Effect of Sheep Grazing and Rainfall on the Ecology of *Lasiurus sindicus*-Dominated Grassland in Hot Arid Zone of India

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Introduction

Thar Desert in India is very fragile owing to frequent drought and low rainfall which causes extreme stress on biodiversity of region especially on livestock due to limited seasonal grazing resources. Despite inhospitable and harsh climate, as well as anthropogenic pressures, Indian arid zone has 682 species belonging to 352 genera and 87 families. Some 63 species are introduced belonging to 37 genera and 9 families. Compared to other deserts of the world, this desert has higher number of endemic species, *i.e.* 6.4%. Poaceae and Leguminosae are the largest species. All these species have typical habitat-plant cover relationship resulting in major vegetation types on hills and rock outcrops, piedmonts and pediments, alluvial plains, saline flats, fresh water lakes/talavs, river and stream banks, sandy hummocky plains and sand dunes of varying shapes and sizes. CAZRI has been actively engaged since inception in assessing the status of natural vegetation, its distribution pattern, utilization trends, economic importance and degradation status at district as well as habitat level. Though fairly good understanding exists on progressive successional trends on major habitats but dynamics of retrogressive trends is poorly understood more so in varying rainfall scenarios. Hence, this study was taken up to understand these trends in respect of *Lasiurus sindicus*, a key grass species along with other associated species in Jaisalmer, in the extreme arid region of India.

Materials and Methods

To know the impact of grazing and rainfall variability on *L. sindicus*-dominated grassland, field experiment was conducted at Central Arid Zone Research Institute, Chandan Experimental Area, Jaisalmer and vegetation parameters were recorded on monthly basis from year 2012-2013. Five Treatments undertaken in the experiments were optimum carrying capacity (CC_o) grazing with animals provided with supplemental feed (T-2), without supplemental feed (T-3), double the carrying capacity (CC_d) grazing with animals provided with supplemental feed (T-4) and without supplement feed (T-5) and in control (T-1). Sequential observations were recorded on cover, density and height of plant following standard ecological methods of quadrat and line transact (Misra, 1968). Data was analyzed for composition and dominance following Muller Dombois and Ellenberg (1977).

Results and Discussion

Decline in *L. sindicus* cover and dominance was much less in paddocks where sheep grazing with supplemental feed (T-2, T-4) than without supplement feed (T-3, T-5). Irrespective of supplemental feed, 70-80% of *L. sindicus* cover was declined in paddock with CC_d (T-4, T-5) in two years. The variation in rainfall during monsoon period was evident from range of rainfall per day (0 to 88.0mm) and cumulative rainfall (133.5 mm for 2012; 164.9 mm for 2013). Changes in *L. sindicus* cover were intervened by the time, duration and quantity of rainfall. The trend of dominance or relative importance value (RIV) of *L. sindicus* indicated the consumption of companion vegetation such as *Ochthochloa compressa*, *Cenchrus biflorus* more passionately by sheep so much so that in companion vegetation cover /dominance declined

by 100% over 2-years period. In contrast, sheep in optimum carrying capacity (occ) and given supplemental feed nearly maintained the percent cover of *Lasiurus sindicus* though cover decline was 60-70% in paddocks grazed by sheep (occ) and not given supplemental feed. This decline however did not aggravate with passage of time due to adequate compensatory regeneration of this grass favoured by adequate rains in 2013.Thus, dominance (Relative Importance Value) of *L.sindicus* in all the four treatments over two years period either maintained (as in T-2) or increased by 50% in T-5, 200% in T-3 and 240% T-4. This indicated that companion vegetation was also consumed more preferentially over *L. sindicus* and though over all cover of *L.sindicus* declined, its RIV increased. Companion annuals and perennial grazable species, as mediated by rain, gives temporary or seasonal rest to *L. sindicus* when it grows and builds up cover and biomass. If rains were less or failed and grazing pressure continues unabated, companion grass, *Ochthochloa compressa* declined by 100% over two years both in terms of percent cover and dominance, trends in both being rain driven. The annual grass, *C. biflorus* followed similar trend. Severity of changes in *L. sindicus* became visible from number of tussocks per paddock over time in these treatments. Overall decline in number of tussocks was merely 10% in paddocks grazed twice the carrying capacity while it increased by 5-10% in paddocks subjected to optimum carrying capacity grazing. This was also confirmed by trends in dominance. Though tussocks stood on the ground, but because of overgrazing their regenerated biomass available for grazing declined by over 80% in all the four treatment.

Conclusion

Continuous grazing of *L. sindicus* rangelands drastically reduces its regeneration capacity, severity being more in double grazing pressure than optimum grazing. Dynamics of companion annuals and perennial grazable species, as mediated by rain, gives temporary or seasonal rest to *Lasiurus sindicus* when it grows and builds up cover and biomass. Being tussocky in nature, *L. sindicus* has shown resilience to climatic variability during two years time. This resilience is further strengthened by regeneration and availability of other palatable species. Resilience is strained more under twice grazing pressure than optimum as was evident from the increase in tussock density in optimum grazing. This also showed a favorable soil seed bank build up despite grazing and climatic variability. Though supplemental feed may have maintained / improved the health of grazing animals, the impact of grazing by animals with or without supplemental feed resulted in marginal differences in vegetation over two years time. Although resilience is showed by *L. sindicus* grasslands, it may be turned to barren landscape within three to five years by continuous grazing.

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