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Impact of logging on microclimatological parameters of post climax vegetation of Parambikulam wildlife sanctuary, Kerala, South India

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Abstract

In the present work, an attempt has been made to quantify the microclimatological data of post climax vegetation , Karian shola of the Parambikulam wildlife sanctuary and adjacent logged area. From the study it was found that there are variations in the average relative humidity of the Karian shola and very adjacent logged areas of sanctuary. It can also be concluded from the present study that the high relative humidity of the Karian shola compensate the water deficiency during the summer period and thus even in rain shadow region, the evergreen forest of Karian shola can survive without any water related stress.

Key words: Karian shola, post climax vegetation, rain shadow region, logging and microclimate.

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1.0 Introduction

Post climax vegetation

In ecological terminology “climax vegetation” is the ultimate stage a vegetation can attain in a given climatic, edaphic, topographic and other features of an area. Western Ghats, North Eastern India and Islands of Andaman and Nicobar, climax vegetation is always ‘Tropical wet evergreen’ type because of high rainfall associated with monsonic and topographic features. While dealing with the forest types of India, tropical wet evergreen forests are considered as the climax vegetation of Western Ghats like in Karian shola and the tropical semi-evergreen forests are considered as derivatives of wet evergreen type, due to anthropic influences, like selective felling, fire etc. Karian shoal (KS) is evergreen in nature and Champion and Seth [1] classified it as “Tropical West Coast Evergreen forest”. Pascal [2] classified the vegetation under *Cullenia-Palaquium-Mesua* series. Contrary to ecological thumb rule, this forest is situated in the rain shadow region (Eastern side) of the Western Ghats. Regarding their existence, no scientific explanation has so far been put forward excepting perhaps for Pascal’s surmises; “that inadequacy of rain fall is compensated by high relative humidity”. This statement has been corroborated by Suraj and Balasubramanian [3].

Selective felling and ecosystem sustainability

Selective felling is an ecologically sustainable practice, as a silviculture system, it is designed to maintain an uneven or all-aged forest of trees varying not only in age, but in size and species as well [4]. The staggering of light cuttings in a forest stand as the trees grow and mature also lessens the ecological and visual impact on a forest and provides an opportunity to create gaps in the forest canopy to encourage natural regeneration. But because of these gaps, the light will starts to enter in to the deep forest and there by gradually change the microclimatic condition. Contrary to clear cutting, the selective harvesting of a timber stand is typically more expensive and produces less timber but is considered ideal for the harvesting and regeneration of shade tolerant species of trees [5]. In the present study, an attempt has been made to ascertain the impacts of selectibr felling carried out in Parambikulam wildlife sanctuary on microclimatological parameters of post climax vegetation in Karian shola of the sanctuary.

2.0 Materials and methods

Study area

The study carried out in Karian Shola, situated in the Anamalai Hills of Western Ghats is spread over both Parambikulam and Indira Gandhi wildlife sanctuaries of Kerala and Tamil Nadu respectively. Karian Shola lies between 10° 28' and 10° 30' N and 78° 48' and 78° 50' E longitude (Figure-1). Parambikulam wildlife sanctuary is well known for timber extraction during pre independent period by selection felling. It is the only post climax vegetation type in the sanctuary having a total area of 1523 hectare. Average elevation is around 600 mtrs, although a few isolated peaks go up to 1400 mtrs. Generally mountain ridges are of tree cover, considerable extents of rocky areas are found in the hilly area like Pandaravarai. The streams originating from the Pandaravarai and Topslip are major water bodies in this area. The Average maximum and minimum temperature in the Karian shola is 24.38^{o}c and 21.55^{o}c. The Pandaravarai peak intercepts the clouds from the western side of the Western Ghats and hence the average annual rainfall of Karian Shola is 701.5 mm. In addition, pre-monsoon showers are observed during April and May. Atmospheric humidity is always high in evergreen part of Karian shola and moist deciduous forest surrounds it [6].

Micro climatic data collection

A thorough reconnaissance survey was conducted throughout the study area by dividing into eight localities so as to gather precise information about the forest. Vegetation of any region especially forest is chiefly determined by meteorological influences as relative humidity of air, temperature, precipitation (rainfall), light and gaseous components of atmosphere including wind.

Microclimatological data of both logged and unlogged areas (Karian shola) were collected. Daily rainfall data of the study area was collected from the various meteorological stations installed in and around the study area. The manual non recording Symon's Rain gauge was used to collect rainfall data. The micro climatological data such as temperature, relative humidity, absolute humidity and dew Point were measured by the help of HOBO pro temp / RH data loggers installed in the study area (one data logger within the KS locality and other in the Anapady(logged area).The HOBO H8 Pro series logger (PART NO. H08-030-08, HO8-031-08) of ONSET Computer Corporation PVT. LTD (www.onsetcomp.com) was used to collect data.

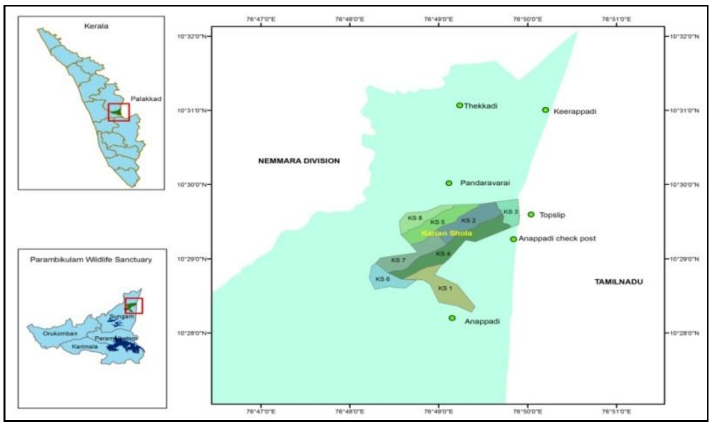

Figure- 1: Location of Karian shola

3.0 Results and Discussion

The Western Ghats are range of mountains with variable climatic conditions .This is mainly due to the gradient in elevation and also the highly variable rain fall experienced by the eastern and western sides of these mountains ranges. This results in high variation in forest ecosystem and biodiversity. Hence, the data collected in the study area regarding climatologically parameters are important for determining the forest type and related ecological studies .

The various climatological parameters collected from the Karian shola (unlogged area) and adjacent logged area (deciduous forest) during three year is given below.

Sl. No.	Microclimatological Parameters	Area	
		Unlogged(Karian shola)	Logged
1	Average rainfall	611.7 mm	604.96 mm
2	Number of rainy day	101.66	101
3	Average Temperature	22.67^0 C	23.65^0 C
4	Average Dew point	20.60^0 C	20.43^0 C
5	Average Absolute Humidity	17.64 gm/m3	17.69 gm/m3
6	Average Relative Humidity	85.73%	59.42%

Table-1:T Average microclimatological parameters for three years (2007, 2008 & 2009)

Table-2:Micro Climatic Data of unlogged and logged area during 2007

Month	1		2		3		4		5		6		7		8		9		10		11		12		13		14	
	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG
JAN	0.29	0	1	0	22.12	21.7	27.12	29.22	17.52	24.34	19.07	18.86	22.65	26.68	12.07	12.14	16.31	14.68	20.1	25.15	10.7	10.25	81.07	64.14	97.85	78.9	45	50
FEB	0	0	0	0	22.2	24.3	28.11	29.25	16	24.56	18.51	20.35	23.68	24.48	9.72	14.63	15.99	15.81	21.3	22.17	6.4	12.17	79.77	61.89	99.85	76.1	25.35	46
MAR	0	0	0	0	23.36	26.5	29.3	29.2	17.71	24.13	20.4	20.18	24.5	24.94	13.36	18.01	17.88	18.07	22.25	22.52	8.6	15.12	83.08	51.65	100	61.5	29.9	40
APR	4.16	3.6	5	9	24.22	26.9	30.2	29.3	19.23	25	21.87	22.79	24.28	24.91	12.66	21.3	19.16	20.05	22	22.62	10.65	18.42	84.39	50.71	99.92	61	37.75	38
MAY	0.97	5	4	10	23.08	26.1	30.51	29.1	19.04	23.27	21.27	22.51	23.58	24.99	14.94	20.54	18.76	19.76	21.15	22.75	12.95	17.65	88.86	59.94	99.96	73	46.55	44
JUN	8.28	13.93	15	24	27.59	27.6	29.9	29.5	26.34	26.73	23.2	23.08	25.21	24.84	21.87	22.06	20.5	20.34	22.09	22.5	19	19.2	73.6	62.49	74.9	74	73.15	50
JUL	17.9	20.35	18	18	24.27	24.6	31.12	28.7	18.66	19.81	22.17	21.95	28.39	25.15	18.66	19.02	19.5	19.19	27.6	23	16	16.1	85.3	70.39	98.1	80	75.55	60
AUG	10.38	20.87	16	16	21.09	22.5	25.17	28.31	18.66	18.66	19.76	21.11	22.18	23.16	17.63	18.39	16.97	20.34	18.2	20.6	15	15.7	88.92	73.34	95.5	82	66.65	63
SEP	9.36	16.53	19	21	25.75	22.5	25.75	27.52	18.85	19.81	20.92	21.59	24	24.79	18.39	19.64	18.46	18.66	21.75	22.7	16.15	16.9	96.53	69.5	100	78	76.35	59
OCT	9.48	14.1	17	18	21.97	21.8	25.46	28.7	18.75	17.9	20.34	20.94	23.09	24.42	18.38	17.9	18.19	18.24	21.75	22.2	15.55	15.3	91.42	68.6	100	74	66.8	62
NOV	1.23	0	2	0	21.54	21	24.79	25.17	19.42	14.47	20.63	19.27	23.54	23.24	8.71	9.51	10.12	16.61	11.9	20.8	8.2	8.7	50.6	67.97	62	75	35.85	58
DEC	8.1	0	5	0	21.39	20.3	25.12	25.17	19.08	14.09	20.48	17.97	23.31	22.09	13.54	6.04	14.15	15.28	16.82	19.5	11.87	6.8	71.01	58.57	81	64	51.32	51

Index: UL = Unlogged, LG = Logged, 1= Average Rainfall (cm), 2= No. of Rainy Days, 3= Ave. Temp (^{O}C), 4= Max. T(^{O}C), 5= Mini. T (^{O}C), 6= Ave. Dew Point (^{O}C), 7= Max. DP, (^{O}C), 8= Mini. DP

(^{O}C), 9= Ave. Abs Humidity (gm/m^3), 10= Max. AH (gm/m^3), 11= Mini. AH (gm/m^3), 12= Ave. Relative Humidity (%), 13= Max. RH (%), 14= Mini. RH(%).

Table-3: Micro Climatic Data of unlogged and logged area during 2008.

Month	1		2		3		4		5		6		7		8		9		10		11		12		13		14	
	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG
JAN	0	0	0	0	22.17	20.7	26.73	35.27	18.66	14.85	19.75	17.29	22.07	29.11	16.57	11.34	16.9	14.68	19.4	28.3	13.7	9.8	83.25	53	96		55.2	34
FEB	2.41	0.83	5	3	22.07	22.7	27.52	29.9	16.38	16.7	18.4	20.44	23.24	24.25	7.57	12.95	15.73	14.68	20.8	22	7.7	10.7	78.15	46	99.7	62	31.1	30
MAR	2.7	3.45	10	11	22.34	24.9	28.7	33.43	15.62	19.39	18.63	20.27	24.12	24.71	11.88	16.32	16.25	16.94	21.8	22.35	5.1	13.65	80.32	39	100	53	15.9	24
APR	0.8	0.5	2	1	24.38	27	29.9	36.97	19.81	22.09	22.18	20.1	24.88	25.17	14.85	19.7	19.51	19.21	22.7	22.7	12.1	16.6	84.76	55	100	70	40.2	40
MAY	0.38	1.3	2	2	24.07	25.7	29.1	33.17	18.66	16	21.57	20.84	23.68	24.61	10.47	7.56	18.81	17.9	21.3	22.5	9.2	7.4	82.94	44	100	56	31.6	32
JUN	0.29	16.76	1	20	22.09	23.7	28.31	31.93	19.42	20.19	21.39	21.24	23.48	23.46	19.42	19.37	18.71	18.43	21	21	16.7	16.1	93.7	52	100	74	57.8	49
JUL	4.8	6.9	9	13	21.55	22.8	25.95	29.1	19.04	19.04	21.16	21.44	23.67	24.26	19.04	19.04	18.48	18.72	21.2	21.9	16.3	16.3	95.6	65	100	76	79.5	53
AUG	10.67	0	17	0	21.56	22.4	25.95	27.12	18.66	19.42	21.22	21.68	24.1	23.63	18.66	19.42	18.56	19.03	21.8	21.3	16	16.7	96.38	68	100	76	69.5	59
SEP	8.5	0	17	0	21.71	23.5	25.56	29.74	18.28	19.81	21.06	21.99	24	25.49	18.12	19.81	18.37	19.34	21.7	23.5	15.5	17.1	93.63	74	100	82	69.5	65
OCT	10.67	0	18	0	22.24	23.4	25.95	30.11	19.42	18.85	20.78	21.78	24.01	25.62	18.64	16.81	18.01	19.11	21.8	23.65	15.6	14.25	88.14	74	100	81	60.4	67
NOV	1.3	0	2	0	21.97	23	25.75	28.11	18.85	16.37	20.92	21.29	24	25.14	18.38	0.68	18.19	18.66	21.75	23.15	15.55	6.55	90.88	68	100	72	64.95	63
DEC	8.38	0	6	0	22.1	23.1	25.85	27.81	19.13	15.61	20.85	20.78	24	24.73	18.51	0.59	18.1	18.13	21.77	22.65	15.57	6.5	89.51	64	100	77	62.67	50

Index: UL = Unlogged, LG = Logged, 1= Average Rainfall (cm), 2= No. of Rainy Days, 3= Ave. Temp (^{O}C), 4= Max. T(^{O}C), 5= Mini. T (^{O}C), 6= Ave. Dew Point (^{O}C), 7= Max. DP, (^{O}C), 8= Mini. DP (^{O}C), 9= Ave. Abs Humidity (gm/m^3), 10= Max. AH (gm/m^3), 11= Mini. AH (gm/m^3), 12= Ave. Relative Humidity (%), 13= Max. RH (%), 14= Mini. RH (%).

Table-4: Micro Climatic Data of unlogged and logged area during 2009.

Month	1		2		3		4		5		6		7		8		9		10		11		12		13		14	
	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG	UL	LG
JAN	0.29	0	1	0	20.84	0	25.95	29.9	16	10.21	16.32	14.48	21.99	20.86	6.96	4.42	13.82	12.32	19.3	17.9	7.2	5.9	73.09	51	100	74	27.4	48
FEB	0	0	0	0	22.6	0	30.71	38.32	16	10.21	16	13.56	23.72	27.59	4.53	2.64	13.63	11.72	21.3	26.3	6.1	5.2	65.43	49	99.1	66	20.4	32
MAR	0.38	0.54	3	5	24.22	5	31.12	39.22	17.9	16.76	19.94	16.42	23.93	34.91	6.03	0.11	17.2	14.1	21.6	38.9	6.7	4.3	76.51	42	100	54	19.1	29
APR	0.54	2.5	1	8	24.93	8	31.52	34.85	19.04	19.42	21.65	20.8	26.69	25.95	10.07	10.41	18.96	17.91	25.1	24.3	9.2	9	80.45	47	100	62	27.4	31
MAY	1.2	3.32	6	8	24.42	8	30.31	34.01	12.19	20.19	22.25	21.54	25.95	25.29	18.62	16.98	19.56	18.66	24.3	23	15.6	13.9	77.24	47	100	64	53.2	30
JUN	5.06	7.8	17	16	22.6	16	28.31	31.52	19.81	19.81	21.68	21.33	23.63	23.57	19.62	18.44	19.01	18.51	21.3	21.1	16.5	15.2	92.98	59	100	77	61	41
JUL	20.6	13.8	25	28	21.2	28	25.17	24.4	19.04	19.81	21.07	21.14	23.63	22.41	19.04	19.81	18.42	18.46	21.3	19.9	16.3	17.1	98.87	60	100	72	71.6	48
AUG	6.26	10.13	10	19	21.8	19	25.95	27.96	19.42	19.81	21.61	21.71	24.51	24.46	19.42	19.81	19	19.05	22.3	22.3	16.7	17.1	97.89	60	100	73	71.6	47
SEP	7.73	1.3	13	11	22.33	11	29.5	31.52	19.42	19.81	21.94	22.28	27.72	26.52	19.42	19.81	19.42	19.64	26.6	24.7	16.7	17.1	96.86	67	100	76	74	57
OCT	9.58	7.8	17	18	21.97	18	25.95	28.7	18.66	17.9	21.38	21.28	24.31	24.72	15.58	13.82	18.73	18.58	22.1	22.6	12.8	11.4	95.33	64	100	73	52.2	55
NOV	5.98	9.8	17	18	21.5	18	25.17	27.52	17.9	14.85	21.2	21.31	25	25.56	17.01	12.46	18.56	18.74	23	23.7	14.5	1.7	97.31	72	100	82	66.6	61
DEC	4.84	0.38	4	6	21.29	6	25.17	28.11	17.9	16.37	20.31	20.26	23.28	23.91	13.57	13.64	17.58	17.52	20.8	21.6	11.4	11.3	91.7	66	100	74	52.7	57

Index: UL = Unlogged, LG = Logged, 1= Average Rainfall (cm), 2= No. of Rainy Days, 3= Ave. Temp (^{O}C), 4= Max. T(^{O}C), 5= Mini. T (^{O}C), 6= Ave. Dew Point (^{O}C), 7= Max. DP, (^{O}C), 8= Mini. DP (^{O}C), 9= Ave. Abs Humidity (gm/m^3), 10= Max. AH (gm/m^3), 11= Mini. AH (gm/m^3), 12= Ave. Relative Humidity (%), 13= Max. RH (%), 14= Mini. RH (%)

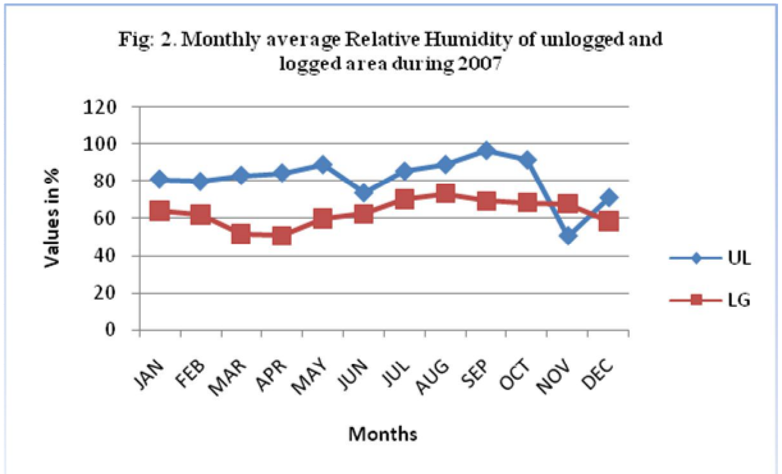
Fig: 2. Monthly average Relative Humidity of unlogged and logged area during 2007
Values in %
120
100
80
60
40
20
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Months
UL
LG

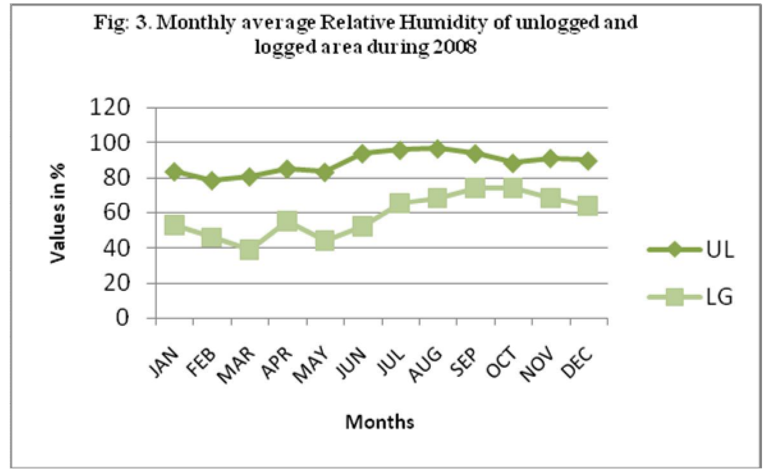
Fig: 3. Monthly average Relative Humidity of unlogged and logged area during 2008
Values in %
120
100
80
60
40
20
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Months
UL
LG

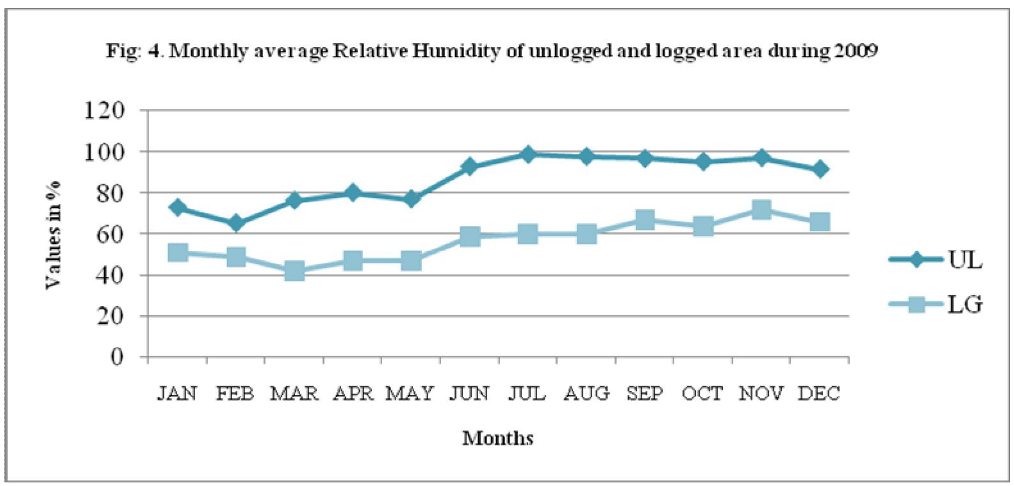
Fig: 4. Monthly average Relative Humidity of unlogged and logged area during 2009
Values in %
120
100
80
60
40
20
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Months
UL
LG

From the study it was found that there are variations in the average relative humidity of the Karian shola and very adjacent logged areas of sanctuary (Table-1, Figure-2, 3 and 4). Average microclimatological data such as average rainfall, number of rainy day, average temperature, average dew point, average absolute humidity and average relative humidity of various parameters for three years (2007, 2008 and 2009) is in the order of 611.7 mm, 101.66, 22.67^0 C, 20.60^0 C , 17.64 gm/m^3 and 85.73%. While those recorded in the logged area is 604.96 mm, 101, 23.65^0 C, 20.43^0 C, 17.69 gm/m^3 and 59.42% respectively. Rainfall data collected from various rain gauges situated in and around Karian shola showed variation in rainfall ranging from an average minimum of 701mm to an average maximum of 1418 mm. This rain fall is very much low to support an evergreen forest. As regarding the relative humidity of Karian shola (unlogged area), it is very high and during the rainy season (June, July, August and September) it is always stationary at 100%. During the non rainy season, it fluctuates (January, February, March and April) around 19.6 to 100%. Even though other microclimatological parameters of logged and unlogged areas are nearly similar, the average relative humidity of these two areas shows tremendous variation (Table-1, 2, 3 and 4). Similarly, the same applies to the dew point which remains very high during the summer season (average maximum value is 30.23 and average minimum value is 2.24). The relative humidity and dew point help the plants to survive even during summer periods. As a result of high relative humidity, the tree transpiration rates should be low which also helps to minimize the water loss during summer [8]. This is the reason why even if the evergreen forest is surrounded by the deciduous forest because of selective felling, post climax vegetation exists in the rain shadow region of Anamalai hills of Western Ghats.

4.0 Conclusion

The overall conclusion of the study is that within the macroclimatic conditions prevailing in any of the area (here, sanctuary) with climatic climax vegetation (here, deciduous forest), there are possibilities of origin of post climax vegetation because of the selective felling and associated development of peculiar type of microclimatic condition coupled with topographical features and such type of a post climax vegetation is Karian shola. But because of the human interference (felling), there may be chance for the gradual conversion (retrogressive succession) of such post climax vegetation in to climatic climax vegetation (here, Karian shola in to deciduous forest). The selective felling will affect the virgin forest of an area. This will also affect the rich biodiversity of forests especially evergreen forests and post climax vegetation if any in nearby felled area. So before the implementation of any of the silvicultural practices in the sanctuary, the post climax vegetation like Karian shola should be avoided.

Reference

1. Champion HG, Seth SK. A revised survey of the forest types of India. Manager of publications, Govt. of India Press, New Delhi, 1968; 404.
2. Pascal JP. Wet evergreen forests of Western ghats of India (Ecology, Structure, Floristic compositions and Succession). Trav Sec Sci Tech Inst de Fr Pondicherry. 1988; 337.
3. Suraj MA, Balasubramanian K. Demystifying the post climax status of Karian Shola in Parambikulam wildlife sanctuary - an ecological conundrum. Project Report, KSCSTE, 2010;163.

4. McEvoy TJ. Positive impact forestry - A Sustainable approach to managing woodlands. Island Press, New York, DC.2004; 268.
5. Nyland RD. Selection system in Northern hardwoods. J Fores. 1998; 96 (7): 18–21.
6. Unniyal VK. . First working plan for Parambikulam wildlife sanctuary. Kerala forest departmentt, Trivandrum.1998; 407.
7. http://www.onsetcomp.com
8. Lindsay B Hutley, David Doley, David J. Yates, Arthorn Boonsaner. Water balance of an Australian subtropical rainforest at altitude: The Ecological and physiological significance of intercepted cloud and fog. Aus J Bot. 1997. 45(2) 311 – 329.