The conservation status of temperate grasslands in southern Africa

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Introduction

The Grassland Biome (25° S - 33° S; 24° E - 31° E) of southern Africa (here defined in the narrowest sense as South Africa, Lesotho and Swaziland) covers an area of c. 360,589 km², straddling the high central plateau of South Africa (‘highveld’), the mountainous areas of Lesotho, and the high-lying ground of the eastern seaboard (uplands or sub-escarpment of KwaZulu-Natal, Eastern Cape, and Mpumalanga). The Grassland Biome (Figure 1), one of nine biomes in southern Africa, accounts for c. 28% of the terrestrial surface area of southern Africa, and is therefore the second largest biome after the Savanna Biome (Mucina and Rutherford 2006). Topographically, the landscape of the Grassland Biome ranges from flat or undulating with hills and valleys, to rugged mountain escarpment. Elevation ranges from 300 m to 3482 m a.s.l. (Thabana Ntlenyana - the highest mountain in southern Africa). Winters are generally cold and dry, with frequent frosts and snow falls in the higher reaches. Rainfall varies spatially from 400 mm to 2,500 mm per annum, corresponding to the MAR in other parts of the world where similar vegetation is found (O’Connor and Bredenkamp 1997). Rainfall is strongly seasonal (summer) and the growing season lasts approximately half the year (Mucina and Rutherford 2006). The development of the Grassland Biome is thought to be linked to global cooling during the late tertiary, accompanied by continental uplift that began in the Early Miocene and culminated in significant uplift of up to 900 m in some parts of the subcontinent during the Pliocene. This uplift moved a core area of the subcontinent into a cool, high-altitude climate, more suitable for grasslands than savannas. Uplift towards the west was less pronounced, resulting in the sloping east-west gradient.

The effect of this gradient, enhanced by the east-west moisture gradient across the subcontinent, is believed to have determined the limits of grassland on our subcontinent (Mucina and Rutherford 2006).

The Grassland Biome is represented by four bioregions (Drakensberg Grassland; Sub-escarpment Grassland; Dry Highveld Grassland; Mesic Highveld Grassland; Figure 2) and 72 vegetation types (units), the latter defined by Mucina and Rutherford (2006) according to similar vegetation structure, macro-climate (mainly the amount of summer rainfall, minimum winter temperatures and frost), and a similar disturbance regime (frequent fire and grazing). The Grassland Biome accounts for three centres of plant endemism (Drakensberg Alpine Centre; Wolkberg Centre; Midlands Putative Centre) whilst a further three centres of plant endemism are shared with the Savanna Biome (Barberton, Sekhukhune and Soutpansberg Centres; Mucina and Rutherford 2006). The Grassland Biome also accounts for three World Heritage Sites (uKhahlamba Drakensberg; Cradle of Humankind and Vredefort Dome).

The latest delineation of the Grassland Biome (Mucina and Rutherford 2006) resulted in the recognition of a new biome on the eastern seaboard, namely the Indian Ocean Coastal Belt Biome, which now includes the humid sub-tropical grasslands and the edaphic grasslands of Maputland and Pondland previously housed in the former Grassland Biome (see Rutherford and Westfall 1986, Low and Rebelo 1996). Furthermore, the Ngongoni grasslands are now part of the Savanna Biome, the thinking being that a subtropical vegetation type is best contained within a subtropical biome. The result therefore is
that the grasslands of the currently defined Grassland Biome are all strictly temperate; the Grassland Biome and the temperate grasslands of southern Africa are synonymous and may therefore be referred to interchangeably.

The temperate grasslands of southern Africa are structurally fairly conservative and uniform (O’Connor and Bredenkamp 1997); they comprise single-layered herbaceous communities of tufted graminoids (predominantly perennial grasses of the Family Poaceae), as well as a forb component of mostly long-lived perennials that re-appear on an annual basis from significant below-ground biomass (corms, rhizomes, tubers or bulbs) until the end of their life-span but are heavily reliant on the production and establishment of viable seed for recruitment. Biomass is mostly attributed to the grass component (Family Poaceae), whilst species richness is attributed mostly to the forb component. Woody plants are rare (usually low to medium-sized shrubs) or absent (O’Connor and Bredenkamp 1997), and are confined to specific habitats serving as fire refugia (rocky hilltops, drainage lines etc.). Grassly or Afromontane ‘fynbos’ (heathland-like vegetation) occurs at the higher elevations and in higher rainfall areas, often on steep, highly leached slopes protected from fire (Mucina and Rutherford 2006). C₄ grasses dominate most of the Biome, except at the higher elevations of the Drakensberg Alpine Centre (i.e. the Maloti-Drakensberg Mtns), where C3 grasses predominate (Low and Rebelo 1996). Canopy cover of the grasslands is moisture-dependent and decreases with low MAR. Cover is also influenced by intensity and type of grazing, as well as by fire (seasonality, intensity) and by minimum temperature (implications for frosts). The temperate grasslands of southern Africa are subdivided into moist (dependent on fire for maintaining structure) and dry types (not dependent on fire for maintaining structure) (Mucina and Rutherford 2006).

The aim of this study was to assess the conservation status of temperate grasslands in southern Africa, discuss possible reasons for the poor level of protection and high degree of transformation, and mention the major current interventions aimed at improving levels of protection.

**Methods**

The conservation assessment of temperate grasslands in southern Africa was based on a GIS-analysis using ArcView GIS 3.2. Areas were calculated using data in the WGS84 datum Lo29 projection. Levels of transformation were based on the National Land Cover (NLC) 2000 coverage (satellite imagery). The transformed areas do not necessarily lie exclusively outside of protected areas (PAs). Protection levels were derived from the formal PA system (i.e. all legislated, formal state and statutory PAs), according to the National Environmental Management: Protected Areas Act 57 of 2003.

**Results**

A meager 2.04% of the region’s temperate grasslands are conserved within PAs (Table 1). This level of protection is less than half of the global total (estimated between c. 4.6% and 5.5%) for the World Temperate Grassland Biome (see Chape et al. 2003, Peart 2008). This also falls short of the IUCN target of 10% formal protection by 2014, and at a local (national) scale, far short of the 12% target (or an additional ± 42,500 km²) by 2028 set as part of South Africa’s National Protected Area Expansion Strategy (NPAES) (SANBI and DEAT 2008). The poor levels of protection often mean that temperate grasslands account for most of the high priority biodiversity areas for PA expansion, which in KwaZulu-Natal is estimated to be c. 46% (Carbutt and Escott 2010). An assessment of conservation priorities in the Grassland Biome identified some 36.7% of the biome being important for biodiversity conservation (Reyers et al. 2005). Some 33% of southern Africa’s temperate grasslands are already irreversibly transformed (Table 1).

All broad temperate grassland units (bioregions) are below target, although the Drakensberg Grassland Bioregion is the most protected (Table 2) principally as a result of the Maloti Drakensberg Transfrontier Conservation Area (comprising the uKhahlamba Drakensberg Park World Heritage Site in South Africa and Sehlabathebe National Park in Lesotho). Priority should be given to the sub-escarpment grasslands, listed in the NPAES as being the only bioregion of the Grassland Biome requiring ‘critically urgent’ attention (SANBI and DEAT 2008), followed by the Dry- and Mesic Highveld Grassland Bioregions (requiring
The conservation status of temperate grasslands in southern Africa.

Table 1. The conservation status of temperate grasslands in southern Africa.

<table>
<thead>
<tr>
<th>Broad Vegetation Unit (= Bioregion)</th>
<th>Total Area (km²)</th>
<th>Area in PAs (km²)</th>
<th>Protected (%)</th>
<th>Transformed (km²)</th>
<th>Transformed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drakensberg Grassland</td>
<td>42,177</td>
<td>2,477.48</td>
<td>5.87</td>
<td>8,222</td>
<td>22.30</td>
</tr>
<tr>
<td>Dry Highveld Grassland</td>
<td>117,753</td>
<td>1,785.57</td>
<td>1.52</td>
<td>32,717</td>
<td>31.51</td>
</tr>
<tr>
<td>Mesic Highveld Grassland</td>
<td>125,044</td>
<td>1,996.70</td>
<td>1.60</td>
<td>51,689</td>
<td>42.91</td>
</tr>
<tr>
<td>Sub-escarpment Grassland</td>
<td>75,615</td>
<td>1,080.19</td>
<td>1.43</td>
<td>27,547</td>
<td>38.60</td>
</tr>
<tr>
<td>Summation for Grassland Biome</td>
<td>360,589</td>
<td>7,339.94</td>
<td>2.04</td>
<td>120,175</td>
<td>33.33</td>
</tr>
</tbody>
</table>

The low level of protection (c. 2%) is also slightly overestimated due to the prevalence of forest patches within these grassland areas, reducing the overall area for grassland conservation. Furthermore, some 70% of the minor vegetation types within the bioregions have no or very little (< 2%) legal protection! As a result, the biome is one of the most threatened in southern Africa, because out of the 72 constituent vegetation types, one is listed as critically endangered, 14 are endangered and 24 are classed as vulnerable (see Reyers et al. 2005). The c. 2% formal protection is also an overestimate or best case scenario given that a further ten years of transformation has taken place since 2000 (the date of the last national land cover exercise).

Discussion

Transformation

The Grassland Biome supports the greatest human population densities and the highest levels of agricultural utilization on the subcontinent, thereby placing it under severe threat and pressure (Meter et al. 2002, O’Connor and Kuyler 2005, Kirkman 2006). The result is that the Grassland Biome is highly transformed (c. 33%; Table 1) and fragmented, with much of its high priority biodiversity located within production (‘working’) landscapes. This is a worldwide trend because grasslands are highly amenable for settlement and use, having provided for man’s needs for centuries. As a result, temperate grasslands are now considered the most altered terrestrial biome on the planet (Henwood 2006).

The primary drivers of transformation by agriculture in the Grassland Biome include the dairy, wool, beef, maize, sorghum, wheat, and to a lesser extent, sunflower industries. A further 65% of the Grassland Biome is grazed for livestock and game (Grasslands Programme, undated). Large stretches of grassland have also been flooded for the construction of large dams, as southern Africa is generally a water scarce country with a MAR around 350 mm. In terms of mining, South Africa is one of the world’s top coal producing countries; an extensive coal belt is located within the Grassland Biome. Exacerbating the problem is that large coal-fired power stations (occupying a large footprint) are located in close proximity to the coal-producing areas, in order to minimize transport costs. Gold mining is a further transformer of temperate grasslands.

Major biodiversity conservation initiatives

The conservation of temperate grasslands is being tackled at a number of levels and scales. At a global level, the Temperate Grasslands Conservation Initiative (TGCI) was birthed in 2006 under the Grasslands Protected Area Task Force of the IUCN World Com-
Table 2. Land-use types responsible for the most transformation in the Grassland Biome (adapted from Reyers et al. 2005). The slight disparity between total transformation values in Tables 1 and 2 is attributed to the inclusion of additional land-uses/habitats within grassland habitat such as water bodies, barren rock and forests, for the calculations in Table 1.

<table>
<thead>
<tr>
<th>Land-use type</th>
<th>Transformation</th>
<th>Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Km²</td>
<td>(%)</td>
</tr>
<tr>
<td>Cultivation</td>
<td>75,833</td>
<td>21.00</td>
</tr>
<tr>
<td>Cultivation</td>
<td>22,041</td>
<td>6.10</td>
</tr>
<tr>
<td>Forestry plantations</td>
<td>9,932</td>
<td>2.80</td>
</tr>
<tr>
<td>Urban and industrial areas</td>
<td>5,843</td>
<td>1.62</td>
</tr>
<tr>
<td>Mines and quarries</td>
<td>933</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>114,582</strong></td>
<td><strong>31.78</strong></td>
</tr>
</tbody>
</table>

The National Grasslands Biodiversity Programme (NGBP), otherwise known as the Grasslands Programme, is a 20-year programme which aims to “secure the biodiversity and associated ecosystem services of the Grassland Biome for the benefit of current and future generations”. Hosted by the South African National Biodiversity Institute (SANBI), the programme is a strategic partnership between three spheres of government, the private sector, civil society and the academic sector. In its first five years, the Programme is focusing on a strategy to mainstream conservation objectives into major production sectors operating in the biome (through the Grassland Partner’s Forum). This strategy includes interventions to integrate biodiversity-compatible land uses into agriculture; to ensure a direct contribution by the forestry sector to biodiversity conservation; to mainstream biodiversity into Gauteng’s economy and to secure biodiversity management in the coal mining sector. The Grasslands Programme recognizes that promoting off-reserve conservation on privately or communally owned land has to form a major component of a grasslands conservation strategy.

Another major intervention that can be employed in the conservation of temperate grasslands is the expansion of existing grassland PAs and the proclamation of newly acquired PAs, including Transfrontier Parks. The Maloti Drakensberg Transfrontier Programme (MDTP) aims (in part) to conserve temperate grasslands and associated biodiversity in the Maloti Drakensberg Region. The Maloti Mtns of Lesotho in particular are poorly protected, as this region is characterized by communal land tenure. Studies have shown that species richness in such communally
grazed areas is significantly lower when compared to conservation areas nearby (Everson and Morris 2006). Currently, only 0.21% of Lesotho’s total area of c. 30,355 km² is under formal protection, comprising Sehlabathebe National Park (64.75 km²) and Masitise Nature Reserve (0.2 km²) (Letšela et al. 2003, Everson and Morris 2006). The further proclamation of Tsehlan dane National Park (53.33 km²) and Bokong Nature Reserve (19.72 km²) will double the area in Lesotho under protection, and linking the two areas through a biosphere reserve as proposed by the Lesotho Highlands Development Authority (LHDA) will extend the area under conservation even further (Letšela et al. 2003). This initiative provides an opportunity to use Community Conservation Areas (CCAs) which recognizes the opportunity to use the potential compatibility of communal resource use and management conservation. A further initiative being driven by SANParks is the establishment of a new grassland PA in the Barkly East-Rhodes district of the Eastern Cape.

Biodiversity Stewardship is another essential weapon in the arsenal because the PA network in southern Africa, whilst fairly extensive (at least outside of the Grassland Biome), is insufficient to safeguard our critically important grassland biodiversity. It is recognized that in order to effectively conserve South Africa’s biodiversity, conservation efforts must focus outside of formally protected reserves, considering that some of the country’s most scarce and threatened habitats are privately owned. To this end, the National Stewardship Programme (Biodiversity Stewardship South Africa), also being rolled out in our provinces, is underway to secure (amongst other ecosystems), conservation-worthy grasslands (including temperate grasslands) on privately owned land. The aim is to get local landowners with viable tracts of conservation-worthy land to proclaim such areas as Nature Reserves (or according to less formal measures such as Protected Environments or Biodiversity Agreements), depending on the landowner(s). A large biodiversity stewardship-based project that is proving highly effective is the Enkangala Grassland Project, which aims to conserve 1.6 million hectares of moist, high-altitude (temperate) grassland spanning three provinces in South Africa using multiple NGO-based partners such as the Nedbank Green Trust and WWF-SA in collaboration with private land owners. It is a coordinated approach to sustainably utilizing these large, contiguous, relatively pristine grasslands through compatible land-uses (e.g. conservancies, stewardship, land acquisition, biosphere reserves, water catchment protection), by making use of a long-term conservation management strategy.

**Conclusion**

The constraints against improving the level of protection and conservation in the Grassland Biome relate largely to burgeoning population levels and high utilization by the agricultural (both for cropping and as commercial rangelands), mining, and forestry sectors. Furthermore, PAs within the Grassland Biome are relatively few, generally small and highly fragmented (with the exception of the UDP WHS). Opportunities for expansion into biologically meaningful, contiguous, mega-reserves (to sustain landscape-scale ecological processes) appear few, particularly given the impact of the transformers mentioned above. High gamma-diversity across our grasslands means that PAs also need to be located across the full extent of the biome, and not clustered into certain areas, to ensure that PAs are representative of all grassland biodiversity. A further constraint is that detailed information relating to informal conservation areas is lacking. No national registry or spatial database exists of these areas. These areas may be contributing meaningfully toward conservation goals and targets, but to what extent is currently unknown. No national standard for the certification and management of these areas has been set, so one can’t assume that all are well managed and therefore adequately safeguarding biodiversity.

Strategies to meet the conservation targets of the Grassland Biome need to recognize the complexities of implementing conservation actions across this landscape. The biome covers a vast area which straddles national boundaries, as well as several provincial and numerous local government boundaries. Much of the important biodiversity of the biome is on land that is privately or communally owned or under production. Transfrontier Conservation initiatives are hindered by politics and lack of funding. Meeting the biodiversity targets for the Grassland Biome requires a concerted conservation strategy that balances conservation and development agendas.
REFERENCES


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conservation status of temperate grasslands

Figure 1. The extent of the Grassland Biome (as defined by Mucina and Rutherford 2006) relative to the formal PA estate of southern Africa.

Figure 2. The four bioregions of the Grassland Biome in southern Africa (based on Mucina and Rutherford 2006).