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ECOLOGICAL CHARACTERIZATION OF PEATLANDS IN THE MALOTI MOUNTAINS, LESOTHO

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SUMMARY

In the Maloti Mountains of Lesotho, peatlands are a common component of the landscape, typically occurring above 2,500 m a.s.l. The wetlands occur in first-order watersheds near the valley headwall, they are also common along the valley side, sloping into the streams. The peat began to develop 3,500 - 4,500 yr. BP, once the valley side slopes stabilized. The peat typically ranges in thickness from 1 to 2.5 m, on slopes between 5 and 18 percent. Compositionally, the peatlands are a grass-sedge fen, with the organic soil horizon being highly decomposed (sapric); there is evidence of frequent fires in the peat core indicating a historical natural fire regime. Many of the peatlands are highly degraded, primarily from overgrazing.

KEYWORDS: mountain peatlands, gully erosion, Lesotho.

INTRODUCTION

The mountain peatlands that occur in the Maloti mountains of Lesotho are unique on the African continent. These wetlands have formed in high elevation valley bottoms and side slopes, reflecting the availability of water, productive vegetation and an adequate growing season to sustain mire development. These wetlands, along with the surrounding uplands, comprise rangelands that are integral to rural livelihoods for livestock grazing, and the collection of foods, medicinal plants and building supplies (Trettin et al., 2008). Grazing is the primary use with the majority of village households owning animals as well as many urban dwellers. The rangelands are communal property which is administration through the Principal Chiefs.

Despite the ecological importance and unique occurrence of these wetlands, there has been relatively little research or documentation on these important wetlands. The objective of this paper is to characterize the ecological setting of these mountain peatlands, providing a synthesis based on available literature and reports.

DISCUSSION

Physical setting

The Maloti mountains, also known as the Lesotho Highlands, are a deeply incised basaltic plateau. The basalt flows are approximately 1,400 m thick. Weathering over the millennia has produced a highly dissected landscape with steep valleys. Peatlands may occur

throughout the Highlands primarily on the valley floor in the headwater catchments. The peatlands occur primarily in the alpine or altimontane zone (2,900 - 3,482 m a.s.l.) (Backéus, 1988).

Climate

The abundance of water during the growing season is likely a major contributing factor to the occurrence of the mountain wetlands. While there are few climatological stations with long-term records in the mountains, Backéus (1988) assembled a 30 year record for two stations, Oxbow (approx. 2,800 m a.s.l.) and Mokhotlong (approx. 2,250 m a.s.l.). The mean annual temperature and precipitation for Mokhotlong was 11.9°C and 584 mm, respectively, and the corresponding values for Oxbow were 7.3°C and 1281 mm (Backéus, 1988). Assessing the spatial variability in precipitation across the Maloti mountains with shorter-term data sets, Sene et al. (1998) found considerable variation with the highest elevation zones receiving the most rainfall, and a noticeable rain shadow effect to the southwest of high mountains which occur primarily in the north and northeastern portion of the range. The estimated range in mean annual precipitation across the entirety of the Lesotho Highlands was 553 – 1059 mm based on 15 years of record Sene et al. (1998). Most the precipitation is in the form of rain during the November – April; however, light snowfall is not uncommon in the winter. The Lesotho Highlands are significant to the surface water resource of Southern Africa because it forms the headwaters of the Senqu (Orange) River, which flows through Lesotho, South Africa, Botswana and Namibia. Although Lesotho makes up only 3% of the total Senqu/Orange River basin, it provides approximately 47% of the river's annual flow (Makhoalibe, 1999).

The Peatlands

The peatlands in the Lesotho Highlands have been termed 'sponges' by local Basotho, and as bogs in the early ecological assessments (van Zinderen Bakker, 1955; Jacot Guillarmod, 1962). However, more recent studies documented that the peatlands are indeed fens (Backéus, 1988; Trettin et al., 2008). The high elevation (> 2800 m a.s.l.) fens tend to occur in two geomorphic settings; valley-head peatlands and valley-side slope peatlands (Fig. 1). The valley-head peatlands are formed on top of lacustrine sediments, which were deposited either in a spring or small pond. The peat is highly humified (i.e. sapric), herbaceous organic matter, with depths that typically vary between 1 and 2 m (Trettin et al., 2008). The water to support the valley-head peatlands is derived from underlying springs and runoff from the adjoining uplands. The valley-side peatlands occur on the longitudinal side slopes (Fig. 1). The valley side slopes are typically steep (> 10%) with the peat overlaying colluvium and bedrock. The valley-side peatlands originate where the surface and shallow subsurface runoff discharged at the base of slope, as the peat is typically thickest at the base. These peatlands are typically asymmetrical with respect to the valley; the apex is abutted to one side with a steep side slope (e.g. >15%) and peat forming over colluvium on the opposing slope (Fig. 1). The peat effectively in-fills the base of the valley and the thickness diminishes from the valley bottom towards upslope. The peat commonly exhibits gravel lenses in the lower (> 50 cm) portion of the solum, demonstrating episodic erosion or landslide events during the early stages of mire development. These peatlands are maintained hydraulically from upslope runoff, and may be functionally connected to the valleyhead peatlands. Flarks and pools are evident (Backéus, 1989), particularly in the valley-head portion of the mire complex.

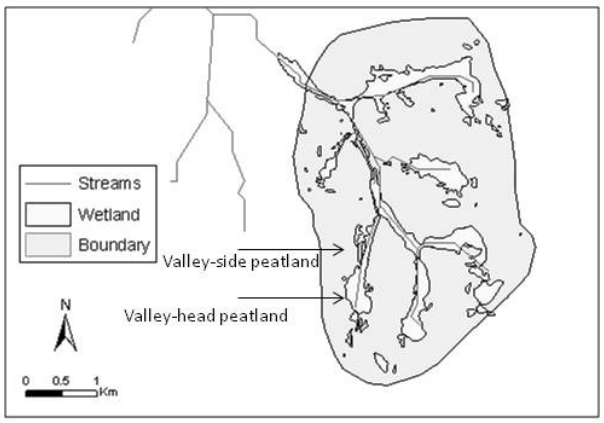

Fig. 1. Schematic showing the relative position of valley-head and valley-side peatlands in headwater valleys in Lesotho.

The peat depth typically varies between 1 and 2 m. The lower portions of the peat profile typically contain thin layers of gravel, evidence of debris flows over the peat surface during the early stages of development. Three samples of the basal peat layer suggest the peat age is between 4,300 to 5,600 yr B.P. (Trettin, unpublished data). Those ages are within the median range for other peat deposits in Southern Africa (Meadows, 1988), but younger than a date reported by van Zinderen and Werger (1974) to be 8,020 yr. B.P.; unfortunately, details about dating of that peat were not provided. There is no documentation about the decomposition rates, or CO_2 and CH_4 emissions from the Lesotho peatlands.

Vegetation

The Lesotho Highlands are grasslands. The first ecological survey recognized two principal community types in the high-elevation range: *Seboku* grassland and *Letsiri* grassland (Staples and Hudson, 1938). They also recognized a *Sehelahala* scrub-shrub community that occurred as a result of overgrazing. Staples and Hudson (1938) also recognized the occurrence of wetlands, calling them swamp grasslands. They noted that these wetlands occurred within the *Seboku* grassland type, with *Danthonia macowani* and *Pentashistis basutorum* common. van Zinderen (1955) and Jacot Guillarmod (1962) were the first to detail the botanical assemblages in the both the upland and wetland portions of the Highlands. More recently, van Zinderen and Werger (1974) and Backéus (1988) have developed community types based on analyses of specific study areas. However, each of the resultant classification systems for wetland vegetation has produced different community types, reflecting the varying methodological approaches and interpretations (Backéus and Grab, 1995). During the inventory of wetlands the Maloti Drakensberg Transfrontier Project developed a wetland

community type classification (MDTP, 2007), and Sieben et al. (2010) conducted a assessment of functional grouping of plants in the Maloti / Drakensberg and reporting that that grasses and sedges were the most important types in the wetlands, with forbs and bulbous plants more prevalent at high elevations. They also found that C_3 plants were predominant at the higher elevation wetlands. While the specific groupings vary among studies, the collective works affirm that grasses (e.g., *Pentachistis oreodoxa*,), forbs (*Haplocarpa nervosa*, *Isolepis cernua*, *Ranunculus meyeri*, *Cortula radicallis*) and sedges (e.g., *Isolepis cernua*) are dominant. In contrast to boreal peatlands, bryophytes do not contribute significantly to the development of the Lesotho peatlands. Correspondence between vegetation community types and soils has not been determined for the Lesotho wetlands.

Land-Use History

Thru most of the 19th century, the Lesotho Highlands were only sparsely inhabited by the Bushman, and used for hunting and food gathering. The first cattle posts indicating grazing by Basotho appeared in 1890; but grazing did not become wide-spread until after 1902 (Staples and Hudson, 1938). By the time of the 1936 survey, there was wide-spread evidence of overgrazing as indicated by the *Sehelahala* scrub community and eroded surface soils in the uplands (Staples and Hudson, 1938). Interestingly, Staples and Hudson (1938) did not comment about erosion in the wetlands; given the thorough nature of their report and their concern about sustainability of the rangeland, it would seem that development of gullies in the wetlands had not yet occurred. However, their report is specific with respect to the effects of over-grazing in the uplands, where soil erosion, increased surface runoff and sedimentation in catchments that had been overgrazed are characterized. Increased surface runoff from the uplands onto the wetland is likely the causative factor that precipitated the development of gullies.

By the late 1960's gullies in the wetlands were evident (Fig. 2), and Jacot Guillarmod (1969) raised concern about continued impacts from use. But it wasn't until relatively recently, that the dire situation about the condition of this unique wetland resource was characterized (Grab and Morris 1997). Unfortunately, there aren't any national-level assessments regarding the condition of wetlands in Lesotho; however, the degradation is considered to be wide-spread (Grab and Morris, 1997; Trettin et al., 2008). The gullies function to drain the peatlands, which facilitates to conversion to drier vegetative communities and encroachment of ice rates (*Otomys sloggetti robertsi*) which can further degrade wetland conditions (Mokotjomela et al., 2009).

Fig. 2. A typical valley-head peatland with an erosion gully; approximate elevation 3,050 m. Also shown sheep grazing on the peatland. (Photo by C.C. Trettin)

PERSPECTIVES

The peatlands of the Maloti mountains are integral to the biodiversity of the region, providing important ecological functions and valuable ecosystem services. Those functions and sevices are threatened by the degradation associated with livestock grazing. The peatlands are being effectively drained through the development of gullies, which are a direct impact of overgrazing. While the consequences of peatland drainage are obvious, consideration of the ramifications of wide-spread degradation in the Maloti mountains is an urgent need. Of particular importance are the direct implications to water resource management, because water is the principal export commodity from Lesotho. An assessment of the carbon stocks of these mountain peatlands along with the surrounding uplands is also warranted. Grasslands typically form high-carbon soils (e.g., Mollisols) as well as wetlands; however, in their eroded state, this landscape is likely a carbon source. Rehabilitation of the peatlands and surrounding uplands could return the landscape to carbon sink.

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