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Site selection for urban solid waste disposal for Warangal city using geospatial techniques

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Abstract
Municipal solid waste management becoming a problem that is facing all over the world. Due to its nature, it has remained one of the major man-made environmental problems for disposal. The most common problems associated with improper management of solid waste include diseases transmission, fire hazards, atmospheric and water pollution, odor and aesthetic nuisance and economic losses. This paper deals with the selection of a suitable new site for the disposal of municipal solid waste generated from Warangal Municipality using GIS techniques. The existing open dumping site in the town is not environmentally sound and socially acceptable as wastes have been dumped from the past 30 years in the same place. In this study, Multi-Criteria Decision Analysis (MCDA) has been used to select the site for solid waste disposal. For this purpose, eight layers have been prepared, out of which three layers (Soil, road network map, LULC) have been used to generate a model based on weighted overlay analysis. The result reveals that out of the chosen probable cirteria, a site with reasonable size, at the optimum distance from residences and accessible to the major roads was nominated as the most suitable site for the municipal solid waste disposal.

Keywords: GIS, MCDA, model generation, solid waste management, weighted overlay analysis

Introduction
The increasing level of municipal solid waste is a serious problem in the urban area of the world. Municipal solid waste management is becoming as one of the major problems for town planning, developers all over the world. As the population increases the quantity of waste also increases. Solid waste has become a major consequence of economic growth, development and rapid population growth, yet some of the greatest challenges to its management are most keenly felt in less developed countries of the world. In India alone, the urban population has increased from 28.53% in 2011 to 31.16% in 2017. The inappropriate method for waste dumping at water body and free abandoned land without proper treatment have to lead to serious environmental pollution and health-related problem. Geographic Information System (GIS) and Remote Sensing are used to get the maximum no. of solutions for solid waste management.

The improper disposal of waste in all major cities due to this environment facing so many problems Due to unplanned development of the large cities, the maintenance of solid waste becoming a major issue. The waste generated from the different sources in different states of matter. With improper disposal of solid waste includes the spread of diseases like fire and health hazards, pollution of water and atmosphere, aesthetic and odor nuisance and economic losses. The widely used methods to manage solid waste are Source reduction, recycling, and waste transformation. Even after the above recovery process, there will be residual matter to be disposed of. The way of getting rid of these wastes in an economic and environmentally friendly approach is called Solid waste disposal (management). The proper method for the waste disposing of plays an important part in the waste management system. Selection of site should be according to government regulations and social, environmental and technical parameters as. Geographic Information System (GIS) and Remote Sensing gives the proper solutions for the solid waste site selection and analyze the spatial data and give the proper results

Study area
Warangal is the second largest city in Telangana state after Hyderabad, spreading across 406.87 km2 (As shown in figure 1) with a population of 7,04,570 (As per Census 2011) which is located at 18.0°N 79.58°E. It has been chosen for the heritage city development and

Augmentation Yojana scheme by the Government of India as it served as the capital of the Kakatiya dynasty which was established in 1163. The city falls from West to East. It is surrounded with hillocks on the Southern, Eastern and Northern sides. An irrigation canal named Kakatiya canal skirts through Northern and Eastern parts of the city. The area of the city is 65km2. The city has a general slope from West to East with level varying from 280.5 to 250 meters.

The current scenario in the study area

The waste dumping site in the study area is at manikonda which is 18 km away from the Warangal city. since, from the last 30 years it is only the dump yard in the city. As GWMC generating 270 to 300 tonnes per day in that only 5-6 tonnes of waste is reused, and the remaining goes to dump yard. As, the results it causes citing pollution of groundwater and air, health complications for residents of surrounding villages. So that GWMC shifting the dump yard site for solid waste disposal.

Population growth

The population is growing rapidly from year to year, because of the migration of people from different places for job opportunities. The percentile increases of the Warangal population for the last census (2001- 2011) is 2.66%/year.

Table 1: Warangal population statistics (As per census)

Years	Warangal Population
1991	447657
2001	558162
2011	704570

Considering this growth rate in table 1, it is expected that Warangal population in the year 2018 will be 905717 using the exponential formula.

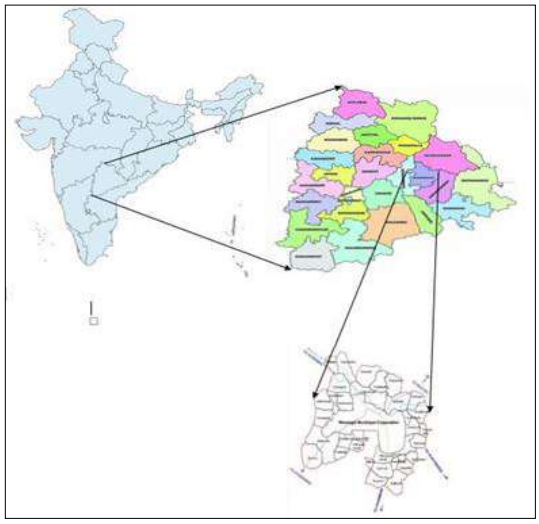

Fig 1: Study area

Materials and methods used for the study

The many aspects of planning and operations for solid waste management are dependent on spatial data so that GIS plays a major role in solid waste management. Collect the required data from the sources and prepare required maps using GIS software.

Using multi-criteria decision-making technique the proper approach for assessing and integrating the various factors for suitability it would be chosen according to the opinion taken from the residence nearby. Buffer zones were created for getting a suitable site. Site suitability criteria of solid waste depend on the area and their feasibility. In these categories, different input map layers including LULC, geology, geomorphology, roads, soil, slope, aspect, and weight are allocated to them based on the different parameters. Ranks of the criteria are given on different scales.

Results and Discussions

LU/LC and geomorphology maps

The LU/LC is defined as the changes made by the man to the land in time and space. The Landsat-8 data is used for the present study area for land use/land cover map generation. The site selection process considers some major factors like it shouldn't be near to the residential area and proper maintenance to protect from the heath diseases and should not effect the environment also Dump yard should be the distance from residential, barren land is most suitable for dumping. In the present study water bodies, built- up area, agricultural and barren land are major classes.

Geomorphology maps used to identify the geomorphic units. Plain and hills are most occupied in the study area.

Fig 2: Digitized map

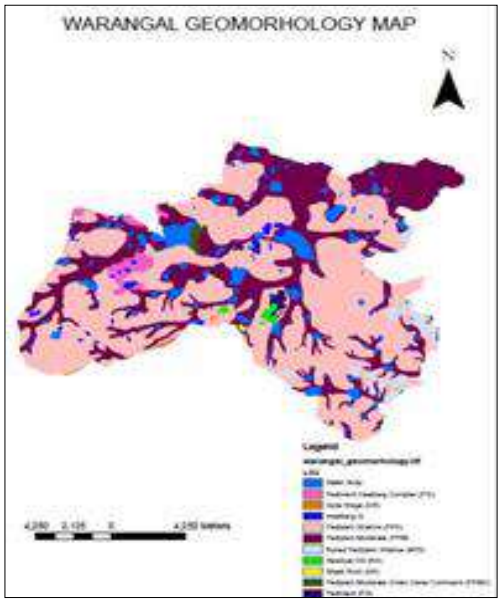

Fig 3: Geomorphology map

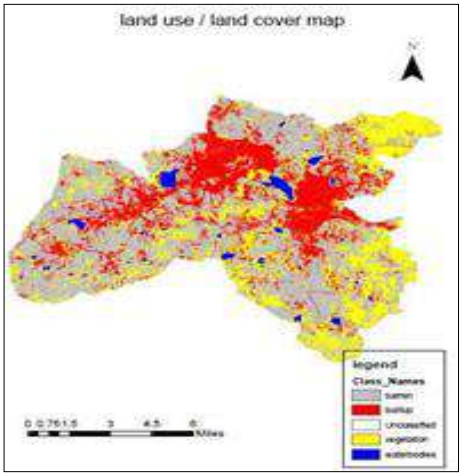

Fig 4: LULC

Road networks

The road network map includes of major roads like national, state highways and other local and village roads. Which connect almost all major and minor roads of city and villages near by.

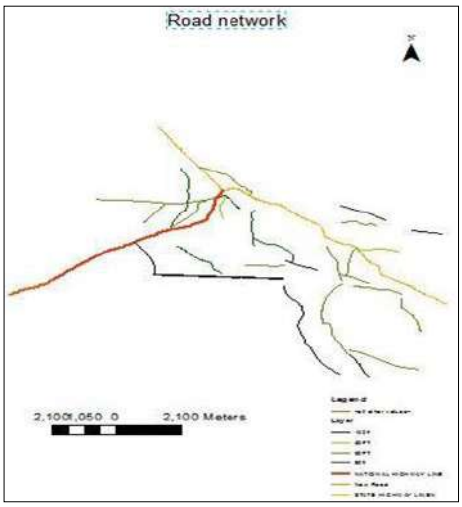

Fig 5: Road network map

Geology and soil maps

The major part of the Warangal covers granite only and remaining is gneiss. Geology map is shown in below Figure 6 and soil map, structural map shown in fig 7 and fig8.

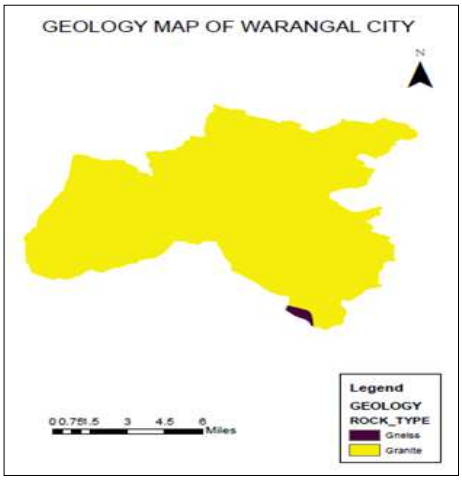

Fig 6: Geology map

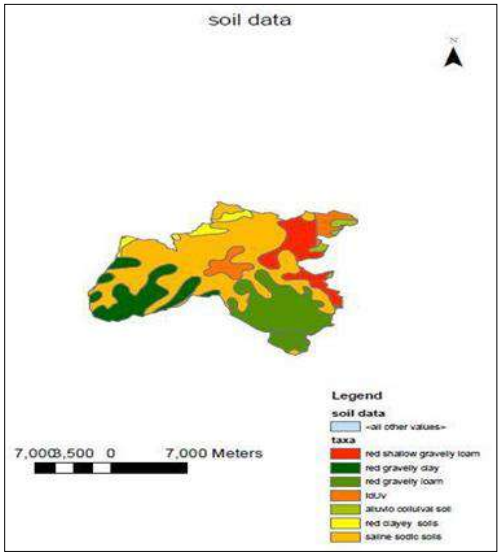

Fig 7: Soil map

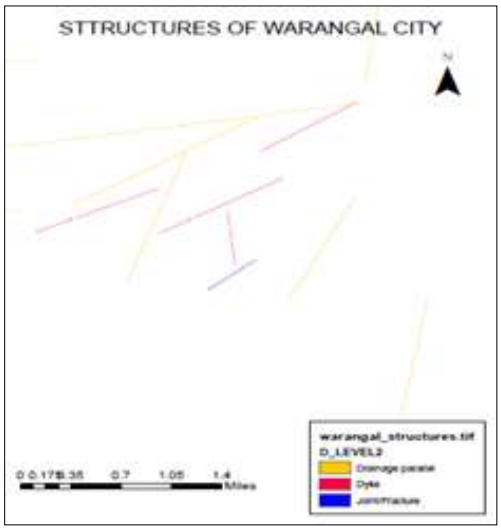

Fig 8: Structural map

Slope and aspect map

Slope and aspect are important factors for site selection. These maps are generated from the ASTER-DEM. The areas with Fewer slopes are ideal for site selection. The slope map and aspect map are shown in below figures.

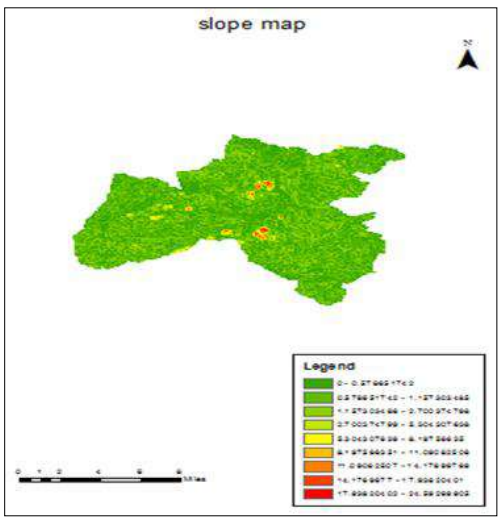

Fig 9: Slope map

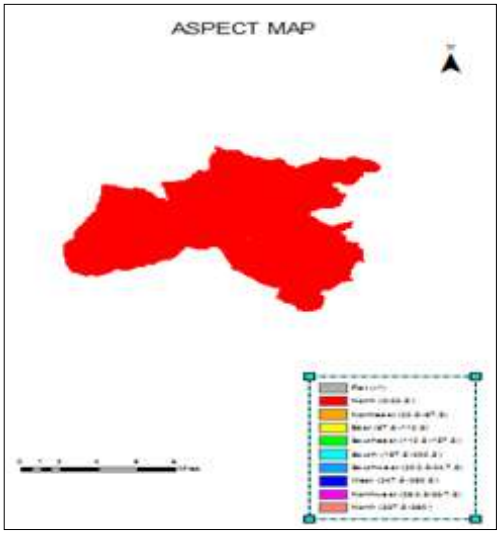

Fig 10: Aspect map

Conclusions

As Warangal city consider as fast developing city in the Telangana state. The Present scenario in the study area is the old dump yard present at manikonda is carrying huge disposal of solid waste from past 30 years. The old dump yard is almost filled and closed by the GWMC and further it cannot be accommodated anymore. In this paper total eight factors are considered and prepared by the GIS software and by using weight age overlay analysis the suitability map will be prepared for the study area. The selected site should economical and accessible for dumping and should not face any further problems.

References

1. Poorna A, VPG. Solid waste disposal site selection by data analysis using GIS and Remote sensing tools: A case study in Thiruvananthapuram corporation area, Int. J. Geomatics Geosci. 2016; 6(4).
2. Sigirisetty BB, Student MT, Pradesh A, Dean-academics A, Pradesh A, Pradesh A. a Multi – Stage, Multi Criteria Approach for Solid Waste Disposal Site Design and Management : a Model Study. 2017; 8(1):370-381.
3. Choudhury E, Das E. GIS and Remote Sensing for landfill site selection-A case study on Dharmanagar Nagar Panchayet, IOSR J. Environ. Sci. Toxicol. Food Technol. ISSN 2319-2402, ISBN 2319-2399. Vol. 1, Issue 2 (Sep-Oct. 2012). 2012; 1(2):36-43.
4. Javaheri H, Nasrabadi T, Jafarian MH, Rowshan GR, Khoshnam H. Site Selection of Municipal Solid Waste Landfills Using Analytical Hierarchy Process Method in a Geographical Information Technology Environment in Giroft, J. Environ. Heal. Sci. Eng. 2006; 3(3):177-184.
5. Lakshmanan. Suitable Site Selection for Urban Solid Waste Disposal Using Gis in, no. January, 2014, 2017.
6. Alanbari MA, Al-Ansari N, Jasim HK. GIS and Multicriteria Decision Analysis for Landfill Site Selection in Al-Hashimyah Qadaa, Nat. Sci. 2014; 06(05):282-304.
7. Yesilnacar MI, Süzen ML, Kaya BŞ, Doyuran V. Municipal solid waste landfill site selection for the city of Şanliurfa-Turkey: An example using MCDA integrated with GIS, Int. J. Digit. Earth. 2012; 5(2):147-164.
8. Karthiheyan PN. Site Selection for Urban Solid Waste Disposal Using Remote Sensing and Open Source GIS In Krishnagiri District, Tamil Nadu. 2016; 2(10):233-239.
9. Bera S, Ahmad M, Kumar A. Suitable Site Selection for Urban Solid Waste Management using GIS Technique-a Case Study of Dhanbad Block Suitable Site Selection for Urban Solid Waste Management using GIS Technique- a Case Study of Dhanbad Block, no. August, 2017.
10. Karsauliya S. Application of Remote Sensing and GIS in Solid Waste Management: A Case Study of Surroundings of River Yamuna, India, Int. J. Environ. Eng. Manag. 2013; 4(6):2231-1319.
11. Sumathi VR, Natesan U, Sarkar C. GIS-based approach for optimized siting of municipal solid waste landfill, Waste Manag. 2008; 28(11):2146-2160.
12. Corporation WM, Area UG. Warangal City Development Plan (CDP), 2011.