Site Suitability Selection For Proposed Ponds in the Gujarat State Using Gis and Remote Sensing

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***Abstract* - Water is very important to all Parts of our life. In this Paper how we can utilize the Water in Our life regarding this how we manage the Water bodies into Water Allocation, River Basin Planning, Pollution Control, Information management, monitoring of water bodies. There is a Proposed sites for Ponds in the Junagarh and Amreli districts of Gujarat which helps the People irrigation, drinking, livestock's and for their daily use life. The various criteria defined by Environmental Impact Assessment were used for identifying sites for Ponds based on the guidelines of Environmental clearance. The basic objectives of Environmental Impact Assessment are to identify, predict, and mitigate the possible impact due to proposed project and the people likely to be affected. The project of Environmental Impact Assessment (EIA) leads to mitigate the negative impacts and enhance the positive impacts for the Sustainable developments.**

***Keywords* - Indian Remote Sensing Satellite (IRS), LISS-III, DEM Images, Geographic Information system (GIS).**

INTRODUCTION

Water harvesting Structures are extremely important to conserve precious natural resources like soil and water, which is depleting day by day at alarming rate. Water is essential for all life forms and is used in different ways such as food production, drinking, domestic, industrial, power generation and recreational use. Out of 2.5% global fresh water only 1% is available for human consumption. According to the World Bank Report (Announce. 2002), India will be in Water Stress zone by 2050. The Land availability level is shrinking day by day. The per capita land availability is in reducing trend and it is estimated that only 0.1 hectare per capita land will be available by the end of 2025. The Participatory management of the harvested water resources ensures effective utilization, maintenance and sustainable operation of the system. It has a great potential of improving land and water resources by integrating recent development with indigenous traditional knowledge. Water is an essential natural resource that shapesregional landscapes and is

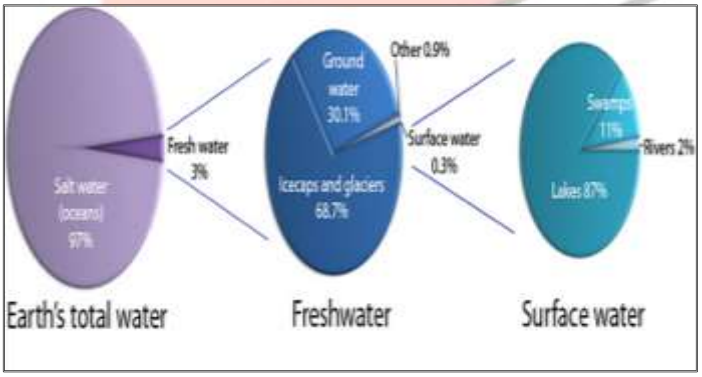


Figure 1.1: Distribution of Surface Water on the Earth

Vital for ecosystemfunctioning and human well- being. Water resource management in India is going to be vitally important to sustain the needs of 1 billion population of India. Figure 1.1 gives distribution of water on the earth.

1.2 Water Management:

Water Management is the activity of planning, developing, distributing and managing the optimum use of water resources. Inan ideal world, water management planning has regard to all the competing demands for water and seeks to allocate water on an equitable basis to satisfy all.

1.2.1 What Constitutes Water Management?

Functions of water resources management are very complex tasks and may involve many different activities conducted by many different players. The following components constitute water resources management (Adapted from Capnet Training Manual: IWRM for RBO, June 2008)

A) Water Allocation:

Allocating Water to major water user's and uses, maintaining minimum levels for social and environmental use while address equity and development needs of society.

B) River Basin Planning:

Preparing and regularly updating the basin plan incorporating stakeholder views on development and management provides for the basin.

C) Pollution Control:

Managing pollution using polluter pays principles & appropriate incentives to reduce most important pollution problems and minimize environmental and social impact.

D) **Information Management**:

Providing essential data necessary to make informed and transparent decisions & development and sustainable management of water resources in the basin.

E) Monitoring:

Implementing effective monitoring systems that provide essential management information and identifying & responding to infringements of laws, regulations & permits.

1.3 Hydrological Information System (HIS)

Hydrological Information System comprises the physical infrastructure and human resources to collect, process, store and disseminate data on hydrological, geo-hydrological and hydro-meteorological variables. This Hydrological Information System provides information on the Spatial and Temporal characteristics of water quantity and quality variables/parameters describing the water resources/water use system in peninsular India.

1.4 Land and water management

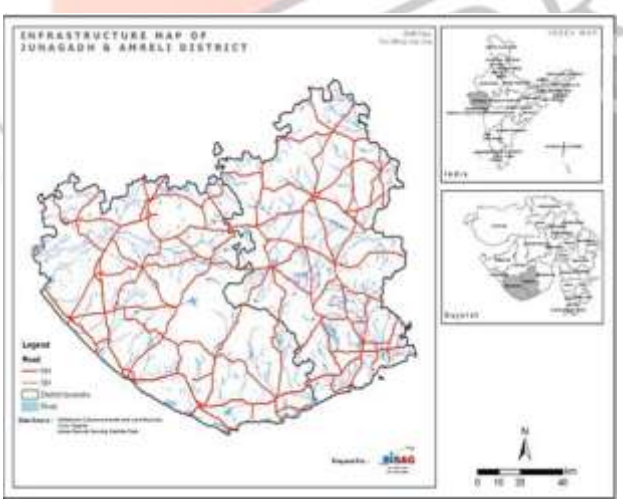
Hydrology information collected at Shaw creek and nearby spring fed streams can be useful to land managers and the public for a number of purposes. Some examples of how the data can be used are listed below:

- Water is an important mechanism for transport of energy, nutrients and chemicals and sediments. Thus, defining the hydrological cycle of a watershed is an important step in understanding erosion processes, water nutrient dynamics, contaminant transport, thermal processes (e.g. permafrost degradation)
- Water quality and quantity data can allow for more precise delineation of anatropous (e.g. salmon) and high value resident fish habitat.
- Soil moisture, Surface weather conditions & water quality provide valuable baseline data for use in prescribed burning programs to maintain wildlife habitat.

Following activities have been carried under surface water and ground water components of the project establishment/up gradation of monitoring networks.

- 147 River Gauging stations have been upgraded and made operational under them hydrology project. Following equipment and material for hygrometry have been procured and installed/provided under the project.
- 196 Metrological stations have been upgraded under this project.
- 666 ground water monitoring wells have been constructed under the project.666 Digital water level recorder have been procured & installed on these wells and the wells have been made operational.
- A network of 154 sites has been established for water quality monitoring under surface water component of the project. Samples collected at these sites are analyzed for various parameters at the laboratories established under the project.

3. Study Area:



Study Area- Amreli and Junagarh is the Study Area as shown in figure above. These are the two Districts of Gujarat State in which Proposed site is being selected for Ponds for faciliting of water to the People needs and for Agriculture.

Gujarat State-An Overview

- Gujarat state is situated in west coast of India. The total geographical area is 1, 96,000 sq/kms with a coastal length of 1600 kms, which is one-third of the coastal length of India.
- The cultivable area of the state measures at 124 Lac hectors which forms two-third of the total area of the state.

State of Water-The Lifeline

- Gujarat has quite fertile land with average rainfall varying throughout state from 14 inches per annum to 45 inches per annum. There are 17 river basins in Gujarat main land, 71 river basins in Saurashtra region and 97 river basins in Kachchh

region. Gujarat State is water scarce state and is frequently hit by droughts due to scanty rain fall. Though, more than 184 Major and Medium irrigation schemes exist in the state, several parts of North Gujarat, Saurashtra and Kachchh regions frequently suffer from severe water scarcity conditions forcing the authorities to supply water by tankers. Thus surface water being insufficient, ground water is being exploited to a great extent to protect the agriculture thanks to which complex problems have appeared.

- 40 talukas have been demarcated as overexploited, 10 as dark and 7 as saline.
- People face drinking water crisis and to sustain life has become a difficult task at many places. Water levels in tube wells in certain areas of North Gujarat have come down to 1000 feet below ground level.

Gujarat has two types of boundaries. : (1) Inland Boundaries (2) Coastal Boundaries. Gujarat state has inland boundaries with the neighboring states. on the northern side of Gujarat state we have Rajasthan, on the eastern side we have Madhya Pradesh and on the southern side lies Maharashtra state. The inland boundaries of Gujarat also include union territory of Daman and Diu and Dadra and Nagar Haveli. On the north-western boundary Pakistan is located.

3.3 Characteristics of Climate of Gujarat

Region	Avg Rain 2000-2011	Avg Rain 2010
Central Gujarat	912.12	512.24
North Gujarat	726.30	530.26
South Gujarat	1923.25	1911.61
Saurashtra	730.18	748.26
Kutchh	310.36	520.25

Table-3.1 Average Rainfall in Different Region of Gujarat

As there are variations in the geographical conditions of Gujarat characteristics of the climate also vary. In Gujarat the winter season is moderately cold and dry. The humidity is also nil. The coastal region is experience less cold. The coastal regions experience moderate climate. Whereas central regions i.e. central Gujarat and North Gujarat experience more cold during winter season. The climate of Rann of Kutch experience continental or temperate climate. Generally in winter temperature is between 4 degree to 29 degree centigrade. In Gujarat summer season is mostly hot and dry. During the summer season the coastal region is less hot. The temperature is more in regions which are away from coastal area. Rann of Kutch experiences extreme heat. In the summer season North Gujarat experience more heat. Generally in summer temperature is between 27 degree to 47 degree centigrade in North Gujarat Area.

Gujarat has total 185 river basins. Out of 185, Saurashtra region have 71 river basins while Kutchh region have 97 river basins. The river basins of kutchh are very small. The available water resource of Gujarat state is as below.

(1) Available Surface Water : 38,000 MCM
(2) Available Ground Water : 12,000 MCM

Total water resources of state are 50,000 MCM. Availability of water resources in different regions are inequitable. The details of water resources are as follows:

Area	Total in MCM	Surface Water	Ground Water	% of Water Resources
South Gujarat Region (South of Sabarmati River)	35700	31750	3950	71.40
North Gujarat(North of Sabarmati River)	5300	2000	3300	10.60
Saurashtra	7900	3600	4300	15.80
Kutchh	1100	650	450	2.20
Total	5000	38000	12000	100

Table- 3.2 The Details of water Resources are

4. METHODOLOGY

4.1 Data Used

In this study, Indian Remote Sensing Satellite Digital Data (LISS-III, Cartosat) from the year 2013 images had been used.

4.1.1 Indian Remote Sensing Satellite (IRS P-6) LISS-III digital data used

S.No.	Satellite	Sensor	Path/Row	Date of Pass
1	IRS P-6	LISS-III	91/57	5 Jan 2013
2	IRS P-6	LISS-III	92/57	10 Jan2013

Table 4.1: Remote Sensing Data

4.1.2 Geo-Spatial Data:

- Water bodies like River, Drainage, Canals
- Land Use
- Roads
- Railway
- Village Boundary

– District Boundary

4.2 ENVI PROCESS-

In this Process we can change the liss-III colour image to gray scale image by the techniques of NDVI.

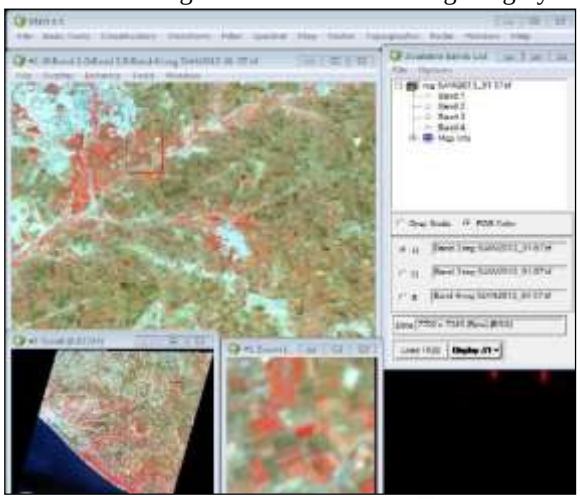


Figure 4.4 : LISS-III Image (Colour Image)

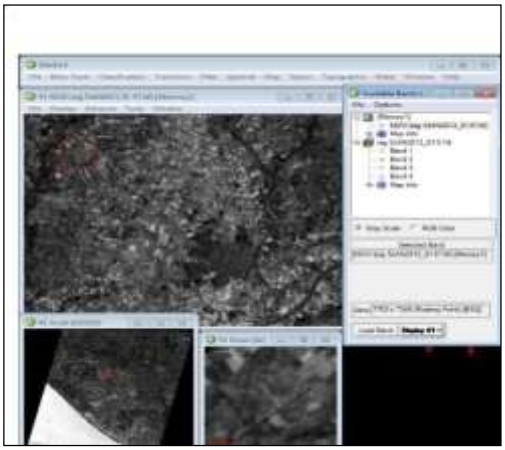


Figure 4.5 : NDVI Image (Gray Scale Image)

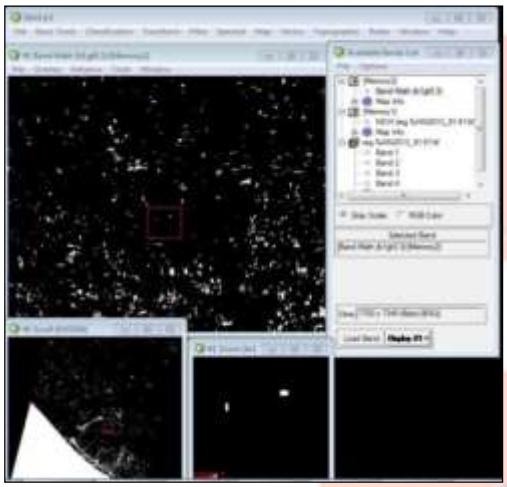


Figure 4.8: Unsupervised Classification by Iso-mean.

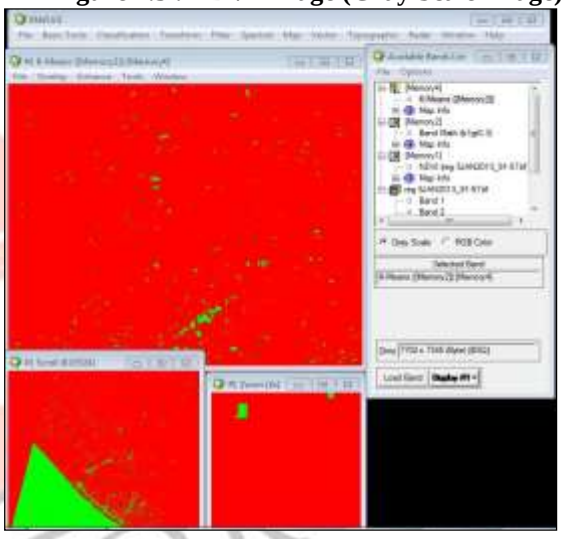


Figure 4.7: Vegetation Area Remaining

By NDVI Image we can easily finding the vegetation area because of this we can removed we can removed the vegetation areas, so this it is beneficial for the establishing suitable site for water harvesting. After which bandmath process is done .By this Process the vegetation area is remaining.

By the use ENVI software in the Tools menu there is an option of by the use of this command we can take bandmath 0.3 an then do processing only the areas is remaining after this vegetation areas we can for establishment of sites. Further this we can classify the vegetation areas into unsupervised classification by Iso-mean further this we can more classify the vegetation areas. There are two types of classification is done i.e. the supervised classification and the unsupervised classification.

The Unsupervised Classification of the vegetation areas helps to removed the unwanted areas of crops that means these areas are not suitable for selectin water harvesting structures in the Junagarh and Amreli Districts. The Green Portion shows the vegetation areas and the red portion shows that the vegetation areas.

RESULTS & DISCUSSION

Major Criteria for Proposed Ponds

Along with canal system ponds in the district were also proposed for diverting
Surplus water from the dams. The criteria for proposed ponds are:

- As far as possible proposed ponds should be in the wasteland.
- It should be in the area where drainage intersects.
- It should be 200 meter away from the major transport network.
- There has to be some natural depression.
- The procedures adopted for identification suitable sites for proposed ponds isas follows:
  - Using ASTER DEM the flow direction was created as shown in the fig no 6.3. The direction of flow is determined by the
  -) Using the flow direction output sink file identifying all sinks or area of Internal drainage was created as shown in figure 6.4. A Sink is a cell or set of spatially connected cells whose flow direction cannot be assigned one of the

eight valid values in a flow direction raster. A DEM that has been processed to remove all sinks is sinks is called a Depression less DEM

– direction of steepest descent from each cell. This is calculated as change in Z-Value/Distance*100.

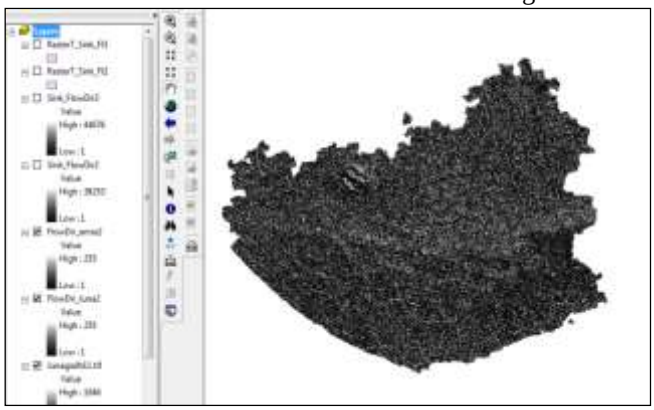


Figure 6.3: Flow direction generated from ASTER DEM

b) Using the flow direction output sink file identifying all sinks or area of Internal drainage was created as shown in figure 6.4. A Sink is a cell or set of spatially connected cells whose flow direction cannot be assigned one of the eight valid values in a flow direction raster. A DEM that has been processed to remove all sinks is sinks is called a Depression less DEM.

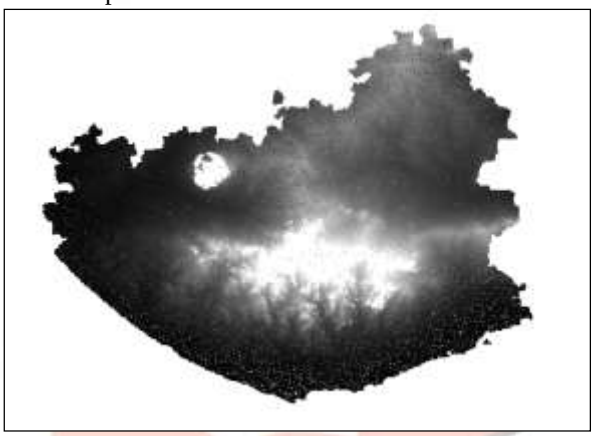


Figure 6.4: Sink file generated using ASTER DEM

C. Using the sink generated file, it has been removed all the small raster it is converted into raster to polygon. Only the Polygon areas area are remaining was created as shown in figure 6.4.

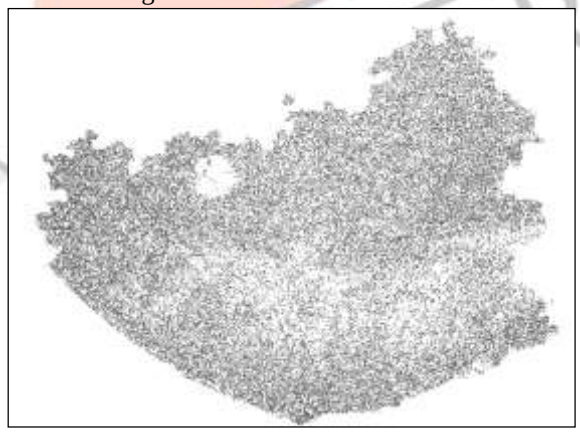


Figure 6.4: Raster to Polygon file generated

5.3 Proposed ponds in Junagarh and Amreli district

Using IRS LISS III digital data wasteland in Amreli and Junagarh district was identified. For proposing pond in Amreli and Junagarh districts 4 to 5 places was selected because of it has highest area under wasteland. The identified wasteland in taluka are shown in fig no 6.4 and 6.5. There are two-two places in the Junagarh and Amreli where all the criteria are fulfil for the establishment of sites for water harvesting Structures in both these districts.

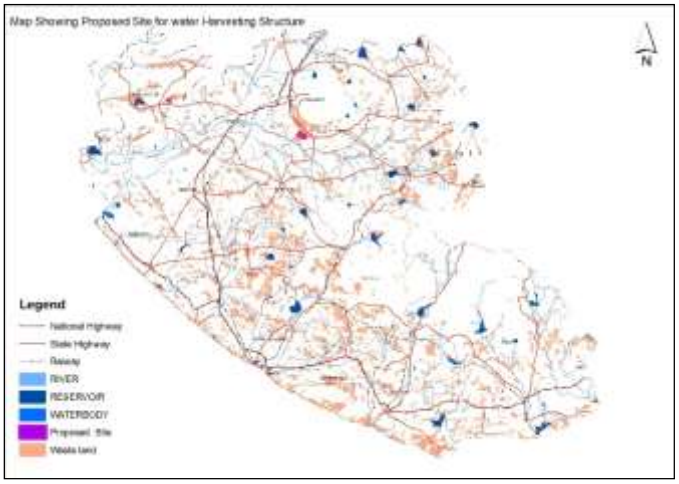


Figure 6.4: Proposed Pond in the Junagarh district

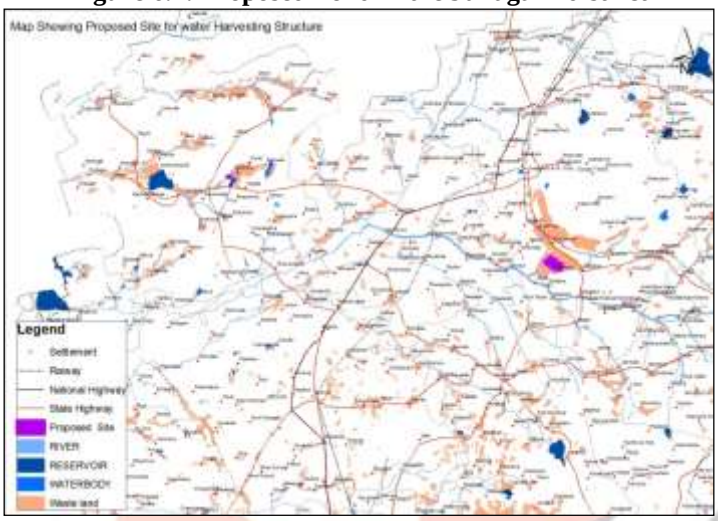


Figure 6.4: Proposed Pond in the Amreli District.

CONCLUSION

Major conclusions of this Study are as follows:

Remote sensing data from IRS P-6 LISS- III and DEM data was analyzed in the present study for diverting surplus water though the natural drainage and proposed canal system.

The result of the study indicate that the Proposed Ponds in the Junagarh and Amreli Districts, it will definitely improve the agricultural production due to availability of irrigation water through Ponds. The improvements in agricultures production will help to improve the economical condition of the farmer in this region.

- The major criteria consider for proposed Ponds system are:
  - Based upon slope and contour derived from data, the area having natural gradients is identified so that the water flows with the gravity level.
  - The most important aspect of diverting surplus water is through the natural drainage so that minimum land acquisitions are required.
- The slope and contour were generated using DEM data so that the water is diverted to the ponds and dams.
- The area for major proposed ponds was identified bases on Criteria like:
  - The proposed pond should be in wasteland.
  - It should be in the area where drainage intersected.
  - It should be at least 200 meter away for the transport network.
- The result of the study indicate that the Proposed Ponds in Junagarh and Amreli districts, it will definitely improve the agricultural production due to availability of irrigation water through Ponds. The improvements in agricultures production will help to improve the economical condition of the farmer in this region.

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