ENVIRONMENTAL IMPACT ASSESSMENT OF SALEM CHALK HILLS USING REMOTE SENSING AND GIS

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ABSTRACT

Environmental protection is faced critical problems due to several factors as the increasing population, demolishing natural resources, environmental pollution, land use planning as well as others. Unplanned land use have become a major problem. Most land use changes occur without a clear and logical planning with any attention to their environmental impacts. Major flooding, air pollution, deforestation, urban growth, soil erosion, desertification groundwater extraction and unplanned mining activities are all consequences of a mismanaged planning without considering environmental impact of development planes. The study area selected is Salem Chalk hill. This hill is well known for various mining activities because of such mining activities, there is a complete depletion of existing ground water and also there is contamination of the ground water. Beside this there are many environmental havocs created like

- Desertification of land near by agriculture lands have their potential brought down drastically
- Increased air and noise pollution

The continuous mining activity has increased the pollution levels, these adverse effects has produced a spot light on this study area even though this gives many mineral resources economically it creates great environmental hazards too. This controversial statement has made me to select this study area. Remote sensing Technique in combination with GIS is utilized for groundwater analysis which is influenced by land use conditions.

1. INTRODUCTION:

Environmental protection is faced critical problems due to several factors as the increasing population, demolishing natural resources, environmental pollution, land use planning as well as others. Unplanned landuse have become a major problem.

Most landuse changes occur without a clear and logical planning with any attention to their environmental impacts. Major flooding, air pollution, deforestation, urban growth, soil erosion, desertification groundwater extraction and unplanned mining activities are all consequences of a mismanaged planning without considering environmental impact of development planes.

Salem is a Geologist’s paradise, surrounded by hills and the landscape dotted with hillocks. As a district, Salem has its significance in various aspects. The district is rich in mineral deposits like Magnesite, Bauxite, Granite, Limestone, Quartz and Iron ore. Allied industries like Magnesite mining, cement manufacture, refractory bricks manufacture, Aluminium smelting etc thrive well.
2. OBJECTIVE OF THE RESEARCH WORK

- To create spatial digital database consisting of landuse/land cover, drainage, topography, lithology, geomorphology and slope with the help of satellite imageries and ground data using GIS
- To create digital elevation model of the study area
- To assess Air and Mine pollution
- To generate change detection algorithms for mine environment
- To assess the magnitude of pollution in the groundwater system

3. LITERATURE SUPPORT

- Environmental Land use Change Detection and Assessment using Multitemporal satellite imagery Mohsen Ahadnejad, Zanjan university.
  He had used supervised classification to study land use changes occurred in maragheh region. Ecological models had also been used to analyze Environmental Impact of Landuse change the area. Landsat imageries of 1989 &1998 were considered, 20 GCP were selected throughout the area using topographic maps. Rate of impact due to the land use changes were classified into 4 district classes as very high impact, high impact, medium impact and low impact.
  He had finally concluded as changes caused by development of industries, population growth, and construction of new buildings etc. this type of changes have the most environmental impact in the area so that the continuation of such trend may endanger the surrounding land as well as the orchards in the area.
4. METHODOLOGY TO BE ADOPTED

- Literature survey Course work completion.
- Preparation of base map from SOI toposheet on 1:50,000 scale
- Preparation of various thematic maps namely drainage, landuse/land cover, soil, geology, geomorphology and lineament from satellite imageries
- Field work and sample collection
  1. collection of soil samples
  2. periodical collection of ground water samples
- sample analysis
- Assessment of air pollution and noise pollution
- Integration of maps and non spatial data using GIS and creation of data base
- Suggestion of methods to improve the existing system

5. STUDY AREA

Salem has the total area of 19.94 sq kms with Latitude of N 11˚19' to 11˚ 58' and Longitude of E 77˚ 40' to 78˚ 50'. The mine is situated at a distance of 5 km from salem town. The run of the hill range is NW-SE. The aspect is North East & South West. It has an average elevation of 278 metres (912 ft). The rivers in Salem are Thirumanimuthar, Vasishta Nadi, Kaveri, Sarabanga nadi

Geology:

The major ore deposits in salem are Magnesite, Limestone, Granite, Bauxite.

Magnesite

One of the world’s best Magnesite deposit occur in Salem. The Magnesite reserves in Tamil Nadu are about 73 million tonnes. Magnesite is used mainly for refractory purposes and in chemical industries. The major Salem district based players in this field are Tamil Nadu Magnesite (TANMAG), a State Government organisation, Burn Standard, a Government of India organisation and Dalmia Magnesite.

Limestone

Tamil Nadu ranks seventh in the country in terms of production of Limestone. Lime stone based Cement and Chemical industries have been flourishing for the past three decades as cement grade limestone deposits are abundant in the State. The total limestone reserves are about 1,473 million tonnes. There are 12 major cement plants functioning in the State. The major players are Tamil Nadu Cements (TANCEM), Dalmia Cements, Madras Cements, India Cements, Grasim Industries, Associated Cement Companies and Chettinad Cements.

Granite

Tamil Nadu is endowed with vast resources of Granite of different colours and shades. The total reserves of granite are about 710 million cubic metres. Granites are used in building facading, flooring, decorative&
ornamental uses and in Monuments. Black Granite and other coloured Granites occurs in salem districts. The major players are the Tamil Nadu Minerals (TAMIN), a Government of Tamil Nadu Enterprise, P.R.P. Granites, Gem Granites, Pallava Granites, Rani Granites and Enterprising Enterprises.

Bauxite

Bauxite occur in the Kodaikanal, Palani, Yercaud and Kolli Hill ranges in the State. The reserves are about 26 million tonnes. Madras Aluminium Company (MALCO) a company of Sterilite Group is based at Mettur manufacturing Alumina.

The study area selected is Salem Charc hill. This hill is well known for various mining activities. because of such mining activities, there is a complete depletion of existing ground water and also there is contamination of the ground water. Beside this there are many environmental havocs created like

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6. BRIEF DESCRIPTION ABOUT THE RESEARCH WORK

1. Preparation of thematic maps
Data source

Satellite data
Topo sheet

Visual image interpretation and Digital data analysis
Preparation of base maps using GIS

Development of Interpretation keys
Detection, recognition & identification
Assessment of changes
Prefield thematic maps Generation pertaining to the research
Selection of areas for ground truth
Field verification and modification of maps
Transfer of thematic details
Map reproduction
Final maps and 3D digital terrain models
2. Sample collection and analysis

Sample collection

- Soil samples
  - Major oxides
  - Trace metals

- Ground water samples
  - Monitoring ground water levels

- Air quality/air pollution studies
  - Major ions
  - Trace elements

3. Data Interpretation

Data Interpretation

- Ground water modelling
  1. Quality modelling using Net Path
  2. Flow modelling using GMS

- GIS for integration of spatial and non spatial data

4. Assessment of Environmental Impact due to the mining activities on ground water, and use / land cover, agriculture.

6. MINING:

The proposed method of mining will be opencast using Semi-mechanized method. The mine will be developed systematically by maintaining a bench height of 6.0 m.

7. BASELINE INFORMATION:

Studies have been conducted during June 2008 in respect of parameters like meteorology, ambient air quality, water quality, noise levels, soil quality, Socio-economics, flora & fauna, landuse in the bufferzone of 5 kms radius.

The findings are discussed as below:
i. Meteorology:

Maximum and minimum temperatures, relative humidity, wind speed and wind direction were collected. The temperature ranged from 21.5°C to 41.5°C and the relative humidity from 42% to 90% during the Study period. The highest wind speed recorded was 17.5 km/hr. The redominant wind direction was observed from NE to SW & N to S direction.

ii. Ambient Air Quality:

Air monitoring stations have been fixed at DALMIA site, Burn & Co, TANMAG regions covering buffer zone. And one station has been fixed at the core zone. The summary of Air quality levels are given in the table below:

<table>
<thead>
<tr>
<th>Stn code</th>
<th>Location</th>
<th>SPM</th>
<th>RPM</th>
<th>SO2</th>
<th>NOX</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – I</td>
<td>Chettichavadi Site</td>
<td>122 -224</td>
<td>44 - 74</td>
<td>15 - 18</td>
<td>19 - 23</td>
<td>BDL</td>
</tr>
<tr>
<td>A-II</td>
<td>TANMAG Site</td>
<td>79 -185</td>
<td>37 – 93</td>
<td>14 – 21</td>
<td>16 – 22</td>
<td>BDL</td>
</tr>
<tr>
<td>A-III</td>
<td>DALMIA Site</td>
<td>101 – 163</td>
<td>35 – 57</td>
<td>8 – 16</td>
<td>10 – 21</td>
<td>BDL</td>
</tr>
<tr>
<td>A-IV</td>
<td>Burn &amp; Co</td>
<td>100 – 158</td>
<td>38 – 72</td>
<td>10 -15</td>
<td>10 – 21</td>
<td>BDL</td>
</tr>
<tr>
<td></td>
<td>Permissible Limit for Rural Area</td>
<td>200</td>
<td>100</td>
<td>80</td>
<td>80</td>
<td>2000</td>
</tr>
</tbody>
</table>

From the above table it is seen that the air quality were well below the permissible limits.

iii. Water Quality:

Water Quality studies yet to be conducted.

iv. Environment of Noise:

Noise levels have to be monitored at four locations. Three stations representing buffer zone villages, one station Forest area represent silent zone and one station representing core zone. Monitoring was conducted during day time as well as night time in buffer zone villages and core zone station.

8. LAND USE:

Land degradation study was carried out with the help of remote sensing products i.e collecting, digitizing satellite imageries and maps.

Steps involved in land degradation study are:

- Data collection
- Scanning the raw Data for the process of digitizing
- Digitization using ArcView software
- Digitized map as input data to ArcView GIS database
- Adding Themes to the digital map by adding all its features
- Creating Attribute Table which contains all the added informations
Analyzing the present Salem map from Satellite imageries
Creating the digital map for the Study area
Creating digital model for the Study area

The above methodologies are pictured clearly below for clear understanding. Each and every step in the process of making a digital model are clearly explained.

8.1 DATA COLLECTED FOR CREATING ARCVIEW GIS DATABASE

The data collected for the creation of ArcView GIS database are from the various departments are listed below:

- Satellite imageries of Salem city
- Salem boundary map
- Salem transportation map – Roadways and Railways
- Water body map
- Location map of study area
- Land use / Land Cover Map

8.2 WORKING PROCEDURE WITH ARCVIEW GIS

The initial step is digitize all the above scanned map. The next step is the storing of the scanned map in ArcView GIS software. This is the scanned image which is stored in ARCVIEW GIS DATABASE which is ready for the next process of DIGITIZATION. The data is ready for the most important process called DIGITIZATION which can be done by opening the database that is stored in the drive.
9. ENVIRONMENT IMPACT ASSESSMENT

The impact on the surrounding environment due to various mining activities is to be predicted using suitable prediction models. The impact on air, water, noise and will be predicted.
10. ENVIRONMENT MANAGEMENT PLAN

The management shall take the following steps to control pollution.

STEPS PROPOSED:

i) Air Quality

a) Drilling :

Drilling with dust extractors

b) Loading & Unloading :

Well maintained hydraulic excavators with sharp bucket teeth
Use of well maintained tippers
Maintenance of smooth mine haul roads to avoid spillage

b) Transportation of Ore :

Proper road maintenance.
Water Spraying on roads on a continuous basis.
Proper loading of trucks and covering with tarpaulin, to prevent leakages.
Drivers will be trained and prohibited from over speeding

d) General :

• Development of green belt along the roads, waste dumps and around the ultimate pit limit in the mine.
• Ambient air quality monitoring shall be done regularly in all the three seasons except monsoon season.

ii) Steps Proposed for land Environment:

a) Afforestation Programme :

A green belt shall be developed using fast growing and dense plants. Any vacant land shall be afforested by planting suitable saplings thus making entire area green. During plan period plantation will be carried out on the dumps along the roads and along the ultimate pit limit covering 5000 saplings per year.

b) Waste Dump Management :

The waste generated during the plan period will be dumped systematically on a plot selected for dumping which is non mineral zone area. About 1.36 million tonnes of waste shall be generated and the same shall accommodated in the available dumping area. It is proposed to stabilise dumps by using hamata grass
species and agave plantation. Retaining walls are proposed at the toe of waste dumps. Check-dams also are proposed to arrest any silt flowing along the nallah.

13. CONCLUSIONS:

The baseline quality of air, water, noise and soil are found to be normal and are well within the permissible limits. The expected increase in the levels of the environment parameters would be marginal as per the impact assessment made.

Starting of the project will have the following benefits

(a) Increased employment. Direct & indirect employment shall be 67.
(b) Increased Revenue to the government
(c) Improved socio-economics

Considering the above positive impact on the community there will be overall development of the area. It is requested that environment clearance be granted for this new mining project.

REFERENCES


