Solid waste management
MRS. MADHUMITA PATEL

Landfill Siting

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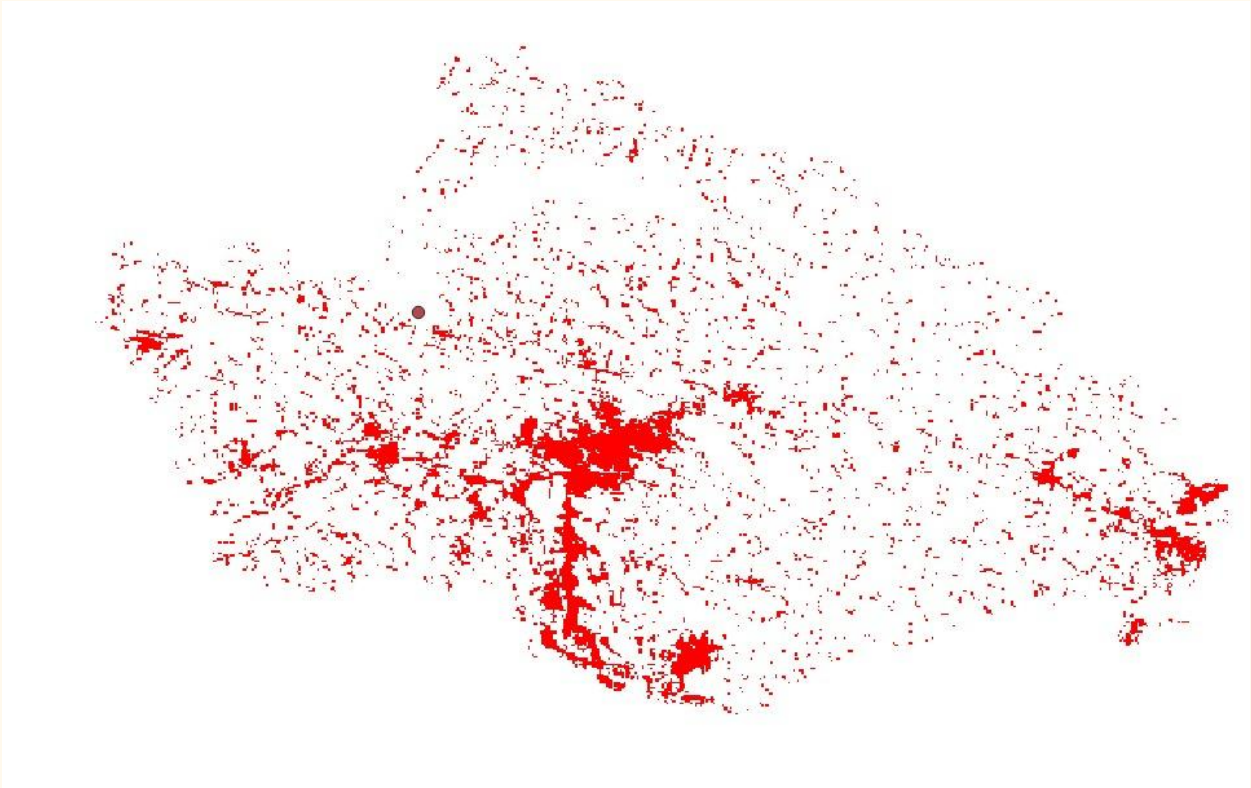


Landfills are where we dump and bury our waste.

What is a Landfill?

A landfill site, also known as a tip, dump, rubbish dump, garbage dump, or dumping ground, is a site for waste materials disposal. The landfill is the oldest and most common form of waste disposal, although the systematic burial of the waste with daily, intermediate, and final covers only began in the 1940s. In the past, refuse was simply left in piles or thrown into pits; in archeology, this is known as a midden.

Why is Landfill siting required?

Landfill siting is essential for ensuring that landfills are constructed and operated in an environmentally responsible, safe, and cost-effective way. Landfill siting is required to ensure that the chosen location meets environmental regulations and standards, such as soil and groundwater protection, air quality, and odor control. Landfills can pose health and safety risks to nearby residents if improperly located. Transportation costs, tipping fees, and operational costs can vary significantly depending on the landfill's location. Therefore, choosing a suitable location can minimize these costs and ensure a more sustainable waste management system.

Landfill site selection methodology:

Overall, landfill site selection methodology involves a comprehensive process that considers technical, environmental, social, and economic factors to ensure the chosen site is suitable and sustainable for waste disposal. It generally involves the following steps:

1. Identification of Potential Sites: The first step is to identify sites that meet the basic criteria for a landfill, such as proximity to transportation infrastructure and distance from residential areas, water sources, and sensitive ecosystems.
2. Screening and Evaluation: The identified sites are then screened and evaluated based on various criteria, such as geology, hydrogeology, land use, and environmental regulations. This evaluation helps narrow the potential sites to a smaller list of suitable options.
3. Field Investigations: The next step involves conducting detailed field investigations of the remaining sites. This includes soil and groundwater testing and environmental and cultural assessments to identify any potential impacts of the landfill on the surrounding area.
4. Cost Analysis: Once the sites have been evaluated based on technical and environmental criteria, a cost analysis is conducted to determine the feasibility and cost-effectiveness of each site. This analysis includes the cost of acquiring the land, constructing and operating the landfill, and transportation costs.
5. Public Consultation and Approval: The final step involves public consultation and approval. This includes consulting with the local community, government agencies, and other stakeholders to gather feedback and address any concerns. Once approved, the chosen site can then be developed into a landfill.

In this project, we have identified potential sites and chosen the final site based on our community waste generation rates. Field investigations, cost analysis, and public consultation is not considered here.

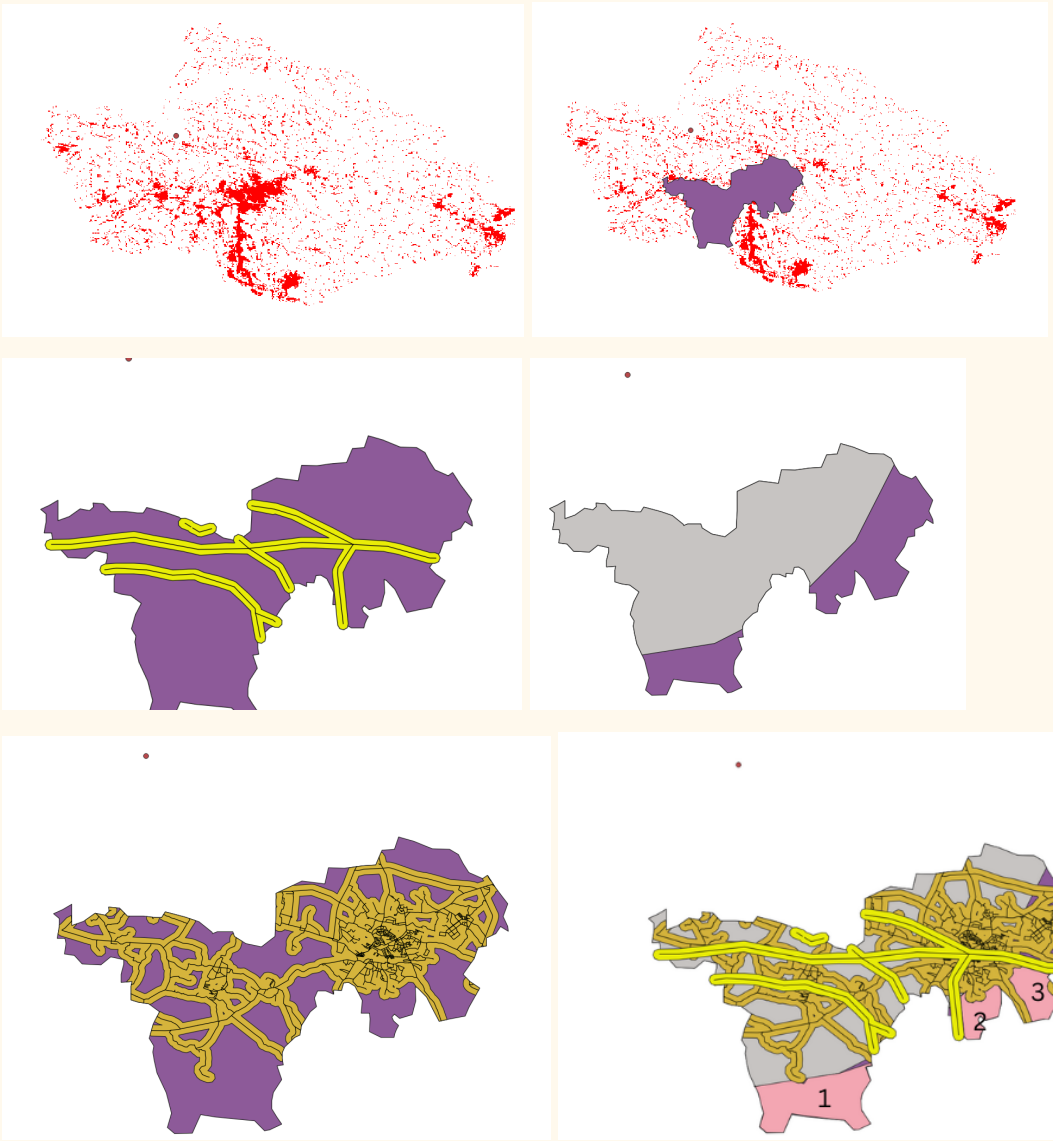
Parameters considerations in Landfill site selection:

Lake/pond	>200m (>500m DW)
River	>100m
Floodplain	Protective Embankment
Highway	>500m
Habitation	>500m
Power lines	>700m
Critical habitat	No
Wetland	No
Coastal Regulation Zone	No
Airport	>20km
Water supply well	>500m
Ground water table level	2m below base of the landfill
Bedrock depth	20m below the base of Landfill
Slope	<1%
Others	Local needs

Steps followed to identify potential Landfill sites:

1. Data Collection: The first step is to collect all relevant data required for the analysis. This data may include satellite imagery, digital elevation models, land use maps, soil maps, hydrogeological maps, and other relevant datasets.
2. Data Processing: The collected data is processed using GIS software to create a base map that contains all the necessary spatial information. This step includes digitizing maps, cleaning and correcting errors in the data, and creating layers of relevant information.
3. Parameters: We have considered 4 parameters: rails, roadways, airport and settlements. We didn't find the waterways dataset so we have not considered it here.
4. Identifications of Potential Sites: The GIS software creates buffers around the parameters mentioned in different layers. Then, these layers are stacked together, and then based on that, potential sites are identified.
5. Site Selection: We selected the final site based on our community size, waste generation rate, and age requirement of the Landfill.

Observations:



Images Analysis:

1. This image shows the settlements of Dhanbad and its nearby area.
2. The purple area represents the Dhanbad region and overlaps with the settlement layer.
3. The black lines in the Dhanbad region show the railway network, and the yellow region is showing a buffer of 500m around the railway network.
4. The dot represents the airport, and the gray region represents the buffer area of 20 km around the airport.

5. It shows the road network and the buffer of 500m around them. We haven't explicitly shown the buffer area of settlement here because it was nearly similar to the road network in the Dhanbad region.
6. It is the final image obtained after stacking the above layers. The pink area is the potential site that can be considered for landfill siting. The area of the above 3 sites is presented below.

Sites	Area in sq meters
1	13193534
2	4389933
3	3489357

Calculation for final site selection:

Our community consists of 7340 residents, and each family generates an average of 4 kg of waste daily. We have considered that each family consists of 4.5 people. We have to select a site which can serve this community for 10 years.

So, firstly we have converted the daily waste generation from kg to metric tons(MT).

4 kg/family/day * 1 family/4.5 people * 1 MT/1000 kg = 0.000881 MT/person/day

Total waste generated over 10 years will be:

0.000881 MT/person/day * 4.54 people/family*7340 family * 365 days/year * 10 years = 105754720 MT

We have assumed landfill to be of standard height of 10 meters and density of waste be 800 kg/m3. Therefore, volume of landfill required be:

105754720 MT*1000 kg/MT/800 kg/m3 = 132193400 m3

Area required to meet community requirements: 13219400 m3/ 10 m = 1321940 m2

Thus, based on the above table, site 1 can serve the community.

Result:

Site 1 will be chosen to serve a community of 7340 residents with an average life of landfill of 10 years.