



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Seasonal vegetation dynamics, goat foraging selectivity, and climate-resilient grazing strategies in semi-arid woodlands, northwestern Zimbabwe

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Abstract

Extensive goat production systems are central to rural livelihoods and ecosystem functionality in semi-arid rangelands, yet seasonal climate variability increasingly threatens forage availability, biodiversity, and pastoral sustainability. This study investigates how seasonal shifts in vegetation accessibility influence goat dietary selectivity, spatial foraging patterns, and adaptive grazing strategies within the teak woodlands of Lupane District, Zimbabwe. Using a mixed-methods design across seven wards, farmer surveys, vegetation quadrat assessments, GPS-based foraging site mapping, and direct behavioural observations were integrated to evaluate wet- and dry-season changes in browse/graze availability and goat feeding responses. Vegetation selectivity was quantified using Ivlev's Electivity Index, dietary diversity through the Shannon–Wiener Index, and seasonal dietary overlap via the Morisita–Horn Index. Results demonstrated significant seasonal differences ($p < 0.05$) in vegetation composition, forage accessibility, and goat behavioural responses. Wet-season conditions supported greater forage abundance and dietary diversity, with goats strongly selecting nutrient-rich browse species such as *Flueggea virosa* while primarily utilising open grassland habitats. In contrast, dry-season forage scarcity reduced accessible vegetation, prompting adaptive responses including intensified woody browsing, exploitation of fallen leaf biomass, and vertical foraging behaviours such as tree climbing, particularly on *Terminalia sericea*. Moderate dietary diversity ($H' = 1.0457$) combined with low seasonal dietary overlap (0.235) revealed substantial flexibility in forage utilisation under climatic stress. These findings position goats as highly adaptable components of multifunctional agro-silvo-pastoral landscapes, capable of sustaining livelihoods under variable environmental conditions while simultaneously exerting pressure on woodland biodiversity. The study highlights the importance of climate-smart grazing management, dry-season forage enhancement, and integrated rangeland governance to strengthen livestock resilience, conserve ecosystem services, and support sustainable land-use transitions in semi-arid regions. This research contributes practical evidence for designing resilient agro-ecosystems that align livestock productivity with biodiversity conservation and climate adaptation goals in the Global South.

Keywords: Behavioural plasticity, dry-season adaptation, ecosystem services, pastoral systems, rangeland governance