International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 7; Issue 9(G); September 2018; Page No. 15692-15694
DOI: http://dx.doi.org/10.24327/ijcar.2018.15694.2874

Research Article

ROLE OF REMOTE SENSING AND GIS IN THE MAPPING AND REVENUE MOBILIZATION OF LIMESTONE DEPOSITS OF JUNAGADH, SAURASHTRA, GUJARAT

***Sreekala Pillai[1] and Nishith Y Bhatt[2]**

[1]Income Tax Department, Ahmedabad
[2]M.G. Science Institute, Ahmedabad

A R T I C L E I N F O

Article History:

Received 15th June, 2018
Received in revised form 7th July, 2018
Accepted 13th August, 2018
Published online 28th September, 2018

Key words:

Remote sensing, GIS, limestone, royalty, revenue mobilization.

A B S T R A C T

The remote sensing and GIS data are now widely used in the revenue mobilization of various mineral deposits in different countries. The technological advancements have aided in reducing the field and operational expenditures at the survey stage. These modern tools are employed for revenue mobilization of limestone deposits present in the coastal districts of Gujarat inwest India. Remote sensing has established that there are abundant mineral wealth in various districts of Gujarat State. A precise assessment of the volume of limestone deposits along the Saurashtra coast has been estimated through the remote sensing data. The present study is focused on the generation of revenue through limestone deposits of the area and corresponding usages of the many varieties of limestone.

INTRODUCTION

Remote sensing is an art and science of obtaining information about an object or feature without physically coming in contact with that object or feature. Remote sensing provides a means of observing large areas at finer spatial and temporal frequencies. Depending on the source of electromagnetic energy, remote sensing can be classified as passive or active remote sensing. In the case of passive remote sensing, source of energy is that naturally available such as the Sun. Most of the remote sensing systems work in passive mode using solar energy as the source of EMR. Solar energy reflected by the targets at specific wavelength bands is recorded using sensors onboard air-borne or space borne platforms. In order to ensure ample signal strength received at the sensor, wavelength/energy andscapableof traversing through the atmosphere, without significant loss through at mospheric interactions, are generally used in remote sensing.

In the case of active remote sensing, energy is generated and sent from the remote sensing plat form towards the targets. The energy reflected back from the targets are recorded using sensors onboard the remote sensing platform. Most of the microwave remote sensing is done through active remote sensing.

Remote Sensing data is one of the primary data sources in Geographical Information System (GIS) analysis.

Corresponding author:* ***Sreekala Pillai
Income Tax Department, Ahmedabad

GIS is a system for capturing, storing, analyzing and managing data and associated attributes, which are spatially referenced to the Earth. In a more generic sense, GIS is a software tool that allows users to create interactive queries, analyze the spatial information, edit data, maps, and present the results of all these operations.GIS technology is becoming essential tool to combine various maps and remote sensing information to generate various models, which are used in real time environment. GIS is the science utilizing the geographic concepts, applications and systems. It can be used for scientific investigations, resource management, asset management, environmental impact assessment, urban planning, cartography, criminology, history, sales, marketing, and logistics. (D. Nagesh Kumar, IISc, Bangalore)

In addition, forecast analyses can be carried out to show the land cover status on a future date if current trend prevails. An understanding of the change prediction is expected to aid in developing policies that would ensure sustainable use of the environment with in a given area. This has been increasingly achievable through the use of both satellite imageries generated through remote sensing data, and Geographic Information System (GIS) tools. (Fanan Ujoh *et.al*.2014).

The remote sensing data applications to natural resources reduces the mapping cost and also enhances the quality, reliability, information and detail of the result. Lately, the remote sensing data are being used extensively for the management of natural resources.

The ever-increasing human population puts direct pressure on the production of natural resources. Remote sensing and GIS

help to manage these non-renewable resources in an organized and better way. (Kumar *et.al*., 2015).

The present study utilizes the application of remote sensing and GIS to the study of natural resources, specifically the mineral limestone and its deposition in various regions of Gujarat. Gujarat accounts for about 11% of the total limestone produced in the country. Deposits of the mineral are distributed over the coastal districts of Gujarat like Junagadh, Jamnagar, Amreli, Porbandar, etc.

The study area covers 21.5816N to21.4940N latitudes and70.4725E to70.4816E longitudes. The study area is located on the coastal part of Saurashtra. Geologically it is covered by the Deccan Trap lava flows to Recent sediments.

MATERIALS AND METHODOLOGY

Data on the royalty received on limestone and district wise income from the limestone (major) and building limestone was collected from the Commissioner of Geology and Mining, Government of Gujarat.

The data with regards to the royalty received on limestone and district wise income from the limestone (major mineral) and building limestone (minor mineral) was collected from the Commissioner of Geology and Mining, Government of Gujarat. The data was then systematized as the need of the present study, tabulated, analysed and conclusions were derived scientifically.

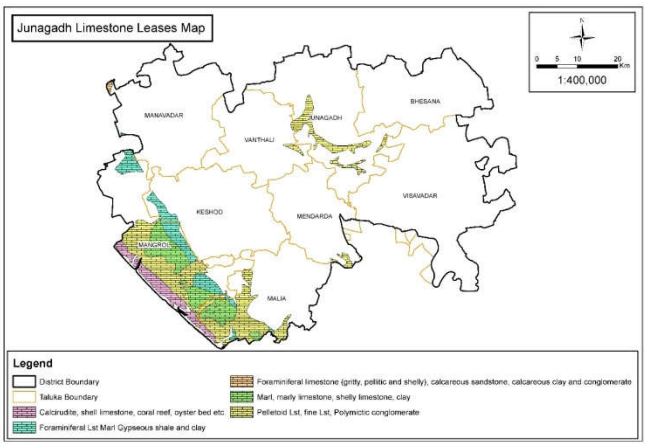

Figure 1 Map showing distribution of limestone deposits in Junagadh district, Saurashtra, Gujarat.

Table 1 Details of district-wise limestone production-major mineral in various districts of Gujarat, Western India.

Serial No.	District	2012	2013	2014	2015	2016
1	Amreli	41.56	43.43	43.36	47.24	44.78
2	Kutch	52.17	53.59	72.99	67.87	64.94
3	Jamnagar	15.58	7.55	5.22	5.63	5.35
4	Junagadh	55.91	24.50	4.81	6.57	44.95
5	Porbandar	24.45	41.20	35.78	42.71	38.58
6	Rajkot	1.22	0.81	0.66	0.88	0.67
7	Surat	1.49	0.34	0.00	1.63	1.62
8	Dwarka	0.00	2.84	4.99	3.96	4.08
9	Gir Somnath	0.00	35.22	62.30	71.85	76.46

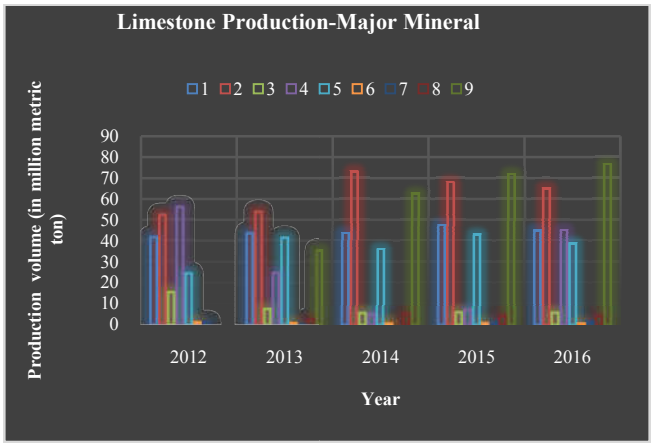

Figure 2 District-wise limestone production-major mineral in various districts of Gujarat, Western India.

Table 2 District-wise production of building limestone in various districts of Gujarat, Western India.

Serial No.	District	2012	2013	2014	2015	2016
1	Amreli	0.04	0.04	0.06	0.06	0.03
2	Kutch	1.54	1.13	1.06	0.76	0.98
3	Gandhinagar	0.05	0.00	0.00	0.06	0.04
4	Jamnagar	2.22	1.33	2.04	2.13	2.46
5	Junagadh	10.31	3.25	2.22	3.83	5.87
6	Porbandar	19.37	9.99	6.73	5.83	8.65
7	Banaskantha	1.10	1.35	1.45	1.99	2.48
8	Rajkot	0.96	0.35	0.54	0.47	0.95
9	Sabarkantha	0.53	0.44	0.41	0.51	4.70
10	Dwarka	0	0.13	0.28	0.01	0.35
11	Gir Somnath	0	2.41	3.56	3.57	3.00

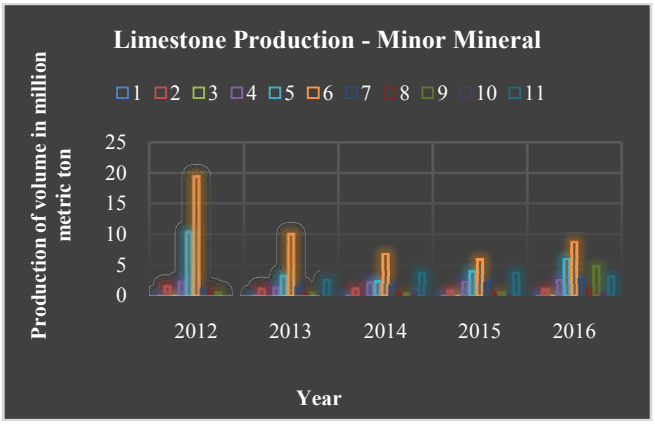

Figure 3 District wise production of building limestone in various districts of Gujarat, Western India.

Based on the analysis of the data in table 1, the study was streamlined to the limestone deposits in the district of Junagadh and the revenue generated by the lease of limestone mines in the district.

Data

Following data have been collected on limestone (major) and building limestone of Junagadh district of Gujarat state and have been analysed for revenue received from the district.

Table 3 Royalty received by the Government of Gujarat from limestone (major) mines in Junagadh during 2012-2017 (in lac rupees).

Sl. No	District	2012-13	2013-14	2014-15	2015-16	2016-17
1	Junagadh	5032.11	2205.36	433.52	591.94	446.13

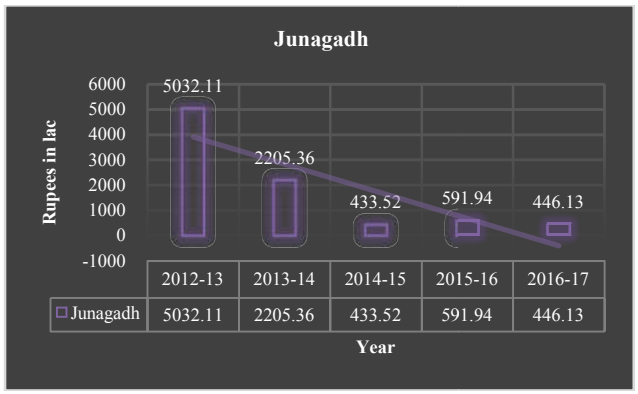

Figure 4 Royalty received by the Government of Gujarat from limestone (major) mines in Junagadh district during 2012-2017 (in lac rupees).

Table 4 Royalty received by the Government of Gujarat from building limestone mines in Junagadh during 2012-2017 (in lac rupees).

Sl. No	District	2012-13	2013-14	2014-15	2015-16	2016-17
1	Junagadh	515.84	162.79	111.16	191.75	293.65

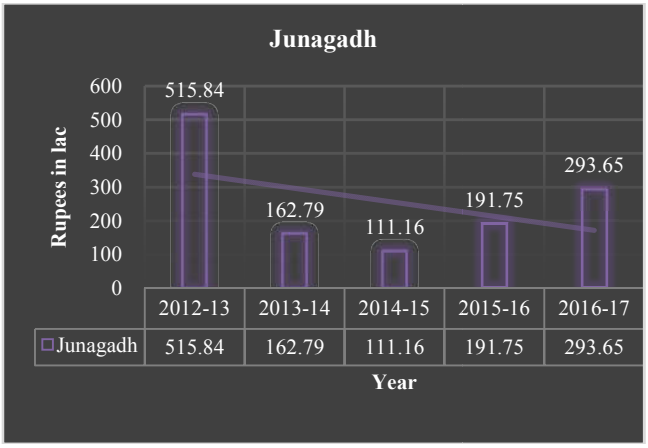

Figure 5 Royalty received by the Government of Gujarat from building limestone mines in Junagadh district during 2012-2017 (in lac rupees).

RESULT AND DISCUSSION

The data collected by remote sensing and GIS as also the royalty data obtained from the Government of Gujarat was analysed graphically. Comparative royalty receipts were calculated. Maximum revenue was received in the year 2012-13 which was 5032.11 lac rupees for limestone (major) in Junagadh district, while minimum revenue collected was for the year 2014-15, which were 433.52 lac rupees. On the other end, highest revenue received forbuilding limestone was in the year 2012-13, which amounted to rupees 515.84 lac in the district, while lowest revenue received was during the year 2014-15 which was only rupees 111.16 lac for the same. For the rest of the years, the revenue generated was intermediate between the highest and lowest figures for both limestone (major) and building limestone in between the year 2012-13 to 2016-17.

It is significant to mention here that the huge drop in the volume of production of limestone in 2014-15 as compared to the previous year i.e. 2013-14, was due to the split of Gir Somnath from Junagadh on 15th August, 2013. The potential limestone areas of Junagadh i.e. Gir-Gadhada (New), Una, Talala, Veraval, Sutrapada and Kodinartalukas are now the part of newly formed district of Gir-Somnath. Hence, the productions of limestone from these talukas were reflected against Gir-Somnath, thereby affecting severely the royalty received through limestone productionin Junagadh.

CONCLUSIONS

From the data collected from the year 2012-13 to 2016-17, it is seen that remote sensingalong with GIS data can be a helpful tool with respect to mineral deposits. It can save time since it is an onsite data.

The highest revenue during the year 2012-13 indicates the highest production of soda ash from limestone produced in Junagadh district in between the year 2012-13 to 2016-17.

The lowest revenue during the year 2014-15 indicates lowest production of soda ash from limestone produced in Junagadh district in between the year 2012-13 to 2016-17.

Normally, use of building limestone occurs locally, in that way the highest revenue during the year 2012-13 indicates the highestconstruction of buildings from building limestone produced in Junagadh district in between the year 2012-13 to 2016-17.

In the same manner, the lowest revenue during the year 2014-15 indicates the lowest production of buildings from building limestone produced in Junagadh district in between the year 2012-13 to 2016-17.

During all these years i.e. 2012-13 to 2016-17 the slab of royalty was same i.e. for limestone (major) it was Rs. 90/- per tonne and for building limestone royalty was Rs. 50/- per tonne.

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Kumar N., Yamaç S.S. and Velmurugan A. Applications of Remote Sensing and GIS in Natural Resource Management Journal of the Andaman Science Association Vol. 20(1):1-6 (2015) ISSN 0970-4183, Printed in India © Andaman Science Association, Port Blair (A & N Islands), India

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