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Nutrient dynamics in a semi-arid grazing land community of southern India

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Introduction Distribution and cycling of nutrients in various components of the ecosystem are very important aspects of ecosystem studies. Nutrients from plants are continuously transferred to the soil via litter, which acts as a reservoir for the plant communities of an ecosystem. The objective of this study was to ascertain the variation of Calcium (Ca), Magnesium (Mg) and Sodium (Na) in the vegetation components and to estimate the annual nutrient budget in grazed and ungrazed plots.

Materials and Methods The study area is located in the southern part of Tamil Nadu ($9^0$58' N; $78^0$10' E), at an altitude of 100m above mean sea level. Average monthly temperature ranges between 35.3 ^{0}C and 25.3 ^{0}C. The mean annual rainfall was 571 mm during the two years of the study. Twenty 50X50 cm quadrats were sampled randomly in grazed and ungrazed plots at monthly intervals. Litter was collected carefully from each plot. Root phytomass was evaluated by excavating soil cores of 25X25X30 cm. Soil samples (30 cm depth) were also taken at the same harvested plot for determination of soil nutrients. Ca, Mg and Na were estimated using an atomic absorption spectrophotometer. The transfer of nutrients between various compartments and the release of nutrients through root and litter disappearance were calculated following a balance sheet approach (Singh and Yadava, 1974).

Results and Discussion Nutrient concentration in various components of both grazed and ungrazed plots are shown in Table 1. Sodium concentration in all components in grazed plots was higher than in ungrazed plots. The trends of soil nutrients in grazed and ungrazed plots were in the following order: Mg>Ca> Na. Storage of Ca and Mg in various components was higher in the ungrazed plots, whereas Na was higher in the grazed plot, except in litter. The accumulation of nutrients in live shoots was in the order: Ca>Na>Na in both plots. The variation may be attributed to their relative requirements in the metabolic processes and to their availability in a semi-arid grazing land ecosystem.

Table 1. Nutrient (%) in the vegetation components (± S.E; n = 5). Values in parentheses are for ungrazed plots.

Components	Ca	Mg	Na
Live shoots	1.23 ± 0.14 (1.31 ± 0.15)	0.13 ± 0.03 (0.23 ± 0.02)	0.63 ± 0.13 (0.15 ± 0.02)
Dead shoot	0.67 ± 0.12 (0.76 ± 0.10)	0.21 ± 0.02 (0.17 ± 0.01)	0.40 ± 0.16 (0.15 ± 0.02)
Litter	0.82 ± 0.16 (0.80 ± 0.13)	0.21 ± 0.02 (0.20 ± 0.03)	0.25 ± 0.12 (0.17 ± 0.03)
Root	1.09 ± 0.11 (0.71 ± 0.09)	0.19 ± 0.03 (0.17 ± 0.02)	0.32 ± 0.11 (0.18 ± 0.04)

Total uptake of Na was higher in the grazed plots than in the ungrazed plots (Table 2). In the ungrazed plots, live shoots stored 50% of Ca, 42% of Mg, and 37% of Na. Relatively lower return of Na in the grazed plot indicates the possibility of their being retained in vegetation for reuse in the following season. Of the total ecosystem nutrients, less than 10% of Ca, 1% of Mg, and 7% of Na were channeled through biological circulation. In the ungrazed plots, less than 5% of nutrients were channeled, except for Ca, which accounted for 13% of the total. Nutrient cycling in a tropical grazing land at Maramalai showed less than 1% of Mg and 6% of Ca were chanelled through biological circulation (Karunaichamy and Paliwal, 2005)

Table 2. Net uptake, release and retention of nutrients (kg/ha/year) Values in parentheses are for ungrazed plots

Nutrients	Soil	Uptake	Retention	Release
Ca	1335 (1204)	123.3 (160.6)	62.0 (64.1)	61.3 (96.5)
Mg	5775 (8307)	17.3 (33.3)	6.3 (10.0)	11.0 (23.3)
Na	756 (785)	49.4 (29.5)	31.3 (5.8)	18.1 (23.7)

Conclusions Cycling of mineral elements in a semi-arid grazing land was regulated by both live shoot and root compartments, and root decomposition accelerated recycling.

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FOREWORD

Rangelands occupy approximately 3500 million hectares of land worldwide and 92 million hectares in Argentina.

Despite the advance of the agricultural frontier, over 70% of our country is occupied by rangelands, the original basis on which our productive systems were structured and the source of many goods and services of enormous environmental importance. For an overview of the importance of production, only the beef industry provides employment for nearly two million people whose first stage is largely natural grasslands, not to mention that goat and sheep production are developed almost entirely on these ecosystems.

Considering the environmental importance, it includes the regulation of watersheds, erosion control, maintenance of habitats for plants and animals, biodiversity, carbon sequestration and scenic value.

The fodder situation in Argentina is weakened, with extensive regions that show advanced erosive processes that affect their stocking rate. On this matrix, there was a phenomenon of decrease of more than 10 million hectares of rangelands in their areas of greatest potential for livestock; though the number of cattle grazing remains stable.

In this scenario, we need a tighter management of not only the stocking rate but also a greater knowledge of the structure and management of our rangelands. It is the role the National Government to study and develop technologies that preserve and make efficient animal production in natural grasslands, especially considering that on them rests the life of many small producers and indigenous people.

INTA, Technological Institute of the Ministry of Agriculture, Livestock and Fishing of the Nation, and the AAMPN will continue promoting the sustainable development of ecosystems of national and regional importance.

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