Nutrient Dynamics in a Semi-Arid Grazing Land of Southern India

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Introduction Cycling and distribution of minerals in various compartments of the ecosystem is most important aspects ecosystem study . The semi-arid grazing land ecosystem at Madurai developed under short evolutionary grazing histories and low moisture regimes , in which grazing pressure has dramatic effects on plant community and biomass (Karunaichamy , 1992) . The objective of this experiment was to study the distribution of N , P and K in the vegetation components and to estimate the annual nutrient budget in grazed and ungrazed lands dominated *by Chrysopogon fulvus* (Spreng) Chiov .

Materials and methods The study area is located in the southern part of Tamil Nadu (9°58′N ; 78°10′E) at an altitude of 100m above mean sea level . Average monthly temperature ranges between 35 .3℃ and 25 .3℃ . The mean annual rainfall was 571 mm during the two-year study . Twenty quadrants of 50×50 cm were sampled randomly in grazed and ungrazed areas at monthly intervals . Litter was collected carefully from each plot . The root phytomass was evaluated by excavating soil cores of 25×25×30 cm . Soil samples (30 cm depth) were also taken at the same harvested plot for determination of soil nutrients . Total N and P in plant components and soil were digested and analyzed colorimetrically by an autoanalyzer . Potassium was 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 balance sheet approach (Singh and Yadava , 1974) .

Results The live shoot component showed higher content of N , P and K in the grazed plot (Table 1) . Live shoots contains higher nutrient content than other components . The trends of soil nutrient concentrations were in the following order K>N>P in both grazed and ungrazed areas . The maximum storage of nutrients was in lives shoots and root components . Content of N and K (mg/m^2) in live shoots showed a significant positive relationship with a linear combination of rainfall , air temperature and soil moisture in both grazed and ungrazed plot .

Table 1 *Nutrient (%) in the vegetation components (± S .E ; n=5) . Values in the parenthesis are ungrazed plot .*

Components	N	P	K
Live shoots	1 .85±0 .04(1 .67±0 .04)	0 .08±0 .01(0 .05±0 .00)	0 .75±0 .06(0 .94±0 .09)
Dead shoots	1 .60±0 .07(1 .49±0 .06)	0 .07±0 .01(0 .04±0 .01)	0 .49±0 .04(0 .59±0 .09)
Litter	1 .57±0 .08(1 .52±0 .08)	0 .03±0 .00(0 .04±0 .01)	0 .50±0 .09(0 .48±0 .08)
Roots	1 .64±0 .07(1 .36±0 .08)	0 .05±0 .01(0 .04±0 .00)	0 .59±0 .05(0 .59±0 .07)

Total uptake of nutrients in plant components was higher in the ungrazed plot than grazed plot (Table 2) . In the grazed plot , of the total ecosystem nutrients , less than 4% of N and 1% of P & K were channeled through biological cycling . About 95% of the nutrients remain in the root debris , organic matter and soil fractions . In the grazed plot , annual release of nutrients in litter and roots to soil was lower than the ungrazed plot .

Table 2 *Net uptake , release and retention of nutrient (kg/ha/year) Values in the parenthesis are ungrazed plots .*

Nutrients	Soil	Uptake	Retention	Release
N	5149(5286)	185(256)	91 .3(71 .7)	93 .7(184 .3)
P	905(991)	7 .2(7 .6)	4 .3(2 .6)	2 .9(5 .0)
K	5828(7566)	70 .9(124 .3)	37 .5(48 .3)	33 .4(76 .0)

Conclusions Cycling of mineral elements in a semi-arid grazing land was regulated by both live shoot and root compartments and faster recycling through root decomposition . Heavy grazing affects productivity and gives way to unpalatable species for invasion (*Barleria buxifolia* Linn .) .The present study clearly indicates that heavy grazing not only degrades the nutrient economy of the system but also slows nutrient cycling within the plant biomass .

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