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ROLE OF SACRED GROVES IN MICROCLIMATE PROPERTIES: A CASE STUDY OF POYYARA SACRED GROVE AND ADJACENT DISTURBED LAND AT VATANAPALLY, THRISSUR, KERALA.

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ABSTRACT The major factor affecting the soil quality and microclimate of an area is based on the vegetation cover in that area. Sacred groves are also having rich diversity of many plant species which are relevant to the maintenance of ecosystem balance. As an ecosystem, sacred groves help in soil and water conservation, besides preserving the biological wealth. Sacred groves enrich the soil through its rich litter and the nutrients generated by litter decomposition. There are many general reports on the importance of sacred groves in maintaining the ecosystem balance however, the scientific data-based research results on their role particularly to maintain the microclimatic aspects of an ecosystem is very less. On analyzing the difference in air and soil temperature under canopy area and open area, it is identified that factors like radiation from sun, speed of wind and availability or non-availability of canopy hold a significant correlation. Therefore, one of the challenging tasks before the ecologist is to make aware the public as well as the concerned organizations and government bodies regarding the important relationship that exists between the vegetation and the climatic conditions in ecosystems through scientific approach (Davis & Richardson, 1995). The present investigation is carried out in this contest. The investigation believes, passing the scientific information obtained from the comparative analysis of climatic conditions existing in the selected sacred grove and the disturbed non-sacred grove land, may influence the concerned towards strengthening the conservation activities of the existing sacred groves, as part of future ecosystem maintenance.

KEYWORDS : Atmosphere, Humidity, Microclimate, Soil conditions, Sacred groves.

INTRODUCTION

The sacred groves in a region are found to influence the interaction between the biotic and abiotic factors such as flora, fauna and microclimate of soil and atmosphere in the region. There are many general reports on the importance of sacred groves in maintaining the ecosystem balance however, the scientific data-based research results on their role particularly to maintain the microclimatic aspects of an ecosystem is very less. When considering the water cycle in a region, the process of evaporation plays a vital role. In the total moisture content of the atmosphere, about 90% of the moisture is generally derived from evaporation loss from land surface and various water resources whereas, the rest of the 10% is found coming from the process of plant transpiration. On analyzing the difference in air and soil temperature under canopy area and open area, it is identified that factors like radiation from sun, speed of wind and availability or non-availability of canopy hold a significant correlation. Therefore, one of the challenging tasks before the ecologist is to make aware the public as well as the concerned organizations and government bodies regarding the important relationship that exists between the vegetation and the climatic conditions in ecosystems through scientific approach (Davis & Richardson, 1995). The present investigation is carried out in this contest. The investigation believes, passing the scientific information obtained from the comparative analysis of climatic conditions existing in the selected sacred grove and the disturbed non-sacred grove land, may influence the concerned towards strengthening the conservation activities of the existing sacred groves, as part of future ecosystem maintenance.

MATERIALS AND METHODS

1. Study area and season

The study area is Poyyara sacred grove and adjacent disturbed non-sacred grove land at Vatanapally which belongs to the Coastal Belt of Thrissur District, Kerala. The study area lies at 10.520 N 76.210 E and has an average altitude of 2.83m. The sacred grove and the same extent of adjacent disturbed non-sacred grove land was selected for comparison. The study was conducted during the pre-monsoon (April-May) and post-monsoon (August-September) period.

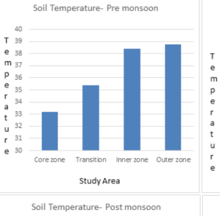
2. Analysis of Microclimate

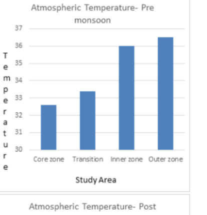
Microclimatic parameters such as temperature and humidity in the soil and atmosphere of all the selected sacred groves and disturbed non-sacred grove lands of similar extent are analyzed and compared. The data collections are carried by demarking the study into four zones. Each sacred grove is demarked into Core zone and Transition zone while each disturbed non-sacred grove lands into Inner zone (the region nearest to the grove region) and Outer zone (the region maximum away from the grove). The climatic parameters are measured by using Thermo-Hygrometer (TA318) during the mid-day period.

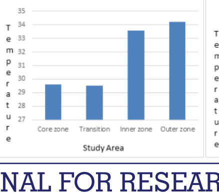
The mean value and standard deviation of different parameters in selected sacred groves and disturbed non-sacred grove lands are determined and compared statistically using 't'test of SPSS statistics 20.

RESULTS AND DISCUSSION

The data indicates the soil as well as atmospheric temperature recorded in the disturbed non-sacred grove region are comparatively higher when compared to the data recorded in the sacred grove region, irrespective of the season. The highest temperature is found generally recorded in the outer zone of disturbed lands and then tended to decrease towards the grove regions in the direction of inner zone of disturbed land transition zone and finally the lowest value is recorded in the core zone of grove.







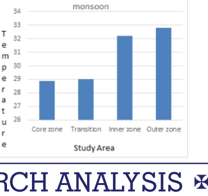


Figure 1: Soil and Atmospheric Temperature status in selected sacred grove and disturbed non-sacred grove land during the pre-monsoon and post-monsoon season

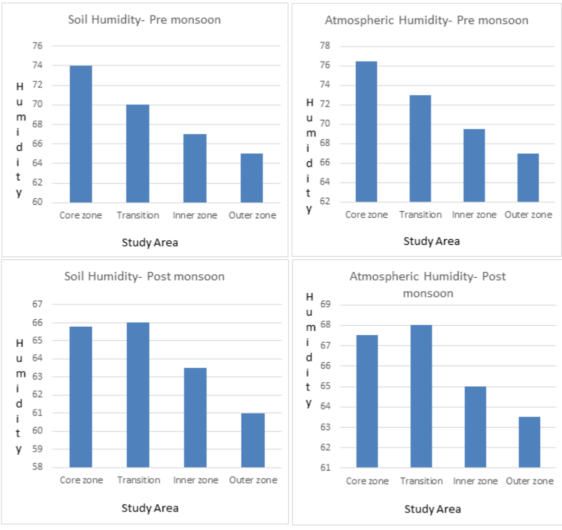


Figure 2: Soil and Atmospheric humidity status in selected sacred grove and disturbed non-sacred grove land during the pre-monsoon and post-monsoon season

The data on temperature in the soil and atmosphere collected are depicted in the figure 1. The data reveals the soil as well as atmospheric temperature recorded in the disturbed non-sacred grove region are higher compared to the sacred grove region during the pre-monsoon and post-monsoon periods. The analysis of temperature recorded in the inner and outer zones of disturbed land showed comparatively higher values of temperature irrespective of the season. In the case of grove, it showed lower temperature. This may be due to the influence of better microclimatic conditions existing in the groves by the influence of thick vegetation. The data on humidity in the soil and atmosphere collected are depicted in the figure 2. Poyyara site showed the higher values of humidity are recorded in the core region of grove during the pre-monsoon and transition zone during post-monsoon periods this is due to the release of large quantity of water vapour through transpiration and its retention might be the factor that contribute to this situation.

Table 1: Soil temperature status in selected sacred groves and disturbed non-sacred grove lands during the pre-monsoon season

Study site	Mean value and SD of soil temperature			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	33.2°C ±0.90	35.4°C ±1.1	38.4°C ±2.4	38.77°C ±2.75
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-2.681	-3.514	-3.340	-1.974
	P<0.05	P<0.05	P<0.05	NS*

NS*- Not significant

Table 2: Atmospheric temperature status in selected sacred groves and disturbed non-sacred grove lands during the pre-monsoon season

Study site	Mean value and SD of soil temperature			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	32.6 °C ±1.0	33.4 °C ±1.2	36°C ±2.2	36.5°C ±2.4
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-0.887	-2.437	-2.598	-2.001
	P<0.05	P<0.05	P<0.05	NS*

Table 3: Soil temperature status in selected sacred groves and disturbed non-sacred grove lands during the post-monsoon season

Study site	Mean value and SD of soil temperature			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	29.6°C ±0.5	29.5°C ±0.8	33.6°C ±1.1	34.2°C ±1.5
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-0.184	-5.734	-0.275	-4.789
	P<0.05	P<0.05	P<0.05	NS*

Table 4: Atmospheric temperature status in selected sacred groves and disturbed non-sacred grove lands during the post-monsoon season

Study site	Mean value and SD of soil temperature			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	28.9°C ±0.4	29°C ±0.6	32.2°C ±1.2	32.8°C ±1.4
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-0.240	-4.519	-4.639	-4.321
	P<0.05	P<0.05	P<0.05	NS*

Morecroft et al. (1998) compared the air and soil microclimates of deciduous forest land with an open site at Witham Woods, Oxford, UK and reported that the effect of forest cover on soil and air temperatures are much considerable and could be lowered under the canopy of forest land than at the open site during the summer. Similarly, Johnson et al. (1985) observed that whole-tree harvesting in an oak forest in Virginia resulted in an increase in the temperature of 6-8 °C in the month of July and August, compared to the adjacent uncut area. The present study results are in same lines with the above observations. The study indicates that the sacred groves are playing an important role in regulating the temperature within the grove and nearest immediate area. This could be due to the dense canopy of sacred groves particularly the tree canopy, which act as a protective cover and provide cool climate to the area. The release of large quantity of water vapour through transpiration and its retention might be the factor that contribute to this situation. Further the ground vegetation covers together with thick layer of litter fall act as insulation to the ground area which considerably reduce the loss of water through evaporation and regulate soil temperature.

The analysis of soil and atmospheric humidity in the present study revealed the Poyyara grove recorded higher values of humidity during the pre-monsoon as well as post-monsoon periods, over the values of humidity recorded in their corresponding disturbed non-sacred grove land. The higher values of humidity recorded in the Poyyara grove can be attributed to the higher rate of evaporation loss of water from rich vegetation and canopy cover. Therefore, the major source of water vapour that contribute towards the humidity factor in the grove is generally from the transpiration. The comparative analysis of humidity values recorded in the grove regions with that of disturbed non-sacred grove regions, the differences are found significant particularly when the humidity values in the core region of grove are compared to inner and outer regions of its corresponding disturbed land.

Table 5: Soil humidity status in selected sacred groves and disturbed non-sacred grove lands during the pre-monsoon season

Study site	Mean value and SD of soil Huminity (%)			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	74.0°C ±4.0	70.0°C ±3.0	67.0°C ±3.0	65.0°C ±3.0
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-1.386	-2.425	-3.118	-2.041
	P<0.05	P<0.05	P<0.05	NS*

Table 6: Atmospheric humidity status in selected sacred groves and disturbed non-sacred grove lands during the pre-monsoon season

Study site	Mean value and SD of soil Huminity (%)			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	76.5 ±3.5	73 ±3.0	69.5 ±3.0	67±3
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-1.315	-2.630	-3.569	-2.449
	P<0.05	P<0.05	P<0.05	NS*

Table 7: Soil humidity status in selected sacred groves and disturbed non-sacred grove lands during the post-monsoon season

Study site	Mean value and SD of soil Huminity (%)			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	65.8 ±2	66 ±1.0	63.5 ±1.0	61±1.0
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-0.155	-1.782	-3.718	-6.124
	P<0.05	P<0.05	P<0.05	NS*

Table 8: Atmospheric humidity status in selected sacred groves and disturbed non-sacred grove lands during the post-monsoon season

Study site	Mean value and SD of soil Huminity (%)			
	Sacred grove		Disturbed non-sacred grove land	
	Core zone	Transition zone	Inner Zone	Outer Zone
Poyyara site	67.5 ±1.5	68 ±1.0	65 ±2.0	63.5±2.0
	The 't' value and significant level of average soil temperature between different regions			
	Core zone X Transition zone	Core zone X Inner Zone	Core zone X OuterZone	Transition zone X OuterZone
	-0.480	-1.732	-3.843	-5.511
	P<0.05	P<0.05	P<0.05	NS*

It is generally estimated that in the atmospheric humidity, only about 10% of the moisture is contributed by process of plant transpiration while the rest of the 90% moisture is contributed by surface evaporation from the ground and water sources (USGS, 2011). The evaporation loss of water from the ground surface usually occurs at higher rate when the influence of external factors such as sunlight radiations and the presence of wind are higher in the area. Therefore, the loss of moisture through evaporation from the surface soil of a highly disturbed forest or open field may be higher compared to the loss of moisture from the grove soil under protection of rich vegetation cover (Abdulsahim, 2003).

CONCLUSION

Analysis of temperature in the soil and atmosphere in the study sites revealed comparatively low temperature is maintained within the selected sacred grove region compared to disturbed non-sacred grove region. However, with respect to the humidity factor, even though the sacred grove exhibited a reverse trend. Therefore, the present study concludes that the sacred groves are playing an important role in rejuvenating and maintaining a better microclimatic condition in the area. However, the study conclude that the grove area is playing a key role in regulating the microclimatic conditions, as there exists a positive correlation between the grove and the level of temperature and humidity.

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