

The functional importance of forbs in grassland ecosystems

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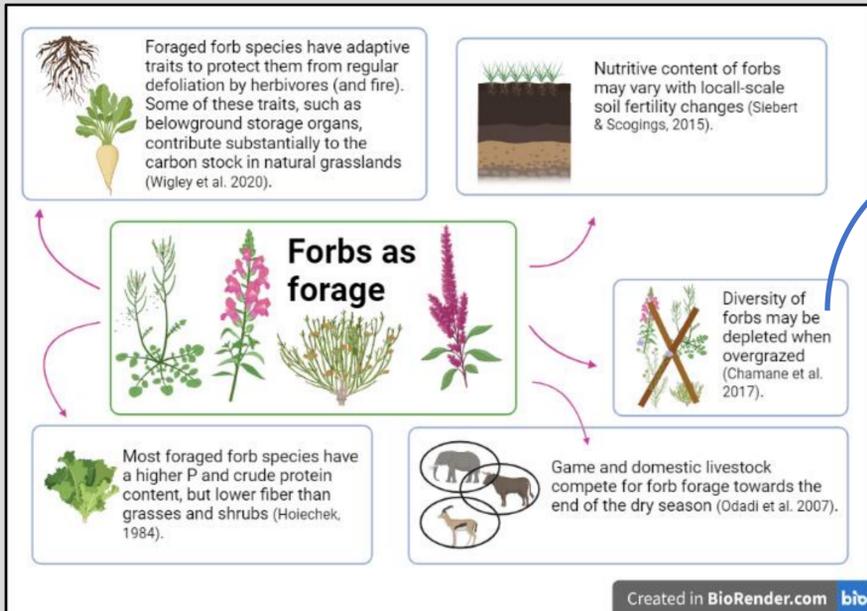


Introduction

Grasslands are much more than just grass. Forbs (i.e., the non-graminoid herbaceous component) represent the largest proportion of total species- and functional richness in grassland ecosystems, which secure important ecosystem functions. Here, we present some highlights of only some of the important functions provided by this hyper-diverse plant life form in Africa.

Forbs as nutritious forage

Forbs are important nutritive dietary components of several indigenous African browsers and mixed-feeders, as well as nutritious food items for livestock. Forb species, specifically members of the Fabaceae and Convolvulaceae contain higher levels of phosphorus and crude protein, but lower fibre content than shrubs or grasses.



Forbs as grazing indicators

Intense grazing reduces mesic grassland diversity (Fig. 1) by depleting forbs, especially erect species with their growing points exposed to defoliation and mechanical damage by trampling. Forbs that consistently decline (i.e., Decreasers) or increase (i.e., Increasers) with increasing grazing intensity are useful indicators for calculating a Forb Condition Index for grassland.

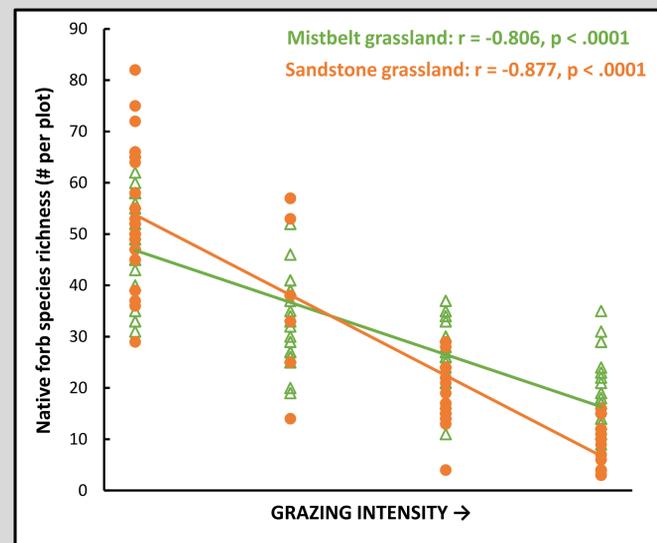


Fig. 1. Grazing reduces forb species richness in two mesic grasslands in South Africa.

Forbs maintain arthropod diversity

Forbs species provide important food sources and habitat for arthropods. When exogenous soil disturbance leads to a reduction in indigenous forb diversity, especially in agricultural and urban ecosystems, various measures of arthropod diversity decrease significantly (Table 1). Arthropod diversity measures are therefore good indicators to determine the level of disturbance in grassland.



Forbs in grassland ecosystems provide habitat and forage for various arthropod species.

Table 1. Hierarchical linear modeling (HLM) comparison of arthropod diversity between sites with or without indigenous forbs. Different superscripts indicate significant effect sizes ($d \geq 0.5$).

Diversity measures	Indigenous forbs		Residual variance	Transect variance	F-value	P-value
	Absent	Present				
Species richness	27.54 ^a	48.15 ^b	68.639	20.84	25.633	<0.001
Abundance	104.6 ^a	194.2 ^b	3636.92	982.84	10.604	<0.001
Margalef's species richness	5.729 ^a	9.001 ^b	1.618	0.67	26.94	<0.001
Shannon-Wiener Index	2.622 ^a	3.139 ^b	0.103	0.061	12.942	<0.001
Simpson Diversity Index	0.895 ^a	0.93 ^b	0.004	0.002	4.941	0.016

Forbs as food and medicinal plants

Some edible grassland forbs also have medicinal properties (Table 2). These are prone to extinction through ploughing and extensive harvesting of underground parts from mature and reproductive plants. Such forbs are rich in carbohydrates, macro- and micronutrients, proteins and vitamins that are essential for human health.



Pyrenacantha kaurabassana is one of the many forb species with multiple ecosystem functions: it is an indigenous leafy vegetable, and also contributes to the total carbon pool of grasslands through its large belowground tuber.

Table 2. Examples of indigenous leafy vegetables with medicinal properties.

Species name	Family	Growth habit	Underground part	Edible plant part	Part(s) used for medicine
<i>Albertisia delagoensis</i>	Menispermaceae	Climber, semi-woody	Rhizome	Leaves	Leaves, rhizome
<i>Ipomoea plebeia</i>	Convolvulaceae	Climber, herbaceous	Tuber	Leaves	
<i>Ipomoea wightii</i>	Convolvulaceae	Climber, herbaceous		Leaves	
<i>Limeum sulcatum</i>	Limeaceae	Perennial, forb		Leaves	
<i>Pyrenacantha grandiflora</i>	Icacinaeae	Climber, semi-woody	Rhizome	Leaves	
<i>Pyrenacantha kaurabassana</i>	Icacinaeae	Climber, semi-woody	Tuber	Leaves	Bulb
<i>Pyrenacantha scandens</i>	Icacinaeae	Climber, semi-woody	Rhizome	Leaves	
<i>Riocreuxia torulosa</i>	Apocynaceae	Climber, semi-woody	Rhizome	Leaves	
<i>Sesamum alatum</i>	Pedaliaceae	Annual, forb		Shoot tips	Leaves, seeds

Conclusions

There is increasing awareness of the important ecological role of forbs in grassland ecosystems worldwide. Grassland management should, therefore, not only be aimed at maximizing the productivity of grasses, but also at maintaining the diversity of forb species that provide multiple functions and services.

We strongly recommend the inclusion of forb functional traits and indices for the assessment and monitoring of the functional integrity of grassland ecosystems.

