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Indigenous vascular plants of the Soutpansberg, South Africa

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Background: The first checklist for the Soutpansberg was published in 1946, and the second list was compiled by the author in 2006 as part of his doctoral thesis. Currently, there is a need for an updated account of the biodiversity of the Soutpansberg Centre of Endemism and Diversity for conservation planning in the Vhembe Biosphere Reserve, within which the Soutpansberg is the principle geomorphological feature.

Objectives: To present an updated list of vascular plants recorded for the Soutpansberg.

Method: The list was compiled from various sources including literature reviews, herbarium specimens, herbarium databases and personal observations.

Results: This article presents the most geographically accurate and taxonomically updated list of the indigenous vascular flora of the Soutpansberg, the northernmost mountain range of South Africa. Altogether 2443 taxa are recorded belonging to 922 genera in 187 families and 64 orders.

Conclusion: The list presented in this article confirms the status of the Soutpansberg as a centre of floristic diversity in southern Africa. Notable is the higher-order diversity of the flora. It is likely that both future surveys and reviews of herbarium collections will add new taxa to the current total.

Keywords: floristic diversity; flora; vegetation; biodiversity; biosphere reserve; Centre of Endemism; Centre of floristic diversity.

Introduction

As part of the Vhembe Biosphere Reserve Biodiversity Initiative, a revised indigenous vascular plant list of the Soutpansberg is presented, 72 years after the first list was published. There is a need to compile an account of biodiversity of the Vhembe Biosphere Reserve (proclaimed 2009) (UNESCO 2018) for conservation planning in line with the national strategy for plant conservation, in particular the target to identify and conserve important areas of diversity (Raimondo 2015). The Soutpansberg Centre of Endemism was described in 2001 by Van Wyk and Smith as encompassing both the Soutpansberg and Blouberg mountain ranges, a regional biological hotspot (Hahn 2006; Mostert et al. 2008). While Hahn (2017) presented an account of the endemic vascular flora of the mountains, no recently published list of the overall floristic diversity of the Soutpansberg is available, despite this diversity underpinning the successful biosphere reserve nomination (Dombo et al. 2006).

The flora of the Soutpansberg, despite early visits by prominent botanical collectors, is rarely covered in contemporary literature, either on its own or as part of the larger provincial or South African flora. The oldest confirmed herbarium specimens from the Soutpansberg in the National Herbarium, Pretoria (PRE), are those of W.C. Nelson who collected *Adenia gummifera* (Harv.) Harms var. *gummifera* (Nelson 351) and *Smilax anceps* Willd. (Nelson 355) in February 1878 on Pisang Kop (South African National Biodiversity Institute [SANBI] 2016). This was followed by F.R.R Schlechter's 1894 collecting numbers 4607–4616 from Mara. From 1900 onwards, most of the early botanists concentrated their collections on the foothills and main roads of the Soutpansberg. In 1916, H.G. Breijer was one of the first naturalists to collect plant specimens extensively throughout the mountain range (SANBI 2016). He continued visiting the area for collecting plant specimens during excursions until January 1923, shortly before his death.

In December 1928, a large contingent of naturalists including General Jan Smuts and John Hutchinson collected extensively within the Soutpansberg; most noteworthy are their collections from Wyllie's Poort and Lake Fundudzi (Hutchinson 1946). In August 1930, Hutchinson returned

to the Soutpansberg accompanied by Jan Gillett, collecting widely throughout the mountain range. It was on this occasion that they collected the type specimen of *Zoutpansbergia caerulea* Hutch., described in 1946 (Hutchinson 1946). *Zoutpansbergia* is a monotypic genus known from the Makgabeng, Blouberg and Soutpansberg area (Hahn 2017).

In January 1931, Bremekamp and Schweickerdt conducted an extensive tour to the northern regions of the Limpopo province collecting 475 plants. Their main collection was from the Soutpansberg and was published by Bremekamp (1933).

In 1932, Obermeyer, Schweickerdt and Verdoorn (specimen nos. 1–438) conducted an extensive survey of the vegetation of the Zoutpan (from Dutch: salt pan) situated on the north-western foot of the Soutpansberg, after which the range is named. Schweickerdt (1933) subsequently compiled an account of the vegetation in the neighbourhood of the Zoutpan. Schweickerdt and Verdoorn (specimen nos. 440–691) conducted a second excursion to the Zoutpan during April 1934, and in 1937, they compiled an enumeration of plants collected in northern Transvaal (now Limpopo) with particular emphasis on those collected from the Zoutpan (Obermeyer, Schweickerdt &Verdoorn 1937).

A book titled *A Botanist in Southern Africa* was published in 1946 by Hutchinson, giving an extensive account of his collecting trips between 1928 and 1930 in South Africa, which included trips to the Soutpansberg. Within this book, he compiled the first species list of the flora of the Soutpansberg and Blouberg, listing 610 taxa from the Soutpansberg of which three were new to science (Hutchinson 1946).

Hahn (1994) compiled the first tree list of the Soutpansberg comprising 534 taxa. As part of his doctoral thesis, Hahn (2006; unpublished) compiled the second list of species of the Soutpansberg comprising 2525 plants, but included non-vascular taxa, and used only coarse distribution data from already available data sets. This list was not ordered according to a phylogenetic system. To make these data available to a broader audience, the following list is presented including taxonomical changes since 2006 and ordered in accordance with the Angiosperm Phylogeny Group IV (2016) phylogeny.

Materials and methods

Study area

The Soutpansberg is delineated as the bounds of the Soutpansberg geomorphic province as defined by Hahn (2011). From east to west, the Soutpansberg extends approximately 210 km, and from north to south, it is 60 km at its widest and 15 km at its narrowest, covering a surface area of 6700 km^2 (Figure 1). It ranges in altitude from 200 m near Pafuri in the east to Hanglip 1719 m (the second highest peak) and Lejuma 1748 m (the highest peak) situated towards the west. Geomorphologically, the Soutpansberg mountain range is characterised by a succession of predominantly east–north-east trending homoclinal ridges (Hahn 2011), which result in strong north–south and east–west altitudinal and climatic gradients with high habitat heterogeneity (Hahn 2006). The rocks of the Soutpansberg dip at approximately 15–35° to the north and rise abruptly in the south. The most prominent characteristic of the Soutpansberg is its mesic southern slopes. In the west, they form high cliffs becoming a steep rolling landscape along the central section with cliffs becoming dominant once again in the eastern extremity. The southern

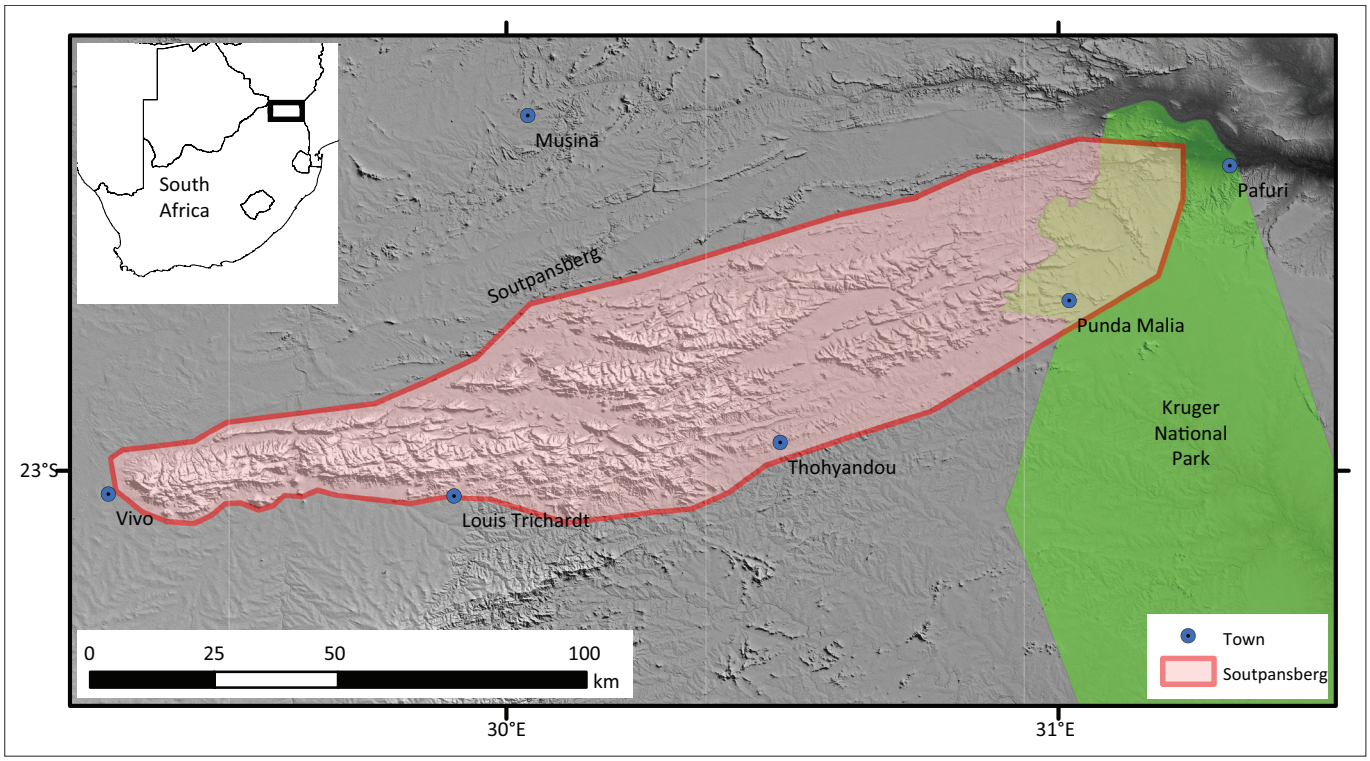

FIGURE 1: Map of the Soutpansberg region.

central regions of the Soutpansberg are also situated in the highest rainfall area with Entabeni receiving up to 1874 mm per annum (Hahn 2006). The Soutpansberg's rainfall steadily diminishes from Entabeni eastwards with Punda Maria receiving 545 mm per annum. Similarly, to the west, the rain shadow of the Great Escarpment causes the rainfall of the region around the town of Louis Trichardt to drop to 618 mm per annum. The combined rain shadows of the Soutpansberg and Great Escarpment cause Waterpoort to have the lowest recorded rainfall of 367 mm per annum (Hahn 2006).

Data acquisition and literature review

This list of the vascular flora of the Soutpansberg was compiled from various sources, spanning a period of three decades, forming part of the Herbarium Soutpansbergensis (ZPB) Biodiversity Information System. Type specimens were mainly sourced from Journal Storage (2017). Collection locality was assessed to ensure as far as possible that included records were restricted to the Soutpansberg.

Nomenclatural and order

Names are in accordance with SANBI (2016) and verified against The Plant List (2013). Lycopodiophyta and pteridophyta are arranged according to The Pteridophyte Phylogeny Group (2016) and gymnosperms following Christenhusz et al. (2011). Angiosperms are ordered according to the Angiosperm Phylogeny Group IV (2016) system. The Fabaceae follows the phylogeny proposed by the Legume Phylogeny Working Group (2017) except for the basal clade of the subfamily Caesalpinioideae, which is assigned under the Mimosoideae. While the higher classification is phylogenetically arranged, genera and taxa are sorted alphabetically. A tree was defined according to the definition of Hahn (1994), whereas succulents follow the criteria of Smith et al. (1997).

Ethical considerations

This article followed all ethical standards for a research without direct contact with human or animal subjects.

Results

Altogether 2443 vascular plant taxa are listed for the Soutpansberg, belonging to 922 genera, 187 families and 64 orders (Table 1). A comprehensive account of the vascular plants of the Soutpansberg is provided in the form of a checklist (Online Appendix 1).

Discussion

The Poales with 284 taxa has the highest order taxa count, followed by Lamiales with 276. Fabaceae with 249 taxa has the highest species count per family, followed by Poaceae (202) and Asteraceae (193). *Cyperus* L. (33), *Indigofera* L. (32) and *Helichrysum* Mill. (29) are the genera with the highest species richness. The Soutpansberg flora shows no sign of single group diversification, with an average of only 13.0 taxa per family and 2.7 taxa per genus recorded. Approximately 12% of the plants occurring within the Soutpansberg can be considered succulent. There are 22 endemic taxa recorded for the Soutpansberg, although this rises to 40 taxa if distributions on the adjacent Blouberg and Makgabeng are included (Hahn 2017). Altogether, 571 tree taxa are known from the Soutpansberg, a number that is approximately one-third of all known trees of southern Africa. This is a substantial number representing 23.4% of the known flora of the mountain range.

The Soutpansberg flora is compared with the flora of southern Africa (flora SA) in Table 1. With 74.2% of southern African vascular plant families, 48.8% of southern African vascular plant genera and 11.8% of the southern African vascular plant taxa represented on the Soutpansberg (on less than 0.25% of the land surface area covered by the flora of southern Africa), the importance of the Soutpansberg as an area of floristic diversity within the region is evident (Table 1). For comparative purposes, the Core Cape Flora comprises 46% (9383 species in 997 genera and 178 families) of the vascular plant taxa of the flora of southern Africa on ca. 4% (90 760 km^2) of the surface area (Manning & Goldblatt 2012). The Soutpansberg's relatively low number of species in contrast to its high family level diversity stands out when compared to the flora of South Africa and that of the Core Cape Subregion.

The Drakensberg Alpine Centre, situated above 1700 m, has a surface area of 40 000 km^2 with 2520 vascular plant taxa recorded in 630 genera and 134 families (Carbutt & Edwards 2004). These figures are comparable with those of the Soutpansberg, the surface area of which is some 17% of that of the Drakensberg Alpine Centre. The three most species-rich families of the latter centre are Asteraceae (430), Poaceae (267) and Fabaceae (136), which are also the three most

TABLE 1: Summary statistics of the vascular plants of the Soutpansberg.

Class	Lycopodiophyta	Pteridophyta	Gymnosperms	Angiosperms	Total	Flora southern Africa	Soutpansberg percentage (%) Flora southern Africa
No. of orders	2.0	11.0	3.0	48.0	64.0	-	-
No. of families	2.0	22.0	3.0	160.0	187.0	252.0	74.2
Families/order	1.0	2.0	1.0	3.3	2.9	-	-
No. of genera	4.0	50.0	4.0	864.0	922.0	1890.0	48.8
Genera/order	2.0	4.5	1.3	18.0	14.4	-	-
Genera/family	2.0	2.3	1.3	5.4	4.9	7.5	
No. of taxa	10.0	102.0	5.0	2326.0	2443.0	20 700.0	11.8
Taxa/order	5.0	9.3	1.7	48.3	38.2	-	-
Taxa/family	5.0	4.6	1.7	14.5	13.0	82.1	-
Taxa/genus	2.5	2.0	1.3	2.7	2.6	11.0	-

diverse families in the Soutpansberg flora. Monocots are, however, very well represented in the Drakensberg Alpine Centre with 830 taxa compared to 528 in the Soutpansberg.

As the Soutpansberg is situated on approximately the 23° line of latitude, a comparison of its flora with those of the Chimanimani Mountain and Nyanga Massif (tropical) and the Wolkberg (subtropical) would be of biogeographical importance. A comparison of the Wolkberg is at present not possible as no checklist for the mountain exists. However, 977 indigenous vascular plants have been recorded for the Chimanimani (Wursten, Timberlake & Darbyshire 2017). Of these, 74 species are endemic to the Chimanimani considerably exceeding the 22 recorded for the Soutpansberg (although, as discussed, this figure increases if taxa whose distribution includes the nearby Makgabeng and Blouberg are included). The Chimanimani flora encompasses 9.4% pteridophyta, whereas for the Soutpansberg the figure is 4.2%. For the Nyanga Massif with a surface area of 2181 km^2, 1374 indigenous vascular plant taxa have been recorded in 156 genera and 634 families; 12 taxa are endemic (Clark et al. 2017). The higher species diversity and endemism in the Soutpansberg compared to the Nyanga Massif could be attributed to the greater surface area of the former. Nonetheless, the considerable family level diversity of Soutpansberg compared to the Chimanimani and Nyanga Massif stands out.

Of the 2326 angiosperms recorded for the Soutpansberg, 22.7% are monocots compared to 30.0% in the Nyanga Massif, 35.8% in Chimanimani and 34.6% in the Drakensberg Alpine Centre. Could this be attributed to the loss (from bush encroachment and silviculture) of the Soutpansberg's high rainfall grasslands, which were situated on soils derived from weathered basalt and which previously covered approximately 10% of the mountain (Hahn 2018)?

Conclusion

Altogether 2443 taxa have been listed for the Soutpansberg belonging to 922 genera, 187 families and 64 orders. The list presented in this article confirms the status of the Soutpansberg as a centre of floristic diversity in southern Africa. Notable is the higher-order diversity of the Soutpansberg flora. It is likely that both future surveys and review of herbarium collections will add new taxa to the current total.

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Authors' contributions

I declare that I am the sole author of this research article.

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Data availability statement

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Disclaimer

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