Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

p-ISSN: 0972-6268 e-ISSN: 2395-3454	Vol. 18	No. 3	pp. 1041-1044	2019

Original Research Paper | Open Access

Application of Geospatial Technology in Evaluating the Impact of Mining Associated Urbanization on Agricultural Lands

M. Prasad*, Y. Sudharshan Reddy, E. Balaji***, V. Sunitha** and M. Ramakrishna Reddy*†**
*Department of Earth sciences, Yogi Vemana University, Kadapa-516 005, A.P., India
**Department of Geology, Yogi Vemana University, Kadapa-516 005, A.P., India
***Department of Geology, Sri Venkateswara University, Tirupati-517 502, A.P., India
†Correspondence author: M. Ramakrishna Reddy

Nat. Env. & Poll. Tech.
Website: www.neptjournal.com

Received: 23-01-2019
Accepted: 29-03-2019

Key Words:
Mining
Urbanization
Geospatial technology
Govindampalle village

ABSTRACT

In this study an attempt was made to assess the mining associated urbanization impact on rural agricultural lands due to expansion of mining dump yards, pulverizing mills and beneficiation plants in and around Govindampalle village, YSR District, A.P by using Geospatial technologies. Various land use and land cover (LULC) classes, mainly, cropland, plantation, fallow land, mining/industrial, water body, settlements and scrub lands were recognized and their impact on the environment has been discussed. Google earth historical imagery during 2010 and 2017 are used to map and assess these land use and land cover changes in the ArcGIS flat form. LULC change detection analysis data showed that cropland, water bodies and scrublands were decreased by 10, 2, 14 and 20 percent, respectively from 2010 to 2017. On the other hand industrial areas and agricultural plantations showed an increasing trend with 14 and 20 percent growth rate respectively.

INTRODUCTION

At present, sustainable development is a concept, which is fast gaining supremacy at global scale. Sustainable development is important because many of the resources are non-renewable and exhaustible; over-exploitation of these resources will certainly affect the needs of our future generations. Globally, land use and land cover change is a dynamic and indispensable concern from environmental point of view (Ruiz-Lunaand & Berlanga-Robles 2003). Further, environmental degradation has become a major threat to the survival of biota on the planet. Sustainable development can be achieved through proper environmental impact assessment (EIA), monitoring, and conservation of natural resources. India is bestowed with valuable natural resources like mineral deposits, forests, rivers, water bodies, wetlands and vast areas of agriculture, which are serving the needs of around a billion people and varied climatic conditions (Veenendaal 2017). Mining activities are one among the major reasons for agriculture destruction, questioning the survivability and sustainability existing in that area. The mining of natural resources is invariably associated with land use land cover changes (Prakash & Gupta 1998). Further, mining activities result in change of topography (Manna & Maiti 2014). Surface mining activities such as ore body exploitation, transportation, dumping and removal of the overburden cause alteration in the patterns of land use/land cover (LU/LC) in surrounding environment (Shegena 2017). Sustainable mining activity requires to uninterrupted monitoring of these changes for recognizing the long-standing impacts of mining on the environment as well as land cover (Gupta 2015). Therefore, monitoring and managing the impact of mining activities on natural resources at regular intervals is necessary to ensure the position of their depleted conditions, and to adopt restoration and conservation measures. Hence, innovative, improved and feasible techniques are required to address and assess these impacts. Recently, geospatial techniques have been widely applied in investigation of mining/urban environment since they can offer a huge amount of earth observation data at global, regional, and local scales (ASPRS Annual Meeting 2017, Prasad et al. 2019). Geospatial technology offer means to study the mining and its associated practice impacts on agriculture/forest environment and also assists in suggesting the environment friendly practices (Goparaju 2017).

SIGNIFICANCE OF STUDY AREA

The study area Govindampalle is a revenue village in Obulavaripalle Mandal of YSR district in the State of Andhra Pradesh, India and fall on Survey of India toposheet No. 57N/8 (Fig. 1). It is located in the northern side of the well known Mangampeta barytes mine and well connected with rail and road networks (Kadapa-Chennai). The Mangampeta barytes mine being an open pit mine, has been producing

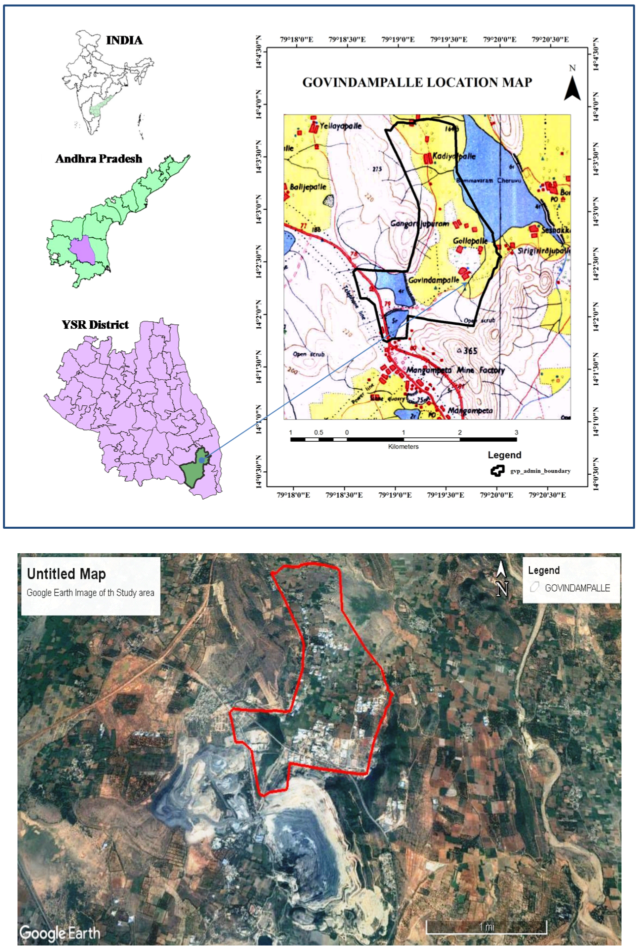

Fig. 1: Google Earth image showing the study area boundary (Red Color).

Fig. 2: Google Earth satellite imagery for the year 2010 (left) and 2017 (right).

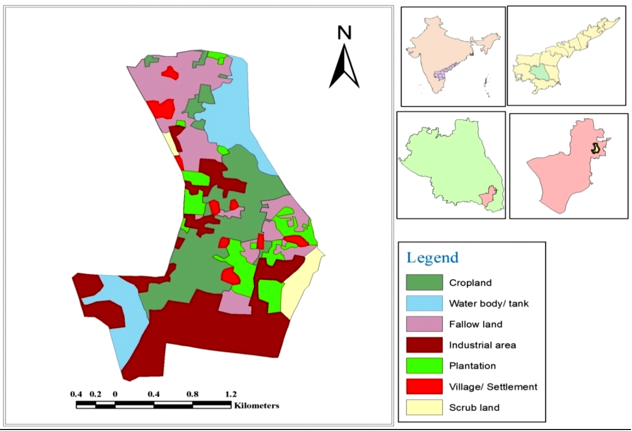

Fig. 3: LULC map of Govindampalle village for the year 2017.

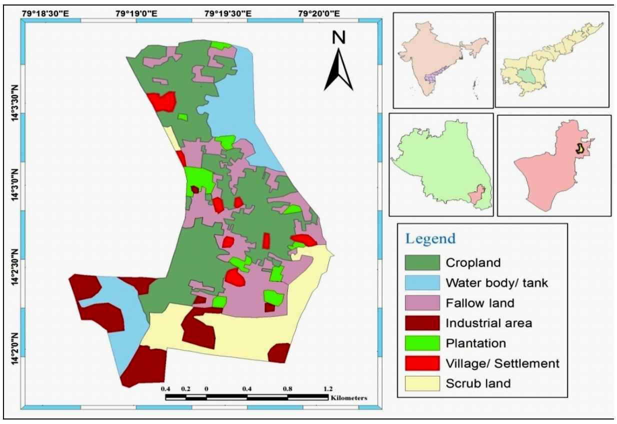

Fig. 4: LULC map of Govindampalle village for the year 2010.

the overburden since 1970's (Sunitha et al. 2015). It is serving barytes for about 172 pulverizing mills around the mine (APMDC 2016), out of this around 80 are located in the Govindampalle revenue village.

MATERIALS AND METHODS

A systematic approach has been made in the present study by integrating the remote sensing data, GIS analysis and field verification. For this, satellite images were collected from Google earth Pro (http://www.earth.google.com) for the years 2010 and 2017 (Fig. 2). Both the images were imported, enhanced, corrected and geo-referenced and projected to the reference system UTM (zone 44) and WGS 84 datum in Arc GIS flat form. On screen visual interpretation was used in the current exercise wherein the GIS LULC vector layer created during the first image (2010) was overlaid on to the later imagery acquired during 2017. The methodology essentially is based on editing the above vector layer for the changed areas, thereby creating the new LULC vector layer for 2017 (Figs. 3-4). The LU/LC classes were made based on image interpretation and ground truth with the aid of SoI toposheet 57N/8, and hand-held global positioning system (GPS). It was found that plains and the lowlands are

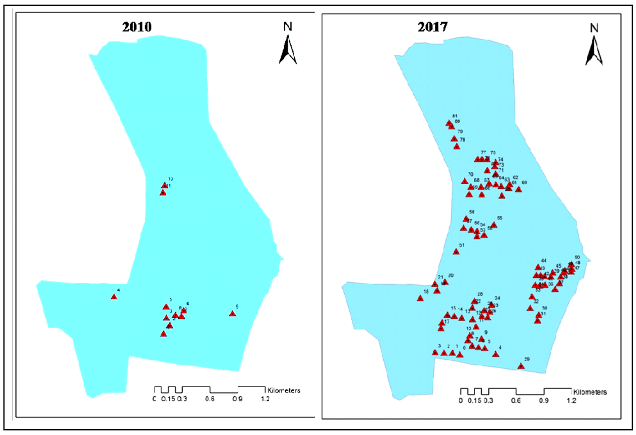

Fig. 5: GPS locations of the Mills/industries in the study area during the year 2010 (left) and 2017 (right).

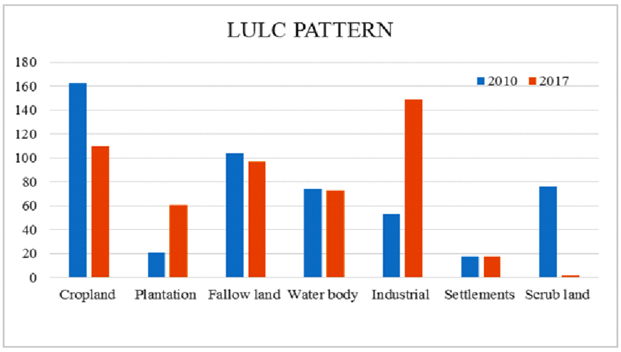

Fig. 6: Depiction of the each LULC class during the year 2010 and 2017.

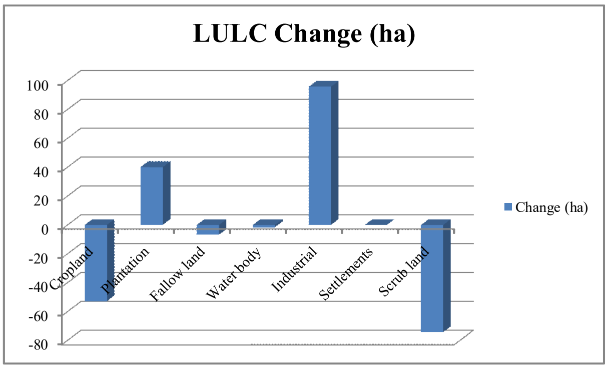

Fig. 7: Illustration of the net change in each LULC class of the study area.

dominated by cropland plantation and scrub/fallow land. Builtup areas (industrial) are well distributed in the entire area, most of them occurring in the vicinity of agricultural lands. After obtaining detailed LU/LC information, the attribute data of land use and land cover of the study area were generated and compared with regard to various features that indicated significant changes. GPS points were utilized for categorization and overall precision appraisal of the classified imagery.

RESULTS AND DISCUSSION

For the last decade, rapid growth in industrial sector led to conversion of agriculture lands into industrial areas at an alarming rate. Clearing of agriculture/forest land for industrial purpose is the major cause of land degradation. The results of the present study show degradation of LULC pattern. As the village is in the rural environment, agriculture is the major income source for the native people, the study area has become an hot spot in the environmental point of view due to rapid industrialization of barytes pulverizing, screening/grading, manufacturing and exporting activities (Fig. 5). Analyses of LULC patterns (Table 1 and Figs. 6-7) show that cropland decreased from 162.28 ha to 109.39 ha during 2010 to 2017, a decrease of 52.89 ha (10 % of the total area) due to establishment of pulverizing mills in the crop agricultural lands. Scrublands decreased by 14% from 2010 to 2017, majority of this class is situated in the vicinity of the mine and road network and water facility. On the other hand industrial areas show an increasing trend with 18% growth rate. Water bodies also show a decreasing trend of 0.32 %. A total of 81 pulverizing mills were established in the Govindampalle village. Agricultural plantation also show an increasing trend with 7% of the total area, which indicates the improvement in socioeconomic status of the local people to grow the long-term plantations like mango, citrus, betel leaf, banana, etc.

CONCLUSIONS

The present work is focused on assessing the possible landscape dynamics in Govindampalle village, Y.S.R District, Andhra Pradesh during the years 2010 and 2017. By using the Google Earth historical imagery these changes were mapped and assessed for their impact on agricultural lands. Though the study area falls in the rural area, because of the world famous Mangampeta barytes deposit located adjacent to the village, the valuable and fertile soils/agriculture fields are being converted into barytes industries/ pulverizing mills and ore beneficiation plants. Results showed that cropland, water bodies and scrublands were decreased by 10%, 0.3%, and 14% respectively from 2010 to 2017. On the other hand industrial areas and agricultural plantations showed an increasing trend with 18% and 7% growth rate respectively. Geospatial technology is proven as a powerful tool for regional and local planning in evaluating the impact of urbanization on agriculture and serve as a framework for a variety of planning programs at the local and regional levels.

Table 1: LULC class distribution in the study area during 2010 and 2017.

LULC CLASS	2010		2017		2010-2017	
	Area (ha)	Area (%)	Area (ha)	Area (%)	Change (ha)	Change (%)
Cropland	162.28	31.93	109.39	21.53	-52.89	-10.41
Plantation	20.97	4.13	61.07	12.02	40.10	7.89
Fallow land	103.63	20.39	96.64	19.04	-6.90	-1.36
Water body	74.23	14.61	72.60	14.29	-1.63	-0.32
Industrial	53.29	10.49	149.02	29.33	95.73	18.84
Settlements	17.49	3.44	17.49	3.42	0.00	0.00
Scrub land	76.28	15.01	1.96	0.38	-74.32	-14.63
Total	508.17	100.00	508.17	100.00	-	-

ACKNOWLEDGMENTS

The first author is grateful to Department of Science and Technology (DST), Government of India for the financial assistance through INSPIRE Fellowship (IF120393) under AORC Scheme.

REFERENCES

APMDC 2016. Andhra Pradesh Mineral Development Corporation published catalogue, Govt. of Andhra Pradesh.

ASPRS Annual Meeting 2017. Imaging Today for a Smarter Tomorrow, March 12-16.

Guptha, N. 2015. Mine reclamation planning of Jharia area (Bastacola) through multi temporal remote sensing and GIS. 14th ESRI User India Conference, Delhi, India.

Goparaju, P.L., Prasad R.C. and Ahmad. F. 2017. Geospatial technology perspectives for mining vis-a-vis sustainable forest ecosystems. Present Environment and Sustainable Development.

Manna, A. and Maiti, R. 2014. Opencast coal mining induced defaced topography of RANIGANJ coalfield in India-remote sensing and GIS based analysis. J. Indian Soc. Remote Sens., 42(4): 755-764.

Prakash, A. and Gupta, R.P. 1998. Land-use mapping and change detection in a coal mining area - a case study in the Jharia coalfield India. Int. J. Remote Sens., 3: 391-410.

Prasad, M., Reddy, M.R.K. and Sunitha, V. 2016. Mapping of river sand mining zones using remote sensing and GIS: A case study in parts of PAPAGNI and PENNAR river beds, YSR district, Andhra Pradesh. Asian Academic Research Journal of Multidisciplinary, 3(7): 45-55.

Prasad, M., Sunitha, V. and Ramakrishna Reddy M. 2019. Application of geospatial technology for landscape monitoring in and around Mangampeta Barytes mine, Andhra Pradesh, India. Environ. We Int. J. Sci. Tech., 14 : 123-142.

Ruiz-Luna, A. and Berlanga-Robles, C.A. 2003. Land use, land cover changes and coastal lagoon surface reduction associated with urban growth in northwest Mexico. Landscape Ecol., 18: 159-171.

Shegena Zewdu, K.V. and Suryabhagavan, M. Balakrishnan. 2016. Land-use/land-cover dynamics in Sego irrigation farm, southern Ethiopia: A comparison of temporal soil salinization using geospatial tools. Journal of the Saudi Society of Agricultural Sciences, 15(1): 91-97.

Sunitha, V., Reddy, D.V. and Reddy, P.R. 2015. Mineral wealth of Cuddapah basin and its use for sustainable development - An overview. International Journal of Earth Sciences and Engineering, 8(6).

Veenendaal, B., Brovelli, M.A. and Li, S. 2017. Review of web mapping: Eras, trends and directions. ISPRS International Journal of Geo-Information, 6(10): 317.