fig. 6: Rainwater pan in the hinterland, about 10 km away from the Panhandle, providing water for cattle and wildlife; surrounded by *Colophospermum mopane* trees (photo: R. Revermann).

Fig. 7: Permanent open water, with *Cyperus papyrus*, *Phragmites* reeds and wooded islands in the background (photo: R. Revermann).

Fig. 8: Flooded area of the Panhandle in March (photo: R. Revermann).

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