INFORMATION

Where is the wetland in a dambo?

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Introduction

Ackermann (1936) was the first to introduce the term "dambo" in the scientific literature (Mäckel 1974). Used in Ci-Cewa to describe valley lands (Roberts 1988), Ackermann (1936) offered a hydrogeomorphic meaning to the term, defining dambos as periodically inundated grass-covered depressions on the headward ends of a drainage system in a region of dry forest or bush vegetation. They are channelless (Mäckel 1974; Boast 1990) shallow linear (Mäckel 1974; Meadows 1985) or lobate (Whitlow 1985) depressions, often with concave cross profiles (Acres et al. 1985; Boast 1990), where seasonal saturation and the closeness of the water table restrict all other vegetation apart from grasses and sedges (Mäckel 1974; Whitlow 1985). This results in a grassy flat (the dambo) that is sharply outlined against the surrounding bush country (Ackermann,1936), usually having miombo woodland on the interfluves (Roberts 1988). Echoed in Ackermann's (1936) definition and all other definitions in the dambo literature (Mäckel 1974; Acres et al. 1985; Mäckel 1985; Meadows 1985; Whitlow 1985; Boast 1990) is the observation that dambos are restricted to locations with seasonally high water content (Mäckel 1974; Mäckel 1985), such as in seasonally-wet tropics and sub-tropics (Meadows 1985). As a consequence, it appears some authors, like Balek (1977), rely on the singular characteristic of seasonal saturation to denote the entire dambo as a wetland.

Mitsch and Gosselink (2007), however, caution against demarcating wetlands based upon the sole presence of water; especially for such systems like dambos whose water table is reported to vary with seasons (Bullock 1990). Moreover, dambos are dynamic; drying up as the case may be when the water table lowers due to down-cutting along a stream channel and dambo dissection (Mäckel 1974; Mäckel 1985), although edaphic indicators of wetlands may be retained. Further, dambo characteristics are noted to vary along a cross profile (Mäckel 1974; Whitlow 1985) in response to the control of topography

on hydrology and vegetation (von der Heyden 2004); so that they are not homogenous. This is illustrated by the tendency to sub-divide them into three zones: margin, floor and bottom (Acres et al. 1985); even though this spatial zonation is not always straight-forward (Whitlow 1985; von der Heyden 2004). The dambo margin is adjacent to the interfluve and is dominated by grasses (Bullock 1992). As conditions become progressively wetter towards the center (bottom), grasses give way to sedges (Bullock 1992). By implication, therefore, it is inappropriate to refer to the entire dambo as the swamp or wetland. This paper corrects this misconception by presenting cases that support the proposition that the wetland component of a dambo is the bottom; so that the transitional zone (floor) constitutes the dambo wetland fringe within which the wetland may expand in response to seasonal changes in moisture.

Dambo: the landscape feature and wetland

The earliest work on dambos focused on geomorphological aspects of these landscapes so that to a geomorphologist, these are landforms and vegetation is a secondary feature; its distribution merely mirroring the synergistic influence of landform and hydrology on species successional cycles. This view is emphasized by comprehensive reports describing dambo morphodynamics and morphology (e.g., Mäckel 1974; Acres et al. 1985; Mäckel, 1985), particularly stressing the role of geology and climate in the evolution of these unique landscapes. In this respect, many authors (e.g., Mäckel 1974; Meadows 1985; Thomas and Goudie, 1985) were more concerned with dambos as landscape features and have written insightful descriptions of the evolution of these features and how their characteristics, such as valley dimensions, shape and curvature, slope angle, soil characteristics, and height of the water table reflect the spatio-temporal variability of processes operating on the landscape. Looked at in this context, a dambo is a subsystem within a wider catchment and is best studied as a geomorphic unit.

At the same time, on the basis of the three features Mitsch and Gosselink (2007) showed to distinguish wetlands from other lands (hydrology, hydric soils, hydrophytic vegetation), it is possible to delimit a wetland component in a dambo landscape; hence sub-setting the landscape by locating an ecological unit which functionally differs from the rest of the dambo geomorphic unit. This is so because for a dambo, features vary along a cross-section, so that the extent of a dambo wetland is defined by determining the spatial limits beyond which all the three characteristics are not expressed. Thus the wetland would be that where there is seasonal inundation, evidence of hydric soils and dominance

of water-tolerant plant species. A look at dambo cross profiles of sites located in different geographic regions shows dambo zones to vary with respect to soil and vegetation characteristics; these being an indication of the control frequency and magnitude of flooding have on the dambo landscape.

Generally, dambo bottoms have more organic content, usually restricted to the top horizon; but it may not rise above 10% due to oxidation during the dry season (Meadows 1985). It has been suggested that accumulation of organic materials in the dambo bottom is a result of slowed decomposition of plant materials due to anaerobic conditions associated with water-logging (Boast, 1990); sometimes leading to a build-up of a peat layer.

Furthermore, dambo bottoms are characterized by clay-rich soils (Mäckel 1974; Young 1976; Acres et al. 1985; Boast 1990; von der Heyden 2004). These may occur underneath the organic layer or the clay-rich layer may form the surface horizon. There is more clay here because the flat terrain restricts soil removal while at the same time it favors colluviation of well sorted clay particles originating from the washbelt and upland zones (Mäckel, 1974). This setting affects dambo bottom soil characteristics and hydrology, so that low hydraulic conductivity of the clay-rich soils (Bullock 1992), together with the restricted dispersion of surface water due to a flat terrain, encourage saturation of dambo bottoms. This accounts for the characteristic hydric soils, the gleys, which are the lowest member of the catena (Young 1976).

Ultimately, the unique environment of dambo bottoms selects for vegetation specifically adapted to the conditions. Typically this includes water-tolerant herbs (e.g., *Setaria sphacelata, Dyschoriste magchena, Emilia javanica, Scirpus spp, Scleria greigifolia, S. welwitschii, Dissotis canescens, Kniphofia linearifolia, Commelina subulata*), sedges (e.g., *Rhynchospora spp, Cyperus alba, Cyperus denudatus*) and ferns (e.g., *Thelypteris confluens*). The same species of plants may occupy the transitional zone, but this is true for dambo landscapes where the water table is relatively high. Otherwise, owing to the abundance of soil moisture at the bottom relative to the other zones, there is a notable dense coverage of grasses and sedges (about 85% to 95% of coverage), with the sedges usually forming a dominant cover (Mäckel 1974).

Since vegetation changes in character away from the center (Whitlow 1985), and that toward the interfluve, soils become more sandy (with pale grey bleached sand gley) (Young 1976), less organic, and less saturated, it is

suggested that the wetland component of a dambo is limited to the bottom zone. This is where typical wetland conditions are manifested. The adjacent dambo floor defines the fringes of the wetland that may be constituted as part under conditions of sustained saturation, as may be the case following frequent inundation.

Conclusion

The misconception that the entire dambo is a seasonal wetland is partly because work on dambos has dominantly focused on their geomorphic characteristics; so much so that the question as to whether this characterization is consistent with established schemes for classifying wetlands has never been posed. This inaction is partly attributed to a lack of comprehensive survey of dambo vegetation (Whitlow 1985) and the reluctance to analyze the spatial variability of moisture within dambos (Bullock 1992); yet these are key ingredients in the definition of a wetland. However, illustrations of dambo cross profiles and analyses of selected reports show that the dambo wetland is confined to the bottom zone, where features satisfy the definition of a wetland. Edaphic and floral characteristics support the view that beyond the bottom is non-wetland, even when the water table periodically rises to the surface.

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