A Study of Primary Productivity on Grassland of Bilaspur District (Chhattisgarh) India

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Abstract- The Primary productivity of a grassland commune located at Kota of Bilaspur district, Chhattisgarh lies between 21°-47' to 23°_8' North latitude and 81°_14' to 83°_15' East longitude. A circular quadrate of 0.35 m^{-2} was used for sampling the above ground plant parts. The size of quadrate was determined by Species Area Curve Method. The grassland community comprised of 17 species (8 were grasses and 9 were non-grasses). *Bothriochloa Pertusa*,*Cynodon dactylon*, *Digitaria longiflora*, among the grasses and *Desmodium Triflorum*, *Parthenium* and *Sida cordifolia* among the non-grasses were found dominant during the study period. The annual grass production was found to be 3502.67 gm^{-2} /year. The non-grass production showed maximum in the month of January (128.20 gm^{-2}) and minimum in the month of June (1.95 gm^{-2}). The annual non-grass production was found to be 782.87 gm^{-2} /year. The study of primary productivity helps to recovery of the natural ecosystems to the earlier balanced state and continuation the biodiversity of grassland community in world.

Index Terms- Biomass, Live green, standing dead, litter, below ground

I. INTRODUCTION

The Indian grassland commune are totally depending upon the climatologically factors and various biotic interferences. Grassland were are important segment in the worlds productivity long before the advent of man and perhaps the extent of grassland will control man's diet population & habits in the future as it was for many other animals' (vandyneal alal 1978). Human activities have mainly affects the grassland all over the world and much of the area has been converted in to agricultural land. As a result of excessive human interference it is difficult to locate virgin grassland in our country. The grassland vegetation mainly consist of a number of perennial grasses mixed with legumes & fob's with the advent of the mansoon in June & fairly good number of special start their growth either through seeds or sporting rhizomes.

The rate of organic matter accumulation in plant tissue in excess of respiratory utilization refers to net primary production while the total weight of the living component present at any given time in the ecosystem accounts for the biomass. The customary approach in ecologically works is to evaluate production as a parameter of productivity as a functional aspect of the ecosystem has attracted much attention during recent year's and much information is available now on primary production & turnover parameters for grassland of tropical & temperate regions. The important contributions to the production relation of grassland communities of India have been revised by sing (1976) pandey (1977) Tiwary & sing (1981).

Litter decomposition is also important in terrestrial ecosystem for maintaining productivity because it regulates the availability of nutrients needed for plant growth. Mson (1977), distinguished there basic process of decomposition namely biological action withering and leaching, key factor affecting decomposition are the decomposer community and its complex nature swift et al 1979, litter quality Berg and Mc Claugherty 1989, Hooper and Vitousek 1998, Kalburtsi et al 1999, Moretto et al 2001, Ross et al 2002 and the physical and chemical characteristics of the environment vitousek et al 1994, Kalburtil et al 1997, 1998, Kaukoura 1998, 1999, Chen and stark 2000.

II. MATERIALS AND METHODS

CLIMATE CONDITION

Bilaspur was Sub tropical temperature remains moderate for most of the year a part from the summer from March to June which can be externally not approx. 45°C. The city receives about 1300 mm of rain mostly in the monsoon season from late to June early October winter last from November to January and are mild although low scan fall to 5°C (42 °F).

The soil of the experimental site was found to be moderately acidic (pH = 6.1). The percentage of soil phosphorus at the protected site remained more or less constant through the year. It ranged from 0.02 to 00.03 percent. The overall organic carbon (0.60%), the percentage of nitrogen in the soil ranged between 0.10 to 0.42% and available potassium (57 to 93 ppm).

Table-1: the pH, conductivity, organic carbon (%), available phosphorus and potassium content of the soil content of the study site (values are in mean ± SD, n = 5 each

depth in cm	pH	Conductivity	Organic carbon (C) (%)	Available phosphorus (P) (ppm)	Available potassium (K) (ppm)
0 to 10	5.15	0.41	0.56	0.65	92.53
10 to 20	6.20	0.32	0.64	0.48	85.47
20 to 30	6.95	0.32	0.60	1.11	57.54

III. SAMPLE COLLECTION AND IDENTIFICATION

PLANT SAMPLING-

- The monthly sampling for above ground biomass will be done in a random way in all the 3 parts of the grassland area by harvest method 3 Quadrates will be taken at each sampling site on each sampling date. The clipping of above ground parts will be done closed to the ground with the help of a scissor. The material will be separated species wise.
- The below ground plant parts will be collected, by monolith method (weaver and darland 1949) 3 Monolith of 25 x 25 x 30cm., will be taken at each site on each sampling time.

SOIL SAMPLE:

Composite soil samples will be collected every month.

PRODUCTIVITY STUDY:

The various parameters of biomass structure and function will be calculated from the sampled plant materials.

BIOMASS AND PRIMARY PRODUCTIVITY

The productivity for each category of plant materials i.e. live green, standing dead, litter and below ground parts was calculated by summing up of the positive increments of concerned biomass during the study period and was expressed as $gm^{-2}/year$.

Litter disappearance (LD) was calculated by subtracting the total net productivity of litter during the year from the difference between final and initial litter biomass (Golley, 1965).Below ground disappearance (BGD) was calculated from the difference between peak below ground biomass and succeeding minimum below ground biomass (Sims & Singh, 1971).Total disappearance was obtained by adding litter disappearance and below ground disappearance.

IV. RESULTS

The green biomass of grasses sedges increased continuously from 0.86 gm^{-2} may to a peak value of 258.31 gm^{-2} in October. The total above ground standing dead biomass in site was minimum 7.60 gm^{-2} in June & maximum 136.08 gm^{-2} in October. The total above ground biomass (green dead) in site increased from a minimum of 23.85 gm^{-2} in June to 422.71 gm^{-2} in October .The litter in site increased from January & reached its peak of 76.43 gm^{-2} in October the belowground biomass of both the sites decreased initially in the rainy season & than increased in site the peak value was 260.30 gm^{-2} in January

The total biomass of site increased from 45.50 gm^{-2} in June to 678.39 gm^{-2} in January where as it fluctuated throughout the year. The below ground/ above ground ratio in site ranged between 0.42 to 0.90.

Live green biomass (grasses, non grasses and total live green) of the study site. The green biomass did not show any trend. It attained a peak during October and minimum in month of May. The standing dead biomass also did not show any trend and the peak in the month of October (133.69 gm^{-2}). Minimum standing dead biomass was recorded in the month of May (4.36 gm^{-2}).Total above ground biomass is the sum total of live green biomass and standing dead biomass. It was found to be minimum in the month of May (5.12 gm^{-2}) and maximum during Oct0ber (406.97 gm^{-2}).

The litter biomass of the community exhibited an decreasing trend from January to May and increasing in June, September and October. There is no litter found in month of July and August. Thereafter the value showed a declined trend till May (18.09gm^{-2}). The litter biomass again showed an increasing trend showing a maximum of (76.43gm^{-2}) during the last sampling period i.e. in the month of October.

The sequence of monthly above ground biomass values showed similar trend to that observed in case of live green biomass values. The below ground biomass values decreased from January (260.3 gm^{-2}) to June (45.61 gm^{-2}) and onwards

the values showed gradual increased from July (58.64 gm^{-2}) to October (251.324). The total biomass of the community ranges from 54.34 gm^{-2} to 734.724 gm^{-2}. The maximum biomass was observed in October and minimum in the month of May.

The non-grass production showed maximum in the month of January (36.54 gm^{-2}) and minimum in the month of May (0.36 gm^{-2}). The annual non-grass production was found to be 134.01($gm^{-2}/year$). The total live green production showed their minimum and maximum value during May ($1.22 gm^{-2}$) and October (273.28gm^{-2}). Out of the annual net live green production (1326.13$gm^{-2}/year$) 89.89% was contributed by grasses and 10.11% by non-grasses. The standing dead production was found to be 659.29($gm^{-2}/year$)

Table- 2: Biomass (gm^{-2}) of different species during the study period.

Month	Live green			Standing dead	Litter	Above ground		Below ground	Total Biomass
	Grasses	Non grasses	Total			Lg + Sd	Lg + Sd + L		
Oct.	189.3	14.77	204.07	73.44	70.12	277.51	347.63	158.30	505.93
Nov.	143.79	14.93	158.72	109.52	72.30	268.24	340.54	168.5	509.04
Dec.	76.49	17.51	94	52.65	56.64	146.65	203.29	130.72	334.01
Jan.	144.18	36.54	180.72	105.42	64.34	286.14	350.48	260.3	610.78
Feb.	25.2 7	2.4	2.4	14.93	41.50	17.33	58.83	82.67	141.5
Mar.	7.10	1.39	8.49	4.40	36.30	12.89	49.19	57.26	106.45
Apl.	8.95	1.2	10.15	17.03	21.06	27.18	48.24	28.20	76.44
May.	0.86	0.36	1.22	4.36	18.09	5.58	23.67	30.67	54.34
Jun.	14.30	1.95	16.25	10.60	18.76	26.85	45.61	21.65	67.26
Jul.	38.43	4.21	42.64	19.26	--	61.9	61.9	58.64	120.54
Aug.	119.45	7.89	127.34	47.39	--	174.73	174.73	98.67	273.4
Sep.	195.14	11.71	206.85	66.60	45.32	273.45	318.77	197.34	516.11
Oct.	254.13	19.15	273.28	133.69	76.43	406.97	483.4	251.324	734.724
Total	**1192.12**	**134.01**	**1326.13**	**659.29**	**520.86**	**1985.42**	**2506.28**	**1544.24**	**4050.524**

Table- 3: Total annual net primary production $gm^{-2}/year$ of different grassland community

Author(s)	Year	Location	Type of community(Dominance)	NPP ($gm^{-2}/year$)
Ambasht *et al.*	1972	Varanasi	Dichanthium	1420
Varshne	1972	New Delhi	Heteropogon	1330
Singh & Yadav	1972	Kurukhetra	Panicum	2980
Mishra	1973	Ujjain	Dichanthium	989
Billore & Mall	1977	Ratlam	Sehima	846
Misha	1978	Berhampur	Aristida	1447
Malana	1981	Berhampur	Aristida	1180
Pradhan	1994	Bhubaneswar	Aristida	1474
Behera	1994	Phulbani	Heteropogon	809
Barik	2006	Berhampur	Aristida	929
Pramod ku. kar	2013	Rangamatia	Mixed Type	6403
Present study		Bilaspur	Mixed Type	989

V. GENRAL DISCUSSION

The annual net above ground production of this grassland, it was observed that the present value showed 989$gm^{-2}/year$. The litter production of the community was evident from January to May and from September to December. No litter production was observed during June, July and August. This may perhaps be due to rapid decomposition of litter.

The rain fall, atmospheric temperature and soil condition were found to be suitable for the growth and development of all species so that September exhibited peak value. Onwards the amount of rain fall, atmospheric temperature along with the soil condition might not be favourable for the growth of vegetation as a result of which a gradual declined in green biomass was observed till to the end of the sampling period.

VI. NET PRIMARY PRODUCTION

Table-3 gives the annual, net primary production of some Indian grassland. It indicates that the net production in this study was no way similar to the findings of other workers as reported earlier. It showed marked higher value compared to the findings of Ambasht ***et al***. (1972), Varshney (1972), Singh & Yadava (1972), Misra (1973), Billore & Mall (1977), & Misra (1978), Malana (1981), Pradhan (1994), Behera (1994), Barik (2006) and Pramod kumar kar(2013). It was observed that rain fall was not a single factor responsible for this variation. There were some other factors including rain fall that influenced the net production in the community. It might be due to phenology of the species, rate of evaporation, temperature variability, fertility of soil etc.

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