NUTRIENT BUDGET OF *THEMEDA TRIANDRA* AND *HETEROPOGON CONTORTUS* DOMINATED GRASSLANDS OF TAMIL NADU IN SOUTH INDIA.

K. Paliwal and K. Manoharan
Ecology Unit, School of Biological Sciences, Madurai Kamaraj University, Madurai - 625 021, India.

ABSTRACT
Nutrient availability of a grassland mainly depends on the productivity of grasses. Total 3252.20 g/m^2/yr dry matter production was recorded in *Themeda* grassland. Annual uptake and return of nitrogen (31.10 g/m^2) phosphorus (3.08 g/m^2) and potassium (29.45 g/m^2) through litter and belowground biomass was higher in Themeda. *Themeda triandra* is better fodder grass than *Heteropogon contortus* in the Eastern ghats grasslands.

KEYWORDS
Nutrient cycle, production, system transfer, Eastern Ghats, Nutrient uptake.

INTRODUCTION
Nutrient cycling is an important parameter in determining the function of an ecosystem and involves flow of the elements between biotic and abiotic environments. The uptake of nutrients through root systems and their release via litter and root decomposition depends upon species, the stage of maturity and the rate of growth of the plants (William, 1964). Net primary production which can be divided into above and below ground parts, is the major energy path way in ecosystems and is crucial for constructing ecosystem budgets (Hansson and Andren, 1986). Hence, in the present investigation, an attempt has been made to study the *Themeda triandra* and *Heteropogon controtus* dominated grasslands in the Eastern Ghats of South India.

MATERIALS AND METHODS
Above ground vegetation was harvested monthly using a quadrate of 50 x 50 cm during study period (February 1987 to March 1988), care was taken not to harvest the same area twice.

Standing dead material was collected separately and litter was collected after harvest. Below ground biomass estimation was carried out by 25x25x30 cm monolith from the centre of harvested plot. The plant samples were separated and brought to the laboratory in polythene bags and processed for the vegetational analysis. Net primary productivity and system transfer function was estimated from the harvest data following Singh and Yadava (1974).

CHEMICAL ANALYSIS
Total nitrogen and phosphorus in plants and soil were estimated using a continuous flow auto analyser (Gradko International Ltd., U.K.). Potassium was determined by an atomic absorption spectrophotometer (Perkin-Elmer, Model 5000) following recommended guidelines for wavelength selections and linear working ranges.

Estimated nutrient content in the plant components were multiplied by respective standing crop phytomass. The nutrient content per gram dry weight of soil was multiplied by the bulk density and the results are expressed as g/m^2/30cm.

RESULTS
Abiotic and Biotic variables: *Themeda triandra* was distributed at higher altitude (1350 m) with low mean temperature (21.9° C) and high rainfall (780 mm). In contrast *Heteropogon controtus* was distributed at lower altitude (710 m) with high temperature (28.6° C) and low rainfall (610 mm). Sandy loam brown soil with high soil moisture was observed in *Themeda* dominated grassland whereas *Heteropogon* was found on sandy red soil with low soil moisture. Compared to *Themeda*, 45.1% aboveground live, 72.4% standing dead, 67.6% litter, 114.3% below ground, 51.7% dry matter production and 67.3% dry matter loss were observed in the *Heteropogon controtus* dominated grassland (Table 1).

Nutrient cycle: Soil nitrogen and potassium were higher in the *Themeda* dominated grassland which showed 14.5% and 11.8% increase of nitrogen and potassium respectively, whereas soil phosphorus was higher (156.3%) in the *Heteropogon* dominated grassland. Nutrient taken up by plants were higher in *Themeda* which showed 245%, 320% and 146% increase of nitrogen, phosphorus and potassium respectively. Compared to *Themeda*, 17% nitrogen 10.8% phosphorus and 32.9% potassium from litter and 35.3% nitrogen, 65.7% phosphorus and 54.3% potassium from belowground live were released to the soil in the *Heteropogon* dominated grassland (Fig.1).

DISCUSSION
Altitudional change is one of the factors to alter the vegetation type, productivity and nutrient cycling of an ecosystem, *Themeda triandra* dominated at higher altitude and *Heterpogon controtus* dominated at lower altitudes were influenced by the abiotic and biotic factors. Rainfall increased the soil moisture condition of the grasslands.

Similar observations were also noted by Pandya and Sidha (1987) and Miller (1987). Productivity was low in the *Heteropogon* dominated grassland which was due to high temperature with low rainfall, which affected the soil moisture. Low productivity leads to poor nutrient availability in the soil.

Compared to *Heteropogon*, nutrients taken up by plants were higher in *Themeda* dominated grassland, which accumulated major portion of nitrogen, phosphorus and potassium. More accumulation of nutrients in shoot, a result of high nutrient content and maximum biomass is a characteristic feature of tropical grasslands (Agrawal and Tiwari, 1987; Chaturvedi et al., 1988). The decrease of nutrient from live shoots to dead shoots is common in temperate (Callehans of Kucera, 1981) as well as tropical grassland (Chaturvedi et al., 1988), Nutrients returned through below ground live plant material and litter were higher in *Themeda* dominated grassland, was due to higher biomass production. Soil phosphorus was higher in the *Heteropogon* dominated grassland which may be due to poor utilization by the plant. Higher nutrient uptake increased the nutrient rich fodder in the *Themeda triandra* dominated grassland (Fig. 1). It is concluded that *Themeda triandra* is better fodder grass than *Hetropogon controtus* in the Eastern Ghats grasslands.

ACKNOWLEDGEMENTS
Financial support from the Ministry of Environment and Forests, Government of India to KP is gratefully acknowledged. We are also thankful to Miss P. Suguna for technical assistance.

REFERENCES
Agrawal, B. and S.C. Tiwari. 1987. Standing state and cycling of nitrogen in a Garhwal Himalayan grassland under grazing, burning and protection against herbage removal regimes. Proc. Indian Acad. Sci. (Plant Sci.)., **97**: 433 - 442.

Callahan, J.M. and C.L. Kucera. 1981. Magnesium flux and storage relationship in missouri tallgrass prairie. Am. Midl. Nat., **106:** 345 - 351.

Chaturvedi, O.P. A.K. Saxena and J.S. Singh. 1988. Structural and functional analysis of grazingland under pine forest in central Himalaya. Acta, Oecel./Oecol. Gener. **9:** 167 - 178.

Hansson, A.C., and O. Andren.1986. Belowground plant production in perrenial grassland(Festuca pratonsis hunds) assessed with different methods. Journal of Applied Ecology 23, 657 - 666.

Pandya, S.M. and V.K. Sidha. 1987. Seasonal variation in plant biomass and primary production in desert vegetation at Khavda of Kutch District (Gujarat). Trop. Ecol. 28: 57 - 68.

William, R.D. 1964. Assimilation and translocation in perennial grasses. Ann. Bot. **28**, 419 - 429.

Table 1
Abiotic and Biotic changes in the *Themeda* and *Hetropogon* dominated grasslands at Eastern Ghats of South India.

	Themeda triandra Dominated Grassland	*Heteropogon contortus* Dominated Grassland
Place	Sirumalai	Hogenakel
Elevation (m)	1350	710
Rainfall (mm)	780	610
Temperature (C)	21.9	28.6
Soil type	Sandy loam brown	Sandy, red
Soil moisture (%)	14.11	4.43
Aboveground live (g/m^2)	555.58	250.33
Standing dead (g/m^2)	472.60	342.21
Litter (g/m^2)	249.72	168.88
Belowground live (g/m^2)	311.48	356.06
Dry matter production (g/m^2/yr)	3252.20	1679.80
Dry matter loss (g/m^2/yr)	1564.50	1052.30

Figure 1
Compartments give an estimate of the net annual nutrient flux (g/m^2/yr) and arrows show the total nutrient (g/m^2/yr) input and output of the grazing land ecosystem.
T - Themeda triandra; H - Heteropogon controtus; N - Nitrogen; P - Phosphorus; K - Potassium.