STRUCTURE AND DYNAMICS OF A DRY TROPICAL GRASSLAND COMMUNITY IN INDIA.

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ABSTRACT

Grasslands are anomalies in the context of world vegetation units. They cover as much as 25% of the earth's surface. Basing upon the ecological and economical point of view grassland plays a very important role. The characteristic features pertaining to structural and functional aspects of a community are essential for any in-depth studies relating to ecology of a place. It provides the knowledge to interpret the ecological imbalance and builds up a picture of the type of vegetation of an area. Although such studies seem to be classical yet, it forms the core of ecological research pertaining to vegetation analysis. Some work has been done on the grassland communities especially in the eastern region of the country. So an attempt has been made to assess the structure and dynamics of a dry tropical grassland community in the Northern part of India and also compared the other grassland community. This study helps to analyze the statistical data and co-relating the findings with other grassland communities of various climatic regions. The task of recovery the biodiversity and natural ecosystems to the earlier balanced state and its preservation has new posed a formidable challenge to all section of the ecologist and environmentalist all over the world.

***Key words*:** dynamics, grassland community, biodiversity

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INTRODUCTION

The structure and dynamics of grassland ecology in India is not very different from that of any other countries in the West. Indeed it has been much influenced by western school which provides the leadership. Ecological investigation in India also provided enough opportunity for Botanical exploration. Indian ecology was developed under the leadership of R. Misra first in Sagar and later at Varanasi by the leadership of R. S. Ambasht. Consequently many school of ecology emerged at Ujjain, Ahmedabad, Pilani, Jodhpur, Pondichery, Berhampur and at many other places of India. Misra (1958) summarized ecological work done in Madhya Pradesh. Misra and Singh (1971) reviewed the progress of ecology in India. Sharma and Ambasht (1987) reviewed the ecological research in Indian Universities.Ecological status of Indian grassland community is mainly controlled by biotic activities as a result of which, the community gradually changes its composition partially or completely. Champion (1936) stated that the grassland in India is stable pre-climax vegetation as a result of impact of fire and grazing. Whyte (1974) reported that most of the grasslands are of seral in nature and belongs to territory communities. Misra (1983) reported that all tropical grasslands of India are of savanna type, a kind of grass dominated land besiege with isolated growth of shrubs or trees at wide intervals and have changed from mesic to xeric in nature during the past few decades.An appreciable amount of work has been done in temperate zone as revealed by the literature survey pertaining to the structure and function of grassland ecosystems. Very few data are available on tropical grasslands, especially in India. With respect to phytosociology, reproductive capacity, production in relation to a variety of ecological factors especially grazing was studied by Sant (1962 & 1965), Singh (1967), Choudhury (1964), Ambasht and Maurya (1970), etc. Ambasht *et al.* (1972) studied the primary production and turnover in certain protected grasslands of Vanarasi and Varshney (1972) studied on the productivity of Delhi grasslands. Singh and Yadava (1974) studied the seasonal variation in composition, plant biomass and net primary productivity of a tropical grassland at Kurukshetra. Singh and Ambasht (1975) reported inter-relationships among community structure and productivity. Billore and Mall (1977) made extensive studies on the biomass structure and nutrient dynamics especially on grazing land of Ujjain. Singh *et al.* (1979) analyzed the photosynthetic structure in relation to organic matter production of grassland community. Singh and Ambasht (1980) worked on the floristic composition and phytosociology of three grass strands in Naugarh forest of Vanarasi division. Ambasht and Singh (1980) worked on the productive status of grasslands in deciduous forests of Vindhyan hills. Ambasht and Pandey (1981) analyzed the seasonal changes in the phytosociological and productive structure of two strands of *Aristida cyanantha*. Misra (1983) has given a detailed account of Indian Savannas. Ram and Ramakrishnan (1988) studied hydrology and soil fertility of some degraded grasslands at Cherapunji of Meghalaya. Ambasht and Sharma (1989) reviewed fifty years of ecological research of Banaras Hindu University. Umashanker (1991) analyzed the nutrient cycling in degraded grassland ecosystem of Meghalaya. Ram and Arya (1991) worked on the plant forms and vegetation dynamics of an alpine meadow of Central Himalaya. Whereas Umashankar *et al.* (1991) studied the structure and seasonal dynamics of a humid tropical grassland in India. The rain fall and grazing effects on net primary production in a tropical savanna was analyzed by Pandey and Singh (1992).Umashanker *et al.* (1993) studied the phytomass dynamics and primary productivity of a humid grassland. Ram and Ramakrishnan (1992) worked on the fire and nutrient cycling in grasslands of Cherrapunji in North Eastern India.

MATERIALS AND METHODS

The experimental site was selected at Rangamatia, inside the Similipal Biosphere Reserve, situated at a distance of 15 kms away from North Orissa University and 11 kms from Baripada, the District headquarter of Mayurbhanj in the state of Orissa. It is located at 86^0 41' E longitudes and 21^0 56' N latitude. The altitude of the site is above 135.7m.The experimental site was protected from grazing and human interferences for a period of 1 year prior to start of the 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 this period was 1906.2 mm of which a maximum of 499.8 mm was recorded during July. The minimum and maximum atmospheric temperature during the study period was found to be normal. December showed the lowest temperature (9.93 ^{0}C) whereas May experienced the highest temperature (38.9^{0}C).The wind velocity was maximum (4.31 km h^{-1}) during April and minimum (1.99 km h^{-1}) in the month of November. The soil of the experimental site was found to be moderately acidic (pH = 5.5). The available phosphorus content was high (1.2 ppm) in lower soil and minimum (0.5 ppm) in middle soil profile. The potassium showed gradual reduction from surface (100.3 ppm) to middle (87.6 ppm) and then to lower (81.1 ppm) soil depth. The overall organic carbon (0.61%), nitrogen based on organic carbon content (0.5 to 0.75%), and available potassium (59 to 140 ppm) were found medium where as the available phosphorus content was found to be very low (< 2 ppm) in the soil. Harvest method of Odum (1960) was employed for the estimation of plant biomass. 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 labeled. Roots including the remaining shoot bases were collected by excavating 25cm x 25cm monolith to a depth of 30cm at the center of each clipped plot. All these samples were labeled properly and brought to the laboratory. All these materials i.e. live green, standing dead, litter and below ground compartments were first dried in open and then transferred to the oven for drying at 80^{0}C for 24 hours and weighed. The biomass values were expressed as g m^{-2}.

RESULTS

The structural attributes i.e. frequency, density, abundance etc. of the experimental grassland community were determined month wise 1m x 1m size quadrats was used for this study as determined by species area curve. *Cynodon dactylon*, *Digitaria abludens*, *Eleusine indica*, *Vetiveria zizanioides* among the grasses and *Phyllanthus fraternus* and *Sida cordifolia* among the non - grasses exhibited higher percentage of frequency throughout the sampling period. The community represented high density value (3439.8 Ind m$^{-2)}$ in the month of September. The density value of the community showed gradual decline in trend from December to January, then to February, March and lowest in the month of April. Thereafter the value increased from April to May, June, July, August and then to September. Again a declined trend of density value was observed from September to December. In Table 1 the grasses showed highest density values as compared to that of the density of non-grasses. The grasses showed higher importance value index (IVI) than that of the non - grasses. The grasses contributed lowest IVI in the month of September (154.839) and non-grasses in the month of April (59.396). The IVI for grasses gradually increases from December to April and then it declined up to September and onwards it showed again an increasing trend till to the end of the sampling period. However, the IVI of non - grasses showed an opposite trend i.e. the value decreases from December to April, then an increasing trend of values were marked from April to September. Thereafter it decreases till to the end of the sampling period. The grasses exhibited peak IVI in the month of April (240.591) and non-grasses in the month of September (145.146).The density based diversity index showed, the highest diversity index value during August (1.325) and lowest in the month of April (0.661). The value gradually decreased from January to April and then it started increasing till August. Thereafter the value exhibited a decline trend till to the end of the sampling period. The dominance index based on density value on the other hand showed an opposite trend compared to diversity index value. The dominance value was maximum in April (0.243) and minimum in August (0.066). Fig. 1 showed a negative correlation was found between diversity and dominance indices ($r = -0.983$, $p = 0.001$).Sequential harvest method was employed for the determination of biomass in the last week of every month. The live green biomass (grasses, non grasses and total live green) of the study site showed gradual declined in trend from December to January, February, March and lowest in the month of April. Thereafter it increased and attained a peak during September and onwards a gradual decreased in trend was observed till to the end of the sampling period.The standing dead biomass gradually decreased from December to June and onwards, the value started an increasing trend and showed the peak in the month of December (181.56 g m^{-2}). Minimum standing dead biomass was recorded in the month of June (5.5 g m^{-2}).The litter biomass of the community exhibited an increasing trend from December to January, February, March, April and May. Thereafter the value showed a declined trend till August (65.08 g m^{-2}).The litter biomass again showed an increasing trend showing a maximum of 108.08 g m^{-2} during the last sampling period i.e. in the month of December. 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 April (423.35 g m^{-2}) and maximum during September (6005.68 g m^{-2}). 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 December (274.76 gm^{-2}) to April (46.42 g m^{-2}) and onwards the values showed gradual increased in trend till September (737.8 g m^{-2}) and then decreased till December.In Fig. 2 the total biomass of the community ranges from 469.77 g m^{-2} to 6743.48 g m^{-2}. The maximum biomass was observed in September and minimum in the month of April. A gradual decrease in total biomass value was found from December to April, then the value started increasing showing a peak during September and onwards the value again followed a decreasing trend till to the end of the sampling period. The primary productivity of 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. Grass production was found to be minimum during May (49.57 g m^{-2}) and maximum in the month of July (1274.09 g m^{-2}). The production of grass exhibited an increasing trend from May to June and then to July. Thereafter the value declined till September. The annual grass production was found to be 3289.53 g m^{-2} yr^{-1}. The non-grass production showed maximum in the month of June (868.55 g m^{-2}) and minimum in the month of September (141.11 g m^{-2}). The annual non-grass production was found to be 2246.10 g m^{-2} yr^{-1}.In Fig 3 the total live green production showed their minimum and maximum value during May (249.00 g m^{-2}) and June (2041.89 g m^{-2}). Out of the annual net live green production (5535.63 g m^{-2} yr^{-1}) 59.42% was contributed by grasses and 40.58% by non-grasses. The standing dead production was found to be 176.06 g m^{-2} yr^{-1}. The rate of production was nil during December to June. July and onwards continuous production of standing dead was observed showing a maximum of 40.81 g m^{-2} during October. Litter production was nil during June, July and August showing in Fig. 3.The net annual litter production was 85.72 g m^{-2} yr^{-1}. Net above ground production was found to be 5711.69 g m^{-2} yr^{-1} of which June showed a maximum of 2041.89 g m^{-2}.The production was found to be nil in the month of January, February, March and April. The net above ground production exhibited a gradual declined in trend from June December showing a minimum of 17.44 g m^{-2} of production. A maximum of 236.55 g m^{-2} of below ground production was observed during June. Then the rate of production gradually decreased till September. A minimum of 23.71 g m^{-2} of production was observed in the month of May. Total below ground production was found to be 691.38 g m^{-2} yr^{-1}.Total net production (6403.07 g m^{-2} yr^{-1}) was derived by adding the above ground net production (5711.69 g m^{-2} yr^{-1}) and below ground net production (691.38 g m^{-2} yr^{-1}). Gross primary production of the community was found to be 8323.99 g m^{-2} yr^{-1}. This was derived by adding respirator loss (1920.92 g m^{-2} yr^{-1}) to total net production of the community. About 89.22% of the total net production remained in the above-ground parts and about 10.78% directed towards belowground parts. From the above ground net production 0.48 g m^{-2} day^{-1} was transferred to standing dead. The transfer rate from standing dead to litter was 0.23 g m^{-2} day^{-1}. The rate of disappearance of litter and below ground were 0.03 g m^{-2} day^{-1} and 1.25 g m^{-2} day^{-1} respectively. The total disappearance of organic matter was at the rate of 1.28 g m^{-2} day^{-1} or in other words about 7.34% of the total net production was lost annually. The transfer function of above-ground net production (0.89) was 8.09 times higher than that of belowground net production (0.11). It was also observed that the transfer function of aboveground net production to live green production and standing dead production were 0.97 and 0.03 respectively. The system transfer function of standing dead to litter production was found to be 0.49. The disappearance of belowground (0.66) was high compared to litter disappearance (0.15). The above ground net live green production to standing dead production (0.03) was found to be very less among the other components of the community. The turnover rates of non-grasses were found to be maximum (98.01%) as compared to that of grasses (90.81%). Among the components of the community i.e. livegreen, standing dead and below ground the turnover rate was not significantly different from each other (93.60%, 96.97% and 93.71% respectively).The litter component showed less turnover rate (79.31%) in the community. The turnover time of livegreen non-grasses on the other hand exhibited one month less compared to livegreen grasses i.e. grasses showed turnover time of 13 - 14 months and the non-grasses showed 12 - 13 months. The turnover time of the livegreen, standing dead and below ground did not show any differences (i.e. 12 - 13 months in each) whereas the litter component exhibited a maximum turnover time (15 - 16 months) among the components of the community.

DISCUSSIONS

Table-1, 2 and 3 showed the mean values of live green, standing dead and litter biomass respectively for different communities reported by various workers in specific climatic regions. Comparisons of these data showed that, in the present findings live green biomass and did not show any similarity with the data of others. It was found to be very high compared to the finding of most of the workers (Porter, 1967; Kelly *et al.*1969; Vershney, 1972; Mall & Billore, 1974; Misra, 1978; Trivedi & Misra, 1979; Naik, 1985; Behera, 1994 and Barik, 2006). Standing dead biomass was found to be less to that of grasslands of South Carolina(Golley,1965),Tennessee (Kelly *et al.*1969), Varanasi (Choudhury,1972), Ujjain (Misra,1973), Ratlam (Mall& Billore,1974) , Berhampur (Misra,1978 and Barik, 2006), Jhansi (Trivedi&Misra, 1979), and Phulbani (Behera,1994). However, it was high than the value reported by Patnaik (1993). Litter biomass, on the other hand showed somewhat similar to the *Heteropogen* grassland of chakia (Singh & Ambasht, 1975) and *Aristida grassland* of Berhampur studied by Barik (2006).Table-4 showed the maximum belowground biomass of various communities in different climatic regions. Here also an attempt was made to compare the present findings with that of other grassland types. The value showed somewhat similarity with the grassland of Berhampur (Misra, 1978; Malana, 1981) and Bhubaneswar (Pradhan, 1994). The maximum biomass value was found to be less than the value obtained by Dahlman & Kucera (1965), Jain & Misra (1972), Choudhury(1972) ,and Misra(1973)and high from the findings of Ovington *et al.* (1963), Sing & Ambasht(1975), Behera(1994) and Barik (2006).

Various compartmental biomasses i.e. the live green biomass with standing dead biomass and standing dead biomass with litter biomass were not significantly related. Whereas livegreen grass biomass and livegreen non-grass biomass, livegreen biomass and below ground biomass, total above ground biomass and below ground biomass showed interdependence.

Net primary production

In the present grassland community the net primary production was calculated to be 6403.07 g m^{-2} yr^{-1}, of which above ground parts contributed 5797.41 g m^{-2} yr^{-1} and the below ground parts contributed 691.38 g m^{-2} yr^{-1}.Table-5 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) and Barik (2006). 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.

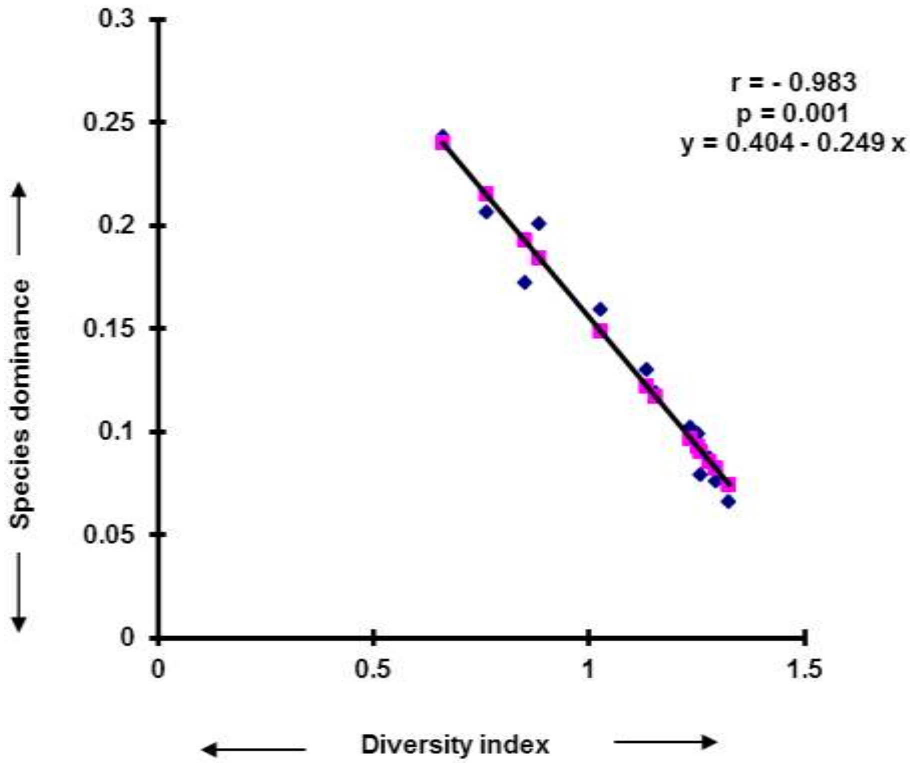

Fig - 1. Relationship between diversity index and dominance index based on density value during the study period.

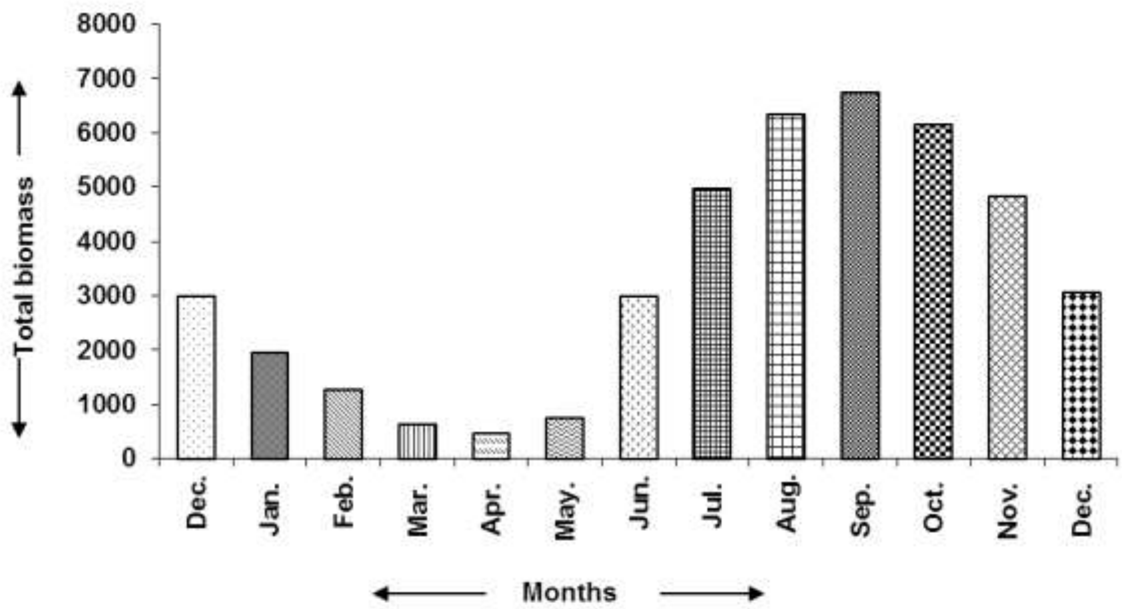

Fig. - 2. Monthly variation in total biomass (g m^{-2}) during yhe study period.

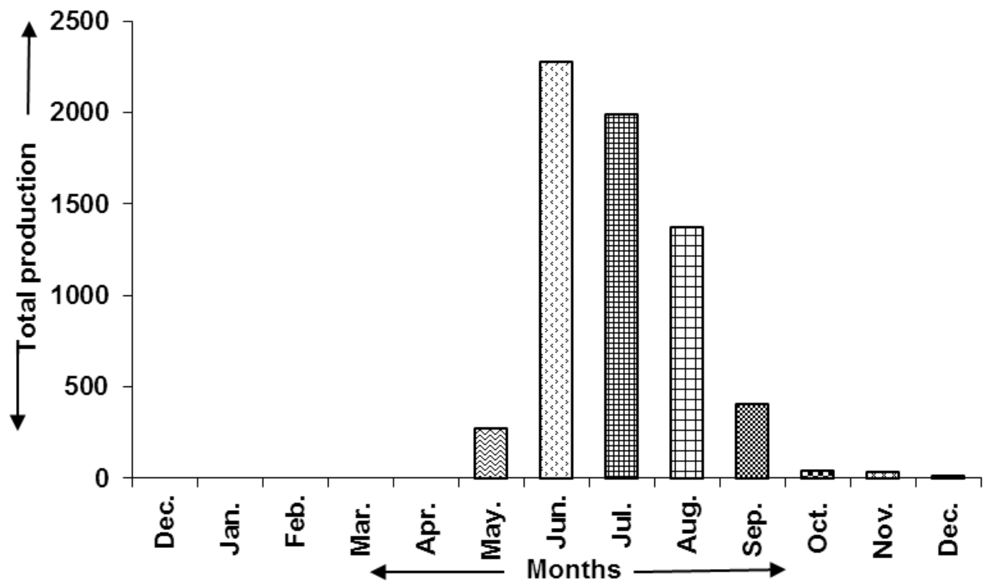

Fig. - 3. Monthly variation in total production(grasses and non-grasses)

Table - 1. Mean above-ground live green biomass (g m^{-2}) of different herbaceous communities.

Author (s)	Year of Study	Location	Type of community (dominated)	Mean live green biomass
Golley	1965	South Carolina	*Andropogon*	90.95
Porter	1967	South Florida	*Muhlenbergia*	119.40
Kelly ***et. al.***	1969	Tennessee	*Andropogon*	219.10
Vershney	1972	New Delhi	*Heteropogon*	333.80
Mall & Billore	1974	Ratlam	Sehima	104.10
Misra	1978	Berhampur	*Aristida*	342.70
Trivedi & Misra	1979	Jhansi	Sehima	197.60
Naik	1985	Rourkela	Mixed type	516.90
Behera	1994	Phulbani	*Heteropogon*	333.50
Barik	2006	Berhampur	*Aristida*	441.30
Present study		Rangamatia	Mixed type	2886.20

Table - 2. Mean above ground standing dead biomass (g m^{-2}) of different herbaceous communities.

Author(s)	Year of study	Location	Type of community (dominated)	Mean standing dead biomass.
Golley	1965	South Carolina	*Andropogon*	335
Kelly *et al.*	1969	Tennessee	*Andropogon*	650
Choudhury	1972	Varanasi	*Dichanthium*	129
Misra	1973	Ujjain	*Dichanthium*	164
Mall&Billore	1974	Ratlam	Sehima	190
Jain	1976	Sagar	*Heteropogon*	338
Pandey	1978	Varanasi	*Aristida*	845
Misra	1978	Berhampur	*Aristida*	232
Trivedi&	1979	Jhansi	Sehima	104

Misra Patnaik	1993	South Orissa	*Heteropogon*	073
Behera	1994	Phulbani	*Heteropogon*	179
Barik	2006	Berhampur	*Aristida*	272
Present study		Rangamatia	Mixed type	095

Table- 3. Mean litter biomass of different herbaceous communities (g m $^{-2}$).

Author (s)	Year of study	Location	Type of community (dominated)	Mean litter biomass
Odum	1960	South Carolina	Forb	300
Ovington ***et al.***	1963	Minnesota	Prairie	279
			Savana	1,365
Wiegert&Evans	1964	Michigan	Poa,Upland	202
Golley	1965	South Carolina	*Andropogon*	250
Choudhury	1972	Varanasi	*Dichanthium*	098
Misra	1973	Ujjain	*Dichanthium*	225
Singh&Ambasht	1975	Chakia	*Heteropogon*	065
Misra	1978	Berhampur	*Aristida*	057
Trivedi &Misra	1979	Jhansi	Sehima	044
Rath	1980	Berhampur	*Aristida*	055
			Aristida (Grazed)	034
Patnaik	1993	South Orissa	*Heteropogon*	062
Behera	1994	Phulbani	*Heteropogon*	049
Barik	2006	Berhampur	*Aristida*	065
Present study		Rangamatia	Mixed type	068

Table- 4. Maximum belowground biomass (g m^{-2}) of different herbaceous communities.

Author (s)	Year of study	Location	Type of community (dominated)	Maximum belowground biomass
Ovington ***et al.***	1963	Cedar Creek	Prairie	669.5
Dahlaman &Kucera	1965	Missouri	Prairie	1,901.0
Singh	1967	Varanasi	*Dichanthium*	583.0
Kelly ***et al.***	1969	Tennessee	*Andropogon*	804.0
Jain & Misra	1972	Sagar	*Heteropogon*	1,537.3
Choudhury	1972	Varanasi	*Dichanthium*	1,008.0
Misra	1973	Ujjain	*Dichanthium*	925.0
Singh&Ambasht	1975	Varanasi	*Heteropogon*	184.1
Misra	1978	Berhampur	*Aristida*	743.2
Malana	1981	Berhampur	*Heteropogon*	727.0
Pradhan & Das	1984	Sambalpur	Savana	256.0
Pradhan	1994	Bhubaneswar	*Aristida*	736.4
Behera	1994	Phulbani	*Heteropogon*	688.9
Barik	2006	Berhampur	*Aristida*	644.1
Present study		Rangamatia	Mixed type	737.8

Table- 5. Total annual net primary production g m^{-2} yr^{-1} of different grassland community.

Author (s)	Year	Location	Type of community (Dominance)	Annual rain fall mm	NPP (g $m^{-2}yr^{-1}$).
Ambasht ***et al.***	1972	Varanasi	*Dichanthium*	725	1420
Varshney	1972	New Delhi	*Heteropogon*	800	1330
Singh & Yadava	1972	Kurukhetra	*Panicum*	770	2980
Misra	1973	Ujjain	*Dichantium*	1030	989

Billore & Mall	1977	Ratlam	Sehima	1257	846
Misra	1978	Berhampur	*Aristida*	1200	1447
Malana	1981	Berhampur	*Aristida*	1355	1180
Pradhan	1994	Bhubaneswar	*Aristida*	858	1474
Behera	1994	Phulbani	*Heteropogon*	1763	809
Barik	2006	Berhampur	*Aristida*	1341	929
Present study		Rangamatia	Mixed type	1906	6403

Table - 6. Turnover rate of organic matter in various plant communities.

Author(s)	Year	Type of community (Dominant)	Turnover rate		
			Live green	Litter	Below ground
Ovington et al.	1963	Prairie	97	45	47
		Savana	98	45	45
Iwaki ***et al.***	1964	*Arundinella*	97	63	19
Golley	1965	*Andropogon*	90-92	--	48-62
Dahlman&Kucera	1965	Prairie	--	--	26
Singh	1967	*Dichanthium*	--	--	51-54
Old	1969	Prairie	--	--	45
Precsenyi	1971	*Artemisietum*	50-60	90-99	40-60
		Peucedanetum	88	60	42
Sims & Singh	1971	Mixed	--	--	22-51
Jain & Misra	1972	*Heteropogon*	--	--	83
Misra	1973	*Dichanthium*	--	82	45
Billore	1973	Sehima	99	96	47
Misra & Misra	1979	*Aristida*	77	119	52
Rath	1980	*Aristida*	105	87	68
Malana	1981	*Aristida*	82	87	42
Naik	1985	Mixed	59	72	30
Pandya & Sidha	1987	Suaeda	--	--	83
Tripathy	1989	Mixed	--	--	96
Patnaik	1993	*Heteropogon*	99	97	74

Pradhan	1994	*Aristida*	101	123	67
Behera	1994	*Heteropogon*	79	97	49
Barik	2006	*Aristida*	64	70	37
Present study	--	Mixed type	93	79	94

Dry matter transfer/System transfer function

The system transfer function of dry matter dynamics of few grassland types in various climatological region. In contrast to the present findings, the values reported by others, TNP to ANP was high to those reported by Singh & Yadav (1974), Misra (1973), Billore & Mall (1977), Rath (1980), Malana (1981), Misra & Misra (1984), Naik (1985), Pandya & Sidha (1987), Pradhan (1994), Behera (1994) and Barik (2006).The system transfer function of total net production to below ground net production, above ground net production to standing dead production and litter to litter decomposition were found less in comparison to most of the workers. Below ground to below ground disappearance was found to be same (approx.) with the result of Malana (1981) and Naik (1985).

Turnover of Organic matter

In the present investigation the turnover rate of litter was found to be less to that observed in case of live green and below ground parts. Compared to other grasslands, the turnover rate of live green of the community showed lower value to that of *Aristida* grasslands as reported by Rath (1980) and Pradhan (1994). It exhibited higher value compared to the findings of Precsenyi (1971), Misra & Misra (1979), Malana (1981), Naik (1985), Behera(1994) and Barik (2006). However it showed somehow similarities with the findings of Golley (1965). The turnover rate of litter was found less to that of Precsenyi (1971), Billore (1973), Misra & Misra (1979), Rath (1980), Malana (1981), Patnaik (1993), Pradhan (1994), Behera (1994) and high to that of Ovington *et al.* (1963), Iwaki *et al.* (1964), Naik (1985) and Barik (2006) It showed nearly same value to that reported by Misra (1973).The turnover of below ground parts of the community on the other hand exhibited much higher value compared to most of the worker (Table-6).This difference in the turnover rates of various plant communities may be attributed to prevailing climatic conditions (i.e. the micro and macroclimatic fluctuation) and interaction among the species of the community.

CONCLUSIONS

Compared to other grassland communities, the present grassland community showed little variation.

However, the factors like soil condition, rainfall, atmospheric temperature, wind velocity and such others, regulates the structure and dynamics of the grassland community. Human exploitation causes a heavy damage to the natural ecosystem. This study helps in recovery of the natural ecosystem in various climatological regions of all over the world.

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