CHANDRASHEKHAR AZAD VISHWAKARMA

Phone : +91- 9717586555, 9968818505
Email : ajadshekhar@gmail.com

Objective: To enhance my knowledge, technical skills, and capabilities and constantly acquire new skill sets and to contribute in the field of science

ǁ Education ǁ

- **PhD awarded** on 05 May 2019 from School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India under the supervision of Prof. S. Mukherjee (Topic: Assessment of Geogenic and Anthropogenic influences on Groundwater in part of South Sikkim using geospatial technique).
- **M.Sc. (Environmental Science)** from Banaras Hindu University, Varanasi in 2012.
- **B.Sc. (Biotechnology, Chemistry)** from Jagatpur PG College (V.B.S. Purwanchal University, Jaunpur), in 2008.
- **Senior secondary (SSC)** from SBUIC, Sewapuri, Varanasi, UP Board in 2005.
- **Higher secondary (HSC)** from SBUIC, Sewapuri, Varanasi, UP Board in 2003.

ǁ Work Experience ǁ

TERI School of Advanced Studies
At present, working as Research Associate-II on a project related to Himalayan water crisis.

Zakir Husain Delhi College, University of Delhi
Taught as Assistant Professor (Guest faculty Environmental Science).

School of Environmental Sciences, JNU, New Delhi
June 2012 to June 2018, PhD Scholar, UGC-JRF, PhD title "Assessment of Geogenic and Anthropogenic influences on Groundwater in part of South Sikkim using geospatial technique"

M.Sc. Dissertation (Banaras Hindu University)
Land degradation assessment using geospatial techniques in a part of Rihand Dam Environment.

Indian Institute of Petroleum, Dehradun
Worked as Project Assistant (level-I) from 06.07.2009 to 30.11.2009.

ǁ Publications ǁ

- Farswan S., **Vishwakarma C.A.**, Mina U., Kumar V. & Mukherjee S. (2019). Assessment of rainwater harvesting sites in a part of North-West Delhi, India using geomatics tools. Environmental Earth Sciences, (2019) 78:329. DOI 10.1007/s12665-019-8332-y
- **Vishwakarma C.A.**, Sen R., Singh N., Singh P., Rena V., Rina K. & Mukherjee S. (2018). Geochemical Characterization and Controlling Factors of Chemical Composition of Spring Water in a Part of Eastern Himalaya. Journal Geological Society of India, Vol.92, December 2018, pp.753-763
- Kumari R., Datta P. S., Rao M. S., Mukherjee S., & **Azad C**. (2018). Anthropogenic perturbations induced groundwater vulnerability to pollution in the industrial Faridabad District, Haryana, India. Environmental Earth Sciences, 77(5), 187. DOI 10.1007/s12665-018-7368-8.
- Sheikh M. A., **Azad C.**, Mukherjee S., & Rina K. (2017). An assessment of groundwater salinization in Haryana state in India using hydrochemical tools in association with GIS. Environmental Earth Sciences, 76(13), 465. DOI 10.1007/s12665-017-6789-0
- **Vishwakarma C.A.**, Asthana H., Singh D., Pant M., Sen R., & Mukherjee S. (2017). GIS based bi-variate statistical approach for landslide susceptibility mapping of South District, Sikkim.

International journal of innovative research in science, engineering and technology, Vol. 6, Issue 7.

- Singh P., Javed S., Shashtri S., Singh R. P., **Vishwakarma C. A.**, & Mukherjee S. (2017). Influence of changes in watershed landuse pattern on the wetland of Sultanpur National Park, Haryana using remote sensing techniques and hydrochemical analysis. Remote Sensing Applications: Society and Environment, 7, 84-92. DOI 10.1016/j.rsase.2017.07.002
- **Vishwakarma C. A.**, Thakur S., Rai P. K., Kamal V., & Mukherjee S. (2016). Changing land trajectories: a case study from India using a remote sensing based approach. European Journal of Geography, 7(2), 61-71.
- Singh, N., Asthana H., **Vishwakarma C. A.**, Sen R., & Mukherjee S. (2016). Soil chemical analysis of gangetic delta plain by combined use of multispectral imagery and XRF spectroscopy. International Journal of Advance Geosciences. DOI: 10.14419/ijag.v4i2.6743
- Singh N., Sen R., **Vishwakarma C. A.**, Asthana H., & Mukherjee S. (2016). Groundwater recharge influencing the arsenic enrichment in the aquifer of west Bengal. International Journal of Advance Geosciences. DOI: 10.14419/ijag.v4i2.6456
- Kamal V., Mukherjee S., Singh P., Sen R., **Vishwakarma C. A.**, Sajadi P. & Rena V. (2017). Flood frequency analysis of Ganga river at Haridwar and Garhmukteshwar. Applied Water Science, 7(4), 1979-1986. DOI 10.1007/s13201-016-0378-3

ll Conferences ll

Oral presentation

- Paper presented on topic **"Changing Land Trajectories in Singrauli Region of Madhya Pradesh: A Remote Sensing Based Approach"** on 2nd URSI-Regional Conference on Radio Science-2015.

Poster presentation

- Poster presented (Best poster award) on the topic **"Land use land cover change analysis in South Sikkim using Landsat datasets"** at Jawaharlal Nehru University, 2018.
- Poster presented on the topic **"Land surface temperature estimation of South Sikkim using Landsat datasets"** at Kitakyushu, Fukuoka, Japan on 07-09 November, 2017.
- Poster presented on the topic **"Assessment of changing land pattern in South Sikkim using multispectral datasets"** at School of Environmental Sciences, Jawaharlal Nehru University, New Delhi held on 29 March 2017
- Poster presented on the topic **"GIS based Bi-variate Statistical Approach for Landslide Susceptibility Mapping of South District, Sikkim"** at National Symposium, IIRS, Dehradun, 2016.

ll Workshops and trainings ll

- Attended 5-days Faculty Development Programme on **"How to Make the Teaching Learning Process Effective"** on 25th to 29th June, 2018.
- National Workshop on Techniques in Hyperspectral Data Analysis and Processing, BHU, Varanasi, 2017.
- Attended online certificate course on **"Microwave Radar Remote Sensing and its Applications"**.
- Attended online certificate course on **"UAV Remote Sensing and Applications"**.
- Attended 12 weeks training program on **"Geospatial Technologies and Application"** organized by National Remote Sensing Centre, ISRO, Hyderabad, 2014-2015.
- Hands on **Advanced Instruments of Water Quality Testing** in National Institute of Hydrology, Roorkee, 2013.

ll Awards and Fellowships ll

- UGC-NET JRF (Environmental Science) 2012

- UGC-NET SRF (Environmental Science) 2015
- CSIR-Travel grant 2017

ll Core Competencies ll

- Hydro-geochemistry
- Water resource management
- Climate change
- Landslide risk assessment
- Land cover change dynamics
- Hyperspectral image analysis
- Landsat data analysis
- IRS data analysis
- Geospatial modelling

ll Personal Details ll

Date of Birth: January 02nd 1988
Languages Known: English and Hindi.
Permanent Address: S/o Lallan Prasad Vishwakarma, Takkhu Ki Bauli, Post-Sewapuri, Dist.-Varanasi, UP, India-221403

ll Referees ll

Prof. S. Mukherjee
School of Environmental Sciences
Jawaharlal Nehru University
New Delhi-110067
Email: saumitramukherjee3@gmail.com, saumitra@mail.jnu.ac.in
Office phone: +91-11-26704312
Mobile : +919313908512
Webpage: https://www.jnu.ac.in/Faculty/smukherjee/

Dr. Kumari Rina
School of Environment and Sustainable Development
Central University of Gujarat
Gandhinagar, Gujarat-382030
Email: rina.kumari@cug.ac.in
Phone: +91-8758346994
Webpage: http://www.cug.ac.in/faculty/sesd/Dr_Kumari_Rina.php

Dr. Prashant K Srivastava
Institute of Environment and Sustainable Development
Banaras Hindu University, India-221005
Email: prashant.iesd@bhu.ac.in
Phone: +91-7571927744
Webpage: http://www.bhu.ac.in/iesd/Final_CVs/Assistant%20Professors/pks.pdf

Environmental Earth Sciences (2019) 78:329
https://doi.org/10.1007/s12665-019-8332-y

ORIGINAL ARTICLE

Assessment of rainwater harvesting sites in a part of North-West Delhi, India using geomatic tools

Sandhya Farswan[1] · Chandrashekhar Azad Vishwakarma[1] · Usha Mina[1] · Vijay Kumar[1] · Saumitra Mukherjee[1]

Received: 14 September 2018 / Accepted: 12 May 2019

Abstract

The study was conducted with an aim to provide practical solution for the groundwater management in three villages namely Singhola, Ghoga and Dhirpur of the North-West Delhi, India. LANDSAT remote-sensing datasets for the last four decades (1977–2018) were assessed to determine changes in vegetation cover at the selected sites. The Google Earth Engine was used to determine how values of the Normalized Difference Vegetation Index (NDVI) were found to have varied spatially and over time for the selected sites. Strong correlations were found between the NDVI values of surface features including waterbodies, forest land, agricultural land and urban areas in Singhola, Ghoga and Dhirpur, respectively. The relative infiltration capacity of soils was highest (92.9%) and lowest (57%) for Singhola and Dhirpur, respectively, due to spatial differences in soil texture. In each village, locations exhibiting a higher soil infiltration capacity could be used for implementing managed aquifer recharge schemes using rainwater harvested from rooftops in the villages. This assessment indicated that the village of Ghoga has the highest potential (3,76,98,013.08 m^3) for aquifer recharge through rooftop rainwater harvesting as compared to the other two villages.

Keywords NDVI · Soil texture · Rooftop capacity · Rainwater harvesting

Introduction

Densely populated areas in many parts of the world that have seasonal rainfall are facing high water scarcity problems, particularly in regions that have a semi-arid climate (Falkenmark et al. 1989). These problems can often be alleviated in regions that are underlain by suitable aquifers by harvesting rainfall and surface runoff and infiltrating the water to ground to store water in aquifers for extractive uses during the dry season. The amount of water that can be harvested in rainy seasons by these techniques depends both on the annual rainfall of the region and the intensity of individual rainfall events (Helmreich and Horn 2009; Abdulla and Al-Shareef 2009). Under suitable conditions, well-managed rainwater harvesting schemes can prevent the water scarcity during dry seasons and support day-to-day essential activities (Kumar and Chander 2018).

The use of engineering measures to harvest rainfall and enhance groundwater recharge is most effective in areas underlain by coarse textured soils, although other factors including macro-structures within the soil profile and vegetation cover can also play a significant role in controlling recharge rates (Horton 1940). The presence or absence of a vegetation cover may also influence infiltration rates through a soil profile (Dekker et al. 2007). The presence of a vegetation cover can increase the water percolation to an aquifer and reduces surface runoff and consequently prevent silting through soil erosion (Mukherjee and Mukherjee 2001). It is, therefore, important to identify sites that have suitable soils and a vegetation cover in areas where rainfall harvesting can be proposed, and this assessment is generally most effective when carried out using remote-sensing techniques. Geomatic techniques can be used to determine spatial pattern of areas where present is present or absent in any region in India using Landsat satellite datasets in the form of a Normalized Difference Vegetation Index (NDVI). Geomatic techniques are also helpful for understanding soil and vegetation characteristics as remote-sensing data can also evaluate the soil-moisture content (soil index) in a region (Vidhya Lakshmi et al. 2015).

✉ Saumitra Mukherjee
saumitramukherjee3@gmail.com

[1] School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India

Published online: 23 May 2019

JOURNAL GEOLOGICAL SOCIETY OF INDIA
Vol.92, December 2018, pp.753-763

Geochemical Characterization and Controlling Factors of Chemical Composition of Spring Water in a Part of Eastern Himalaya

Chandrashekhar Azad Vishwakarma[1], Ratan Sen[1], Neha Singh[2], Priyadarshini Singh[1], Vikas Rena[1], Kumari Rina[3] and Saumitra Mukherjee[1]*

[1]School of Environmental Sciences, Jawaharlal Nehru University, New Delhi - 110 067, India
[2]The M. S. University of Baroda, Pratapgunj, Vadodara - 390 002, India
[3]School of Environment and Sustainable Development, central university of Gujarat, Gandhinagar - 382 030, India
**E-mail:* saumitramukherjee3@gmail.com

ABSTRACT

This paper focuses on the suitability of spring water for drinking and irrigation purposes in a part of eastern Himalaya, south Sikkim. There are many anthropogenic and geogenic factors contributing as a source of major cations and anions in the spring water. The spring water chemistry show a variation in EC, pH, TDS, Temperature, Na^+, K^+, Mg^{2+}, Ca^{2+}, Fe^{2+}, Pb, Mn, Cu, HCO_3^-, Cl^-, PO_4^{3-}, NO_3^-, F^- and SO_4^{2-}. Mainly two types of water quality indexing has been used, one for suitability of spring water for drinking purposes and the other for irrigation purposes. For drinking purposes, Piper diagram used for determination of water type, water quality index (WQI) for quality monitoring and saturation index for mineral dissolution in water. % Na, RSC (Residual Sodium Carbon) and SAR (sodium absorption ratio) have been used for irrigation suitability. Piper diagram shows that $CaHCO_3$ type of water was dominant in the study area. The WQI depicted excellent category and SAR, percent sodium and RSC (Residual Sodium Carbon) depict excellent, good and permissible category for irrigation purposes. Principle component analysis (PCA) was used to determine the major influencing factor responsible for the variability in the parameters analysed of spring water.

INTRODUCTION

Sikkim is one of the smallest Indian states of Eastern Himalaya consisting of four districts namely East, West, North and South. Major region of the state is hilly with an elevation ranging from 230 to 8583 meters (Roy, 2009). The people of Himalayan region mainly depend on spring water for livelihood, drinking water, sanitation, and irrigation (Mahamuni and Kulkarni, 2012). Most of the rainfall flows off as surface runoff through kholas, streams, and intermittent spring due to the steep slope. Springs get recharged through infiltration of rainfall through fractures, joints, weathered zones of the rocks and through soil covers. Spring discharge increases by 2 to 6 times during the monsoon season as compared to the pre-monsoon season. It plays a very significant role for fulfilling the water security to nearly 80% of the rural households (Roy, 2009).

Although Sikkim is endowed with rich water resources but due to poor management, degradation in water quality has been observed in recent years. Being a tourist spot and a commercial hub, most of the towns in Sikkim are growing rapidly. Therefore, there is a need for proper management of water supply systems of these towns which can fulfill the water supply demands of consumers as well as tourist population. The state of Sikkim exclusively depends on surface water sources like streams, rivers, lakes and springs. The springs originate from the underground aquifers which are recharged with rainwater (P.H.E., 2012-2013).

The water quality of the study area is relatively good as it is a lowland area (Verghese, 1990). As discussed earlier, the spring water is the main source of livelihood and it comes through various geological structures like fractured and joints. The chemistry of groundwater affected by many factors like geology of the area, the extent of chemical weathering of various rock types and other anthropogenic factors (Singh et al., 2015). The chemical quality of groundwater is evaluated based on its suitability for agricultural and domestic purposes (Mukherjee, Kumar, & Koertvelyessy, 2005). All these factors are responsible for various water types which may vary from place and time (Ako et al., 2012). The run-off water interacts with weathered zone of schist, gneisses, quartzite and phyllite rocks (Tiwari, 2012). Due to gravity flow, the spring water reaches the household of lower areas. It is discussed that with increase in the run-off time, the surface-water interaction predisposes the water to microbial and mineral contamination present within rocks. Due to hydro-meteorological conditions, Sikkim receives the maximum rainfall amounting to more than 2500mm (P.H.E., 2012-2013). The precipitated water is responsible for weathering process. Therefore, the present study was carried with emphasis on the spring water hydro-geochemistry which helps in determination of the acquisition process of solute into water and primary and secondary minerals saturation states in groundwater. The chemical characteristics of groundwater were analyzed with the help of hydrogeochemical facies and hydrogeochemcial signatures such as dissolution, ion exchange process, precipitation and calcite buffering mechanism. Conventional graphical plots have been used to determine various hydrogeochemical processes controlling the hydrochemical characteristics of an aquifer in the study area (E. J. Singh, Gupta and Singh, 2013). Principal component analysis and correlation matrix are used in this study to identify the interaction between physico-chemical parameters of water and to understand the important variables which affect the quality of water (E. J. Singh et al., 2013).

STUDY AREA

The study area belongs to a part of south Sikkim extending from 88.271° E to 88.538° E longitude and 27.078° N to 27.336° N latitude (Fig. 1). Climatic condition in the study area can be broadly divided into tropical temperate and alpine zone. The climate and weather of the whole state is mainly governed by elevation which ranges from 230 to 8583 meters. The average annual rainfall in Sikkim is 2739 mm. The rainfall of pre-monsoon occurs in April to May and monsoon operates normally from the month of May and continues upto early October. South Sikkim has a lower elevation and is dominated by cultivated land. It is characterized by Himalayan topography with series of crisscross ridges and ravines (CGWB, 2017). This variation is due to the south direction of drainage pattern. Most part of the state is encompassed by Precambrian rocks (NIC, 2017).

0016-7622/2018-92-6-753/$ 1.00 © GEOL. SOC. INDIA | DOI: 10.1007/s12594-018-1098-0

Environmental Earth Sciences (2018) 77:187
https://doi.org/10.1007/s12665-018-7368-8

ORIGINAL ARTICLE

Anthropogenic perturbations induced groundwater vulnerability to pollution in the industrial Faridabad District, Haryana, India

Rina Kumari[1] · P. S. Datta[2] · M. S. Rao[3] · S. Mukherjee[4] · C. Azad[4]

Received: 12 October 2017 / Accepted: 18 February 2018 / Published online: 28 February 2018

Abstract

The study area Faridabad District is situated in the south-eastern part of state Haryana in the National Capital Region Delhi, India. From past few decades, change in land use pattern has affected water resources in the area both in terms of quantity and quality. To avoid further degradation of groundwater, the present study aims to identify the sources and the processes contributing to groundwater salinity and pollution, based on hydrogeochemistry in integration with GIS. The groundwater vulnerability has been assessed by rock–water interaction, geochemical processes, river/canal seepage, pollution and intermixing, variation in land use activities. The study suggests that the region-specific factors such as unplanned land use pattern and waste disposal, drainage as well as intermixing of groundwater play significant role in groundwater pollution besides geochemical processes. Salinity in shallow aquifers is usually as a consequence of leaching of evaporates in waterlogged areas along canals during rain or irrigation; mineral weathering; evaporation induced concentration of dissolved salts; saline groundwater movement from deeper to shallower aquifers due to continued indiscriminate groundwater over-abstraction; and expanding lateral extent of pollution in the overexploited aquifers.

Keywords Groundwater · Salinity · Geochemical processes · Groundwater recharge · Geochemical modelling · Faridabad Haryana

Introduction

The concept National Capital Region (NCR), Delhi, originated to relocate the commercial activities to keep pace with increasing migration of population, dynamic changes in land use and land cover; and to achieve environmentally sustainable development. Over the past decades, the NCR, India's largest and the world's second largest agglomeration of people has faced rapid growth in population, urbanization, industrialization and agricultural intensification, which caused scarcity of water. Faridabad District in Haryana State—a part of the NCR is one of the largest industrial estates of Asia, housing a number of small, medium and large industries, such as agro-based, chemicals, electroplating, fertilizers, dyeing, textile, weaving, pharmaceuticals, machinery parts, and wooden products. Along with industrialization, the area has also experienced high agricultural development. The consumption of fertilizer increased from 130.77 kg/Ha in 2000–2001 to 329.55 kg/Ha in 2010–2011 (Agricultural Department of Haryana 2013). Increasing urbanization and industrial activities also lead to increase in solid waste generation. Presently, 200 MLD of sewage is generated, and about 85 MLD is being discharged to the River Yamuna without any treatment. The present industrial water demand is about 20MLD and the same is expected to reach 100MLD in 20 years. In 2001, sewer network covered 65 per cent of urban population in the district which has increased to cover only 70 per cent of the population in 2011 (NCRPB 2013).

Although Agra canal and Gurgaon canal were constructed to meet the irrigation water demand, yet, about one-third of the treated sewage in the area is utilized for irrigation. The rest of sewage is discharged into Budhiya Nala and Gaunchi

✉ Rina Kumari
kmreenaraj@gmail.com

1 Central University of Gujarat, Gandhinagar, Gujarat 382030, India

2 Independent Consultant on Water and Environment, New Delhi 110012, India

3 National Institute of Hydrology, Roorkee, Uttranchal 247667, India

4 School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India

Environ Earth Sci (2017) 76:465
DOI 10.1007/s12665-017-6789-0

ORIGINAL ARTICLE

An assessment of groundwater salinization in Haryana state in India using hydrochemical tools in association with GIS

Muzzafar Ahmad Sheikh[1] · C. Azad[2] · S. Mukherjee[2] · Kumari Rina[1]

Received: 22 October 2016 / Accepted: 27 June 2017

Abstract Unplanned abstraction of groundwater due to various land use land cover activities and variations in monsoonal rainfall have greatly affected the availability and quality of groundwater resources in semi-arid regions of India. In the present study, a study of the hydrogeochemical characteristics of groundwater was undertaken in the Sonipat district of Haryana in India together with the use of stable isotope ($\delta^{18}O$ and δD) measurements and GIS analysis. A total of 53 groundwater samples were collected from seven blocks of the district, and 14 water quality parameters and stable isotopes ($\delta^{18}O$ and δD) were analysed to infer hydrogeochemical processes taking place in the area. The integration of hydrochemistry with GIS is very helpful to understand the factors governing in the area. The majority of the samples showed Na–Cl type of hydrochemical facies. The trilinear plot for major cations and anions in groundwater indicates dominance of sodium, calcium, chloride and bicarbonate ions. Nitrate plumes in the groundwater appear to be migrating in groundwater from the central and south-western parts of the area towards the urbanized areas. A total of 64% of the samples exceed the maximum permissible limit of 1.5 mg/L given by WHO for fluoride. Besides natural sources such as silicate and carbonate weathering, ion exchange, and reverse ion exchange, the leaching of surficial salts and untreated industrial wastes along with unregulated abstraction are contributing to poor groundwater quality in the study area. An assessment of saturation indices has shown that groundwater in the area is unsaturated with respect to anhydrite, halite and gypsum suggesting significant contribution of Ca^{2+}, Mg^{2+} and other ions in the groundwater. A scatter plot of $\delta^{18}O$ versus Cl also suggests mixing of saline water with fresh groundwater.

Keywords Hydrogeochemistry · Geochemical modelling · Saturation index · Stable isotopes ($\delta^{18}O$ and δD) · GIS · Sonipat

✉ Kumari Rina
kmreenaraj@gmail.com

1 School of Environment and Sustainable Development, Central University of Gujarat, Gandhinagar 382030, India

2 School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India

Introduction

Haryana, a part of national capital region (NCR), is one of the states in India that are undergoing the greatest rate of economic growth. The population of the NCR has increased from 9.93 million in 2000 to 11.86 million in 2010 and is expected to double by 2021. This rapid growth of population, the rising demand for improved agricultural varieties and increasing industrialization pose a serious threat for the availability of water in the region. Thus, the concept of NCR was formulated, to develop a metropolitan area around the Delhi to divert the population pressure from the region (NCR 2011–2012). The state of Haryana is an industrial hub of the country and has more than 1347 big and medium industrial units and 80,000 small-scale industrial units (CII 2010).

Besides industrialization, Haryana is also an agriculturally rich state in north-western India which covers an area of 4.42 million hectares and accounts for 1.3% of country's total geographical area. The gross cropped area of the state is 6.51 m ha, and the net cropped area is 3.64 mha with a cropping intensity of 184.9%. The total consumption of fertilizers in the region was 42 kg/ha in

Published online: 06 July 2017

European Journal of Geography Volume 7, Number 2:63 - 73, June 2016
©Association of European Geographers

CHANGING LAND TRAJECTORIES: A CASE STUDY FROM INDIA USING A REMOTE SENSING BASED APPROACH.

Chadrashekhar Azad VISHWAKARMA
School of Environmental Science, Jawaharlal Nehru University, New Delhi, India

Somnath THAKUR
Punjab University, Department of Geography, Chandigarh, India

Praveen Kumar RAI
Banaras Hindu University, Institute of Science, Department of Geography, Varanasi, India
rai.vns82@gmail.com, bhu.praveen22@gmail.com

Vikas KAMAL
Jawaharlal Nehru University, School of Environmental Science, New Delhi, India

Saumitra MUKHERJEE
Jawaharlal Nehru University, School of Environmental Science, New Delhi, India

Abstract

The change in land use land cover (LULC) pattern is the result of natural and socio-economic factors and their use by human being over time and space. Change analysis plays an important role in natural resource management and in the assessment of environmental change. Land use land cover changes over a period of 25 years have been studied with the help of remote sensing and GIS in a part of Sonbhadra district of Uttar Pradesh and Singaruli region of Madhya Pradesh. The study area situated is situated in the vicinity of Govind Ballabh Pant Sagar reservoir. The present study is focused on the changing land use practices and their implications in the study area. Land use and land cover patterns at different time viz. 1991, 2000 and 2014 were analyzed and compared using a hybrid method of classification in ERDAS Imagine version-14. Data for this purpose was sourced from remote sensing satellite imageries of LANDSAT (TM of 1991 & ETM+ of 2000 & 2014) and Survey of India (SOI) topographic sheets on 1:50000 scale. After downloading Landsat data it has been proceed and further analyzed in Arc GIS version- 10.3. In this method, a statistics of area change in agriculture, barren land and forest cover, which is governed by variation in geology and prevailing structural anomaly were calculated.

Keywords: *Land use, land cover, Landsat, ARC GIS, remote sensing, ERDAS imagine*

1. INTRODUCTION

Land Use Land cover (LULC) and human/natural modifications have mainly caused in deforestation, biodiversity loss, global warming and an increase of natural disaster flooding (Mass et. al. 2004; Zho et. al. 2004; Diwedi et. al. 2005). These environmental problems are often connected to LULC changes. The term land use describes the land, which uses for several activities of human whereas land cover states the naturally occurring land parcels like natural vegetation, water bodies, rock/soil etc. (Kumar et al. 2012; Kahlon, 2015). Therefore,