In search of spring mires in Namibia

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In search of spring mires in Namibia: the Waterberg area revisited

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SUMMARY

The scarcity of peatlands and mires in Namibia is well known. Peatlands have been found in the north, which is the wettest part of the country. In the 1930s, spring mires were reported by German geologists in the Waterberg area, which also has relatively high annual precipitation. This short note reports some field observations and a literature search for old documents that mention the occurrence of springs and spring mires in the Waterberg region. The search was done by IMCG members who visited the Waterberg area in August 2014. We found springs, but no real mires. However, we found remnants of what might have been a large spring mire similar to that reported by the German geologist Paul Range, who found “local spring mires (Quellmoore) with a peat thickness of several metres in northern South-West Africa”. Whether or not our peat remnants were situated at the same site as the Range discovery could not be assessed. We compared the landscape position of the peat remnants and spring in the Waterberg area of Namibia with information from an ongoing ecohydrological study in the Waterberg area of Limpopo Province, South Africa.

KEY WORDS: hydrology; irrigation; peat; Quellmoore; water meadows

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INTRODUCTION

Namibia is the most arid African country south of the Sahel (Matambo & Seely 2010). Mean rainfall ranges from less than 50 mm year^{-1} along the Atlantic coast to more than 600 mm year^{-1} in the Caprivi Strip (Mendelsohn *et al*. 2002; Figure 1). The mean annual temperature is around 17 °C in the coastal area and 21 °C farther inland (Sweet 1998).

Namibia is famous for its drylands and deserts, and for the abundant wildlife of its National Parks, but little is known about the occurrence of mires and peatlands. Joosten (2010) lists Namibia as one of 30 countries “in which peatlands are known, but where they are extremely rare and deserve further research and conservation”. With only 0.012 % of its area covered by peatland, Namibia is one of the least peaty countries in the world (Joosten 2010). A provisional study based on soil maps (Van Engelen & Huting unpublished table) estimates that 98 km^2 of Histosols occur in Namibia. Half of this area is situated in the north-eastern Caprivi Strip (Howard-Williams & Thompson 1985) where annual precipitation exceeds 550 mm. Tacheba (2002) states that “Namibian literature on wetlands mainly focuses on the Caprivi province but there could be more peat resources in the provinces west of Caprivi, e.g. Kavango”. The occurrence of peatlands was noticed because of the incidence of frequent and long-lasting fires (Tacheba 2002). Peatlands in the Lake Liambesi area, where (subsoil) peatland fires occur regularly (Tacheba 2002), may reach depths of more than one metre (Goldammer 1998).

A promising search area for mires elsewhere in Namibia would be the Waterberg area between Tsumeb and Grootfontein (‘fontein’ means ‘spring’ in the Afrikaner language), where mean annual precipitation is between 350 and 400 mm (Mendelsohn *et al.* 2002; Figure 1). The name Waterberg is interesting because it means ‘Water

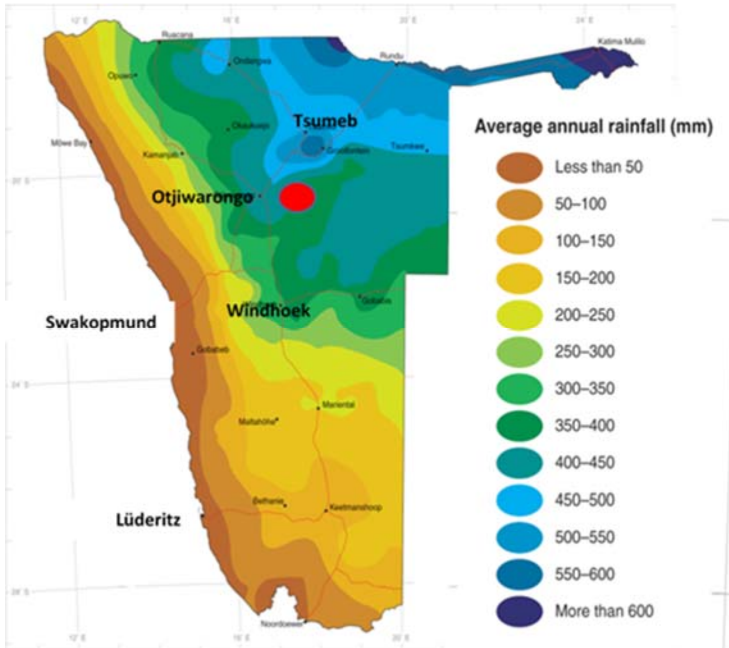


Figure 1. Map of Namibia showing average annual rainfall (Mendelsohn *et al*. 2002) and the location of the Waterberg (in red).

Mountain' in Dutch and Afrikaans. In The Netherlands the toponym Waterberg is used for an area north of the city of Arnhem at the foot of the National Park "Hoge Veluwe". It is unclear who first gave the name 'Waterberg' to the plateau in Namibia. The 1852 topographic map of Galton (1853) used the Damara name 'Omuvereoom' (also written 'Omuverume'), meaning 'a door' or 'a pass' (Galton 1853) and referring to the narrow valley (5 km long) that separates the southern extremity of the Omuvereoom Mountain from its sister hill, la Kabaka (Schneider 2007). The name Waterberg was probably introduced by Afrikaans-speaking Africans, rather than by Germans, as the first German farmers did not arrive until 1892 (Cubitt & Joyce 1999).

There is another Waterberg area in the South African province of Limpopo, where a sandstone plateau is able to store much groundwater. The San (Bushman) people had already discovered this area two thousand years ago (Taylor *et al.* 2003). The name of the nearby town 'Bela Bela' means 'boiling-boiling', whilst the former name 'Warmbad' (warm bath) refers to a large spring which provides several cubic metres of hot (53 °C) water per hour (Olivier *et al*. 2008). Groundwater at such high temperatures does not normally come from a local mountain aquifer, but rather originates from very deep aquifers (up to several thousands of metres below the earth's surface) and discharges *via* geological faults (Olivier *et al*. 2008, Grootjans *et al*. 2010, McCarthy *et al*. 2010).

The Waterberg area in Namibia is centred around a plateau of eroded sedimentary (sandstone) rock, 8–10 km wide and 48 km long, that formed 220 to 180 million years ago (Cubitt & Joyce 1999, Grünert 2013). The plateau rises more than 200 m above the surrounding plains to an average altitude between 1650 and 1700 m above sea level (www.namibweb.com/waterberg.htm). There is some evidence in German literature for the historical presence of spring mires in this vicinity. On 02 April 1930 the German geologist ("Bergrat") Konrad Keilhack presented a lecture at the German Geological Society (Haack 1930). Keilhack was a well-known geologist with an explicit interest in (sub)tropical peatlands (Keilhack 1914, 1915a, 1915b, 1930) who published an extensive textbook on groundwater and spring hydrology in 1912 (Keilhack 1935). In his 1930 lecture Keilhack mentioned that Paul Range (the second government geologist of the German Colonial Administration, appointed in 1906) discovered spring mires at Waterberg in south-west Africa "that had developed due to continuous irrigation ('Berieselung') by non-calcareous seepage water". Also, Straka (1960) referred to a report by Keilhack that "local spring mires (Quellmoore) with a peat thickness of several metres are present in northern South-West Africa". Indeed, the name 'Waterberg' is well chosen because many springs emerge from its slopes, supporting lush vegetation which contrasts sharply with that of the surrounding thorn savannah (www.namibweb.com/waterberg.htm, Grünert 2013).

In August 2014, members of the International Mire Conservation Group (IMCG) visited the Waterberg Plateau National Park (Namibia) in search of historical and current evidence of springs and spring mires. In this short note we report our observations at two locations that we were able to access, and compare them with observations of a spring mire at similar altitude in the Waterberg area of Limpopo, which also has similar hydrogeology and rainfall.

SPRINGS NEAR GROOTFONTEIN

The Bernabe De La Bat Rest Camp is located south of the plateau at the base of the National Park. This area was the scene of heavy fighting in 1904 (Figure 2), when the German colonial "Schutztruppe" under General Von Trotha won the Battle of Waterberg against an uprising of the local Herero people.

Förster (2003) studied how the Herero kept their history alive by storytelling and on this basis presented much local information about events during the battles around the Waterberg. The use of the springs and the consequent use of grazing grounds was probably an important cause of the uprising. Several Herero storytellers mention events at the start of hostilities, referring to the place Ondjombombapa (= white water hole). Ondjombombapa is the watering place next to the graves of the first German patrol that was defeated there by a group of Herero warriors. Another historic well (Ohamakari), situated south of the Waterberg (now on the farm Hamakari), is "remembered and memorised as a venue of the most prominent battle: that's where the fiercest battle occurred".

After the war with the Herero (and Nama) people the German colonial administration confiscated the land around the Waterberg and sold it to German settlers. Many of the German farms still carry the names of wells that were used by nomadic Herero in pre-colonial times.

In the vicinity of the base camp we found small patches of peat where springs and spring rivulets provide a continuous supply of water, the water having infiltrated higher up on the Waterberg. However, the patches of peat have become very shallow (no more than 15 cm thick) and, in a formal sense, can (no longer?) be referred to as peatland.

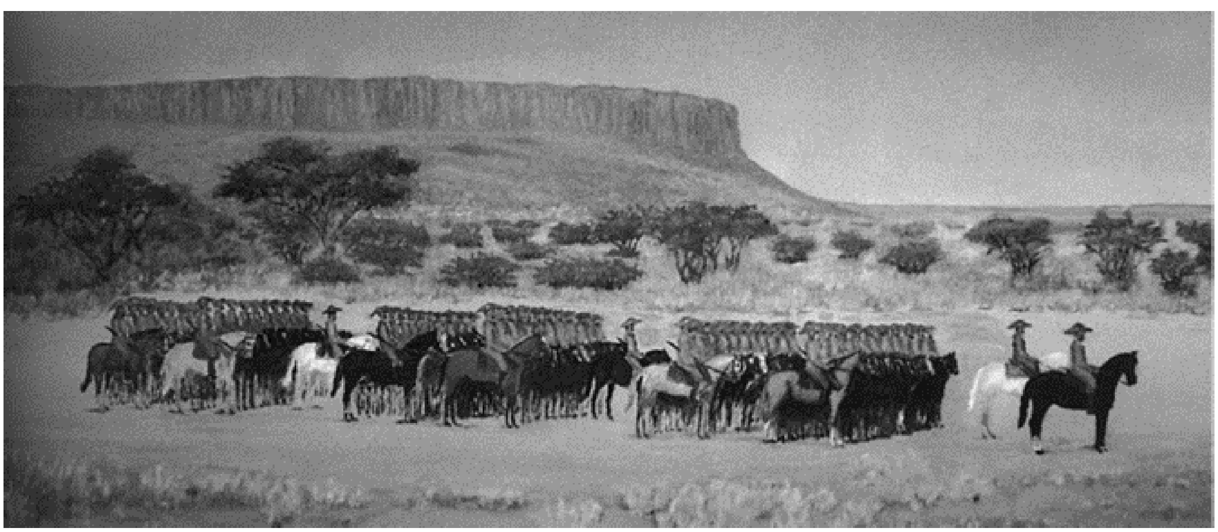


Figure 2. The German colonial army in front of the Waterberg. Detail of a painting by Lutz Menge (copyright: Museum Grootfontein), from Förster (2003).

REMNANTS OF A SPRING MIRE IN THE OTJOSONGOMBE VALLEY?

Förster (2003) (LF) also mentions early observations of the Waterberg area by German travellers and missionaries: "*The first German travellers and missionaries in Namibia ascribed an aura like home to the landscape due to its fertility and its numerous springs situated in the middle of a relatively dry country ….. it was again and again described as a landscape resembling European landscapes*". For example, the Rhenish missionary Carl Hugo Hahn noted down the following on the scenic landscape near the settlement at the Waterberg during an exploratory journey through north-east Namibia in autumn 1871: "*We were now in Otyozondjupa* (= place of calabashes; name of the historic settlement place at the Waterberg; LF). *Everything was completely new to us. We had never before seen or expected such a thing in these parts of Africa. [...] The rushing of the small stream across the rocks was a sound that awakened sweet old memories. The view behind us into the valley was delightful. Time and again we shouted: Oh, how beautiful, how lovely is it here! It is as if we were in Europe!*" (Archive of the Vereinte Evangelische Mission 1871).

We visited one such valley, which has been used as a tourist facility since 2000. The first Europeans to visit this valley were Charles John Andersson and Francis Galton, who passed through the Waterberg area in March 1851 on their way to northern Namibia. Galton was a cousin of Charles Darwin (Galton & Bettany 1891) and published a book on his travels in 1853 (Galton 1853; Figure 3). He wrote: "*From the top of Omuvereoom* (= Waterberg), *about Otjironjuba* (= name of the small river), *nothing but a wide bushy extent could be seen. The brook sprang from several boggy spots, and fell in pretty cascades down the hill.*"

San (Bushmen) and Dama(ra) have probably lived in the valley for centuries, but in 1870 Herero people settled and occupied the area around the Waterberg Mountain. They call the valley Otjosongombe ("place of cattle"). Otjosongombe was the scene of action during the Battle of Waterberg on 11 August 1904. In 1911 Friedrich von Flotow, the grandson of the well-known composer of the same name, acquired the Otjosongombe Farm and started to cultivate citrus fruits and vegetables. Later (1952–1971), the main emphasis shifted to cattle farming. Since 2000, the Otjosongombe Valley has become a centre for tourism based at the Waterberg Wilderness Lodge.

Some of the spring water that supplies the valley is used for drinking and the remainder flows through the valley, flooding the grasslands in many places (Figure 4). The groundwater that feeds the spring originates from the plateau and is forced to the surface in the valley by the presence of impervious layers (Grünert 2013). Near the spring we found a layer of highly decomposed peat approximately 15 cm thick. Closer to the present stream, shallow peaty layers 10–20 cm thick are also present. The wet grassland grows almost entirely on mineral soils with a high content of organic matter in the topsoil. There are many sites where seepage of iron-rich groundwater can be observed (Figure 4). A deep erosion gully exposes grey-to-black sandy deposits which contain organic matter, and similar material is evident in termite hills across quite a large area around the spring. Further downstream, black soils are not present and the termite hills are all grey-yellow (Figure 5).

If the occurrence of these organic-rich sediments in the valley (Figure 5) indeed points to the occurrence of spring mires, the original mires could have looked like the illustration presented in Figure 6. Most of the groundwater was probably discharging at the valley flanks, where we found black sediments (Figure 5). These sites are now heavily eroded by a mountain spring (Figure 6a). The stream was probably much smaller at that time because it is most likely that the groundwater discharge did not occur at a single point (as it does now), but was more dispersed ("several boggy spots"; Galton 1853).

MATLABAS MIRE IN THE WATERBERG AREA OF SOUTH AFRICA

The mountainous massif called Waterberg in the Limpopo Province of South Africa covers an area of approximately 14,500 km^2. The sedimentary rocks were deposited >1.5 billion years ago and now form multi-coloured sandstone cliffs rising around 1400 m above the surrounding plains (Taylor *et al*. 2003) to an average altitude of 600 m above sea level with some peaks up to ~2000 m a.s.l. The National Park Marakele, which lies at the heart of this mountainous area, has slightly higher annual rainfall (600–1000 mm; Cumming 1999) than the Waterberg region of Namibia. Within the National Park boundaries there is a large spring mire (100 m × 500 m) in a valley at altitude 1575–1600 m a.s.l. (Bootsma 2015). This mire fits Keilhack's description of the Namibian spring mires quite well.

"In the course of the day, we arrived at a magnificent fountain, called Otjironjuba the Calabash on the side of Omuvereoom. Its source was situated fully two hundred feet above the base of the mountain, and took its rise from different spots; but, soon uniting, the stream danced merrily down the cliffs" (Galton 1853).

"A gigantic fig-tree had entwined its roots round the scattered blocks of stone by the side of Otjironjuba fountain, its wide and shady branches affording a delicious retreat during the heat of the noon-day sun" (Andersson 1856).

Figure 3. In 1851 Francis Galton and Charles Andersson visited the Otjironjuba spring at the slope of the Omuvereoom (= Waterberg) Mountain (Namibia) and described what they saw (upper left). The red line on the Galton map indicates their travel route. The present-day photos (upper right and lower left; August 2014) of the fig trees indicate that, apart from the planted flowers (*Impatiens walleriana*), little seems to have changed in the scenery.

The ecohydrology of the Matlabas Mire (2012–2014) was studied by Bootsma (2015). It is a sloping spring mire which, during dry periods, is fed only by very calcium-poor groundwater originating from relatively small hydrological systems and arriving from various directions. For most of the year this groundwater flows slowly over large parts of the mire surface (termed "Berieselung" of groundwater by Konrad Keilhack). In very wet periods, surface water from a mountain stream also flows over the mire. When the flow intensity is too high the streams split and parallel watercourses arise (Figure 7), only to merge again or disappear farther downslope. During very dry periods the water table drops below the surface but the peat remains wet.

This mire is not pristine, but probably slightly influenced by former grazing activity that appears to have triggered minor peat erosion. Its vegetation is

Figure 4. View of a valley below the Waterberg escarpment (Namibia) with irrigation grassland flooded by a small stream (upper left). The valley is still being grazed by cattle (upper right). The origin of the stream is a spring, where the water is partly intercepted in a plastic tank and used for the production of drinking water (lower left). Note the flowers (*Impatiens walleriana*) that have been planted in the spring area. Downstream grasslands do not receive irrigation water, but are influenced by groundwater that seeps up in the valley (lower right).

characterised by a *Miscanthus junceus*, *Kyllinga melanosperma* and *Thelipterys confluens* community which dominates the wettest part of the mire. Between this permanent wet zone and the dryland lies a vegetation community dominated by *Panicum dregeanum* and *Aristida canescens*. The *Miscanthus* grass forms large, sturdy tussocks that are elevated (by 1–2m) above the water surface and are important in reducing the energy of surface water and slowing down its movement. In some instances the spaces between tussocks form channels in which surface water flows.

CONCLUSIONS AND FURTHER RESEARCH

Our observations in the Otjosongombe Valley may well point to the former occurrence of a spring mire. Unfortunately we did not find clear observations by visitors during the period between 1850 and 1900, when German settlement in the valley had not yet taken place. Galton (1853) mentioned that the river originates from “several boggy spots”, but does not mention the peat thickness of these boggy spots. Also traditional (Herero) storytellers mention the presence of a spring, but no specific details have

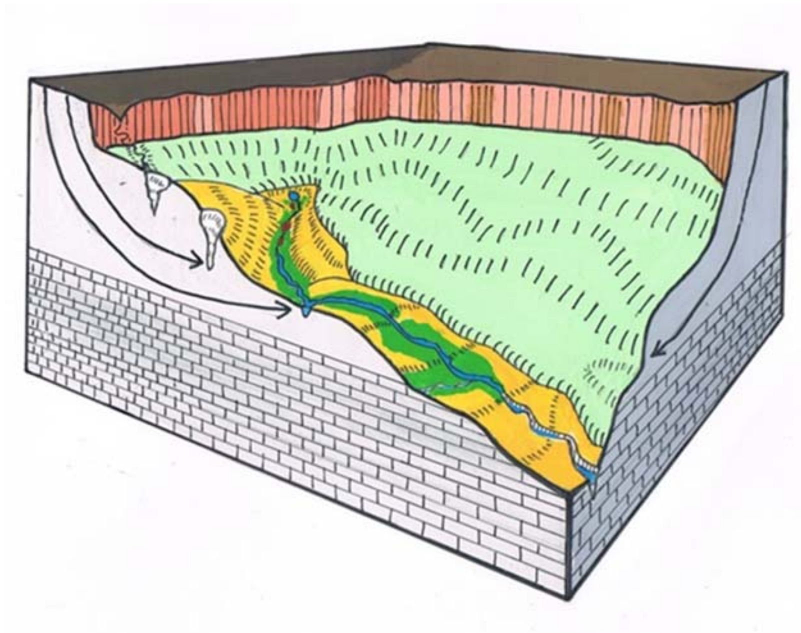
Figure 5. Possible remains of a former peat cupola at Waterberg, Namibia, where the sandy black sediment has been eroded by a mountain stream (upper left). The sediments show bands of lighter and darker grey material, possibly indicating remnants of peat with different contents of organic matter (upper right). Termite hills close to the spring are black, again indicating a high content of organic matter (lower left), while farther away from the spring area the colour of the termite hills is grey-yellow, indicating a low content of organic matter (lower right).

been communicated. Nonetheless, some German geologists who were familiar with spring mires in Europe mention the presence of spring mires with deep peats (several metres) in the Waterberg area, but the exact location of these spring mires remains unclear.

In the valley that we visited, the present stream is unusually straight, which points to digging of ditches (the present lodge still uses about 50 % of the water from the spring). Intensive use of spring water would have caused concentration of water flow to the present spring and the (artificial) stream. Moreover, cattle watering holes have been dug and are still being fed by water from the stream. Downstream of the farm the stream runs dry as it has become an infiltrating water body, resulting in the occurrence of dry savannah vegetation.

Although the activities of German settlers during the first half of the 20th century would have accelerated the decline of the peat cupolas around the spring, the possibility that the Herero people have also influenced the hydrology of the spring

(a)



(b)

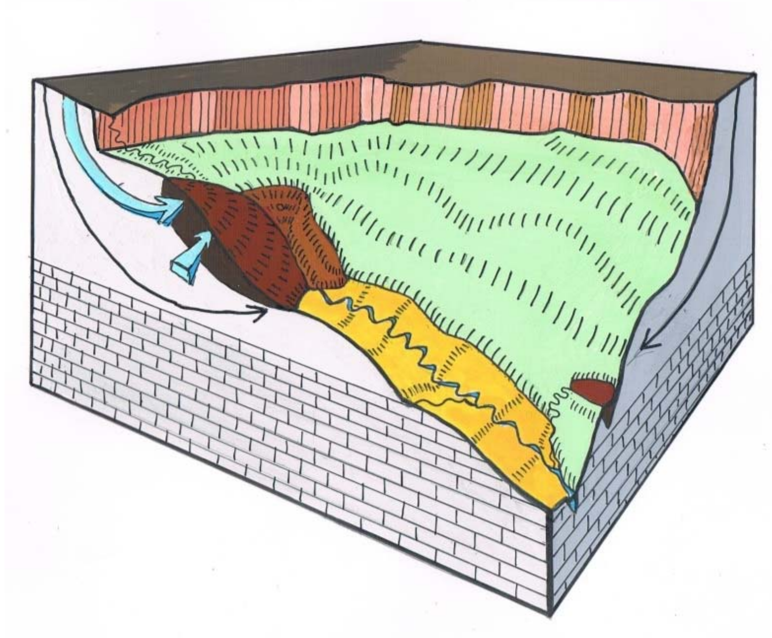


Figure 6. (a): Schematic presentation of the valley Otjosongombe ("place of cattle"), south of the Waterberg Plateau (Namibia). The lower parts of the valley are influenced by surface water from a central spring. Remnants of peat were found near the spring. Discharge of groundwater was observed at many places along the stream (see also Figure 4). On the left-hand side, two deep erosion gullies are shown. (b): Reconstruction of a past spring mire in the valley Otjosongombe based on the occurrence of organic rich soils around the spring.

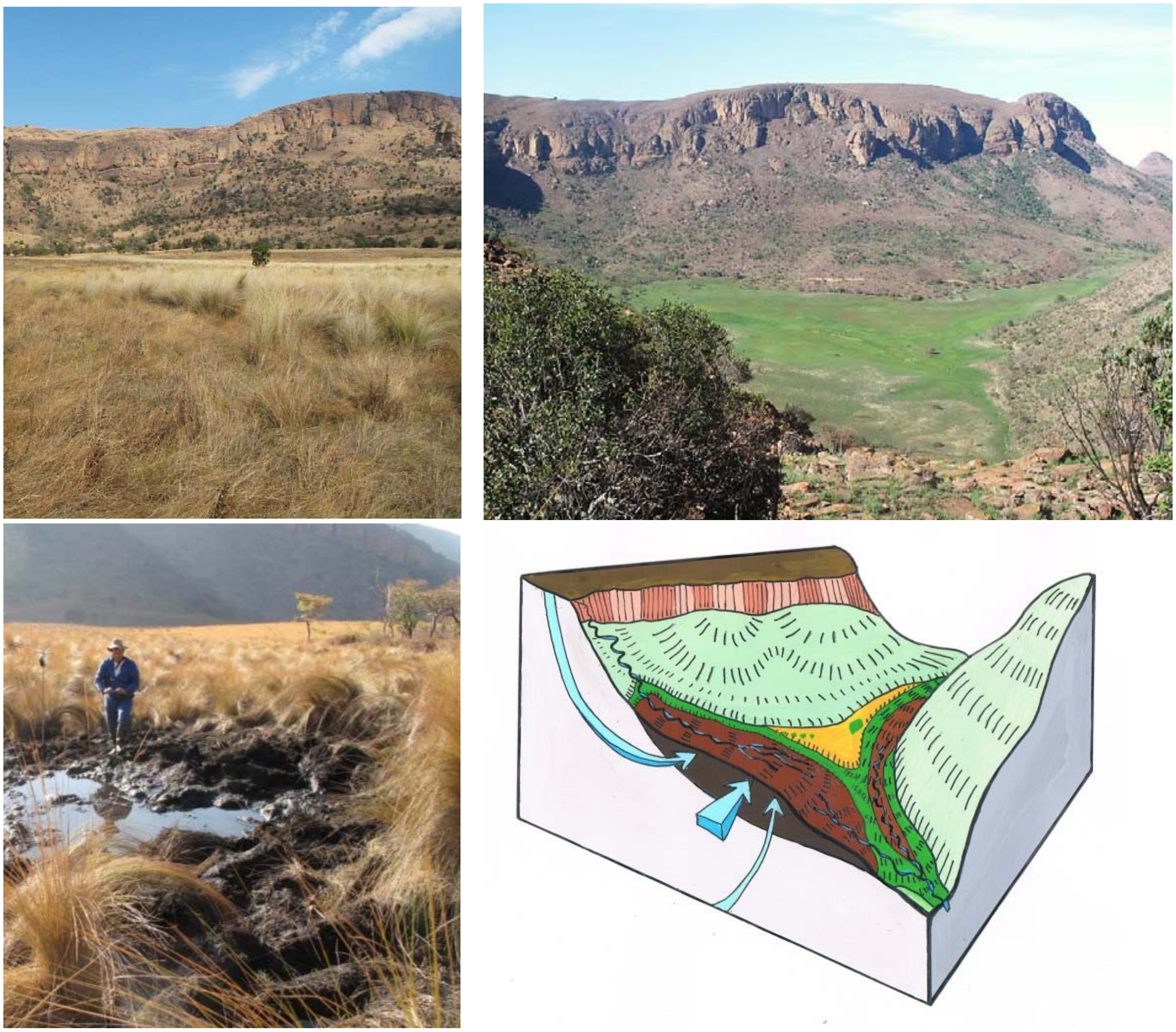


Figure 7. The spring mire ‘Matlabas” in the Waterberg Region of Limpopo, South Africa. Upper left: close-up of the mire, which shows wetland vegetation on the flanks and tussocks of *Miscanthus junceus* dominating the vegetation in the central area where surface flow of a small river occurs. Upper right: overview of the mire. Lower right: a conceptual model of the Matlabas Mire, showing the interaction of groundwater flow and surface water flows. In dry periods, elephants can do significant damage to the vegetation (lower left).

system cannot be ruled out. The Herero have used the springs and rivulets for their cattle since 1870. If they tried to increase the availability of water by connecting smaller streams to a central waterhole (there are stories relating the presence of fish in a central waterhole; Förster 2003), then it is likely that the hydrological pressure in the cupolas was lost, increasing their vulnerability to erosion by mountain streams that discharge surface water from the plateau. There are two deep erosion gullies in the surroundings of the present spring. More accurate analyses of the carbon contents of the supposed remnants of the spring mire (both dry and wet soils) are needed. It would be also very interesting to conduct a survey of the area to investigate whether any spring mires still exist. In fact, a more extensive peat survey for Namibia as a whole is needed. Even present-day estimates of the peat deposits of mires give, at best, only an indication of where peatlands could formerly have been present. Estimates based on the occurrence of peat fires or (potentially) peat-forming vegetation can easily over-represent the real occurrence of peatlands.

ACKNOWLEDGEMENTS

Baps Snijdewind is acknowledged for her critical but supportive comments on an earlier version of the manuscript.

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Submitted 24 Dec 2014, final revision 22 Jly 2015
Editor: Olivia Bragg

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