Application of GIS And Remote Sensing In Assessment of Solid Waste In Urban Parts of Bengaluru

Dr. Lakshmi. C[1], Dr. Prasad CSMV[2]
[1]Professor, Dept of Civil Engineering
[2]Professor & Head, Dept of Civil Engineering
[1, 2] SJBIT

Abstract- *Solid waste management is considered as a major challenge for urban activity, though scientific methods and supporting literature are available. There are potential risks to environment and health due to improper handling of solid waste. In most of the cities, 50% of total budget is wasted on solid waste management activity, and least weightage is given to waste treatment option. According to the Municipal Solid Waste 2000 Rule, segregation of waste is compulsory, but still a truthful result is not achieved. The second most preferred solid waste management technique is recycling and reuse of solid waste. Geographical Information System can be used as a decision support tool for planning waste management. In GIS, as the work is carried in layers, there are least chances of confusion and error. The purpose of the research is to use Geographic Information System (GIS) as a tool to aid the decision-making process and to test its effectiveness using some established government guidelines. Also the system is capable enough to coordinate between spatial and non-spatial data.*

Keywords- Geographical Information System, Waste management, Segregation, Fermentation, Spatial information, Anaerobic decomposition.

I. INTRODUCTION

HESolid waste management is the collection processing recycling or disposal, and monitoring of waste material. Solid waste management is becoming a major public health and environmental concern in urban areas of many developing countries. The public sector in many countries is unable to deliver services effectively, regulation of the private sector is limited and illegal dumping of domestic and industrial waste is a common practice. In general, solid waste management is given a very low priority in developing countries.

Geographical Information System can be used as a decision support tool for planning waste management. In GIS, as the work is carried in layers, there are least chances of confusion and error. The purpose of the research is to use Geographic Information System (GIS) as a tool to aid the decision-making process and to test its effectiveness using some established government guidelines. Also the system is capable enough to coordinate between spatial and non spatial data. GIS is one of the new technologies which have contributed lot in very less time span to the waste management society. The best suited method for quantitative analysis of accumulation of solid waste in the identified sensitive urban areas of Bangalore which facilitates in dealing with waste management planning and Providing some better alternatives in allocating and relocating the existing and the new proposed waste disposal.

The segregation at the identified location further helps in carrying out different processes such as aerobic and anaerobic decomposition to convert solid waste in to useful products such as manure and bio energy.

II. STUDY AREA

Rajarajeshwari Nagar and Hemmigepura are residential and industrial localities in Bangalore, Karnataka, India. It is located in the southwestern part of Bangalore along the Mysore Road next to Nagarbhavi to the north and Kengeri to the West. The area is about 28.4 sq.km and has an population of 75,321members.

Image from google earth of the study area

III. LITERATURE REVIEW

The consumption of the energy is directly proportional to the progress of the mankind. Energy has been universally recognized as one of the most important inputs for economic growth and human development. There is a strong two-way relationship between economic development and energy consumption. On one hand, growth of an economy, with its global competitiveness, hinges on the availability of

cost-effective and environmentally energy sources, and on the other hand, the level of economic development has been observed to be reliant on the energy demand. With ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries, the global demand for energy is expected to increase rather significantly in the near future. The primary source of energy is fossil fuel, however the finiteness of fossil fuel reserves and large scale environmental degradation caused by their widespread use, particularly global warming, urban air pollution and acid rain, strongly suggests that harnessing of non-conventional, renewable and environment friendly energy resources is vital for steering the global energy supplies towards a sustainable path.

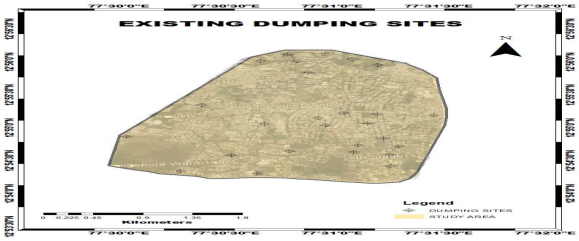
IV. OBJECTIVES

1) To quantify the waste collected at certain sensitive places designated as urban areas of Bangalore using remote sensing and GIS technologies.
2) To frame of guidelines for the work to be proposed in dealing with waste management planning for the case study area is carried out.
3) To provide some better alternatives in allocating and relocating the existing and the new proposed waste disposal.
4) To help segregate the waste at the initial generation stages upon which suitable method of treatment will be carried out for further disposal is determined.
5) To conduct qualitative analysis on solid waste for recycling and reuse purposes in different forms

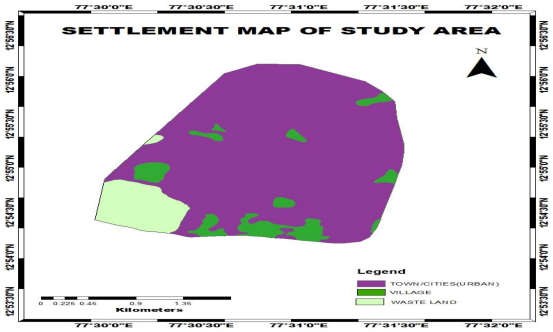
V. METHODOLOGY

There are four sources from where the data is available, which are stated below:

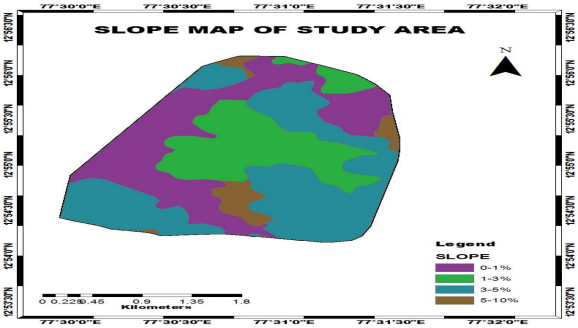
- The maps containing the spatial information and the Satellite image of the city. The maps should be placed on the satellite images to counter tally the map data precision.
- The spatial data, which gives the information about the location of different articles. Like the point of interest, the waste bins & open dumps location collected with the help of GPS device. This spatial information will be correlated and incorporated on the maps. The information will be consisting of location of other buildings on the map.
- The third is attribute information. This forms the attribute data giving the information about the spatial elements.



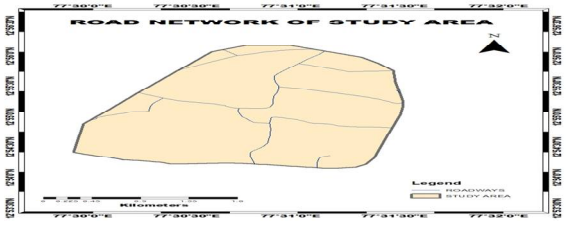
MAP-1.EXISTING DUMPING SITES OF STUDY AREA



MAP-2.SETTLEMENT MAP OF STUDY AREA



MAP-3.SLOPE MAP OF STUDY AREA



MAP-4.ROAD NETWORK OF STUDY AREA

VI. ABOUT THE CASE STUDY AREAS

The information of the existing situation will be available from different sources. The information gathered will be from the satellite image, GPS locations for the point of interests (waste bins and open dumps municipal city maps. All the information from different sources will be used to prepare the GIS database.

- MAP-1 shows the points of existing dumping sites of the study area. which will help us to manage the solid waste efficiently.
- MAP-2 shows the settlement map of the area which helps in knowing the type of waste, quantity of waste of the study area.
- MAP-3 shows the slope and topography of the study area helps in type of treatment to be adopted.
- MAP-4 shows the existing paved surface of the study area which helps in determining the optimized route.

VII. ROUTE OPTIMIZATION

It is the process of determine the most cost-efficient route. Its more complex than simply finding the shortest path between two points. It needs to include all relevant factors such as the number and location of all the required stops on the route. Other things that can influence the result are:

- number of turns or intersection along the route
- left hand turns(crossing the line of traffic)
- best or nearest driver to dispatch on the route
- traffic congestion for current time of day
- best approach(access) to stop on the route

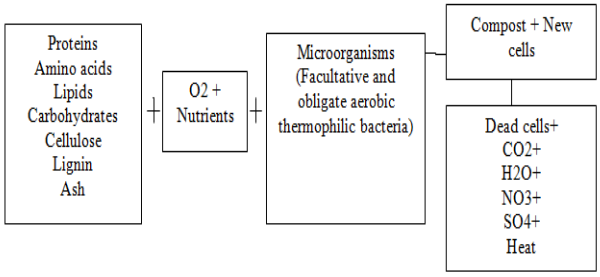
VIII. TRANSFER STATION

Solid waste transfer stations are facilities where solid waste, mainly municipal solid waste (MSW), is unloaded from collection vehicles or containers for reloading into larger, long-distance vehicles for transport to landfills or other permitted solid waste facilities for final disposal. Facilities that move solid waste from one mode of transportation to another, such as rail to road, can also be considered transfer stations. At many transfer stations, workers screen incoming waste to recover recyclables or materials inappropriate for disposal at a solid waste landfill, such as large appliances, tires, automobile batteries, and similar items. MSW that quickly decomposes, such as food waste, must be removed from a transfer station by the next day. Recyclables may be stored in containers for a longer period of time. Combining several truck loads of waste into a single shipment reduces trips to and from the disposal site, saving communities money on labor and transportation. Transfer stations may be publicly or privately owned. Transfer station owners and operators must have a solid waste facility permit from IDEM, as well as any required local land use permits, before constructing and operating a transfer station. Transfer station operators must prevent contamination from leaving the site. To do this, modern transfer stations must transfer waste inside an enclosed building with concrete floors and a waste water collection system.

IX. AEROBIC COMPOSTING

Aerobic composting is the most commonly used biological process for the conversion of the organic portion of municipal solid waste to stable hunts like material known as consort. All aerobic composting processes are similar in that they all incorporate three basic steps.

Pre-processing and municipal solid waste Aerobic decomposition of the organic fraction of the municipal solid waste.Product preparation and marketing.



In general, the chemical and physical characteristics of consort vary according to nature of the starting material, the condition under which the composting operation will be carried out and the extent of decomposition.

X. CONCLUSION

GIS is the best suited method for quantitative analysis of accumulation of solid waste in the identified sensitive urban areas of Bangalore which facilitates in dealing with waste management planning and providing some better alternatives in allocating and relocating the existing and the new proposed waste disposal.

The segregation at the identified location further helps in carrying out different processes such as aerobic and anaerobic decomposition to convert solid waste in to useful products such as manure and bio energy.

C++ PROGRAM TO QUANTIFY AND TO ASSIGN NUMBER OF TRIPS FOR COLLECTION

```
#include <stdio.h>
#include <conio.h>
#include <math.h>
int total-sum(total-sum(houses));
int volume-solid waste(volume-solid
waste(sum,occupents,waste_rate,density,solid waste)
int total trips(sw_d,weutein_v_capacity)
intavg(sum,nt)
int main( )
```

```
int sum, sw_d,nt,Avg ;
int occupants, waste_rate, collections_frequency,type_service;
intcollection_crew,collectives_v_capacity,density_solidwaste;
int houses[]={};
inti,n=6;        //n=array seize of houses

printf("\n Enter no of occupants:\n");
scarf(:%d", & occupants);
printf("\n Enter the solid waste generation rate in
kg/person/day:\n");
scarf("%d", & waste rate);
printf("\n collection frequency per week:\n");
scarf("%d", &collection_frequency);
printf("\n Enter type of collection service:\n");
scarf("%d", &type_service);
printf("\n Enter collection crew size:\n");
scarf("%d,&collector_crew);
printf("\n Enter collection vehicle capacity in m3;(n");
scarf("%d",&collection_v_capacity);
printf("\n Enter compute density of the solid waste in
collection vehicle in terms of kg/m3:\n');
scarf("%d",&density_solid waste);
printf("\n Enter the no of houses in total\n");
for (i=0; i<n;i++)
scarf("%d",&houses);
printf("sum,sw_d,nt,Avg",%sum,%sw_d,%nt,%Avg);
intotal_sum(houses)
{
iti,sum;
for (j=0; j<size of (houses);j++)
{sum+=houses;
}return sum;
}
itvolume_solidwaste(sum,occupants,waste_rate,density_solid
waste)
{
it find-vol=(sum*occupants*wasterate*>)
it op=(final_vol/density_solidwaste);
return op;
}
it total trips(sw_d,collectives_v_capacity)
{
it c;
printf("Enter collection capacity\n");
scarf("%d",&c);
int op=(sw_d/c);
return op;
}
itavg(sum,nt)
{
int op=(sum/nt)
return op;
}
```

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