International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.14, pp 17-21, 2017

Assessment of Water Quality related to Land Use/Land Cover Pattern change in Yercaud, Salem

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Abstract : The study reviewed the relationship between the land use and water quality in yercaud lake, Salem in order to find the impact on land use change on yercaud through Geographical Information System (GIS). The land use and land cover data expose the losses in vegetation cover of the watershed. LU/LC map was prepared by using Arc-GIS 10.1 software. Correlation and Regression analysis were applied for fifteen parameters. Correlation analysis was used to observe the processes controlling the effects of land use on the water quality in this area. Regression analysis generates an equation to describe the statistical relationship between the water quality and land use pattern changes. This indicates the level of relationship, it should be studied in multiple scale and this study useful for develop effective management of Lake Ecosystem.
Keywords : Water quality; Correlation analysis; Regression analysis; Land use; ecosystem.

Introduction

Water plays a vital role in our life. The surface water bodies which are the most important source of water for human activities are unfortunately under severe environmental stress and are being threatened as a consequence of development activities. These water bodies are manmade or natural reservoirs to provide water for irrigation or domestic purpose. Remote sensing is the science of deriving information about the earth resources from images acquired from a distance.Land is an important resource for human beings. It is the resource for plans, animals, energy, etc., change in land use pattern is one of the expected results of watershed program. In the context of watershed land use pattern can be defined as taking up suitable interventions based on the slope percentage and soil type of the land. Land cover and land use are two different concepts in its intrinsic signification. Landover emphasize particularly on its nature properties and it is the synthetically reflection of various elements in global surface covered with natural body or manual construction. Using remote sensing classification method, whatever used or non-used covering object in surface can be separated. However, land use, emphasizing more on land's social properties, is the output of reconstruction activities that human adopts a serial of biologic, technologic measure to manage regulate the land chronically and periodically according to determinate economic and social purpose. Thus, land use is a process of turning natural ecosystem into social ecosystem, and the process is a complicated procedure by the synthetic effect from nature, economy and society.

Study area

Salem District in Tamil Nadu, India is geographically situated between the North latitudes 11°14´ to 12°53´ and East longitudes 77 °44´ to 78° 50´ covering an area about 7905.38 square kilometers. Salem District consists of nine Talus *viz.*, Attur, Edappadi, Gengavalli, Mettur, Omalur, Salem, Sangagiri and Yercaud. The present study area (YercaudTaluk) is one of the nine taluks in Salem District.

Yercaud is a hill station situated in Salem District, Tamil Nadu. It is located in the Shervaroys range of hills in the Eastern Ghats. The total extent of Yercaud Taluk is 382.67 km2, including reserve forest. It is situated at an altitude of 1515 meters (4970 ft) above the sea level. The yercaud range consists of a chaean plutonic rocks of charnockite series and these have weathered into the rugged masses of hills. It is so named owing to a lot of trees categorized as a forest near the lake, the name signifying lake forest. A popular tourist destination, Yercaud is also called Jewel of the South. The climate of Yercaud is moderate and pleasant. There is neither a sharp winter nor a roasting summer. Winters are fairly mild, starting in September and ending in December. During winter, the hills are covered in mist. Winters range from 12 °C to 25 °C and summers from 16 °C to 30 °C. Rainfall is 1500–2000 mm.

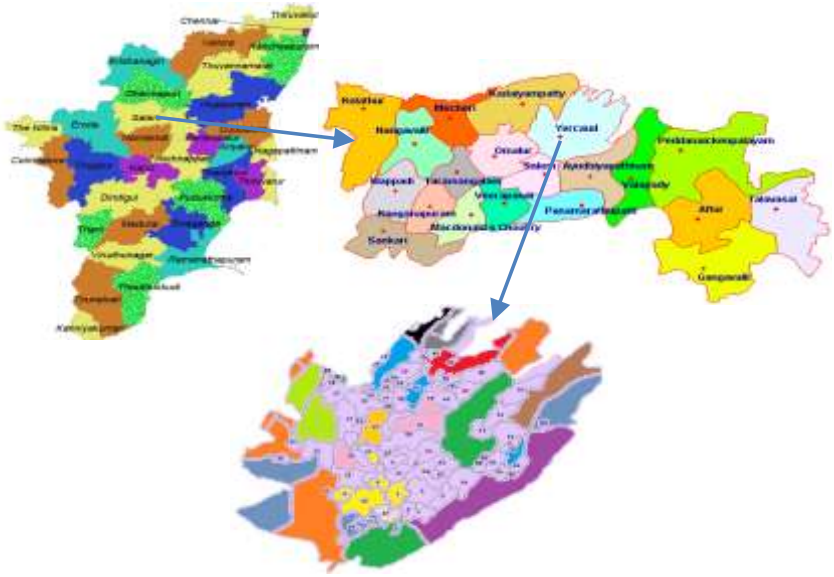

Figure 1: Study area map

Methodology

Collected sample was subjected to chemical analysis. The water samples are analysed for 15 parameters: like pH, turbidity, EC, PO_4, Hardness, TDS, Ca, Mg, Na, K, Cl, HCo_3, So_4, No_3, F. using the standard procedure for analysis. Some of the physic-chemical parameters are found by using Field Water Testing Kit.

Table 1 Sample analysis

S.No	PARAMETER	DESCRIPTION
1	pH	Measured by using pH meter
2	Total Alkalinity	Estimated by neutralizing with standard HCL acid
3	Hardness	Using Water sample analysis kit
4	EC	EC Meter
5	TDS	Using Water sample analysis kit
6	Calcium	Titration method using standard EDTA
7	Magnesium	Titration method using standard EDTA
8	Chloride	Using Water sample analysis kit
9	Sulphate	Using UV spectrometer
10	Sodium	Using flame photometer
11	Potassium	Using flame photometer
12	Nitrate	Using Water sample analysis kit

Data preparation

All satellite data were studied by assigning per-pixel signatures and differentiating the watershed into five classes on the basis of the specific Digital Number (DN) value of different landscape elements. The delineated classes were classified as Agriculture, Built up, forest land, waste land, water bodies.

Statistical Analysis

Statistical analysis was carried out using statistical package for social sciences (SPSSVersion14). Correlation is a broad class of statistical relationship between two or more variables. Hence, it can be considered as a normalized measurement of covariance. The correlation study is useful to find a predictable relationship which can be exploited in practice. It is used for the measurement of the *strength and statistical significance of the relation between two or more parameters*.

The correlation coefficients(r) were calculated and correlation matrix was obtained. Here, r is a dimensionless index which is in the range of -1.0 to +1.0 inclusive 0. It exhibits the extent of a relation between variables. The values of r from 0 to 1 and its indications are shown in *Table 2.*

Table 2 Indications of values of Correlation co-efficient (r)

Value of r	Indication of the Relation
0.0-0.2	Very Poor Correlation
0.2-0.4	Slightly Significant Correlation
0.4-0.6	Moderate Correlation
0.6-0.8	High Correlation
0.8-1.0	Very High Correlation

Result and Discussion

Land Use/Land Cover Changes:

Area of land use is derived from land use pattern map by using ArcGIS software. Based on the analysis agricultural land in the area is 32.33% in 2010 to about 32.18% in 2016. This result shows the agricultural land was reduced 0.15% and the built up area was increased 0.45% during the study period where as the forest area also decreased 0.28%. The figure 2 shows the land use pattern variation.

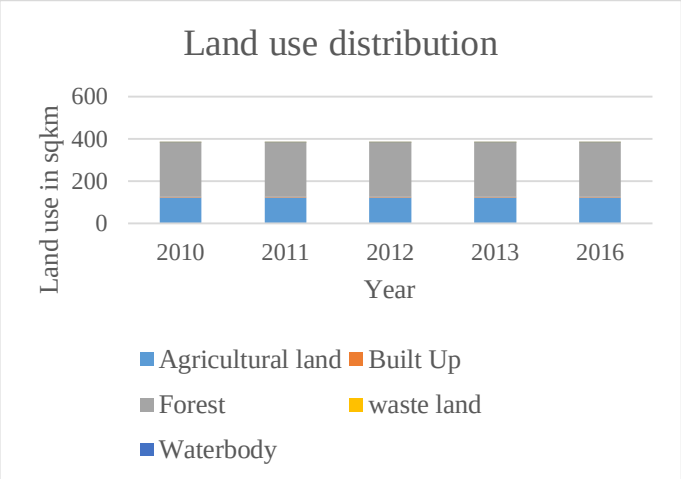

Figure 2: Land use distribution

Correlation between Land use and Water Quality:

The different types of land use showed correlation with some water quality variables in different scales.Agricultural land use showed poorly correlated physico-chemical parameters (pH, calcium, phosphate, magnesium). During the study period the maximum pH is 8, calcium 33, phosphate 0.01, magnesium 12. These values are within the permissible limit as per the WHO standards. Statistical results shows due to agricultural land increases the pollution rate slightly increase.Built-up area very highly correlated with water body (r=0.947), turbidity (r=0.965), total alkalinity (r=0.854), sulphate (r=0.814). Highly correlated with sodium and TDS (r=0.797,0.706). Slightly correlated with potassium and fluoride (r=0.375,0.438).Forest land poorly correlated with magnesium and phosphate (r=0.052,0.137), slightly correlated with calcium (r=0.262). Forest land covers 0.67% of total area, from the past year data forest land slightly reduced. Compare with built-up area this area will not distress the water quality in the particular region. Waste land covers 0.24% and water bodies covers 0.088% of total area. Waste land slightly correlated with calcium (r=0.259) and poorly correlated with magnesium (r=0.138).

Comparing relationship land use and water quality:

Comparing the strength of relationship of water quality parameters with land use indicators by using linear regression model, we used R^2, β values. For the case, Temp had a significant relationship with wasteland, in the whole watershed. For the case, pH had significant relationship with agricultural land, rainfall there is no significant relationship with water body, waste land, forest land and built up land. EC directly related with agricultural land and magnesium had significant relation with rainfall and agricultural land.

Discussion

Land use/ land cover transformation is one the major environmental changes up-to-the-minute around the earth and consequently it has been disturbing water quality. For example, the land uses of yercaud has been changing rapidly, especially from agriculture land to urban land from year 2010 to 2016 due to rapid population growth, urbanization, tourism arrival in the area.The analysis of urban development during the period of 2010 is 0.68% and it is drastically increase in the year 2016 as 1.13% indicated that most of the urban growth occurred in the portion of forest and agricultural lands, offered for new development.Since, Built-up land showed positive correlation with turbidity, alkalinity, sulphate, sodium and TDS. It showed the increment of built-up land create contamination on water quality.Agriculture land was negatively associate with water body and slightly positively correlated with calcium, phosphate and magnesium.

Conclusion

In this study, the water quality parameters like turbidity, total alkalinity, EC, sulphate, sodium, TDS, and fluoride are appropriate parameters to have relationship with land use indicators since they showed significant relationship with agriculture, forest, built-up and water body in different scales. For the case of land uses, agriculture and built-up are important land use indicators to link water quality variables. By consideration of suitable water quality variables and important land use indicators helps to link land use and water quality parameters for decision making process in the study region. This study also demonstrates the importance land use changes, water quality changes and helpful for future planning, watershed management.

References

1. F.J. Thakoret.al., “Water Quality Index of Pariyej lake Dist. Kheda- Gujarat” current world environment volume 6(2), 225-231 (2011).
2. BhavenN.Tandel, Dr. JEM Macwan, &Chirag K. Soni “*Assessment of Water Quality Index of Small Lake in South Gujarat Region, India "* in the Journal of Agricultural research at pp 34-38 & 2010.
3. Agbaire.P.O., “Seasonal Variations of Some Physico Chemical Properties of River Ethiope Water in Abraka, Nigeria,” Journal of Applied Science & Environment Management, Vol.13 (1), 55-57, (2009)
4. “Guidelines for Water Quality Monitoring”, Central Pollution Control Board, INDIA, MINAS/27/2007-08
5. Indian Standard Specifications for Drinking Water, IS: 10500.1992

6. J.Yisa and T.Jimoh, "Analytical Studies on Water QualityIndex of River Landzu", American Journal of AppliedSciences 7 (4):453-458, ISSN 1546-9239 (2010)
7. Abdul-Razak, A. B. Asiedu, R. E. M. Entsua-Mensah and K. A. A. deGraft-johnson, "Assessment of the Water Qualityof the Oti River in Ghana" West African Journal of AppliedEcology,vol. 15,(2009)
8. S.Gyawali, K.Techato and S.Monprapusson, "Assessing the Impact of Land Use on Water Quality across Multiple Spatial Scales in U-tapao River Basin, Thailand" Journal of Institute of Science and Technology, 2015, 20(2): 54-60, © IOST, Tribhuvan University.
9. A.R. Keshtkar, M. Mahdavi, A. Salajegheh, H. Ahmadi, A. Sadoddin, B. Ghermezcheshmeh, "Exploring the relationship between land use and surface water quality using multivariate statistics in arid and semi-arid regions"DESERT 16 (2011) 33-38.
10. Naseema Khatoon, Altaf Husain Khan, Masihur Rehman, Vinay Pathak, "Correlation Study For the Assessment of Water Quality and Its Parameters of Ganga River, Kanpur, Uttar Pradesh, India" ,IOSR Journal of Applied Chemistry (IOSR-JAC) e-ISSN: 2278-5736. Volume 5, Issue 3 (Sep. – Oct. 2013), PP 80-90.

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