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(Thesis Title)

INFLUENCE OF CATTLE GRAZING AND GLADE AREAS ON INVERTEBRATE ASSEMBLAGES IN A SAVANNA ECOSYSTEM, NORTHERN KENYA

Thesis Abstract

Northern Kenya is a vast semi-arid area where large tracts of land are dedicated to ranching, conservancies and pastoralism. Various studies have been conducted in this region to understand how grazing influences the vegetation patterns, its composition and re-growth characteristics. However, few studies have been conducted on the effect that grazing has on invertebrate assemblages. This study therefore investigated the effect of cattle grazing on invertebrate assemblages within Lewa Wildlife Conservancy, and across glade patches established from areas that held kraals in past years.

Sampling of invertebrates was carried out across seasons over a ten month period using pitfall trap and sweep net, at a six-week interval, and the results obtained subjected to an analysis of variance. Vegetation data for plant community characteristics and biomass was collected using line intercept method. Soil was collected once during the study period in all the 45 plots to test for soil pH, nitrogen, bulk density and organic carbon. Soil pH was measured using a soil solution ratio of 1:5 (1 part soil to 5 parts 0.01M Calcium chloride), Total Nitrogen was measured using the Kjeldahl method, a

	soil auger and metal core rings were used to collect disturbed and undisturbed soil samples respectively and Organic Carbon content was measured using the Walkley and Black method. A total of 339 invertebrate species from 296 families were collected; pitfall trap method accounted for 200 species [59%] and sweep net method had 139 species [41%]. Of this total invertebrate collection, 160 families were from the order Coleoptera [54%] while Orthoptera, Hemiptera, Hymenoptera, Diptera, had 51 [17%], 33, [11%], 32 [11%], 20 [7%] families respectively. Invertebrate diversity and abundance were not significantly different across the three treatments; glades, grazing and control. Invertebrate species diversity had a p-value of 0.89 (α 0.05) and invertebrate species abundance a p-value of 0.70 (α 0.05) for invertebrates collected using sweep net method. Similarly, for invertebrate species collected using pitfall method, invertebrate diversity had a p-value of 0.60 (α 0.05) and invertebrate abundance a p-value of 0.34 (α 0.05) for those collected using pitfall method. However, when grouped into their different orders, invertebrate species revealed significant differences in abundance where $p = 0.03$. Invertebrate species from the order Coleoptera dominated in abundance in glades and grazed plots. A percentage count yielded results showing glades from the year 2010 having the highest percentage (24%) of insects compared to glades established in the other four years. Glades from the year 2009 and 2012 had the lowest invertebrate percentage count at 18% while those of the year 2008 and 2011 recorded similar invertebrate percentage count at 20%. However, these differences in percentage counts, across the years, were insignificant when analyzed using the chi-square method. Invertebrate species diversity was not significantly different across glades of different years, $p = 0.14$; $p = 0.15$, α 0.05, using sweep net and pitfall trap methods respectively, indicating evenness and similarity of invertebrate species across the glade patches. However, an analysis of variance on invertebrates collected across glades of different years, using pitfall method, revealed a significant difference on invertebrate species abundance ($p = 0.049$

α 0.05) and a post hoc Tukey test showed the source of variation emanating from plots of 2009 and 2010 glades.

Invertebrate species diversity and abundance were significantly different across seasons ($p = 0.00$, α 0.05) and invertebrate species abundance was higher in the wet seasons than in the dry one. Vegetation biomass was not significantly different across the three treatments but was significantly different across seasons ($p = 0.0009$ α 0.05), with the highest amounts of vegetation biomass occurring in the first wet season and the lowest amounts in the dry season. A negative and significant correlation was established between Diptera species and forbs biomass ($r = - 0.29$, α 0.05) and between Hemiptera species and perennials biomass ($r = - 0.26$, α 0.05). Other invertebrate species namely Hymenoptera, Coleoptera and Orthoptera did not significantly correlate to vegetation parameters, showing that vegetation has an indirect effect on these species.

There was a negative and significant relationship between invertebrate species from the order Coleoptera and soil bulk density ($r = - 0.52$, α 0.1) where control plots had the highest bulk density of 1.16 g/cm^3 and lowest numbers of Coleoptera species. Invertebrate species from the other orders, this are, Diptera, Hymenoptera, Hemiptera and Orthoptera, did not give significant correlations, indicating lack of a direct relationship between invertebrate species from those orders and the measured soil attributes.

From this study, invertebrate species patterns reveal important ecological trends in grazed conservancies and can therefore be used for ecological monitoring. Controlled grazing in such conservancies should be encouraged as it does not affect the ecological integrity for biodiversity conservation. Moreover, in practicing this, these conservancies will meet their corporate responsibility of supporting neighboring grazing communities.

Keywords: kraals, glades, grazing, invertebrates, savanna, cattle