

Fire frequency drives habitat selection by a diverse herbivore guild impacting top-down control of plant communities in an African savanna

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Abstract

In areas with diverse herbivore communities such as African savannas, the frequency of disturbance by fire may alter the top-down role of different herbivore species on plant community dynamics. In a seven-year experiment in the Kruger National Park, South Africa, we examined the habitat use of nine common herbivore species across annually burned, triennially burned and unburned areas. We also used two types of exclosures (plus open access controls) to examine the impacts of different herbivores on plant community dynamics across fire disturbance regimes. Full exclosures excluded all herbivores >0.5 kg (e.g. elephant, zebra, impala) while partial exclosures allowed access only to animals with shoulder heights ≤ 0.85 m (e.g. impala, steenbok). Annual burns attracted a diverse suite of herbivores, and exclusion of larger herbivores (e.g. elephant, zebra, wildebeest) increased plant abundance. When smaller species, mainly impala, were also excluded there were declines in plant diversity, likely mediated by a decline in open space available for colonization of uncommon plant species. Unburned areas attracted the least diverse suite of herbivores, dominated by impala. Here, herbivore exclusion, especially of impala, led to strong declines in plant richness and diversity. With no fire disturbance, herbivore exclusion led to competitive exclusion via increases in plant dominance and light limitation. In contrast, on triennial burns, herbivore exclusion had no effect on plant richness or diversity, potentially due to relatively little open space for colonization across exclosure treatments but also little competitive exclusion due to the intermediate fire disturbance. Further, the diverse suite of grazers and browsers on triennial burns may have had a compensating effect of on the diversity of grasses and forbs. Ultimately, our work shows that differential disturbance regimes can result in differential consumer pressure across a landscape and result in heterogeneous patterns in top-down control of community dynamics.