Suitable Site Location For Solid Waste Disposal Using Gis And Rs Techniques

Vaibhav A. Augad[1],Mukhopadhyay S.[2], AnujaRajagopalan[3], Ranade S.D.[4]
Department of Environment and Water Resources Department
[1, 2] College Of Engineering,Pune, India
[3, 4] CWPRS, Pune, India

Abstract- *Solid wastemanagement is a global environmental problem in today's world. There is an increase in commercial, residential and infrastructure development due to the population growth and this has negative impact on the environment. Urban solid waste management is considered as one of the most serious environmental problems confronting municipal authorities in developing countries.One of these impacts is due to location of dumping site in unsuitable areas. This paper deals with selecting suitable site for the disposal of solid waste generated from Yerawada regionand surrounding areas using GIS and remote sensing techniques.*

Keywords *- GIS, RS, Solid Waste, Analytical Hierarchy Process, MSW*

I. INTRODUCTION

Solid waste management is a burning problem all over the world. The major environmental issues which are posing threat are the disposal of effluent and toxic waste because of the urbanization and the fast growth of population. Improper management of solid waste can lead to the problems like odour nuisance, fire hazards, transmissionof diseases, pollution of water and atmosphere and economic losses which is the main concern. The safe disposal of the solid wastes was not a serious problem as long as the population was small and the land available for assimilation was large. There has been a significant increase in solid waste generation in India over the years from 0.1 kg per person per day in small towns to 0.5 kg per person per day in large towns. Presently most of the municipal solid waste in India is being disposed unscientifically (Akolkar, 2005). Solid waste which is generated from human and animal activities is left useless. It is utmost important to properly manage solid waste and then to dispose it at a suitable site.

II. AIM

- To identify suitable sites for solid wastes disposal which will satisfy the specification laid down by the Ministry of Environment.
- Role of GIS and RS techniques for suitable site selection.

III. OBJECTIVES

- To identify the solid wastes collection points.
- To select the most suitable sites for solid wastes disposal using multi-criteria analysis in GIS.
- To set the criteria and sub criteria used in the development of GIS database.
- To generate thematic maps for various resources.
- To assign knowledge based weightage for each thematic map.
- To integrate thematic maps with ARCGIS

IV.STUDY AREA

Yerawada is a region falling under Pune municipality in Maharashtra state. The area liesinLatitudes18°32'30"N to18°37'30"Nand Longitudes 73°51'30"E to 73°55'30"E. The total area of the municipality is 61.69sq.km. The boundary of the municipality isWagholigao. Yerawada is having a population of 664960. The Average annual rain fall is around 722mm. Theamount of solid wastegeneratedis approximately 95 to100 tons per day.The study area is shown in the Figure 1.

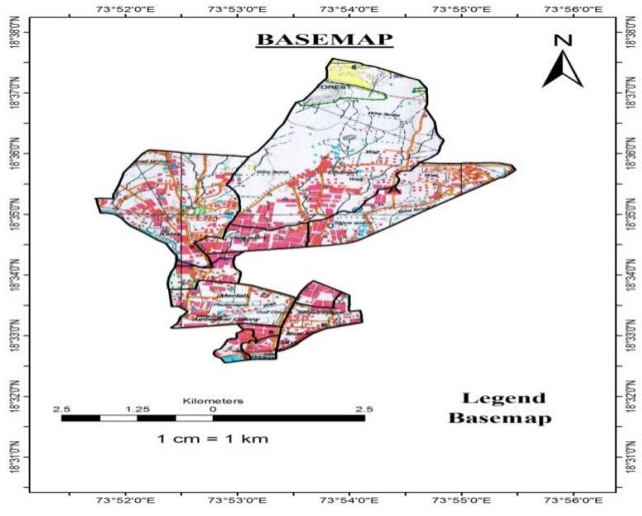

Figure 1: Base map of the study area

V. METHODOLOGY

Methodology used for the process of suitable site location for solid waste disposal was based on the analytical hierarchy process. Digitisation was done with the help of ArcGIS software. LISS III image of IRS P6 satellite of 23m resolution acquired during January 2013from National Remote Sensing Centre (NRSC), was processed. It was geocorrected in Geomatica software using UTM Projection and WGS 84datum. The methodology consists of the criteria and sub criteria for considering different parameters. The Criteria and sub criteria used in development ofGIS database as shown in the Table 1.

Table 1: The Criteria and sub criteria used in development of GIS database

Physical Criteria	Slope
	Drainage
	Water Bodies
	Residential Areas
Socio EconomicCriteria	Population
	Distance From Major Roads
	Distance From Major Drainage
	Distance From Major Residential Areas

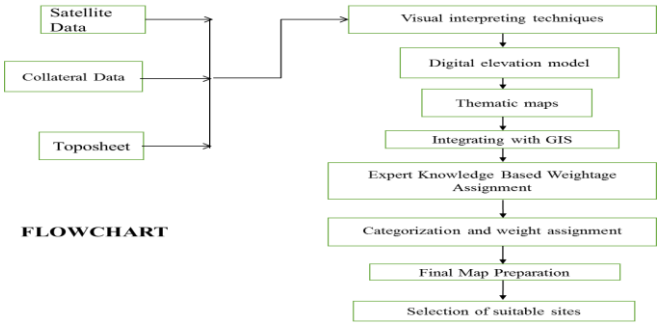

Figure 2 : Flow Chart Showing Methodology

a) Weighting the parameters

Table 2: weightage assigned for each parameter

DATA LAYERS	% INFLUENCE
SLOPE	**30**
LAND USE LAND COVER	**30**
ROAD BUFFER DISTANCE	**10**
RESIDENTIAL BUFFER DISTANCE	**15**
DRAINAGE BUFFER DISTANCE	**15**

Weightage is assigned as per the analytical hierarchy process. The five point scaling system was used to give suitable score to different classes of different parameters.

Table 3: Relative Importance Factor

Extremely less important	1
Less important	2
Moderately important	3
More important	4
Extremely More important	5

VI. RESULTS AND DISCUSSIONS

Slope is one of the important parameter alongwith land use land cover for suitable site selection. So the buffer zones were created and different zones were assigned different weightages.

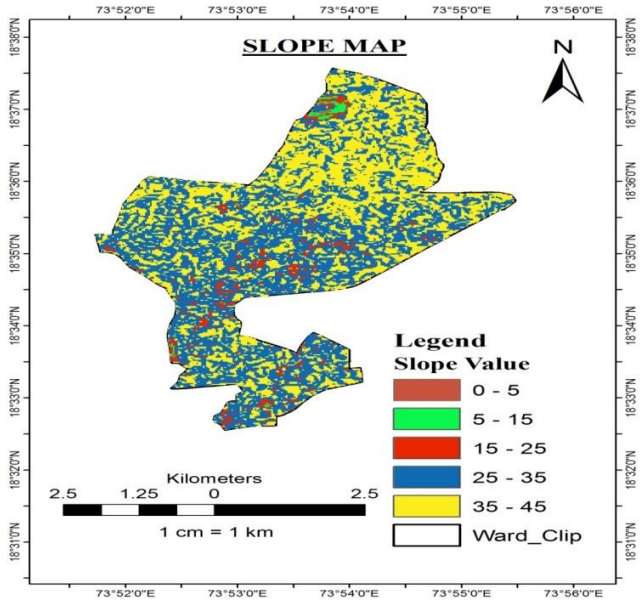

Figure 3: Slope map of the study area

Table 4: Suitability scores given for slope map of the study area

Slope Value in degrees	Suitability Scores
0 - 5	**5**
5 - 15	**4**
15- 25	**3**
25 -35	**2**
35 -45	**1**

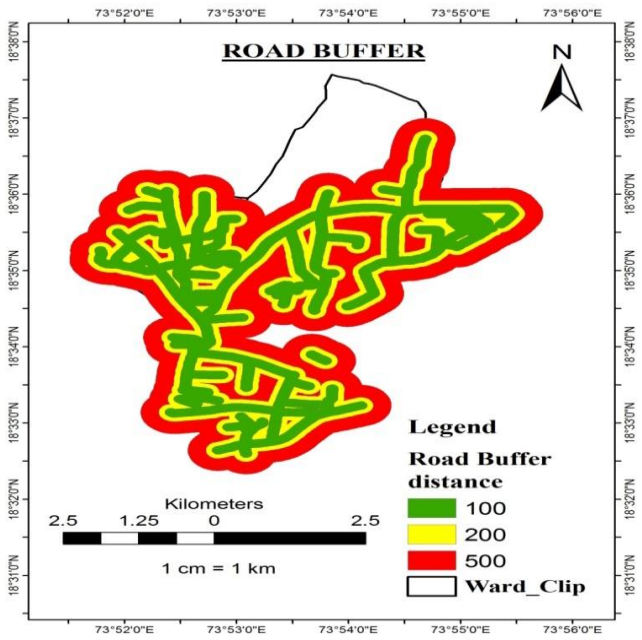

Figure 4: Road Buffer map of the study area

Table 5: Suitability scores given for Road Buffer Distance

Road Buffer Distance	Suitability Scores
100m	3
200m	4
500m	5

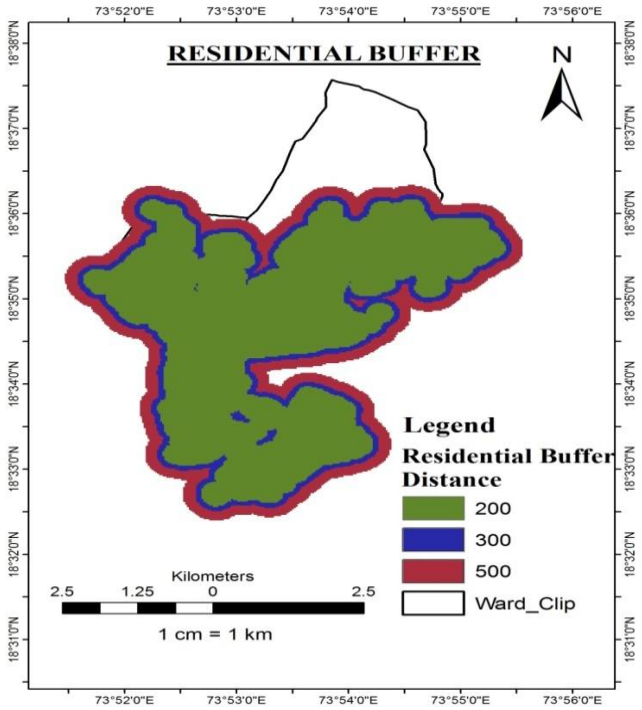

Figure 5:Residential Buffer map of the study area

Table 6: Suitability scores given for Residential Bufferzones

Residential Buffer Distance	Suitability Scores
200m	3
300m	4
500m	5

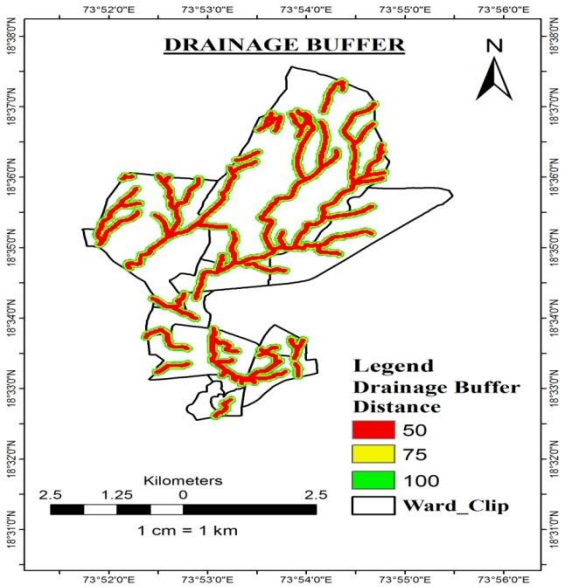

Figure 6: Drainage Buffer map of the study area

Table 7: Suitability scores given for Drainage Buffer zones

Drainage Buffer Distance	Suitability Scores
50m	1
75m	3
100m	5

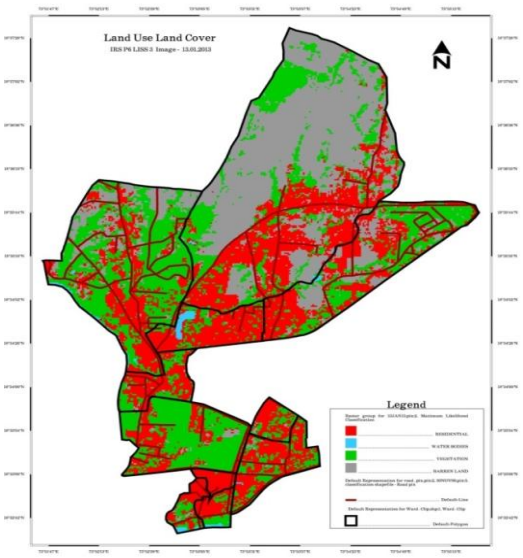

Figure 7: Land Use Land Covermap of the study area

Table 8: Suitability scores given For Land Use Land Cover map

Land Use Land Cover	Suitability Scores
Built/Residential	1
Forest	2
Agriculture	3
Barren	5

Residential Buffer maps, Road Buffer maps, Drainage Buffer maps, Soil map and Land Use Land Cover map were given some weightage with the help of overlay analysis and different ranking was given to different classes of different parameters in ArcGIS software as shown in the above tables. Then all these maps were converted to raster form and separate raster maps were created using weightage and ranking given to different parameters. Then all these raster converted maps were overlaid with the help of overlay weighted analysis in ArcGIS software.

The output generated with the help of GIS and RS techniques is shown below. The site suitability map shows the three different zones of suitability which are suitable, less suitable, and not suitable.

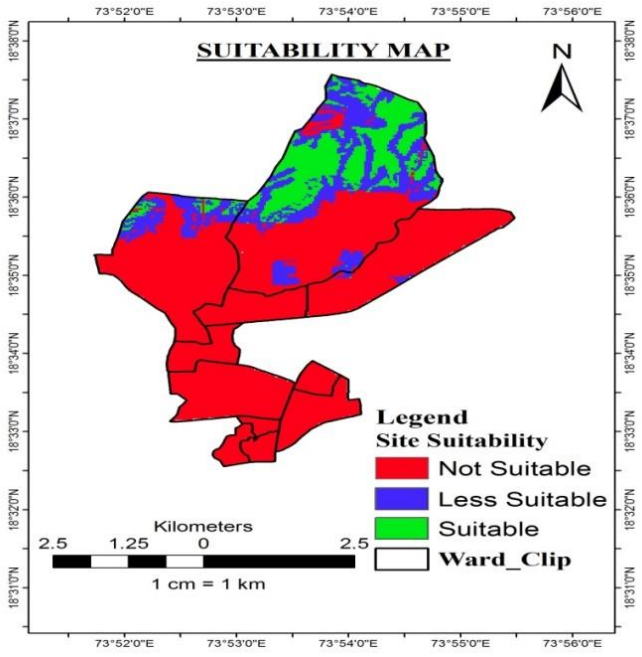

Figure 8: Site Suitability Map

VII. CONCLUSION

The present study was to identify the solid waste disposal sites using RS and GIS techniques. This study produced suitable site locations for the study area.GIS and RS added an advantage over conventional method.Integrated GIS and Remote sensing technology facilitate to identify the suitable site location for solid waste disposal.The interlayer ranking and intralayer weightage gives the final map of suitable site locations for solid waste disposal.Overall result demonstrates that the use of GIS and RS techniques are effective tool to study suitable site.GIS and RS set a platform for the decision making. The whole area was divided into three zones as suitable, less suitable and not suitable zones. So from environmental, transportation and economic point of view suitable site is selected.

ACKNOWLEDGMENT

The authors are thankful to the Solid waste management Department, Pune Municipal Corporation for providing all the data required for the project work. The authors wish to thank Mr. V. Sivakumar, Senior technical officer, C-DAC, Pune-411007 for his support and guidance.

REFERENCES

[1] 1. S. Sunder Rajan, L.Yeshodha, S. Suresh Babu 2014. RS and GIS Based Site Suitability Analysis for Solid Waste Disposal in Hosur Municipality, Krishnagiri District. International Journal of Innovative Research in Science, Engineering and Technology, Vol. 3, Issue 3.

[2] Nishanth T., Prakash M.N., Vijith H 2010. International Journal Of GeomaticsAnd Geosciences Volume 1, No 2.

[3] M.C. Sashikkumar and M. Lalwin 2013. Selection of suitable sites for solid waste disposal for Manur block of Tirunelveli district using GIS techniques. Journal of Geomatics.

[4] Er. Subhrajyoti Choudhury, Er. Sujit Das 2012. GIS and Remote Sensing For Landfill Site Selection- A Case Study on Dharmanagar Nagar Panchayet. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) Volume 1, Issue 2.

[5] Rinsitha. T, Manjubashini. A, Dr. Satheesh Herbert Singh. D 2014. Solid Waste Dumping Site Suitability Analysis ForChengalpettu Town Using GIS. International Journal of Recent Development in Engineering and Technology Volume 2, Issue 2.

[6] Ayo Babalola, Ibrahim Busu 2011. Selection of Landfill Sites for Solid Waste Treatment in Damaturu Town-Using GIS Techniques. Journal of Environmental Protection, 2011, 2, 1-10.