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Title of Thesis :Spatiotemporal Distribution of Aquatic Invasive Plants in Kuttanad Wetland Ecosystem
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Abstract

Abstract

A study of aquatic invasive plants of Vembanad Lake south of Thannermukkam bund and AC (Alappuzha-Changanassery) canal in the Kuttanad wetland ecosystem using multispectral imageries was undertaken to assess the spatiotemporal variation in the aquatic weed area, its distribution, extent and trends in variation. The study also aimed to analyse the contribution of climatic factors in explaining the changes in the spatiotemporal distribution of aquatic invasive plants. The study employed medium resolution LANDSAT imageries for mapping and monitoring the aquatic weed distribution. The digital image processing software used for classification of the multispectral satellite imageries to estimate the area of aquatic weeds was ILWIS 3.31 Academic version (Integrated Land and Water Information System) by ITC. The supervised classifications of the multispectral imageries were carried out with the help of the ground truth data collected from several Ground control points (GCPs). The study revealed the usefulness of multispectral satellite imageries obtained from satellites like LANDSAT in studying the spatiotemporal changes in the aquatic invasive plant distribution. However, the effects of cloud cover in obscuring the spectral reflectance data limits the availability of usable imageries.

The study utilised cloud free imageries for the determination of the areal distribution of the aquatic invasive plants and cloud free imageries were not available for the rainy period. The spatiotemporal variations in aquatic invasive plants showed a cyclic trend in its distribution. The mean area of the aquatic invasive plants distribution during the period under consideration was 3.25 km2. Among the months taken for the study, monthly mean aquatic weed distribution was maximum in the month of September with a value about 5.4 km2. In the seasonal distribution, the southwest monsoon season (5.4 km2) had the maximum aquatic weed distribution, followed by the winter season (4.0 km2), Northeast monsoon season (3.4 km2) and summer season (2.3 km2).

Factor analysis and stepwise regression analysis was performed to understand the effect of climatic parameters on the spatio-temporal distribution of aquatic invasive plants. The dependent variable considered in the analysis was the aquatic weed area and the independent variables were maximum temperature, minimum temperature, average temperature, relative humidity, total rain, average rain, evaporation and sunshine hours. Among the climatic factors, temperature has got a negative relationship with the aquatic weed area i.e., as temperature increases the aquatic weed area decreases. From the correlation analysis, it was seen that the maximum temperature has got the maximum negative correlation (-0.63) with the aquatic weed area among the variables considered.

The regression analysis revealed that there is a statistically significant relationship between the maximum temperature and aquatic weed area as the p-value is less than 0.001. It was found that 39.67 per cent of the variation in aquatic weed distribution can be explained by the regression model. The regression equation obtained is

AWA = 27.93 - 0.757 Tmax

where AWA = Aquatic weed area (km2) Tmax. = Temperature maximum (°C)

The forward and backward step wise regression analysis also showed that the maximum temperature has got more effect on the aquatic weed distribution than the other climatic variables considered. The aquatic weed area was more during the rainy season as nutrient rich sediment from the agricultural lands is swept into the lake by the rains and floods, which lead to the proliferation of the aquatic invasive plants. The areal spread of aquatic invasive plants is not only influenced by the temperature, but also by other factors such as dissolved oxygen, nutrient load, light intensity and pH. The intrusion of saline water from the sea into the fresh water lake also plays an important role as salinity has a detrimental effect on the growth of these aquatic invasive plants.The regions with the menace of aquatic invasive plants in Kuttanad wetland ecosystem need sustainable management. The study of the spatio-temporal distribution of aquatic invasive plant area using remote sensing techniques provided useful information about the aquatic weed growth in the study area and this method can be utilized for mapping and monitoring the areal spread of aquatic invasive plants.