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Below Ground Biomass of a Grassland Community of Kaptipada Forest Range of Mayurbhanj District in Odisha, India

D. L. Bhuyan[1], K. L. Barik[2*]

[1]Lecturer in Botany, Anandapur College, Anandapur, Keonjhar, Odisha, India

[2]Assistant Professor of Botany, North Orissa University, Takatpur, Baripada, Odisha, India

Corresponding Email : lochannou@gmail.com

ABSTRACT

The below ground biomass of a grassland community of Kaptipada forest range (21^0 51' N; 86^0 53'E) in Odisha was carried out following "short term harvest method" of Odum (1). The below ground biomass values of the experimental site exhibited an increasing trend from July to August and then attend a peak in the month of September (204.78 g m^{-2}). Onwards, a gradual decrease in value was observed showing a minimum of 18.90 g m^{-2} during April. Thereafter, the value again showed an increasing trend till the end of the sampling period. The maximum below ground biomass value of the community, when compared to other grassland communities, present study did not show similarity. This variation in below ground biomass value might be due to the variation in topography, species composition, climatic condition, soil characteristics and the biotic interference of the locality.

Keywords : Grassland, Community, Biomass, Below Ground.

I. INTRODUCTION

Grassland plays an important role for overall growth and development of herbivores. Besides, from the prehistoric times to till date, man has been dependent on the grasses for food, shelter and unani medicine. The knowledge about the below ground portion of various plant species is essential for analysis of functional aspects of a community. Literature review reveals a lot of information on below ground biomass of different herbaceous communities at various climatic regions by Odum (1), Ovington **et al.** (2), Wiegert & Evans (3), Dahlman & Kucere (4), Singh (5), Kelly **et al**. (6), Jain & Misra (7), Choudhury (8), Misra (9), Mall & Billore (10) , Singh & Ambasht (11), Trivedi & Misra (12), Rath (13), Tiwari (14), Pradhan & Das (15), Misra & Misra (16), Naik (17), Patnaik (18), Pradhan (19), Behera (20), Pucheta **et al.** (21), Barik (22), WenHong **et al.** (23), Fiala (24), Kar (25), Rout & Barik (26), Chawpattanayak & Barik (27), Dash & Barik (28) and many others. However, very little work has been made so far on the below ground biomass of a grassland community especially in the forest belt of Odisha.

1.1 Aim of the Study

The aim of this investigation is to study the below ground biomass of a grassland community of Kaptipada forest range of Mayurbhanj district in Odisha.

1.2 Study Site and Environment

The experimental site was selected at Kaptipada forest range (21° 51' N and 86° 53'E), situated at a distance of 56 kms away from North Orissa University and 52 kms from Baripada, the District headquarter of Mayurbhanj in the state of Odisha. The altitude of the site is above 135.7m. The experimental site was

protected from grazing and human interferences for a period of one year prior to start of this investigation. The climate of the locality is monsoonal with three distinct seasons viz. rainy (July to October), winter (November to February) and summer (March to June). The total rainfall during the study period was 1389.4 mm of which a maximum of 289.6 mm was recorded during July. The mean minimum and mean maximum atmospheric temperature was found to be normal. January showed the lowest temperature (13.37°C) whereas April experienced the highest temperature (41.21°C). The soil of the experimental site was found to be almost neutral. The available phosphorus content was high in upper soil and minimum in lower soil profile. The available potassium content was high in middle soil and minimum in lower soil profile. The organic carbon content of soil was found to be very low (29).

II. MATERIALS AND METHODS

Harvest method of Odum (1) was employed for the estimation of various compartmental biomass values. 10 quadrats of 50cm x 50cm size were randomly harvested / clipped, 1cm above the ground during the last week of each month. The samples were packed in polythene bags separately. The dead leaves, stems, seeds, flowers etc. lying on the ground, known as litter, were handpicked from each clipped plot, bagged and labelled. Roots including the remaining shoot bases were collected by excavating 25cm x 25cm monolith to a depth of 30cm at the centre of each clipped plot. All these samples were labelled properly and brought to the laboratory. All green plant materials were separated and referred as live green compartment. All yellow / yellowish brown dry plant materials known as standing dead were separated from the mother plant. The below ground portion containing root, rootstocks, rhizomes etc. were washed with low pressure tap water. Care was taken not to leave any plant material escape during processing. All these plant materials i.e. live green, standing dead, litter and below ground compartments were first dried in open and then transferred to an oven for drying at 80 ^{0}C for 24 hours and weighed. The biomass values were expressed as g m^{-2}.

III. RESULTS AND DISCUSSION

Fig - 1 shows the monthly variation in below ground biomass of the experimental site. It was observed that, the below ground biomass of the community gradually increased from July to August and then attend peaked in the month of September. Onwards, the value exhibited a decreasing trend and lowest during April. Again, an increasing trend of below ground biomass value was observed till the end of sampling period. A maximum of 204.78 g m^{-2} and a minimum of 18.90 g m^{-2} of below ground biomass value were observed during the month of September and April respectively. The rainfall, atmospheric temperature and relative humidity of the locality as well as the soil condition of the experimental site perhaps goes in favour of the growth and department of below ground parts of the plant as a result, from July to September and April to July, a gradual increase in below ground biomass value was observed. From September to April a gradual decrease in below ground biomass value was observed. This might be due to adverse climatic condition followed by decomposition of rhizoidal system of the plant in the community.

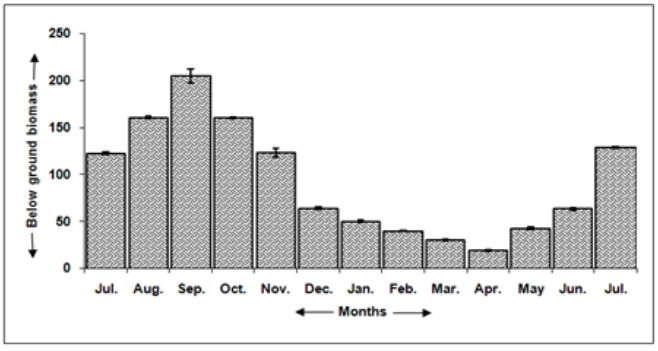

Fig -1 Monthly variation in below ground biomass value (g m^{-2}) of experimental grassland community during the study period (values are Mean ± SD, n=5 each).

Table-1 reveals the maximum below ground biomass of different herbaceous communities. On comparison the maximum below ground biomass of the present study did not show similarity with the others. The value was found to be higher than the values reported by Singh & Ambasht (11) and Patnaik (18) where as less than that reported by Ovington **et al.** (2), Wiegert & Evans (3), Dahlman & Kucere (4), Singh (5), Kelly **et al**. (6), Jain & Misra (7), Choudhury (8), Misra (9), Mall & Billore (10) , Trivedi & Misra (12), Rath (13), Tiwari (14), Pradhan & Das (15), Misra & Misra (16), Naik (17), Pradhan (19), Behera (20), Pucheta **et al.** (21), Barik (22), WenHong **et al.** (23), Fiala (24), Kar (25), Rout & Barik (26), Chawpattanayak & Barik (27) and Dash & Barik (28).

Table - 1. Maximum below ground biomass (g m^{-2}) of different herbaceous communities.

Author (s)	Location	Type of community (dominated)	Maximum below ground biomass
Ovington **et al**. (1963)	Cedar Creek	Prairie	669
Wiegert & Evans (1964)	South Michigan	Upland	685
Dahlman & Kucere (1965)	Missouri	Prairie	1901
Singh (1967)	Varanasi	*Dichanthium*	583
Kelly **et al.** (1969)	Tennessee	*Andropogon*	804
Jain & Misra (1972)	Sagar	*Heteropogon*	1537
Choudhury (1972)	Varanasi	*Dichanthium*	1009
Misra (1973)	Ujjain	*Dichanthium*	925
Mall & Billore (1974)	Ratlam	*Sehima*	873
Singh & Ambasht (1975)	Varanasi	*Heteropogon*	184
Trivedi & Misra (1979)	Jhansi	*Dichanthium*	436
Rath (1980)	Berhampur	*Aristida*	851
Tiwari (1986)	Garhwal	Himalaya	722
Pradhan & Das (1984)	Sambalpur	Savanna	256
Misra & Misra (1984)	Berhampur	*Aristida*	743
Naik (1985)	Rourkela	Mixed type	753
Patnaik (1993)	South Orissa	*Heteropogon*	170
Pradhan (1994)	Bhubaneswar	*Aristida*	736
Behera (1994)	Phulbani	*Heteropogon*	689
Pucheta **et al. (** 2004*)*	Argentina	*Deyeuxia*	1264
Barik (2006)	Berhampur	*Aristida*	644
WenHong **et al.** (2008)	China	Meadow	1385
Fiala (2010)	USA	Meadow	600
Kar (2012)	Rangamatia	Mixed type	738
Rout & Barik (2013)	Bangiriposi	*Cynodon*	630
Chawpattanayak & Barik (2015)	Rairangpur	*Chrysopogon*	616
Dash & Barik (2015)	Jharpokharia	*Chrysopogon*	698
Present Study	Kaptipada	Mixed type	205

IV. CONCLUSION

The below ground biomass value of the experimental grassland community of Kaptipada forest range of Odisha did not show similarity with other grassland communities of different location. This variation in below ground biomass might be due to the influence of topography, soil characteristic, species composition,

biotic interference and climatic condition of the locality.

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VI. REFERENCES

[1]. EP Odum, Organic production and turnover in the old field succession, Ecology, 41, (1960) 39-49.

[2]. J.D. Ovington, D. Heitkamp, D. B. Lawrence, Plant biomass and productivity of Prairie, Savana, Oakwood and Maize field ecosystems in central Minnesota. Ecol. 44, (1963) 52-63.

[3]. R.G. Wiegert, F.C. Evans,Primary production and the disappearance of dead vegetation in a old field in South-East Michigan, Ecol. 45, (1964) 49-63.

[4]. R.C. Dahlman, C.L. Kucera, Root productivity and turnover in native Prairie, Ecol., 46, (1965) 84-89.

[5]. J.S. Singh, Seasonal variation in composition, plant biomass and primary production in grassland at Varanasi, Ph.D. Thesis, BHU, Varanasi (1967).

[6]. J.M. Kelly, P.A. Opstrup, J.S. Olson, S.L. Auerbach, G.M. Vandyne, Models of seasonal productivity in eastern Tennessee. Festuca and Andropogn ecosystem, Oak Ridge National Lab. Report, 4310, (1969) 296.

[7]. S.K. Jain, G.P. Misra, Changes in underground biomass and annual increment in upland grassland of Sagar, Trop. Ecol., 13, (1972) 131-138.

[8]. V.B Choudhury, Seasonal variation is standing crop and net above ground production in Dichanthium annulatum grassland at Varasani, In : Tropical Ecology with an emphasis on organic production, P. M. Golley and F. B. Golley (eds.), Univ. of Georgia, Athens, (1972) 51-57.

[9]. C.M. Misra, Primary productivity of a grassland ecosystem at Ujjain, Ph.D. Thesis, Vikram Univ., Ujjain (1973).

[10]. L.P. Mall, S.K. Billore, Dry matter structure and its dynamics in Sehima grassland community. I. Dry matter structure, Trop. Ecol., 15, (1974) 108-118.

[11]. U.N. Singh, R.S. Ambasht, Biotic stress and variability in structure and organic (net primary) production of grassland communities at Varanasi, India. Torp. Ecol., 16, (1975) 86-95.

[12]. B.K. Trivedi, G. P. Misra, Seasonal variation in species composition, plant biomass and net community production of two grasslands in Sehima, Dichanthium cover type, Trop. Ecol., 20, (1979) 114-125.

[13]. S.P. Rath, Composition, productivity and energetics of grazed and ungrazed grassland of Berhampur, Ph.D. Thesis, Berhampur University, Berhampur, Orissa, India (1980).

[14]. S.C. Tiwari, Variation in primary production of Garhwal Himalayan grasslands, Trop. Ecol., 27, (1986) 166-173.

[15]. G.B. Pradhan, M.C. Das, Seasonal variation in plant biomass and net primary productivity of a Savanna type hill ecosystem of Sambalpur, India, Trop. Ecol., 25, (1984) 172-178.

[16]. M.K. Misra, B.N. Misra, Biomass and primary production in India grassland, Trop. Ecol., 25, (1984) 239-247.

[17]. B.K. Naik, Phytosociology and primary production of a natural grassland community of western Orissa. Ph.D. Thesis, Sambalpur University, Sambalpur, Orissa (1985).

[18]. S.K. Patnaik, Ecological studies of an upland coastal grassland of South Orissa. Ph. D. Thesis,

Berhampur University, Berhampur, Orissa, India (1993).
[19]. D. Pradhan, Primary production and phytosociology of a grassland community of Bhubaneswar. Ph. D. Thesis, Berhampur University, Berhampur, Orissa (1994).
[20]. B.K. Behera, Community structure, primary production and energetic of a grassland community of Boudh-Kandhamal (Dist-Phulbani) in Orissa, Ph D. Thesis, Berhampur University, Berhampur, Orissa (1994).
[21]. E. Pucheta, I. Bonamici, M. Cabido, S. Diaza, Below ground biomass and productivity of a grazed site and a neighbouring ungrazed exclosure in a grassland in central Argentina. Austral Ecology, 29, (2004) 201-208.
[22]. K.L. Barik, Ecological analysis of an upland grassland community of Eastern Orissa, India. Ekologia, 5:1-2, (2006) 137-150.
[23]. M. WenHong, Y. YuanHe, H. JinSheng, Z. Hui, F. JingYun, Above and belowground biomass in relation to environmental factors in temperate grasslands, Inner Mongolia. Sci. in China Series C-Life sci. 51:3, (2008) 263-270.
[24]. K. Fiala, Below ground plant biomass of grassland ecosystem and its variation according to ecological factors. Ekol., 29:2, (2010) 182-206.
[25]. P.K. Kar, Life from and primary productivity of a grassland community of Rangamatia (Dist-Mayurbhanj) in Orissa. Ph.D. Thesis, North Orissa University, Takatpur, Baripada, Orissa, India (2012).
[26]. P.K. Rout, K.L. Barik, Below ground biomass of a grassland community of Bangiriposi in Odisha. Int. J. of Adv. Res. in Sci. & Engi., 2:10, (2013) 251-255.
[27]. B.N. Chawpattanayak, K.L. Barik, Below ground biomass of a grassland community of Rairangpur in the district of Mayurbhanj, Odisha, Int. J. of Scientific Res. in Sci. & Techno., 1: 1, (2015) 85-89.
[28]. A. Dash, K.L. Barik, Standing crop biomass of a grassland community of Mayurbhanj District, Odisha, Int. J. of Scientific Research, 4:8, (2015) 319-321.
[29]. D.L. Bhuyan, K.L. Barik, Assessment of floral diversity of a grassland community of Kaptipada forest range of Mayurbahnj district in Odisha, India, Int. J. Scientific Research, 6:2, (2017) 663-665.