

APPLICATION OF GIS AND REMOTE SENSING FOR SOLID WASTE MANAGEMENT

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ABSTRACT:

Safe disposal of solid waste is most important step in solid waste management. In this paper an effort has been made to identify suitable sites for safe disposal of municipal and other solid waste generated in Peshawar City District. Selection of suitable site depends on a number of factors to ensure environment friendly disposal of solid waste. To make sure that a proper location is selected, an organized procedure must be developed and followed. For analysis and identification of suitable site, SPOT satellite image of 2010 was the main source of data for the study. Topographic sheets of the whole district were used as a database. Different types of layers like Road, Rivers, airport and Contours were also drawn from the topographic sheets. Water table data was collected from District Health Office and field survey. Using multi-criteria analysis in Arc GIS 9.3 software, surfaces were generated for all these layers with spatial analysis tools. Different weights were given to these layers for creation of weight maps. The sites were selected in such a way as to have minimum environmental consequences. Suitable sites were suggested using the EPA parameters for selection of landfill site. Several important criteria taken in the present study were; distance from residential areas, distance from airport, distance from water bodies, accessibility, water table, land values, stability of slope and land use pattern. Rivers and built up areas were restricted. Based on these criteria the whole city district was divided into three regions i.e least suitable, moderately suitable and most suitable. The most suitable sites were located mostly in southern parts of the district where weights of suitability were the highest.

Keywords: Accessibility, Suitability, Land use pattern, Land values, EPA parameters.

MATERIAL AND METHODS:

This study is based on the collection of primary and secondary data. The procedure for data collection is as follows:

Satellite image of 2010 of Peshawar city was the main source of data for the study. Topographic sheets of the district Peshawar were used as a database.

First of all the topographic sheets and satellite image were Georeferenced using tie points. Lambert Conformal Conic coordinate system was retained in this process. The other layers like

3 rivers, major roads, contours were digitized from the topographic maps. For these purpose topographic sheets of scale 1:50,000 were used.

Ground water table data was obtained from District Health Office as well as from the field. Data for ground water table was converted into surfaces using IDW interpolation technique. Literature about the solid waste was collected from different books, articles and journals.

The collected data was then analyzed using different software like ERDAS IMAGINE, but Arc GIS 9.3 was the main software used for analysis. ERDAS IMAGINE was used for image enhancement and analysis. While Arc GIS was used for the final analysis of the layers.

Then the satellite image was classified for different land uses to get the land use layer. These layers were interpolated in the Arc Map followed by reclassification of the interpolated surfaces. New numerical values were given to different classes for analysis.

Finally, all these raster surfaces were combined in the raster calculator. Then this combined weighted map was reclassified for the identification of final map. Areas with lowest weights were assigned as least suitable while areas with highest weights were assigned as the most suitable location with minimum environmental consequences.

Pakistan Environmental Protection Agency (EPA) has established following guidelines for solid waste management that were incorporated in this study.

Adequate land area and volume to provide the landfill capacity to meet projected needs for at least twenty five years, so that costly investments in access roads, drainage, fencing and weighing stations are justifiable.

The land should not be in areas where adequate buffer zones are not available or in areas immediately upwind of a residential area in the prevailing wind direction(s).

Areas characterized by steep gradients, where stability of slopes could be/are problematic.

The seasonally high table level (i.e. 10 year high) of the groundwater should be below the proposed base of any excavation or site preparation to enable landfill development.

No environmentally significant wetlands of important biodiversity or reproductive value, sensitive ecological and/or historical areas should be present within the potential area of the landfill development.

There should be no private or public irrigation, or livestock water supply wells down-gradient of the landfill boundaries because they are at risk from contamination -alternative water supply sources are readily and economically available.

RESULTS AND DISCUSSIONS:

The analysis was based mainly on the parameters taken from guidelines of Environmental Protection Agency (EPA) of Pakistan. The selection of suitable sites required different

information about the geographical conditions of Peshawar city district. Parameters necessary for the process of selection of suitable disposal sites are described with Figures below.

CONCLUSION:

Use of technology for real life problems have made it easy to find their proper solution without wastage of time and resources. The analysis criteria used in the identification of suitable sites for solid waste disposal in Peshawar city district indicated that using the GIS/RS technology can help local planning authorities to identify proper disposal sites. Presently solid waste is disposed at open spaces just outside the municipal boundary creating health hazards for the surrounding population. Some of the waste is 13 thrown to larger water channels particularly the Bara river, making its water unfit for drinking purpose. GIS is now most widely used instrument to assist in the finding of suitable sites for landfill siting purposes. Using GIS for assessment of potential dumping sites will save time and resources. Usually local planning authorities have only limited resources and expertise to execute a sustainable siting procedure which causes considerable harm to the environment. This requires analysis of a great deal of spatial information and factors that can affect the optimum selection of site. Though there is a limitation of data availability. For this study seven different thematic layers were taken for GIS analysis. Some other factors like industrial areas, geological structure and wind direction that may also affect the siting of suitable sites but they were not included in the present study due to data limitations. After analyzing the thematic layers, most suitable waste disposal landfill sites were identified. These sites in general meet the required criteria of the suitable sites. Amongst them the local planning authorities must select the “potential landfill” sites by a careful ground preliminary survey.

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