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Water Shed Management For Erode District Using Gis

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Abstract

Traditionally watersheds were spatial extents that capture rainwater. Recently it has been identified that unless the watersheds are not managed in an integrated sustainable manner, then not only the water resources but also other resources such as vegetation, fertile soil, fauna and flora get depleted. Rational management of upper and lower parts of a watershed is equally important for the sustenance of the environment. Therefore it is extremely important to use an integrated spatial approach for managing watersheds and river basins. The remote sensing and GIS for watershed management constitutes theoretical aspects of Geographic Information Systems (GIS) & Remote Sensing and their application for watershed management.Water is one of the most important natural resource and physi-ological necessity to mankind. Fresh water is one of the basic necessities for sustenance of life. Use and development of water resource in a sustainable manner is very important in mod-ern age due to regular increase in water crises. Remote sensing and GIS techniques are very powerful tools for analyzing and manipulating the data for the purpose of water resource development and management.

Keywords: Water Shed Management, Erode District, Using GIS

1 INTRODUCTION

The application of principals of the mathematical statistic to quantities geomorphology is essential is meaningful conclusion are to be achieved. In practice, a particular geometric propriety of a drainage basin (i.e.) the length of the stream segments is sampled by measuring from maps or aerial Photographs or by different field surveys. When samples of say 50 or 100 measurement are thus obtained, the standard methods of frequently distribution analysis are used. The individual measurement, termed verities is grouped into classes, and the nature of the distribution examined. The many geometric properties of drainage basins particularly those having the dimension of length area, volume are characteristically, log normal in distribution, where as others properties, particularly dimensionless rations and angular values Melton collected an extensive body of morphometric data on drainage basin and discusses the sample size-requirement for use in statistical test. Micro watershed level Planning requires a hast of inter-related information to be generated and studied in relation to each other remotely sensed data provides valuable and up to date spatial information on natural resources and Physical terrain parameters. Geographical information system (GIS) with its capability of integration and analysis of spatial, spatial multi-layered information obtained in a wide variety of formats both from proved to be effective tools in planning for micro watershed development., used Participatory Remote Sensing and GIS for Micro Level Watershed Planning and Management and' also studied, remote sensing as a applied to Land and water resources Inventory of Bhavani, watershed, Idduki District, Erode. The agricultural areas along the streams are constantly washed and undergo sheet erosion thus converting valuable agricultural land into unproductive wasteland. For a major part of the year, the hills remains barren except for few small areas displaying a Varity of thorny scrubs and few scattered trees growing along the less assessable slopes. The degradated ecosystem has affected the life of the residents within the micro-watersheds. There is always a scarcity of fuel, fodder and water for drinking and domestic use. The depleting vegetation covers has resulted in excessive soil erosion exposing barred rock waste. The steep rocky hill slopes facilities high runoff leading to poor ground water recharge and increased siltation in the villages tanks and ponds. The human race through the ages has striven to locate and develop water resources. Most of the habitations and cities are developed close to the rivers. Over ninety percent of liquid fresh water available at given moment on the earth lies beneath the land surface. Groundwater, unlike surface water, is available in some quantity almost everywhere. Groundwater has long been regarded as the pure form of water compared to surface water, because of purification of the former in the soil column through anaerobic decomposition, filtration and ion exchange. This is one of the reasons for the excessive consumption of groundwater. Recently, due to increase of population, consumption of water also increases rapidly, so not only availability of water but also quality of water is a challenge for us. The fast growing population, rapid Urbanization and industrialization, coupled with spatial and temporal variation has effected water availability, water quality problems etc.. The remote sensing and GIS technologies are being practiced for water resources development and management since the first Landsat satellite was launched in 23 July 1972 by NASA.

In succeeding years, several remote sensing satellites were launched for various purposes and of various resolutions, which provided a new dimension to the remote sensing technology. Now, most common remote sensing systems operate in one or several of the visible, infrared, or microwave portions of the EM spectrum. The series of satellites now known as LANDSAT launched by the US evolved in concept from the photographic observations of the early Mercury and Gemini orbital flights. Data from those manned earth orbital flights indicated the practice of observing from space orbits what is broadly referred to as "earth resources".

These observations and the thoughts they generated led to the NASA (National Aeronautic and Space Agency of the US) satellite program that developed the first satellite of the world called "Earth Re-sources Technology Satellite" (ERTS), which was launched in July 1972; it was later on renamed "Landsat-1" and the latest satellite in this series is Landsat-8 launched in 2013[55]. The reafter, the satellites were also launched by other countries such as former USSR, Japan, European Space Agency (ESA), India, France and Canada as well as China and Brazil. With the advancement of technologies, the nature of remote sensing itself has changed during past few decades from a relatively qualitative art relying on inference for information to a quantitative science capable of measuring system states in some cases. Thus, extensive improvements in the field of remote sensing have been made and it is still developing as an exploratory science to meet the growing challenges of the world. This re-view paper deals with the works conducted on ground water field using of Remote Sensing and GIS techniques

2. STUDY AREA

Erode District lies on the extreme north of Tamil Nadu. It is bounded mostly by Karnataka State and also River Palar covers pretty long distance. To the East lies Namakkal and Karur Districts. Dindigal District is its immediate neighbour to the South and on the West, it has Coimbatore and Nilgiri Districts, as its boundaries. Thus Erode District is essentially a land-locked area having no sea-cost of its own. Erode District situated at between 10 36" and 11 58" North Latitude and between 76 49" and 77 58" East Longitude.

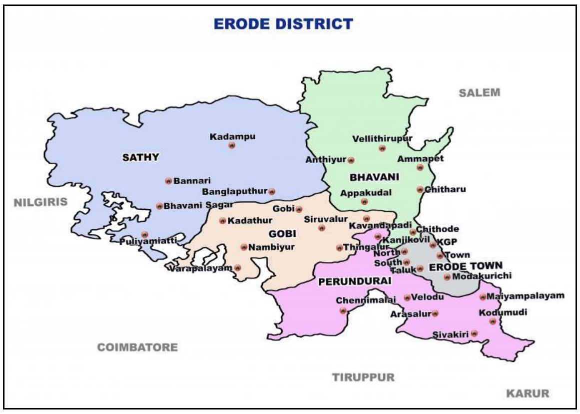

Figure. 1 Erode District Map

The region comprised in the district can be portrayed as a long undulating plain gently sloping towards the river Cauvery in the south-east. The two major tributaries of river Cauvery viz. Bhavani and Noyyal drain the long stretch of mountains in the north. A part of the eastern boundary of the district is formed by river Cauvery, entering the district from Salem and flowing in a southernly direction. (Figure.2)

Figure. 2 River Map Of Tamilnadu

2.1 Jurisdictional Changes

Erode District came into being as a result of the bifurcation of Coimbatore District, through the G.O.Ms.No.1917, Revenue dated 31.08.1979. Bhavani, Erode and Sathyamangalam taluks were included in Coimbatore district which had a composite character, at the beginning of the century. Of these, Sathyamangalam Taluk was renamed as Gobichettipalayam taluk retaining Sathyamangalam as a sub-taluk. In 1975, Sathyamangalam sub-taluk was upgraded into a taluk. In 1979 Perundurai Sub Taluk was upgraded into taluk. These five taluks were grouped together to constitute the new district of Erode. Now Erode District consists of 5 taluks viz., Sathyamangalam, Bhavani, Gobichettipalayam, Perundurai and Erode. There are 4 Municipalities in the district viz., Sathyamangalam, Bhavani, Gobichettipalayam, and Punjai Puliampatti. The other four Municipalities in the district viz. Periasemur, Kasipalayam, Surampatti and Veerappanchatram have been merged recently with Erode Corporation. There are 42 Town Panchayats, 230 Village Panchayats and 375 Revenue Villages. There are 14 Community Development Blocks in the district.

2.2 Soils

The soils of the district are mostly red sand and gravel with moderate amounts of red-loam and occasional black loam tracts. Vast stretches of the upland regions are mostly and gravelly. Red-loam occurs mostly in land under Kalingarayan channel and in beds of tanks in Erode Taluk and to some lesser extent in the valleys in Perundurai taluk. It also occurs in the hilly tracts of Bhavani taluk. Soils of Bhavani, Erode and Perundurai taluks are chiefly gravelly, stony and sandy of the red variety. Soils of Gobichettipalayam and Sathyamangalam taluks are mostly of the red sandy variety. Red loam is prevalent mostly in Gobichettipalayam and Perundurai taluks.

2.3 Minerals

Though the district cannot boost of great mineral wealth, it has a few varied items of significance. Both opaque and translucent varieties of fine quality of Feldspar is found abundantly in Erode taluk. Mica and Muscovite occur in Vairamangalam near Bhavani and near Punjai Puliampatti respectively. Asbestos is found to occur in a few places of Bhavani and Perundurai.Doddan Combai forest in Gobichettipalayam is bestowed with rich iron ore. This ore is found to be of very fine quality and rich in metal. Traces of gold also have been found in a few auriferous veins in Gobichettipalayam.

2.4 Rivers

Bhavani, Cauvery and Noyyal are the main rivers of the district. Other significant river is Palar in the North. Palar constitutes the boundary between Erode district and Karnataka State in the North. The Bhavanisagar main canal along with the above mentioned rivers provide proper drainage and facilities for assured irrigation in the district. Bhavani rises in the silent valley in Palghat ranges in the neighbouring State of Kerala after receiving Siruvani, a perennial stream of Coimbatore District and gets reinforced by the Kundah river before entering Erode District in Gobichettipalayam. Bhavani is more or less a perennial river fed mostly by the South-West monsoon. North-East monsoon also supplements its water resources. This river runs for over hundred miles through Erode District traversing through Bhavani and Gobichettipalayam taluks. It feeds the Bhavanisagar reservoir which takes an easterly course flowing through Gobichettipalayam, Sathyamangalam and Bhavani taluks before it ultimately joins river Cauvery on the Salem borders.

2.5 Land And Landuse Pattern

As per revenue land records, the total geographical area of the district is 572,264 hectares. Of those 199,389 hectares have been brought under cultivation as net area sown. This accounts for34.8% of the total area of the district. Area sown more than once is 25,397 hectares i.e. 12.73% of the total net area sown. Total cropped area is 224,786 hectares i.e. 39.2% of the total area in the district. Forests account for 227,511 hectares i.e. 39% of the total area. Cultivable waste has been reduced to mere 1707 hectares in the district. Less than 9.2% of the total area is put to non-agricultural use (53,004 hectares). However, 14.5% is accounted for by fallow lands (83,368 hectares). Trees, crops, groves, Orchards etc. together account for about 0.6% of the total area in the district. Of the 199,389 hectares brought under cultivation, 25397 hectares are sown more than once, thus enhancing the total area cropped to 224,786 hectares. If this is taken into account, the percentage of total cropped area to total area of the district will work out to 39.2% thus publishing better utilization of available land resources in the District.

2.6 Irrigation

The sub-soil in most parts of the district being sandy and surface soil thin and of poor quality, the farmers have to depend heavily on irrigation facilities. The uncertain aspects of North-Eastern monsoon and not too favorable contribution from the South-West monsoon make the plight of local agriculturists miserable. The chief sources of irrigation in the district are the canals and wells and these constitute the main stay of the farmers. As noted earlier, the main sources of irrigation are the canals and wells.

3. METHODS

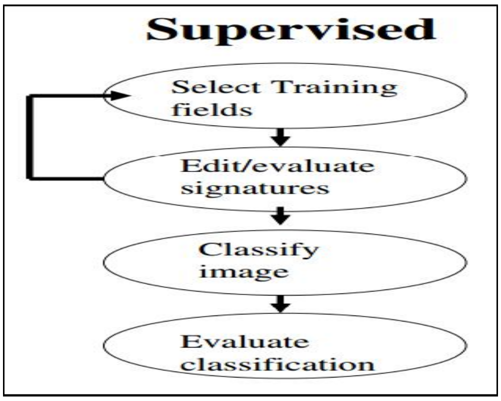

Figure. 3 Methods

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3.1 Training Set
Training: The process of defining criteria by which patterns or features are recognized. Signature: Result of training that defines a training sample or cluster parametric based on statistical parameters that assume a normal distribution (e.g., mean, covariance matrix) and non parametric are not based on statistics but on discrete objects (polygons) in feature space. (Figure.4)

3.2 Supervised Training Set Selection
- **Objective:** Selecting a homogenous (unimodal) area for each apparent cluster.
- **Digitized polygons**: High degree of user control often results in overestimate of cluster variability.
- **Seed pixel**: Region growing technique are used to reduce within class variability; works by analyst setting threshold of acceptable variance, total pixels, adjacency criteria (horizontal or vertical diagonal).

3.3 Training Stage
Training/Test Area classification: look for misclassification between classes; training areas can be biased; better to use independent test areas • Quick alarm classification: on-screen evaluation of all pixels that fall within the training decision region (e.g. parallelepiped) (Figure.5)

Figure. 4 Supervised Training Set Selection

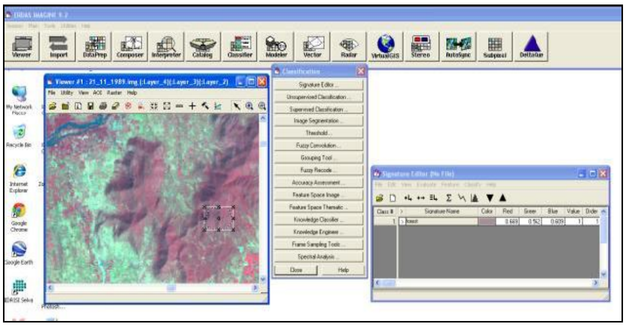

FIGURE 5 Shows How To Edit Signature From Satellite Image In Erda

3.4 Spatial Distribution Of Land Use Categories-1990
Landsat TM imagery of 11 April 1990 was visually analyzed and classified different kinds of land use in Erode District. The spatial distribution of land use was assessed geographically and their aerial extent quantified and shown in the Table 1. The histogram of land use spatial distribution and the different categories of land use and land cover features are classified under levels. (Figure.6)

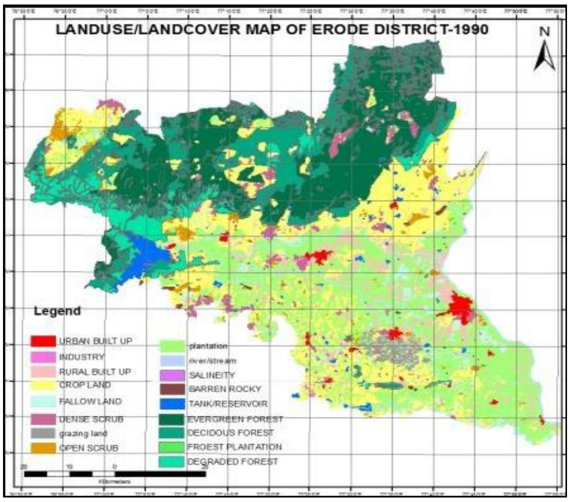

Figure 6 Land Use And Land Cover Map

Figure. 7 shows Forest Cover Map Of Erode -1990

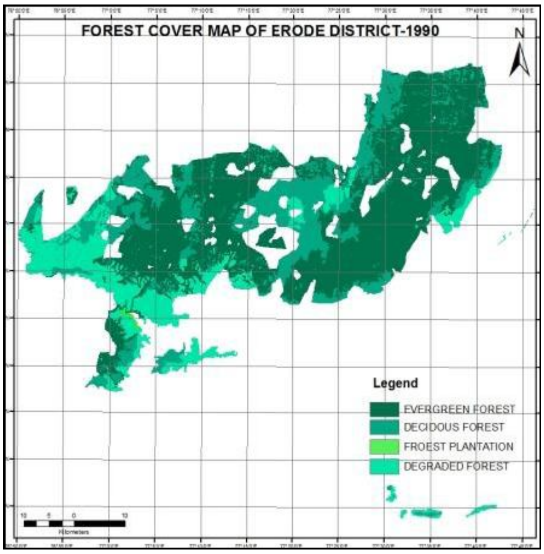

Figure. 7 Forest Cover Map Of Erode -1990

3.5 Spatial Distribution Of Land Use Categories-2000
Landsat TM 17 April 2000 satellite image downloaded from USGS website was visually analyzed and classified different kinds of land use in Erode District. The spatial distribution of land use was assessed geographically and their aerial extent quantified and shown in the Table 1. The histogram of land use spatial distribution are shown

in Figure 8 .The different categories of land use and land cover features are classified under level I and II .

Table 1 Land Use/ Land Cover Statistics Of 2000

S.No	Level I	Level II	Area in Hectare	Area in %
1	Built up	UrbanBuilt Up	6362.13	1.11
		Rural Built Up	15966.70	2.77
		Industry	1205.66	0.21

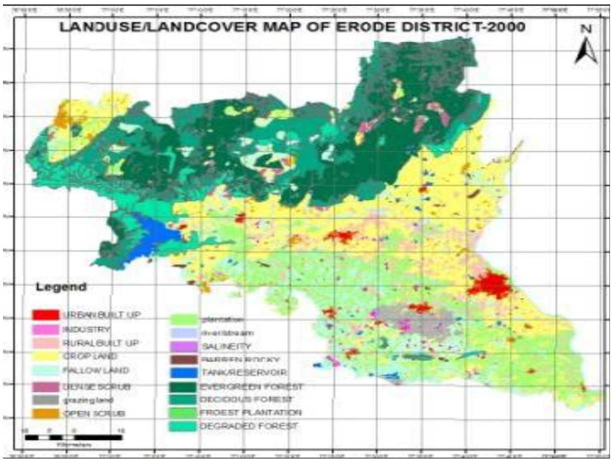

Figure 8 Land Use/ Land Cover -2000

Figure. 9 shows Forest Cover Map Of Erode -2000

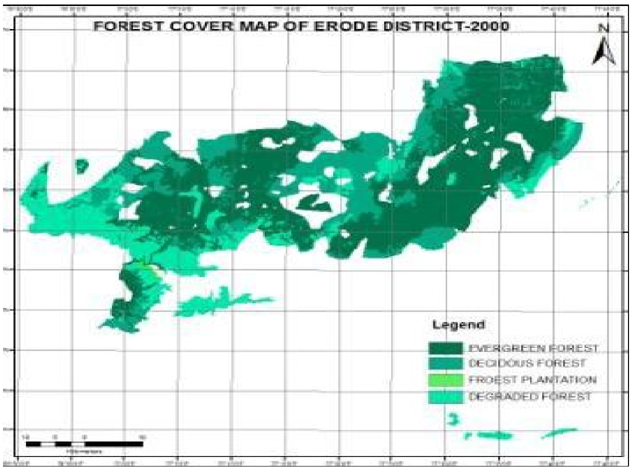

Figure 9 Forest Cover Map – 2000

3.6 Land Use Change Detection (1990-2000)

The land use change detections from 1990 to 2000 reflect that changes especially in the crops has increased 19.57% and plantation crops has decreased -51.81%. Cultivation practices has increased mainly due to human population growth who exerted in agriculture actives for their survival, increasing number of irrigation wells and free electricity for agriculturalist announced by the Government of TamilNadu , in July 1989. Built-up land has increased 43.32% due to high growth rate of human population. Decreasing trend of land use is also due to industry increased 197.77% It was observed that the -37.24% of Evergreen forest and Deciduous forest to 51.56% has increased in the reserved forest and open scrub has decreased to -31.62. Salinity land is found to occur in and around land. It was observed that the 97.40% affected the useful land. (Figure.10)

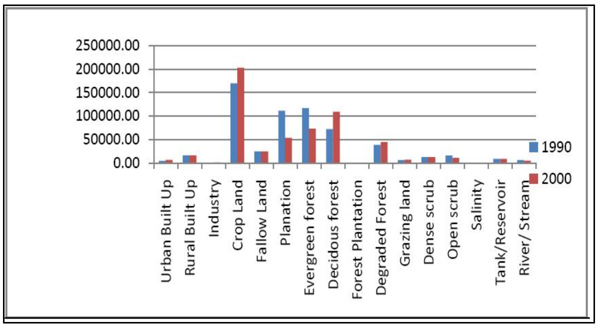

Figure. 10 Histogram Of Land/Land Cover Classification Of 1990

4. WATERSHED MANAGEMENT

Restoring watersheds, improving water quality, and protecting aquatic habitats are clear goals of the Forest Service. Many partnerships exist among Federal, State, and local governments, as well as private landowners, to inventory riparian resources and restore critical riparian habitat. Water management across jurisdictional boundaries, however, requires a great deal of cooperation and understanding among vastly different groups and individuals. Geospatial technologies such as remote sensing and geographic information systems (GIS) have proven to be invaluable tools for collecting resource baseline data and establishing common ground to discuss watershed management constructively.

The digital, color-infrared (DCIR) camera is a practical tool for acquiring imagery along river corridors and generating detailed hydrologic and vegetation information. Resource specialists can use this technology to characterize riparian systems over large areas and aid compliance with the Clean Water Act (CWA), Endangered Species Act (ESA), and Pacific Northwest Forest Plan (PNFP). To support watershed restoration, the Rogue River National Forest, the Medford District Bureau of Land Management, and the Remote Sensing Applications Center (RSAC) jointly developed a practical and operational set of procedures to assess riparian and aquatic resources.

4.1 Need For The Study

Now a days water scarcity increases rapidly due to decrease of ground water. The ground water is also polluted due to various artificial man-made activities. Due to this, quality of the water is reduced. This will produce various adverse impacts on human beings, animals and plants.Therefore, it is necessary to monitor the water quality.

4.2 What Is Watershed Management

A watershed is an area of land that drains into a common water body, such as a river or lake. A watershed can also be also known as a basin or a catchment. A watershed is an ecosystem with complex interacting natural components. Human activities have a direct influence on the quality and quantity of surface water, groundwater and other natural resources in the watershed. Upstream activities influence river flows and water quality downstream. Surface and groundwater systems have a limited tolerance for stress, and long term problems can develop that are costly and difficult to remediate.

By its very nature, watershed management must be integrated and address both water and the related land resources that affect or are affected by water. Water includes floods and droughts, surface water and groundwater, water supply and water quality. Related land resources include streams, wetlands, forests, soil, fisheries, flora and fauna. The premise that “everything is connected to everything else” lies at the heart of watershed management. By understanding the natural functions of a watershed before change occurs, harmful impacts on the system can be identified so that prevention, remediation, or improvements can be incorporated into management plans. Watershed management is not so much about managing natural resources, but about managing human activity as it affects these resources. The drainage area of the river provides the natural boundary for managing and mitigating human and environmental interactions. Because human activity includes actions by governments, municipalities, industries, and landowners, watershed management must be a co-operative effort. Effective watershed management can prevent community water shortages, poor water quality, flooding and erosion. The expense of undertaking watershed management is far less than the cost of future remediation.

4.3 Relationship Of Watershed Management To Water Supply

Water supply typically means water piped to households and businesses by a municipality or water utility.Water supply also means water taken by households for domestic use or livestock watering, by farmers for crop irrigation, and by rural industry for processing or washing. More recently, environmental concerns have led water managers to acknowledge the water needs of aquatic/fishing functions and wetland functions, in effect representing other competing users of the water resource.

4.4 Watershed Characterization And Assessment

GIS has been widely used in characterization and assessment studies which require a watershed-based approach. Basic physical characteristics of a watershed such as the drainage network and flow paths can be derived from readily available Digital Elevation Models (DEMs) and USGS’s National Hydrography Dataset (NHD) program.This, in conjunction with precipitation and other water quality monitoring data from sources such as EPA’s BASINS database and USGS, enhances development of a watershed action plan and identification of existing and potential pollution problems in the watershed.

4.5 Successes In Watershed Management

4.5.1 Restoring Multiple River Corridor Values And Uses By Choosing Most Cost-Effective Strategies

A local wastewater treatment plant was targeted for an expensive upgrade to reduce nitrate levels believed to be responsible for an ammonia toxicity problem in Boulder Creek. Intensive-survey monitoring of River indicated a number of other factors could be contributing to the decline of the diverse fish populations from the Creek’s mountain canyon to its high plains. For example, stream monitors found stream habitat so degraded that it was unsuitable for most forms of aquatic life and could be contributing to the buildup of toxic concentrations of ammonia in the water. A physical habitat restoration program was undertaken to restore the complexity of the stream channel, stabilize the stream banks, revegetate the riparian corridor, create buffer strips to reduce agricultural and grazing runoff, and rebuild diversion and return flow structures to minimize impacts on aquatic habitat. Because of limited funding, key portions of the channel were prioritized and targeted for restoration.

4.5.2 Water Supply Protection

In the mid-eighties, several counties in the rapidly urbanizing area of Virginia developed a comprehensive land use plan for the Occoquan Reservoir watershed and adopted zoning ordinances regulating the location, type, and intensity of future land uses. This was done after maximizing the limits of treatment technology for the wastewater treatment plants discharging into the tributaries upstream of the reservoir and after intensive data collection and model development. multiple objectives such as:

- Improved Transportation System
- Economic Development
- Efficient Provision Of Community Services

4.6 Watershed Hydrology

A watershed represents a unique physical unit within which water moves continuously in a cycle that begins with rain or snow. Within the watershed landscape, plant leaves will intercept some rain and snow, where it will evaporate back into the air. Rainwater and melted snow may infiltrate the soil or flow overland to be stored temporarily in depressions, wetlands or lakes. Groundwater forms when surface water seeps through the soil to varying depths and collects in aquifers. Groundwater can remain stored underground and then re-emerge as springs or discharges to rivers, lakes or wetlands, within a period varying from a few days to thousands of years.

Natural watershed characteristics, such as geology, climate, landform, soils, and vegetation influence the processes responsible for water cycling. Therefore, these characteristics help determine how much water is available as surface supplies in rivers or lakes, or as groundwater in aquifers.Climate affects the watershed directly by the distribution of rainfall and temperature. Variations in rainfall can be described by the intensity and type of storms, which in part influence groundwater recharge, streamflow and flooding patterns. Light rainfall that extends over a long duration has more time to infiltrate the soil and replenish groundwater supplies. Alternatively, high intensity thunderstorms that deposit large volumes of rainwater in a relatively short period of time cause rapid overland runoff and flash flooding of rivers and streams.

The shape of the land, determined by geology and weather, greatly influences drainage patterns. The density of streams and the shape of a watershed, in turn, affect the rate of overland runoff relative to infiltration. Soil types influence the rate of water movement. For example, finely grained soils, such as clays, have very small spaces between soil particles, inhibiting infiltration and thus promoting greater surface runoff. Conversely, coarse soils, such as sands, have larger pore spaces allowing for greater rates of infiltration and reduced runoff. Soil texture, structure, moisture holding capacity and local topography are important factors determining the susceptibility of land to erosion.

4.7 Current Issues In Water Management growth

A major watershed issue is keeping the watershed healthy (economically, socially and environmentally) while accommodating growth. Urban areas are progressively looking for additional surface and groundwater supplies. Increasingly, these supplies are being depleted by others or are being contaminated by pollutants. Growth management includes planning ahead for determining appropriate land uses, ensuring adequate water supply; protecting surface and groundwater quality; allocating water with consideration for long-term planned commitments to future water supply and the environmental needs; and planning growth with consideration for the river and groundwater system capacity to receive wastewater.

Surface Water And Groundwater Quality

Water supply for both human consumption and for maintaining aquatic/fishing resources is dependent on maintaining adequate quality in surface water and groundwater.

Water Allocation

Water allocation will become an increasing issue as growth proceeds. Increasing population and intensif ication of agriculture both result in an increase in water use. Instream demands include recreational and industrial uses (i.e., hydroelectric production, navigation). The aquatic ecosystem, including fisheries, wetland and riparian habitats, is also dependent on a sustainable supply of water for its existence.

River System Capacity For Wastewater

At a watershed scale, surface water is used to dilute effluent from sewage treatment plants and a variety of non-point sources of pollution. A watercourse's capacity to assimilate contaminants is directly dependent on the quantity and quality of water available for dilution.

Contaminant Pathways And Treatment Processes

The water cycle serves as a pathway for the transport of natural and introduced materials that influence the quality of the water. However, there are natural purification processes operating within the watershed that help protect the integrity of water supplies and overall environmental health.

4.8 Watershed Restoration

Watershed restoration studies generally involve evaluation of various alternatives and a GIS provides the perfect environment to accomplish that efficiently and accurately.GIS has been used for restoration studies ranging from relatively small rural watersheds to heavily urbanized landscapes. Coupled with hydrodynamic and spatially explicit hydrologic/water quality modeling, GIS can assist in unified source water assessment programs including the total maximum daily load (TMDL) program. As an example, alternatives for restoring a water body or a watershed can be studied by creating digital maps that show existing conditions and comparing them to maps that represent the alternative scenarios. GIS can also provide a platform for collaboration among researchers, watershed stakeholders, and policy makers, significantly improving consensus building and offering the opportunity for collaborative work on interdisciplinary environmental policy questions. The integrating capabilities of a GIS provide an interface to translate and emulate the complexities of a real world system within the confines of a digital world accurately and efficiently.

4.9 Components Of Watershed Management

4.9.1 Entry Point Activity (Epa)

Entry Point Activity is the 1rst formal project intervention which is undertaken after the transect walk, selection and

1nalization of the watershed. It is highly recommended to use knowledge based entry point activity to build the rapport with the community. Direct cash based EPA must be avoided as such activities give a wrong signal to the community at the beginning for various interventions. Details of the knowledge-based EPA to build rapport with the community ensuring tangible economic bene1ts to the community members are described here.

5.9.2 LAND AND WATER CONSERVATION PRACTICES

Soil and water conservation practices are the primary step of watershed management program. Conservation practices can be divided into two main categories:
In-situ and 2) Ex-situ management. Land and water conservation practices, those made within agricultural 1elds like construction of contour bunds, graded bunds, 1eld bunds, terraces building, broad bed and furrow practice and other soil-moisture conservation practices, are known as in-situ management.

5. GIS APPLICATION FOR WATER RESOURCE MANAGEMENT

Remote sensing (RS) is the science and art of obtaining in-formation about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object area, or phenomenon under investigation. Remote sensing is the science of acquiring information about the Earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information.
The radiation emitted or reflected from various objects are of different amount. Same the emitted or reflected radiations are recorded by various sensors. Various sensors have different type of bands which records specific ranges of electromagnetic radiation (EMR). Every radiation or light is made of Electro-magnetic energy and reflected according to the surface or object interacted with. Generally, smooth surface reflects more radiations that’s why the tones recorded by the sensors are light. In the case of surface water, the most of the radiations are transmitted through water so they provide generally dark tone. For the management and development of water resources, re-mote sensing data provides a platform for doing initial and fast survey. Although, very few remotely sensed data can be directly applied in hydrology, such information is of great value since many hydrological relevant data can be derived from remote sensing information. However, the use of RS technology involves large amount of spatial data management and re-quires an efficient system to handle such data. From the ground water point of view, occurrence and movement of groundwater is mainly controlled by many factors such as rock type, landform, geological structures, soil, land use, rainfall etc.Remote sensing based groundwater prospect zone map serves as a base for further exploration using hydro geological and geophysical methods to locate well sites. Remote Sensing data and GIS play a rapidly increasing role in the field of hydrology and water resources development.Remotely sensed data are most useful where they are combined with numerical modeling, geographic in-formation systems, and ground-based information.Selection of suitable sensors has definitely a cutting edge on natural resource exploration and management including groundwater. Parameters relevant for hydrogeology are spatially distributed and may show significant temporal variability. Earth Observation (EO) data, when used jointly with in situ data, can provide an essential contribution for the creation of inventories of sur-face water resources, the extraction of thematic maps relevant for hydrogeological studies and models (land cover, surface geology, lineaments, geomorphology) or for the retrieval of geophysical parameters; water quality, temperature, soil mois-ture etc. (Gert et. al., 2000).Concentration of drainage density and lineament density also helps the infiltration ability of the groundwater system.Remote sensing, GIS and MIF techniques are found efficient to minimize the time, labor and money and thereby enable quick decision making for Sustain-able water resources management.

5.1 Approaches Of GIS Application In Watershed Management

The integrated approach of GIS and Remote Sensing is being recognized universally as the unique highly effective and extremely versatile technology for evaluation, management and monitoring of natural resources and environment. With the concept of multidisciplinary integrated approach got an impetus in monitoring and management of resources and environment.

5.3.1 Watershed Management Decision Support System

There is a growing consensus that an effective way to control non-point source pollution and enhance the long-term sustainability of agriculture and rural communities is through locally based planning and management at the watershed scale. Coordinated resource management of a watershed requires the simultaneous consideration of physical and socioeconomic interrelationships and impacts. In order to address these considerations, it is necessary to integrate a large amount of spatial information and knowledge from several disciplines. To be useful, the information and knowledge must be made available to decision makers in a rational framework.

5.3.2 For Bmp Assessment Model Using GIS

Best management practices (BMPs) as storm water control systems are widely used in agricultural and urban areas to prevent flooding, reduce soil loss, provide water retention, and most importantly reduce pollutant loadings to receiving water bodies (Chen et al., 1995). BMP performance varies from site to site and season to season. A user-friendly tool is needed to evaluate the performance of BMPs, project future storm water quantity and quality in drainage systems, and identify key design parameters to improve BMP pollutant removal efficiencies.

5.3.3 GIS As An Integrating Instrument For Micro-Watershed Planning And Management

Micro-watershed planning has been conceived and adopted for holistic development of rain-fed farming in recent years. Watershed Management is fast becoming a blue print for agricultural development in most parts of the country today. The ultimate goal of watershed management is to achieve and maintain a balance between resources development to increase the welfare of the population and resource conservation to safeguard resources for future exploitation and to maintain ecological diversity both for ethical reasons and as an assumed prerequisite for the survival of mankind. A micro-watershed, as defined by Bali in 1978, ranges in between 1-10 sq km or 100-1000 hectares.

4.3.5 Groundwater Modeling In Watershed

GIS applications are beneficial in terms of watershed management issues, such as locating possible sites suitable for groundwater recharge, because:

- A large amount of the information required (soils, land-use, and slope maps) to evaluate potential recharge sites currently exists in digital format.
- GIS allows a great number of factors to be viewed on uniform media.
- GIS has the ability to update information on features and corresponding data. This is essential for water resource management projects
- A GIS database provides decision-makers with a comprehensive visual and tabular means for analyses on which to construct and support decisions.
- Utility of this type of database would be for regional and city planners as well as for water supply and water quality monitoring.

Groundwater modeling is an attempt to replicate the behaviors of natural groundwater or hydrologic system by defining the essential features of the system in some controlled physical or mathematical manner. Modeling plays an extremely important role in the management of hydrologic and groundwater system.

5.ADVANTAGES OF WATERSHED PLANNING

5.1watershed Management Help Provide Adequate Clean Drinking Water

5.1.1 Seeing The Big Picture

This section describes how the watershed management process can aid decision-makers, planners, engineers, ecologists, and citizens in obtaining adequate, clean drinking water and at the same time ensuring that environmental concerns are being addressed. The watershed plan is used as a blueprint for managing and protecting groundwater and surface water supplies. It is at this time future water supplies are identified, risks of contamination are assessed, and the plans for water supply protection are put into place.

5.1.2 Managing Watershed Groundwater Supplies (Aquifers)

A regional groundwater analysis is usually carried out as part of an overall watershed study to help answer these questions. The municipality carries out more detailed well field studies after the regional analysis is completed. The four stages in the analysis are: defining the aquifer system, defining the aquifer characteristics, installing a monitoring system, and modelling the aquifer system. This analysis determines the safe yield of the aquifer, the environmental impacts of increased withdrawals, and requirements for groundwater protection.

An understanding of regional groundwater flows and their interrelationship with surface water can be obtained by the application of water budget and groundwater flow modelling. This is presently done by the Grand River Conservation Authority in co-operation with its member municipalities. More detailed smallscale groundwater studies to define groundwater protection areas and optimize well field operations are usually carried out by municipalities after the regional analysis has been completed.

5.1.3 Managing The Regional Groundwater System

Under the present planning, there has been a shift in responsibility for land use decisions away from the provincial level of government to the local level. Groundwater is no different. Before the 1980s, the Ministry of the Environment carried out several regional groundwater studies. Since the1980s, little work was undertaken to understand groundwater movement on a regional or watershed scale.

5.1.4 Monitoring The Aquifer System

A monitoring network is necessary to evaluate existing and future conditions dealing with groundwater quantity and quality. Because it may take years to detect slow moving groundwater contaminants at the wellhead intake, monitoring ambient groundwater conditions provides an early alert to trends in groundwater quality.

5.1.5 Protecting The Aquifer System

A comprehensive groundwater management strategy must address protection of the water sources, management of water use, and management of land use that may present a source of contamination. The sensitive groundwater areas indicated by the regional mapping can be protected by identifying them in municipal official plans and developing appropriate policies. Development in these areas should be limited or prohibited.

Over pumping of the aquifer system can be regulated under the Ontario Water Resources Act administered by the MOE. A good knowledge of the regional groundwater system can make it easier to interpret requests for increased withdrawals in the context of the needs of current users, their long term plans and
the requirements of the natural environment.

6. CONCLUSION

Remote sensing and GIS methods permit rapid and cost effective natural resource survey and management. Moreover, remotely sensed data serve as vital tool in groundwater prospecting and management. The remote sensing data helps in fairly accurate hydrogeomorphological analysis and identification and delineation of land features. Remote sensing is not applicable directly for the ground water purpose. Groundwater occurrence being subsurface phenomenon, its identification and location is based on indirect analysis of some directly observed terrain features like geological and geomorphic features and their hydrologic characters of lithology, hydrogeomorphology and lineament is been taken up. Satellite remote sensing provides an opportunity for better observation and more systematic analysis of various geomorphic units, lineament features, following the integration with the help of Geographical Information System to demarcate the groundwater potential zones.

Furthermore, monitoring of water quality can be achieved with the aid of remote sensing techniques at least to a certain extent. The detailed reviews presented in this paper indicated that the current applications of RS and GIS techniques in groundwater hydrology are limited to three areas: (i) exploration and as-sessment of groundwater resources and potential zones (ii) selection of artificial recharge sites, (iii) GISbased subsurface flow and pollution modeling. RS and GIS based applied groundwater research is also required in conjunction with field investigations to effectively exploit the expanding potential of RS and GIS technologies, which will perfect and standardize current applications as well as evolve new approaches and applications in the future.the remote sensing technology has great potential to revolutionize groundwater monitoring and management in the future by providing unique and new data to supplement the conventional field data. Overall changes in the landscape has shown an increased trend for urban development (43.32%) and growth of industry to 198% and forest to 52% . Such development is guided or often times constricted by various environmentally sensitive or protected areas (e.g. Reserve Forests.) and existing high-density development. The study has revealed that satellite data has the unique capability to detect the changes in land use quickly. From the analysis it is found that the satellite data is very useful and effective for getting the results of temporal changes. With this effective data it is found that the agriculture land is decreasing at the rate of increasing the settlements

References

[1] SP Wani, TK Sreedevi, TSV Reddy, Venkateswarlu B and Prasad CS. 2008. Community watersheds for improved livelihoods through consortium approach in drought prone rainfed areas. Journal of Hydrological Research and Development. 23:55-77.

[2] T.Subramani, K.Babu ,A Study On Agricultural Drainage Systems , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, May 2015 , pp. 304-312 , 2015

[3] T.Subramani, D.John Prabakaran ,Uniformity Studies And Performance Of Sprinkler And Drip Irrigation , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5 , pp. 284-293 , 2015

[4] T.Subramani, P.Malathi ,Drainage And Irrigation Management System For Salem Dist Tamilnadu Using GIS , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 199-210 , 2015

[5] T.Subramani, Identification Of Ground Water Potential Zone By Using GIS, International Journal of Applied Engineering Research (IJAER), Volume 10, Number 38, Special Issues, pp.28134-28138, 2015

[6] T.Subramani, C.T.Sivakumar, C.Kathirvel, S.Seka, Identification Of Ground Water Potential Zones In Tamil Nadu By Remote Sensing And GIS Technique International Journal of Engineering Research and Applications , Vol. 4 , Issue 12(Version 3), pp.127-138, 2014.

[7] T.Subramani, S.Badrinarayanan, K.Prasath, S.Sridhar, Performanance Evaluation of the Cauvery Irrigation System, India Using Remote Sensing and Gis Technology, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.191-197, 2014.

[8] T.Subramani, M.Chandrasekaran, Saline Ground Water and Irrigation Water on Root Zone Salinity, International Journal of Engineering Research and Applications,Vol. 4, Issue 6(Version 2), pp.173-179, 2014.

[9] T.Subramani, T.Manikandan, Analysis Of Urban Growth And Its Impact On Groundwater Tanneries By Using Gis, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.274-282, 2014.

[10] T.Subramani, P.Malathi , " Land Slides Hazardous Zones By Using Remote Sensing And GIS" ,

International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 211-222 , 2015

[11] T.Subramani,"Identification Of Ground Water Potential Zone By Using GIS", International Journal of Applied Engineering Research (IJAER), Volume 10, Number 38, Special Issues, pp.28134-28138, 2015

[12] T.Subramani, P.Krishnamurthi, "Geostatical Modelling For Ground Water Pollution in Salem by Using GIS", International Journal of Engineering Research and Applications ,Vol. 4, Issue 6(Version 2), pp.165-172, 2014.

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