Under Canopy Vegetation of Desert Landscape in Western Rajasthan: An Ecological and Economic Assessment

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***Abstract*: Plants are integral part of our biosphere and essential component for the existence of mankind. The vegetation provides many ecological services and some of them are economically important to human in term of fodder, food, fibers and medicine. Unfortunately the usefulness of under canopy plants in any landscape has been ignored while introducing any new species in an ecosystem. This ignorance of importance of under storey plants is attributed to the lack of monetary value of different services rendered by these plants. The present study reveals on ecological- economics of under canopy vegetation in arid area of university premises of Bikaner lies in western Rajasthan of India. The various phytodiversity components of under canopy vegetation are evaluated in term of scoring based on longevity, biomass productivity for food , fodder ,medicine and soil stabilization by ordinal analysis. The present study aims to evaluate ecological as well as monetary potential of wild plants occurring in under canopy of desertic landscape. These indigenous plants exhibit an imperative value for a common man and contribute towards sustainability of total ecosystem.**

Keywords: Ecological economics, under canopy vegetation, phytodiversity, biomass productivity

I. INTRODUCTION

This peculiar landform is part of Thar desert lies in district Bikaner under category of tropical dry deciduous and thorny forest with direction 28°01'N Latitude 73°22'E and area approximately eleven hundred acre the landscape endowed low level of biological diversity and habitat heterogeneity with abundance of herbs , shrubs and grasses. The environmental impacts of transforming this grazing land through construction of infrastructure and human activities as university campus flourishes and demarcation of boundary in each direction shall leads it towards an isolated patch of an ecological unit so far which diminish this unique landscape in floral and faunal aspects. The area comprising with undulating plains, dunes and have tropical dry climate with meager of rainfall pattern. A study was conducted for assessing the current status of vegetation with reference to regeneration and indigenous in character.

II. MATERIAL AND METHODS

Extensive field studies has undertaken by the help of mapping and traverse method of the area in several directions and put stakes at number of points, photography, and quadrate methods for community structure to calculate the frequency (Raunkiaer's 1934, J.T. Curtis 1951), density(Oosting 1958), abundance, cover and basal area(Hanson and Churchill 1961) and Importance value index(Phillips 1959), comparison of stands by using Ecology Workbook by (R.Misra 1954).The following indices phytoecological parameter (Dular,A.K.,2015) were used for the present study to ascertain species richness, diversity ,evenness and dispersion of the permanent vegetation of the study area. Percentage frequency=No. of sampling units in which the species occurred/Total no. of units studied x100.Abundance= Total no. of individual species/Total no. of quadrates in with species found. Relative Dominance= Total basal area of the species/Total basal area of all species x100, Relative Density= Number of individuals of the species/Number of individuals of all species x100, Relative frequency=Number of occurrence of the species/Number of occurrence of all species x100, Absolute density of individual species=Relative density of the species/100 x total density of all species,Importance value index (IVI) =Relative density+ Relative frequency+ Relative Abundance(Philiips 1959), Distribution of species (Contagious or regular) =AxF=100xD (Cole 1946, Ashby 1963, Fracker and Brischle 1944), High frequency x low Abundance=regular distribution, Low frequency x high Abundance=contagious distribution. The scoring is based on the criteria of longevity and biomass productivity of plants species for five major uses food, fuel, fodder, medicine and soil stabilization(Belal and Springuel,1996).The values of each plant species is further converted into monetary equivalence to estimate the monitory value of plant diversity of all plant species growing on plantation floors.Ten quadrats of 1*1meter square were laid randomly to find out the numbers of plants species per quadrat and occurrence of a species per quadrat was recorded and relative density of each species was calculated. The life cycle and biomass productivity are two important parameter

to measure plant performance as former represents how long a plant can provide the services and the latter represents the amount of productivity in that period. The individual score of a species was further calculated with respect to the maximum score. If no information for the uses of a plant was available then its score resulted in zero. On other hand a plant with perennial life cycle and biomass productivity more than 100gm scored the maximum;e.30. the economic value for all uses of a plant species, by following method (Chopra,et al.1997),Pt=Pi*Si/St; Pt=Total economic value for all the uses of a plant species,Pi=Mean market price of a plant species, Si= score obtained for the various uses, St= Total maximum score for all the five uses(30).The mean market price for a particular use was obtained from the market and this value was multiplied with the total scores of a plant for its various uses to estimate the economic value.

Table.1 An ecological parameters of the desertic landscape

Botanical name of herbaceous plants	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total number of individual species	Frequency %	Density	Abundance
Octhocloa indica	32	17	12	20	25	18	22	21	12	09	188	100	18.8	18.8
Heliotropium indicum	5	14	*5*	*3*	-	*8*	*2*	-	*7*	*3*	*47*	*80*	*4.7*	*5.87*
Euphobia microphylla	*01*	*03*	*08*	*05*	*05*	*04*	*12*	*02*	-	*01*	*39*	*90*	*3.9*	*4.33*
Indigophera linnaei	*01*	*01*	-	*02*	-	*02*	*02*	*07*	-	*01*	*16*	*70*	*1.6*	*2.2*
Boerhavia diffusa	*01*	*05*	*02*	*02*	*02*	*02*	-	*05*	*03*	*02*	*24*	*90*	*2.4*	*2.6*
Convovulus desertii	-	*01*	-	- -	-	-	-	-	*02*	-	*03*	*20*	*0.3*	*1.5*
Eragrostis minor	-	*01*	-	-	*16*	-	-	-	-	*01*	*18*	*20*	*0.8*	*9.0*
Fagonia cretica	-	*02*	-	*01*	-	-	*02*	-	*04*	*02*	*11*	*50*	*1.1*	*2.2*
Acacia italica	*02*	*01*	*01*	-	-	*01*	-	-	-	-	*05*	*40*	*0.5*	*1.25*
Aerva persica	*01*	*01*	*01*	*02*	*01*	-	-	-	-	-	*06*	*50*	*0.6*	*1.2*
Aristida funiculata	*02*	-	*01*	-	*01*	-	*01*	*02*	*02*	-	*09*	*60*	*0.9*	*1.8*
Tribulus terrestris	*03*	*04*	-	*01*	*04*	*01*	*01*	*03*	-	*02*	*19*	*80*	*1.9*	*2.37*
Aerva pseudotomentosa	*02*	*01*	*03*	*01*	*01*	*01*	*01*	*01*	*02*	*02*	*15*	*100*	*1.5*	*1.5*
Crotolaria burhia	-	*01*	*05*	-	*02*	*01*	-	*01*	-	-	*10*	*50*	*1.0*	*2*
Cyprus rotandus	*01*	*01*	*01*	-	-	-	*01*	*02*	*02*	*02*	*10*	*60*	*1.0*	*1.42*
Indigofera cordifolia	*01*	*01*	*01*	*01*	*04*	*03*	*01*	*01*	*01*	*01*	*15*	*100*	*1.5*	*1.5*
Cenchrus setigerous	*01*	*02*	*02*	*01*	*01*	-	-	-	*02*	*01*	*10*	*70*	*1.0*	*1.42*
Lasiurus sindicus	*01*	*01*	-	-	-	-	--	-	-	-	*02*	*20*	*0.2*	*1.0*
Tragus biflorus	*04*	*03*	*02*	*03*	*03*	-	-	*01*	*01*	*01*	*18*	*80*	*1.8*	*2.25*
Brachiaria ramosa	-	-	-	-	-	*01*	*01*	*02*	*02*	*02*	*08*	*50*	*0.8*	*1.6*
Gisekia pharnacoides	*01*	-	-	-	-	-	-	*02*	-	-	*03*	*20*	*0.3*	*1.5*

Botanical names of Plant species	F	Fu	Fo	M	SS	RD	IVI	Score of Longevity	Score of Biomass productivity
Octhocloa indica	+	_	+	+	+	39.4	76.03	2	2
Heliotropium indicum	_	_	+	+	_	9.8	25.53	2	2
Euphorbia microphylla	_	_	+	+	+	8.1	22.33	1	1
Indigophera linnaei	_	_	+	+	_	3.3	12.66	1	1
Boerhavia diffusa	+	_	+	+	_	5.04	16.64	1	3
Convovulus desertii	+	_	+	+	+	0.63	4.6	1	2
Eragrostis minor	+	_	+	+	+	3.7	18.82	1	2
Fagonia cretica	+	_	+	+	+	2.3	9.8	1	3
Acacia italica	+	+	+	+	+	1.05	6.4	2	2
Aerva persica	+	+	+	+	+	1.26	7.34	2	3
Aristida funiculata	_	_	+	+	+	1.89	9.76	2	2
Tribulus terrestris	+	+	+	+	+	3.9	14.43	2	3
Aerva pseudotomentosa	+	+	+	+	+	3.1	14.02	2	3
Crotolaria burhia	+	_	+	+	+	2.1	9.37	2	2
Cyprus rotandus	_	_	+	+	+	2.1	9.4	1	2
Indigofera cordifolia	_	+	+	+	+	3.1	14.02	2	2
Cenchrus setigerous	+	+	+	+	+	2.1	10.3	1	3
Lasiurus sindicus	+	+	+	+	+	0.4	3.63	1	3
Tragus biflorus	_	_	+	+	+	3.7	14.05	1	3
Brachiaria ramosa	+	_	+	+	+	1.6	8.27	2	2
Gisekia pharnacoides	+	+	+	+	+	0.6	4.57	2	2

III. RESULT AND DISCUSSION

Quantitative evaluation by establishing statistically designed census quadrate sampling method revealed that present study area as a remnant of Thar Desert is highly generic endowed with low biological diversity and habitat heterogeneity but due to the anthropogenic activities leads or transforming into an abandoned landscape. It is assumed that if prevailing condition sustained this ecological habitat became degenerated drastically and the succession and regenerational process become curtailed and fragility increases. In the present study it is observed that maximum relative frequency of species are *Octhocloa indica, Aerva pseudotomentosa, Indigofera cordifolia* and minimum relative frequency was observed of *Convovulus desertii, Eragrostis minor Lasiurus sindicus, Gisekia pharnacoides* species respectively. The relative maximum density are found of species *Octhocloa indica* and minimum with species *Convovulus desertii, Lasiurus sindicus.*The relative maximum abundance shown by species *Octhocloa indica, Eragrostis minor* and minimum relative abundance of *Cyprus rotandus, Cenchrus setigerous, Lasiurus sindicus* respectively.It was observed that maximum IVI related to the species *Octhocloa indica , Heliotropium indicum , Euphobia microphylla* showing their ecological dominance while minimum IVI observed for species *Convovulus desertii, Lasiurus sindicus, Gisekia pharnacoides* respectively.The total basal area of the studied quadrates in present landscape comprises of(123522.8 sq.cm) with maximum basal area of species *Octhocloa indica* is

(49075.6sq.cm) and minimum basal area with *Lasiurus sindicus* (498.2sq.cm)and *Gisekia pharnacoides* (747.3sq.cm) respectively. Detail studies of flowering and fruiting phenology have been conducted in almost every area of present study randomly. The criteria for scoring plants species for its use value regarding to longevity assigned as 1= Annual, 2=Biennial, 3=Perennial. The biomass productivity scores assigned as 1= <10, 2=10-100 and 3=>100 gm/plant. The results show that different species may produce flowers and fruiting annually in favorable period of monsoon. The majority of species rely on air borne and animal to transfer their pollen, seeds are also transfer by animal dispersal during grazing or consuming comes through their excreta which are abandoned due to demarcation of the boundary around the campus. The under canopy vegetation is a major ecological important for sustainability in term of nutrient recycling, soil stabilization, genetic pool etc. the present study reveals and statistically proved with indices of richness, even, dominance and diversity. The present approach seems to be the most suitable evaluation of plant diversity in indigenous landscape in term of biomass production and duration of stay in the field to provides various services which anticipated in term of economic measures to various ecological services to allocate due importance to common uses rightly judge their value and sustain our ecosystem in better way.

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