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Grundling, Piet-Louis; Grootjans, Albert

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Peatlands of Africa

P. Grundling and A. P. Grootjans

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Abstract

An abundance of different wetland types occur across the continent but the occurrence of peatlands are less common. Africa, the second largest landmass on earth, is a continent with diverse landscapes ranging from snow-capped mountains on the Equator (e.g., Kilimanjaro) to the world’s largest desert, the Sahara in the north, and Fynbos Biome the world’s richest and smallest floral kingdom located in South Africa. The variety of mires and peatlands on the world’s second largest continent are an expression of its diverse landscapes and associated climatic conditions. Local communities often depend on these peatlands (as with most other wetland types) for their livelihoods. However, these peatlands are often poorly managed and mostly severely degraded and in

P. Grundling (✉)
Centre for Environmental Management, University of the Free State, Silverton, South Africa
e-mail: peatland@mwweb.co.za

A.P. Grootjans (✉)
Centre for Energy and Environmental Studies, University of Groningen, Groningen, The Netherlands
Institute of Water and Wetland Research, Radboud University Nijmegen, Nijmegen, The Netherlands
e-mail: a.p.grootjans@rug.nl

developing areas frequently threatened by future developments. Africa's peatlands are poorly researched and inventories on where they occur and their conservation status are lacking. Many opportunities exist to do research, implement wise use practices and restoration.

Keywords

Africa • Arid • Peatland • Threats • Tropical

Introduction

Africa, the second largest landmass on earth, is a continent with diverse landscapes ranging from snowcapped mountains on the equator (e.g., Kilimanjaro) to the world's largest desert, the Sahara in the north, and the richest (and smallest) floral kingdom in the south: the fynbos biome. An abundance of different wetland types occur across the continent. These include large systems such as Sahelian floodplains (e.g., the Niger) in Western Africa and the Sudd in Sudan (Rebelo and Moghraby, [► The Sudd, South Sudan](#)). The world's largest inland delta, the Okavango Delta, occurs in Botswana, and extensive tropical swamp forests occur in the central Congo Basin (Joosten et al. [2012](#)). The lakes of the Great Rift Valley in Eastern Africa also contribute to this rich diversity of Africa's wetlands, as do the ephemeral pans in the deserts of southern and Northern Africa and the alpine mires of Lesotho, Tanzania, Rwanda, and Ethiopia (Fig. [1](#)).

The extreme range of habitats characteristic of this continent and their rich biodiversity are threatened by cultivation, harvesting, damming, and draining by a human population that is just as diverse. Nowhere are anthropogenic impacts more evident than in the continent's peatlands with rural populations often dependent on the availability of water and organic soils for cultivation. This means that natural peat-forming systems (mires) probably are much less abundant than the estimated area of peatlands. Peatlands are wetlands that have a minimum peat depth of 30 cm, and peat has a minimum percentage of sedentarily accumulated material consisting of at least 30 % (dry mass) of dead organic material (Joosten and Clarke [2002](#)).

The African continent is primarily an uplifted plateau located in the tropical and subtropical zones (McCarthy and Rubidge [2005](#)). The average rainfall of the continent is 652 mm/year, which is well below the global average of 860 mm/year. In many parts of Africa even the average rainfall is not very reliable and large fluctuations in groundwater level occur. Peatlands are therefore restricted to the tropics with its high rainfall, the uplands of Lesotho and Ethiopia with cool climates, and regions with sustained groundwater discharge such as the Mozambique coastal plain and the karst landscapes of southern Africa.

Fig. 1 Peatlands in Africa: percentage cover per country (Adapted from Joosten 2010)

Peatland Distribution

It is estimated that as much as 50 % of the world's wetlands could be peatlands, which include mires (supporting peat-forming vegetation). Peatlands occur in most African countries (Figs. 1 and 2) but often as small features in the landscape of less than a few hectares, as, for instance, the interdunal depressions in the Highveld, South Africa (Fig. 3), or the seeps and sloping mires in the mountain areas of Lesotho and Ethiopia (Fig. 4). But extensive peatlands also occur, such as the 7,000 ha Rugezi Marsh in Rwanda (Fig. 5) at the equator (Hategekimana and Twarabamenye 2007). Even more extensive mires occur in the Okavango Delta in Botswana and the Sudd catchment in Sudan (Fig. 6), but it is unknown how much peat such systems actually have. They have rather thin organic layers often associated with swamp forests, and we know little about the actual peat resources. It is estimated that the equatorial areas of Africa, such as the Gulf of Guinea and Central Africa, may contain about 14 % of the global area of peat swamp forest. Estimates of the total peatland area in Africa vary between 4,856,500 ha (Andriess 1988) and

Fig. 2 Countries hosting the most extensive mires and peatlands in Africa (Adapted from Joosten 2010)

Fig. 3 Tevreden Pan during winter in South Africa: a mire formed by floating *Phragmites australis* mat in an endorheic depression in the Highveld grassland – a biome severely threatened by coal mining (Photo P.L. Grundling © Rights remain with the author)

over 11,000,000 ha (Joosten 2010), which is less than 1 % of the total land surface area of the continent.

In the wet equatorial belt of Africa, a distinction can be made between the areas flanking the Gulf of Guinea (e.g., Benin) and the Lower Congo Basin (e.g., Congo-Brazzaville), which are both large depressional areas with extensive lowland mires (Lappalainen and Zurek 1996; Joosten 2004), compared to those in eastern parts of Central Africa. In the eastern parts, peat formation occurs mainly in upland valleys following recent geological uplift, rift formation, and volcanism (e.g., in Rwanda and Burundi). In these high-altitude regions, the conditions for peat formation are more similar to temperate regions (Deuse 1966; Andriesse 1988).

Fig. 4 A sloping mire in Lesotho with flowering *Kniphofia caulescens* (Photo P.L. Grundling © Rights remain with the author)

Fig. 5 Cultivation by the raised-bed technique in the Rugezi Marsh in Rwanda leads to siltation and sediment deposition in downstream wetlands (*left*). As a consequence, such marshes lose their ability to purify water as illustrated in the *right* photo indicating high loads of suspended solids and turbidity (Photo credits: A. Linström © Rights remain with the author)

Mire Types

Original mire types in Africa reflect the drier climates of the continent; the systems are almost always groundwater fed. Fens are thus the dominant mire type, while rainwater fed bogs, which are often the dominant mire type in the temperate northern

Fig. 6 The Okavango Delta in Botswana – It is yet to be established to what extent parts of the Okavango Delta might contain peat (Photo: A.P. Grootjans © Rights remain with the author)

hemisphere, are rare. Peat-forming species include swamp forest species (e.g., *Ficus* and *Syzygium*), sedges (Cyperaceae, such as *Papyrus* and *Cladium*), grasses (e.g., *Phragmites* and *Miscanthus*), and mosses such as *Sphagnum*. Peat stratigraphy in Africa reflects a diversity of depositional environments and is very variable between sites (Hamilton and Taylor 1986; Smuts and Akiaoue 1999). A detailed description on African mire types is not available, but based on limited research in Rwanda and more extensive work in southern Africa, the following types have been noted: (i) groundwater rise mires; (ii) terrestrializing fens; (iii) sloping fens; (iv) groundwater through-flow mires, mostly treeless; and (v) flood mires. Groundwater rise mires mostly consist of relatively productive swamp forests. They are abundant in the Central Congo Basin (Joosten et al. 2012). Peat layers are usually shallow (less than 1 m). Terrestrializing fens are floating mats that may or may not produce peat. The extensive *Papyrus* swamps in the Okavango Delta partly belong to this type and probably do not accumulate much peat. Sloping fens, sometimes even with *Sphagnum* species, are groundwater-fed mires. Usually the groundwater comes from springs that are sustained by groundwater that is forced to surface due to occurrence of geological faults. The systems are most frequent in mountain areas. Groundwater through-flow mires have been found in interdunal depressions along the east coast of South Africa. Flood mires are mires that are influenced by both groundwater and surface water. The surface water regularly floods these systems and may inundate them for several months. They are usually very productive. The vegetation may consist of swamp forests, but can also be treeless.

Fig. 7 Cultivation of a papyrus fen in Kenya: note the drainage pattern (Photo: H. Joosten © Rights remain with the author)

More detailed information on a local mire typology for South Africa is presented by Grundling et al., ► [Peatland Types and Tropical Swamp Forests on the Maputaland Coastal Plain, South Africa](#).

Threats and Future Challenges

Agriculture, mining, and damming for electricity production and/or water reservoirs are some of the main threats to peatlands in Africa. Many low-lying peatlands in Africa have been converted into agricultural land (Figs. 5 and 7), while upland mires are increasingly threatened by grazing (Fig. 8). Pristine mires are under severe threat of conversion and degradation due to mining for minerals in valleys where mires occur (such as coal and diamonds), in particular in southern and Central Africa. Logging of forests and draining of swamp forests for timber and cultivation are a continuous threat in many parts of the continent. Furthermore, the damming of peatlands for hydroelectricity (e.g., by Eskom in South Africa and planned schemes in the Congo Basin) and also extraction of peat for energy (e.g., Burundi and Rwanda) pose severe threats to peatlands in Africa. Access routes in and across mires to these developments are often cause for concern (Figs. 9 and 10).

Various studies have shown that Africa is particularly vulnerable to climatic change (Hulme et al. 2001; Challinor et al. 2007). The semiarid and subhumid areas, in particular, will be most adversely affected by a shift toward a drier regime with extremely unreliable rainfall. This will not only affect the natural character of

Fig. 8 Livestock grazing the Berga mire in Ethiopia (Photo: M. Drummond © Rights remain with the author)

Fig. 9 The alpine fens of Lesotho are critical to water security for the southern African region, but they are often eroded and degraded due to overgrazing, partly as a result of the flooding of the lower valleys by hydroelectricity schemes (Photo P.L. Grundling © Rights remain with the author)

peatlands but also people will be affected, leading to increased dependence and pressure on the remaining peatlands.

In general, wetlands are resilient, dynamic systems that change over time. However, peatlands in Africa cannot easily adapt to major changes in hydrological conditions associated with a combination of climatic change and anthropogenic

Fig. 10 A dugout canoe (kano) in an artificial canal on the Rugezi mire, Rwanda. Artificial channels (dug to supply more water to the hydropower facility) drain the wetland but also provide a means of transport for local people (Photo P.L. Grundling © Rights remain with the author)

impacts. It is expected that increased carbon emissions will result from these combined threats. While Africa covers 20 % of the world's landmass, it only contains 3.45 % of the peatland area and hosts 2.4 % of its carbon, yet 10–15 % of its peatlands are degraded, and it releases 4.3 % of global peat CO₂ emissions (Joosten 2010). Due to drought and drainage, these peatlands also become more fire-prone in drier areas, and in Sub-Saharan Africa (South Africa excluded) peat emissions are equivalent to 25 % of all fossil fuel emissions (Joosten 2010).

The variety of mires and peatlands in Africa are an expression of its diversity in landscapes and associated climatic conditions. Local communities often depend on these wetlands, where they occur in close proximity, for their livelihoods. However, these peatlands are poorly managed and mostly severely degraded and threatened by future developments. Basic inventories for Africa's peatlands are lacking and they are not well researched. Therefore, many opportunities exist to implement wise-use practices, restoration, and applied research projects.

Cross-References

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- Peatland Types and Tropical Swamp Forests of the Maputaland Coastal Plain, South Africa
- Peatlands
- Rugezi Marsh, Rwanda
- The Sudd, South Sudan
- Wetlands of the Okavango Delta
- Zambezi Delta, Mozambique

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