Nutrient cycling in a tropical grazing land ecosystem of southern India

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Introduction The nutrient component of any ecosystem operates in a dynamic state through a series of inputs and outputs of the essential elements. Nutrients from plants are continuously transferred to soil via litter formation, which act as a reservoir for the plants in an ecosystem. Most of the studies on nutrient budgets and flux rates have been reported in forest communities and to a lesser degree in grassland. The present study was, therefore, aims to understand the variation of calcium (Ca) and magnesium (Mg) in the vegetation compartments and to quantify annual budget by estimating the annual uptake from soil and its release to soil.

Materials and methods The study was conducted at Maramalai, Kanniyakumari District, Tamil Nadu ($8^0$10' N; $77^0$27' E). *Cympogon flexuosus* Watson is the major dominant species of the grazing land ecosystem. Aboveground vegetation was harvested at monthly intervals laying ten quadrats (50X50 cm) randomly. Litter was collected separately. In order to sample the root, three soil monoliths (25X25X30 cm) were excavated from the centre of each harvested quadrats. Soil samples were collected monthly by digging to 30 cm depths. Ca and Mg concentration in plant components and soil 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 Singh & Yadava (1974).

Results Nutrient content in plant components were maximum in the live shoot followed by litter, root and dead shoots (Table 1). Generally live shoots contain a greater amount of nutrients than the root. The decline of nutrient concentration from live shoot to dead shoot is a common phenomenon in temperate (Agrawal, 1988) as well as in tropical grazing lands (Karunaichamy, 2003). Nutrient levels may be attributed to their relative requirement in the metabolic process and to availability of the nutrients in the grazing land ecosystem. Mg concentration in root was positively correlated with soil moisture in different months as evident from the regression, Y=0.034+0.013X (r=0.88, P<0.05). Annual uptake and release of Mg was maximum followed by Ca (Table 2). From the total uptake, large amount of nutrients was channelled to live shoots than root. The amount of nutrients returned to the soil through root was more than litter decomposition. It is interesting to note that major portion of nutrients was retained by the soils. Less than 1% of Mg and 6% of Ca was channelled through biological circulation.

Table 1 Nutrient concentration (%) in various components (± SE; n = 5)

Nutrients	Live shoot	Dead shoot	Litter	Root
Ca	0.25 ± 0.03	0.17 ± 0.03	0.29 ± 0.04	0.22 ± 0.03
Mg	0.29 ± 0.02	0.18 ± 0.02	0.33 ± 0.06	0.28 ± 0.04

Table 2 Net uptake, release and retention of nutrients (kg/ha/yr)

Nutrients	Soil	Uptake	Retention	Release
Ca	166	102 (100)	88 (85.4)	15 (14.6)
Mg	1256	122 (100)	103 (85.0)	18 (15.0)

Values parenthesis is percentage relative to uptake

Conclusions The results of the present study demonstrate that cycling of Ca and Mg in a tropical grazing land at Maramalai is regulated by their greater accumulation in live shoots and slow recycling through decomposition. The present study clearly indicates that grazing land of this study area not only reduces the nutrient economy of the system but also slow down its circulation within the plant biomass. The lowest rate of transfer of nutrients from live shoots to dead shoots and the lower amount of nutrient releases through litter and root in the grazing land becomes clear.

References

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