ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 6, Issue 4, pp: (371-375), Month: October - December 2018, Available at: www.researchpublish.com

TIME SERIES DROUGHT HAZARD MAPPING AND WATER QUALITY MODELING AT COMMUNITY LEVEL IN PALAKKAD DISTRICT USING GEOINFORMATICS

GOPAKUMAR P G[1], SUBIN K. JOSE[2]

[1]Department of Geology, Christ College, Irinjalakuda

[2]Corresponding Author: Department of Environmental science, Christ College, Irinjalakuda,

Author Email: josesubin@gmail.com

Abstract: **Drought is one of the major environmental disasters, which have been occurring in almost all climatic zones and damage to the environment and economies of several countries has been extensive and death toll of livestock unprecedented. Drought damages are more pronounced or prominent in areas where there is a direct threat to livelihoods. The advanced technologies like remote sensing and geographical information system are very essential to identify the drought condition. Groundwater is regarded to be the most valuable natural resources. The distribution of groundwater is not uniform through the area. Remote Sensing (RS) and Geographical Information System (GIS) techniques have been used to observe and more systematic analyze various groundwater resources and its demarcation. Groundwater resources are contaminated due to industrial and domestic pollution, depletion induced quality deterioration, over pumping etc. The analysis of physico chemical parameters will help to find the overall quality of area. By integration of different physico-chemical parameters into GIS base and comparison according to the defined standards of drinking water quality would help to generate Water Quality Index map of an area which is very useful in determining the groundwater quality status of the area. The present work identified the drought prone area and Water Quality Index map of Palakkad district with the help of field data, remote sensing and GIS data. The result is useful for the drought management and issues associated with water quality and ground water depletion.**

Keywords: **Drought, Geographic Information System, Remote Sensing, Water Quality Index.**

1. INTRODUCTION

Water causes controversial problems in many parts of the world. Too much of water causes flood and too little causes drought, too poor causes famine, poor quality causes health hazards and poor management creates competition and conflicts (Vijith,2007). Out of the weather related disasters, drought is the most complex one and both the causes and multifaceted are not well understood. Drought is a dangerous natural hazard which is normal to all climate regions (World Meteorological Organization, 1975). It should not be viewed as merely a physical phenomenon rather; drought is the result of interaction between a natural event and demand placed on water supply by human use. Drought as a natural disaster is peculiar due to its slowness and lengthy duration. The severity of the drought depends upon its duration, the degree of moisture deficiency, and the size of the affected area (Karamouz,2015). Drought is a hazard that requires many months to emerge and that may persist for many months or years thereafter. This type of hazard is known as a “creeping hazard**”** (Abdel,2014) and results in serious economic, social, and environmental impacts.

ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 6, Issue 4, pp: (371-375), Month: October - December 2018, Available at: www.researchpublish.com

Dynamic nature of drought with complex phenomenon having multiple effects from a major challenge in planning, monitoring, predicting, assessing impacts and offering solutions to drought hit areas. Because of these complexities, high quality data and improved tools to capture the spatial and temporal dimensions of drought various satellite platforms and the technology available for analysis such as geographic information system and other integrative tools like global positioning systems are needed (Zhao,2008). The effective management of resources and disasters require relevant information regarding it in real-time. Also the possible prediction and monitoring requires rapid and continuous data and information generation or gathering. The space technology or remote sensing tools offer excellent possibilities of collecting this vital data and it can be effectively analyzed, displayed and managed by geographical information system(Jerrod,2016, Ganesh, 2018).

Water quality index (WQI) for the groundwater and surface water is important for the estimation and safe usage of water. He collected ground water samples and subject it to various physicochemical analysis and WQI for 12 parameters are determined. WQI reveals that the groundwater of the area needs any degree of treatment before consumption and it also protected from contamination.

2. MATERIALS AND METHODS

The present study has mainly two objectives. First identification of drought prone areas, second is to find the water quality index of the study area. Materials and methodology are designed in such a way as to satisfy each objective. Landsat ETM data is used for deriving NDVI of the study area. The images are downloaded from Global Land Cover Facility (GLCF) (Wilhite,2000). Slope and elevation of the study area are generated from Shuttle Radar Topographic Mission (SRTM) data. Annual rainfall is collected for a period of 10 years because the changes in rainfall are the main indicator of drought. Water quality data of 2017 and 2018 are used to find the ground water quality of the study area. Geomorphology map, Soil map, Land use land cover map, Rocks and minerals map, Geohydrology map prepared by Geological Survey of India were also used for the identification of potential ground water zone and drought prone areas.

The Survey of India toposheet and Landsat ETM+ satellite image were used for the preparation of all the thematic layers. These layers were used for the identification of drought prone areas. Various thematic maps like geomorphology, depth to water level, slope, rainfall, drainage density, landuse/landcover, NDVI, geohydrology, soils and rocks & minerals were prepared. The weighted overlay analysis technique was employed to determine the drought prone zone identification. The weightages of individual themes and feature score were fixed and added to the layers depending upon their suitability to hold groundwater and potential and to cause drought. Higher values of the scores indicate higher possibilities for groundwater availability and drought proneness. Spatial Analyst extension of ArcGIS 10.4 was used for converting the features to raster and also for final analysis. In this method, the total weights of the final integrated map were derived as sum or product of the weights assigned to the different layers according to their suitability. Finally, the village vise groundwater condition has been assessed by superimposing the village map over the drought prone area maps.

The various physico-chemicals attributes of water samples such as pH, Electrical Conductivity (EC), Total Hardness (TH), Calcium (Ca), Magnesium (Mg), Carbonates (CO3), Bicarbonates (HCO3), Sodium (Na), Potassium (K), Chloride (Cl), Nitrate (NO3), Sulphates (SO_4), Flouride (F) etc were collected from CGWB. The different locations of sampling stations with its corresponding physico-chemical analysis values were imported into GIS as point layer. All the three years of data are imported like this. The spatial distribution of each water quality parameters are generated by using the Inverse Distance Weighted tool in the spatial analyst toolbox of Arc.Map. This spatial distribution of the selected water quality parameters are used to generate water quality index (WQI) of the study area. Water quality index (WQI) is defined as a technique of rating that provides the composite influence of individual water quality parameter on the overall quality of water. WQI turns the complex water quality data into information that is understandable and usable by public. The BIS and WHO standards for drinking have been considered for calculation of WQI.

3. RESULTS AND DISCUSSION

Different thematic maps like geomorphology, depth to water level, slope, drainage density, landuse/landcover, NDVI, geohydrology, soils and rocks & minerals were prepared and reclassified in relation to the drought severity factors. The depth to water level map of 2018, and 2008 were interchangeably used to generate three years drought vulnerable maps of Palakkad district. By integrating the water level depth of two years, a mean or combined drought vulnerability map of the district are generated. The output maps were come out with taluk wise drought severity assessment. Careful analysis of the two year drought analysis shows an increasing pattern of drought in the district. This may be due to the changing climatic parameters, land use pattern and human exploitation. The analysis this drought vulnerable maps help to identify the drought hit areas in the district. The map shows four different classes as low, moderate, high and severe.

The values of selected parameters of groundwater quality data in during, pre and post monsoon seasons and BIS and WHO water quality standards were used for calculating water quality indices. Quality status is assigned on the basis of calculated values of water quality indices to include the collective role of various physicochemical parameters on the overall quality of drinking water. WQI computations were made from the equations. The spatial distribution of the WQI map generated for the study area during, pre and post monsoon seasons are presented in the map. The Water quality map show four classes like very poor, poor, moderate and good quality areas. The analysis of the two years of WQI map shows that in 2018 water quality of the district are comparatively not suitable than in 2008 . This may be due to the climatic as well as human activities.

4. CONCLUSION

Dynamic nature of drought with complex phenomenon having multiple effects from a major challenge in planning, monitoring, predicting, assessing impacts and offering solutions to drought hit areas. Because of these complexities, high quality data and improved tools to capture the spatial and temporal dimensions of drought various satellite platforms and the technology available for analysis such as geographic information system and other integrative tools like global positioning systems are needed. India being a tropical country with hot and humid climates and high temperature conditions. Delay in the monsoons as well as high evaporation rate of the surface water bodies is making some of the regions into drought areas. As the drought is dynamic in nature, which builds over a time, timely and reliable information is essential for effective drought monitoring and management. In India the pollution especially water pollution is increased and the quality of drinking water decreased. Satellite remote sensing provides multi-spectral, multi spatial and multi temporal data useful for drought monitoring, assessment and management. The GIS based method is use full for the analysis of water quality. The present study is a comprehensive evaluation and integrated analysis of drought and water quality analysis, which has been carried out by using satellite based remote sensing and GIS techniques. Adverse climatic conditions may further convert these high drought prone areas to severe drought areas. Some action plans comprising of water pollution prevention ,drought proofing works, employment generation programmes and social security programs were discussed for managing the drought prone and increasing the water quality.

ACKNOWLEDGEMENT

We express our sincere gratitude to INDIAN COUNCIL OF SOCIAL SCIENCE RESEARCH (ICSSR), New Delhi for the financial support for the project.

REFERENCES

[1] Vijith.H (2007): Groundwater potential in the hard rock terrain of Western Ghats: A case study from Kottayam district, Kerala using Resourcesat (IRS-P6) data and GIS techniques. Journal of the Indian Society of Remote Sensing, Vol. 35, No. 2, 163-171.

[2] Wilhite, D.A (2000): Drought: A Global Assessment, Natural Hazards and Disasters Series, Routledge Publishers, U.K.

[3] World Meteorological Organization (1975). Drought and agriculture. WMO Report no.392, Technical note no.138.WMO Geneva, Switzerland.

[4] Zhao.H, Tang.Z, Yang.B and Zhao.M (2008): Agriculture drought and forest fire monitoring in Chongqing City with MODIS and meteorological observations. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. 37(B7), 421-428.

[5] Nishadi Eriyagama, Vladimir Smakhtin, Nilantha Gamage;2015; “Mapping drought pattern and impact”; A global perspective; International water management institute research report.

[6] Karamouz.M, Zeynolabdein.A, Olyari.M.A; 2015; “Mapping regional drought vulnerability: A case study”; International archives of the photogrammetry, Remote Sensing & Spatial information science ; Vol XL-1/ W5.

ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 6, Issue 4, pp: (371-375), Month: October - December 2018, Available at: www.researchpublish.com

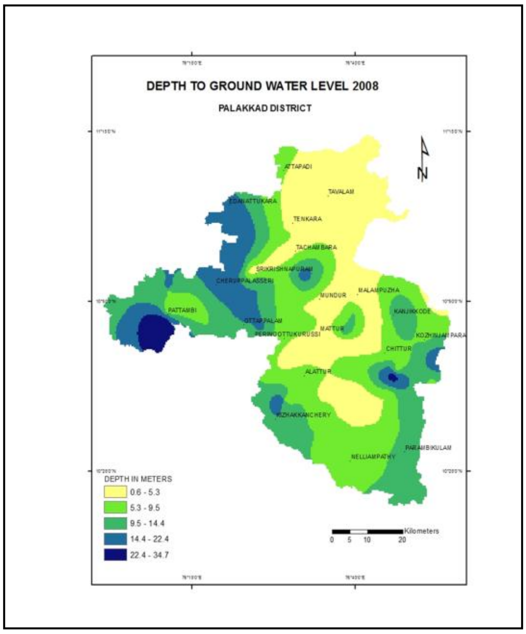
[7] Abdel Aziz Belal, Hassan. R. El- Ramady, Elsayed.S.Mohammed, Ahmed. M. Saleh;2014; "Drought risk assessment using Remote sensing & GIS techniques"; Arabian journal of Geosciences; Springer publication; Vol 7; Issue 1; pp. 35-53.

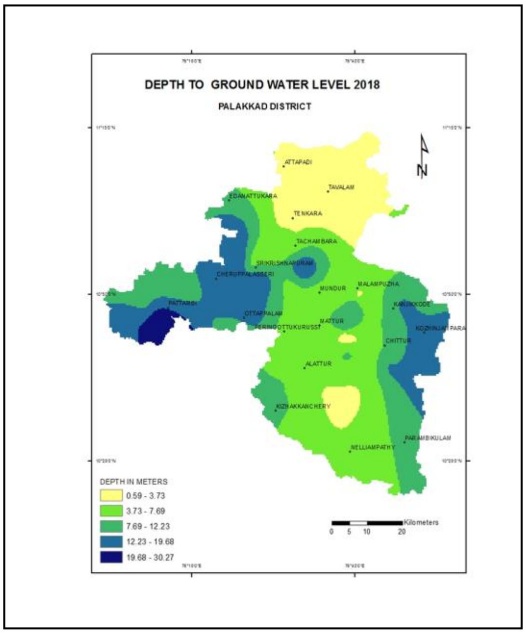
[8] Jerrod Lessel, Alexandra Sweeney, Pietro Cerrato;2016; "An agricultural drought severity index using quasi-climatological anomalies of remotely sensed data"; International journal of remote sensing; Taylor & Francis publication; issue 4; pp. 913-925.

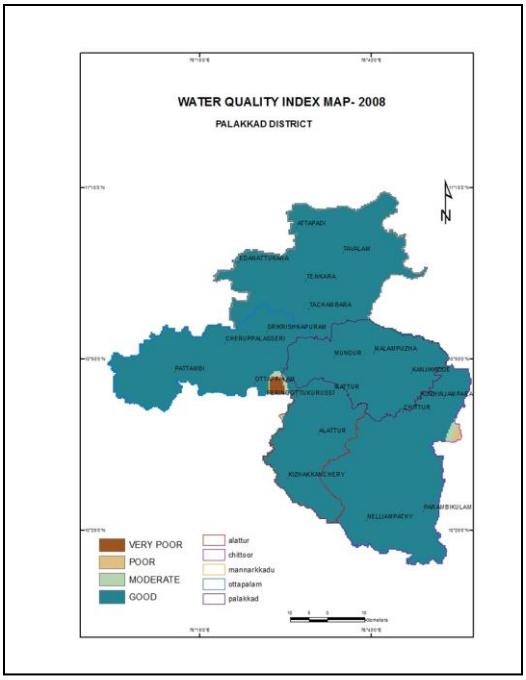
[9] Ganesh Raju J , Shweta Sharma ; 2018; "Identification Of Water Potential Zones In Drought Prone Area's – A Case Study Of Rolla Mandal, Ananthapuram, Andhra Pradesh, India" ; International Journal Of Trend In Scientific Research And Development ; Vol 2; Issue 2.

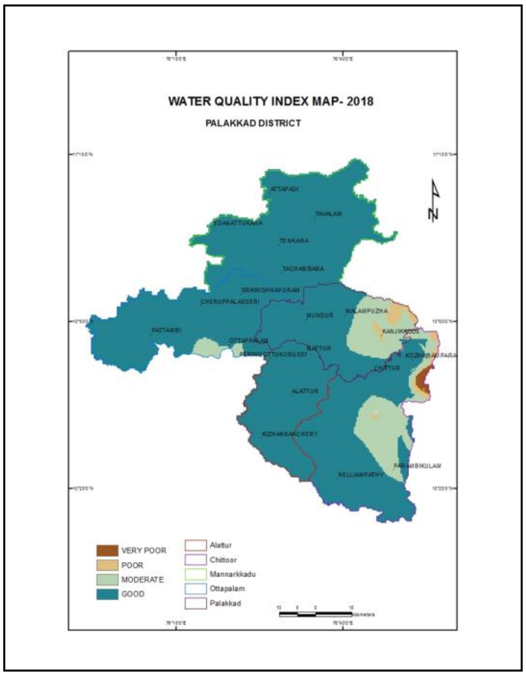
APPENDIX – A

List of Figures:









ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 6, Issue 4, pp: (371-375), Month: October - December 2018, Available at: www.researchpublish.com