Identify suitable areas for, removing and burying rubbish at Ham industrial and solid Waste to using GIS (case study Ilam Township)

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Abstract. Collecting, removing and burying waste material in an economic scientific way is a major environmental problem. So, considering the significance of the case, the author managed to carry out this research to examine the ways people take to remove the waste and bury it. However, to manage and analyze different spatial data, GIS is a useful tool that in the short time and with a little cost can fulfill the goals more accurate. At this research, it is essayed to determine the best range for prescribed factors (as a model) and then to find and select the best sites for solid waste disposal on the map. In the research, the area more subject to burying waste in city Ilam using information geography system and AHP model to this end layer of information including elevation, slope, soil, drainage, vegetable, transitional road were provided, then the layers corrected in GIS environment regarding errors. And finally weights were applied in expert choose software environment through combining and overlapping information layers in GIS environment suitable areas were indentured. Result of this study indicates the suitable area there are more in the west area. After selection of appropriate items of rubbish burial using AHP and based on concerned standards various regions have been hierarches appropriate regions for rubbish burial is placed on waste north country as the region is placed on large rainfall most of this country is forming by jungle and agricultural lands above regions involve low plant covering with having suitable bed stone and appropriate distance with surface waters and connection routs and residential areas these restrictions consist 83-8 km area at west rout of country and neighbor of Iraq border.

Keywords. solid waste, site selection, AHP, geographic Information System, city Ilam

Introduction

Despite increased efforts to prevent, reduce, reuse and recycle waste, the appropriate management of municipal solid waste (MSW) remains a major environmental issue (Lanneret and Rebers, 1997; Williams, 2005). Currently, there are two principal options for managing such MSW—landfill disposal or incineration in waste-to-energy (WTE) facilities (Landreth and Rebers, 1997; Williams, 2005). However, concerns have been raised in the past that emissions from both landfills and incinerators may pose environmental health risks that make both options less than optimal (Rushton, 2003). Both of these technologies have been improved in the last 20 years. Modern landfills are required by Subtitle D rules (Lee et al., 2000) to include a non-permeable liner at the bottom, be capped at the top, and contain and treat emissions as much as possible (Landreth and Rebers, 1997; Williams, 2005). Municipal solid waste (MSW) is a waste type that includes of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint and batteries (Farrell and Jones, 2009). MSW management is a major challenge in urban areas throughout the world, especially in the cities of developing countries (Zhen-Shan et al., 2009). Management of MSW can be evaluated as a cycle with
many closely related stages. The cycle begins with the production of goods and continues with generation, storage, sweeping, collection and final disposal of waste (Ojeda-Benitez and Beraud-Lozano, 2003). Selection of an optimum place for waste disposal material is consequence of managing wastes so it will be necessary to several purpose decision (Conutt, 2007). Central places for waste disposal is final place for analyzed, material or unuseable disposal (Daniel, 1993). For example in Europe & North American at year of 2004 (one by one) 58868 present from solid waste has translated to control landfill centers. (Bryan, 2009) in Iran a lot of productive solid waste would transfer to central of landfill waste station in case of 6500 ton of productive waste in Tehran would land fill in Kahrizak center daily (Safari, 2002). Product & management of water waste in land fill waste center are the most important case of environment in that places considerable so selection of suitable area for land fill waste is the first step of productive (Sener et al, 2006). Data process of evaluation and analyze for routes provisions should be down (Daneshvar et al, 2003). Durin to find a place should be consider to dynamics of natural area such as flood, fault, slopes... (Emery, 2007) because the most importance of effective water waste environmental in landfill centers are running flat water pollution and under ground waters (Singhal, 2002). Amount of water waste in landfill centers are high depending to how much rain this area (Shroff, 1999) the rate of productive water waste in rainy area more than dry zone because a lot of rain penetrate to landfill center specifications of water waste in landfill center is depending to several factors that significant changes of rate productive water waste (El Fadl, 1997). The most important factor of designing for landfill center is management of duration of collection penetrability & filtering the most important of weather forecasting with effect to running water waste center are the rate raining weather temperature, humidity (Shroff, 1998). The most of the factors of affecting the intensity of rain fall is sewage special slow raining for long time heavy rain for short time will case to saturate the center covering of water waste so penetration of rain in center will be decrease (Canziani, 1989) maximum & minimum severity of water waste in land fill is used by evaluation model WBM from hydrologic watering rate at landfill center has been measured (Fenn, 1975, Schroeder, 1994) the growing population in Iran with the new establishing center of population or luck of policy of evaluation and diverse activities based on of Urban planning comprehensive and sustainable national macro frills types factors creating the crisis is natural environment and human health and quality of health in high risk and have a variety damage (Abdoli, 2000) actually the municipal waste management system in Iran is in terms of critical and it would for from good condition for anyone not wearing some of the waste productive in some cities such as hospitals with the reason of having the pollutants and high risk environment should be have special significance one of the most important studies as landfill is positioning of waste disposal and suitable zone for landfill would be down locate a suitable location for urban development projects essential in landfill as the Quebec state in Canada, Chatanooga, Washington, Brazil, Massachusetts in use correct locating for solid landfill is one of primary factors of sustainable development in 1992 (Williamhandricks and Davidbkylky in the research as GIS in locating landfill in the Vermont state of America a 210 hectare area in terms of physical one economic indicators such as good soil depth of soil rock... land and evaluated and appropriate places in the area identified mad in 2002. Vastava & Nasvat in research and locate a landfill in the city using GIS, RS with regard to criteria such as geology faults gradients of earth kind of rock and soil surface water and ground water depth urban centers existing communication networks the distance from airport and... and using this system and to weight the indicators with using this system and to weight the index through a couple of 5 separate locations waste landfill in different sizes for 800/000 people choose this city (Vastava & Natha, 2006) John Bennett in 2004 progress report and GIS a and geographer system in Rome offered in solid waste management (Bennet, 2005) and in 2003 and with the help of in tenet & GIS mapping support to this important issue for employees of city services and it was converted to roman citizens v. Sengtlanthr the solid waste management project in the city has to offer the purpose of this project GIS in the management of municipal solid waste was in Vientay city centersayed manhood anvar research on solid waste management in Dhaka Bangladesh's capital city has down and the subject stated that this issue has become acute in Bangladesh Vastava and Naswat in 2002 as a research location interpolated using GIS, RS for landfills around the city ransy with regard to criteria because geology faults gradients of earth kind of rock and soil surface water and ground water depth urban centers existing communication networks the distance from airport and... using this system and to weight the indicators with using this system and to weight the index through couple of 5 separate locations waste landfill in different sizes for 800/000 people choose this city, These types of models have been used for a number of waste management problems ranging from location of hazardous waste sites (Merkhofer and Keeney, 1987; Briggs et al., 1990), ocean disposal sites (Leschine et al., 1992) and urban solid waste...
management systems (Hokkanen et al., 1995; Hokkanen and Salminen, 1994). However, these models suffer from the drawback that a number of the criteria can not be expressed numerically and therefore cannot be accurately accounted for in these models. Ilam city with a population over 300,000 people located in waste (figure 1) considering that more than 100,000 tons garbage produced daily in this city and now the city's solid waste landfill is not a desirable situation and with respect particular environment conditions and the need to locate a suitable site for landfill in this city and research to the industries has been down.

![Figure 1. Iran’s Geographical Map](image)

**MATERIALS AND METHODS**

In final criterion locate a suitable place to achieve the least adverse effects on the environment natural resources surrounding the site is waste disposal and the minimum cost economic engineering has the optimum features So after determining 7 suggestion area with scale of 1.25000 and with 1.25000 scale topographic maps data from 1.25000 scale the rest of suggestion area on based 28 parameters at 7 basic groups such as geological, pedology, meteorology, hydrological, hydrogeological access and distance from population and industrial centers were reviewed and rated. Therefore the parameter 28 in 5 categories more excellent, excellent good, average and poor were then 28 degrees with respect to the importance of each parameter in this phase of the study was about weight.

**Coefficient of determination criteria and following criteria**

Each area is measured in terms of credit standards (Bowen, 1990) the AHP method is specific weight of criterion that user should be applied to different methods also any criteria can be divided into several smeceller sub criteria and compare and weight them together in this research the overall goal is selecting right place for landfill (waste) in Ilam city is intended in first level the second level include 7 criteria 1. geological, 2. pedology, 3. hydrological, 4. hydrogeological, 5. meteorology, 6. communication ways, 7. population centers third level is also include 28 sub criteria the term has been screened by the table 1 use to assess the degree of preference between two sub criteria (Faraji Sabokbar, 1384) the main advantage of this methods is to help to decision makers for a complex problem in to a hierarchical structure in their and them solve the problem. To determine the coefficient of the following criteria and following criteria there are specific ways that most common is compared two to two. criteria in this method are compared two to two and the degree of importance of each criterion relative to another is determined to d this the standard method (provided by scale time) be used the method is that attribute to each binary compare one number between 1 to 9.
Using a relative scale weight scale ethmoid can be qualitative and qualitative elements of the image to determine the accuracy of the index weighting of agreement ((CI)) is used approach based on graph theory in particular vector is calculated ((scaled time 1980)) AS a consistency index of 0.1 or less the weighting is correct and other wise the relative weight given to the criteria should be modified and re-weighting should be done (karam, 2002).

**Matrix of binary comparisons**

Note that the second level hierarchical analysis 7 criteria are in place.

So according to relation #1[N*(n-1)]/8  [8*(8-1)]/2=28

Based on the comparison matrix 7*7 and different criteria are compared with the binary and the amount of sieves time based on (table1)allocated because it is a diagonal matrix 7 a comparison is done such as geology here is very important to the intersection of these two measures of 7 and the diameter of the symmetric matrix where the value is 7/1(table2)the next step is to calculate the average row matrix can then be used as the relative weight at this level so the weight and the rest is standard for geological (table3) next double standards such as scale level2 level3 as compared as level two.

**Coefficient of options**

The coefficient of correlation criteria and the criteria of the options must be determined in this stage the judging is based on binary comparison of criteria a options and 2 scale hour quantity & thereby analogue matrix of binary criteria or options is recorded (table4)

<table>
<thead>
<tr>
<th>geographical</th>
<th>pedology</th>
<th>hydrological</th>
<th>Hydrogeological</th>
<th>meteorology</th>
<th>Relating routs</th>
<th>Population centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>pedology</td>
<td>1.3</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>hydrological</td>
<td>1.4</td>
<td>1.3</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>hydrogeological</td>
<td>1.5</td>
<td>1.5</td>
<td>1.3</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>meteorology</td>
<td>1.6</td>
<td>1.6</td>
<td>1.5</td>
<td>1.3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Relating routs</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Population centers</td>
<td>1.7</td>
<td>1.6</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.2</td>
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<table>
<thead>
<tr>
<th>geological</th>
<th>pedology</th>
<th>hydrological</th>
<th>Hydrogeological</th>
<th>meteorology</th>
<th>Relating routs</th>
<th>Population centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.471</td>
<td>0.274</td>
<td>0.144</td>
<td>0.073</td>
<td>0.055</td>
<td>0.047</td>
<td>0.039</td>
</tr>
</tbody>
</table>

**Review and analysis of factors affecting hazardous waste location city of ilam (following criteria) Geographical parameters**

Material thick alluvium slope distance from major and minor faults unstable ground earthquake risk as parameters have been studied geological the second parameters of the instability (liquefaction)risk status related earth quake are seismic zone there fore for each of them is them is the weight for each of the parameters of earth material and slope away from that fault given the degree of their importance in the waste disposal site maximum weight of at least 0.082 and 0.0129 respectively for these parameters is in order.

**Parameters of soil science**

In the initial proposal of a single layer of vegetation was used step 5 in the in formation layer of soil erosion permeability and use vegetation and land use capability and capacity in soil science has been considered as parameters at this stage the minimum weight 0.049nd maximum weight 0.075for the parameters were used in soil science.
**Hydrological parameters**

First major and minor rivers and privacy of existing hydraulic structures is the restricted areas were used at this stage of the hydrological parameters of the proposed areas are considered as more accurate scoring considering that the first consideration and also have a total weight of at least 0.029 and 0.037 for the maximum they have to.

**Parameters of the hydrological**

Considering the interaction of ground water resources and wastes buried location of ground water resources supply and drainage areas of these resources the exploitation of ground water the depth and the hydraulic load and...In site tracking plans the region of feeding and charging if these sources exploitation points of these ground waters depth and hydrolic loads of them had been important and besides quantity material of above source the quality study of these source has especial surveys for these reason at first stage of exploitation sources of underground water (well spring and ghanat) the hydrologic parameter is only considered in this stage the suggestive regions based on 4 hydrologic parameter such as distance from well spring and ghanat depth of underground water quality of underground water direction of underground water (distance from down stream population centers) has Been ranked according to table with some of maximum weight 0.026 and minimum of 0.019.

Weather condition is one of basic factor on site tracking studies for discharge site of especial residues in this case the region with frigid weather moist local with harsh rainfall floody region and windy local should be considered particularly at first stage two information layer of evaporation and degree of rainfall has been considered in this stage these two parameters along with two parameters of predominant wind speed and distance of population sites on downstream has been used on ranking by notice of these two parameters on first stage is also considered in this stage totally maximum weights of 0.013 and minimum of 0.017 has been considered for these meteorology parameters.

**Accessible parameters**

In the first stage the bounds of origin and detour ways on country is considered as illicit regions at this stage these 2 parameters along with distance from power line have been used as accessible parameters in scoring to suggestive regions by notice to important degree of these parameters the maximum weight of 0.010 and minimum of 0.012 has been intended.

**Mineral industrial and population centers parameters**

The suggested appropriate carry distance for caring particular residues is about 50 KM as radial of production center in some regulations the required time for arriving to landfill is considered instead of average distance there by in addition to distance parameters such as traffic and roads quality also are considered the maximum time for one road of rubbish collection has been suggested about 30 to 45 minutes for ordinary vehicles (with 5 ton capacity) the exception of it can be carried by large trucks that in this case 2 hours is considered useful although this is dependent of local conditions distance parameters of cities distance from countries distance from mineral and industrial towns and distance from protective regions has been considered as parameters of mineral industrial and population centers and by notice to important degree of these parameters the maximum weight of 0.007 and minimum of 0.09 has been intended.

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**Table 4. comparative weight of sub-criteria**

<table>
<thead>
<tr>
<th>Distance to fault</th>
<th>variation</th>
<th>landslide</th>
<th>erosion</th>
<th>penetrable</th>
<th>land use</th>
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</thead>
<tbody>
<tr>
<td>0.129</td>
<td>0.087</td>
<td>0.082</td>
<td>0.075</td>
<td>0.069</td>
<td>0.57</td>
</tr>
<tr>
<td>vegetable</td>
<td>Capability land use</td>
<td>Distance to drainage</td>
<td>Distance to main stream</td>
<td>Distance to dam</td>
<td>Well. Distance to</td>
</tr>
<tr>
<td>0.051</td>
<td>0.049</td>
<td>0.037</td>
<td>0.033</td>
<td>0.029</td>
<td>0.026</td>
</tr>
<tr>
<td>depth ground water</td>
<td>Quality ground water</td>
<td>flowdraction</td>
<td>evaporate</td>
<td>Rain( millimeter)</td>
<td>Speed wind</td>
</tr>
<tr>
<td>0.024</td>
<td>0.021</td>
<td>0.019</td>
<td>0.017</td>
<td>0.015</td>
<td>0.013</td>
</tr>
<tr>
<td>Distance to main road</td>
<td>Distance to secondary road</td>
<td>Distance to line convection</td>
<td>Distance to village and city</td>
<td>Distance to industry city</td>
<td>Area reserve</td>
</tr>
<tr>
<td>0.012</td>
<td>0.011</td>
<td>0.010</td>
<td>0.009</td>
<td>0.008</td>
<td>0.007</td>
</tr>
</tbody>
</table>
After selection of appropriate items of rubbish burial using AHP and based on concerned standards various regions has been hierarched appropriate regions for rubbish burial is placed on waste north country as the region is placed on large rainfall most of this country is forming by jungle and agricultural lands above regions involve low plant covering with having suitable bed stone and appropriate distance with surface waters and connection routs and residential areas these restrictions consist 83-8 km (table 6) area at west rout of country and neighbor of iran border the height of region is between 347 to 425 meter region material is large classic residues along with clay and silt and toward east north is changed to fine and plaster forms slope premium of regions are appropriate from 2 KM north of center high pressure pylon ford river and also gas pipe line mainly port of whole restrictions has been composed of asmarcalics as well as aniderity elements of this structure called calhor age of this structure is related to senozueec very small part of 3 restriction on south is sequence of red to gray grits and calcits with gypsy middle layer there is different subordinate faults in more than 10 KM (table 7) distances this restriction has high danger from seismograph danger which shows 30% acceleration of quality acceleration the slope of region is low and it is useful for constructing landfill there is centenary area for rubbish burial on west country which has been considered useful with regard of environment and natural condition with this priority based on especial condition the regions is given in 6 and 7 table and it is notable that 1 and 2 restrictions that involve large areas has been built by local interpretation and consideration of ways for war time and it is not exist on maps concerning areas simply is determined (figure 2) some site that was chosen as selection sites was studied and considered carefully in this period 3 selection site such as 1, 2 and 3 sites using maps with 1:25000, scale and field observation was studies with more detail the situation of selection sites is given, on 3 and 4 figure.

Table 5. Area and distance to city ilam

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1 site</th>
</tr>
</thead>
<tbody>
<tr>
<td>553</td>
<td>444</td>
<td>154</td>
<td>1561</td>
<td>374</td>
<td>911</td>
<td>5914</td>
<td>Area(hectare)</td>
</tr>
<tr>
<td>47</td>
<td>50</td>
<td>67</td>
<td>55</td>
<td>59</td>
<td>53</td>
<td>65</td>
<td>Distance to city ilam(km)</td>
</tr>
</tbody>
</table>

Table 6. quality areas for, removing and burying rubbish at Ham industrial and solid

<table>
<thead>
<tr>
<th>temperature</th>
<th>high</th>
<th>Distance to drainage</th>
<th>Rain</th>
<th>Distance to Fault</th>
<th>penetrable</th>
<th>topography</th>
<th>land use</th>
<th>vegetable</th>
<th>areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2422</td>
<td>300</td>
<td>5km</td>
<td>425</td>
<td>3</td>
<td>high</td>
<td>lowland</td>
<td>Arid wasteland, weak pasture</td>
<td>Area1(fig6)</td>
<td></td>
</tr>
<tr>
<td>-2422</td>
<td>436</td>
<td>4km</td>
<td>400</td>
<td>1.5</td>
<td>moderate</td>
<td>lowland</td>
<td>Arid, wasteland weak pasture</td>
<td>Area2(fig7)</td>
<td></td>
</tr>
<tr>
<td>-2422</td>
<td>333</td>
<td>3.5km</td>
<td>370</td>
<td>1.7</td>
<td>moderate</td>
<td>mild</td>
<td>Arid, wasteland weak pasture</td>
<td>Area3(fig8)</td>
<td></td>
</tr>
<tr>
<td>-2523</td>
<td>300</td>
<td>3km</td>
<td>370</td>
<td>1.5</td>
<td>Moderate and low</td>
<td>mild</td>
<td>pasture</td>
<td>pasture</td>
<td>Area4(fig9)</td>
</tr>
<tr>
<td>-2533</td>
<td>150</td>
<td>2.7km</td>
<td>370</td>
<td>1.5</td>
<td>low</td>
<td>mild</td>
<td>pasture</td>
<td>pasture</td>
<td>Area5(fig10)</td>
</tr>
<tr>
<td>22</td>
<td>500</td>
<td>600m</td>
<td>480</td>
<td>1</td>
<td>low</td>
<td>ragged</td>
<td>pasture</td>
<td>pasture</td>
<td>Area6(fig11)</td>
</tr>
</tbody>
</table>

Fig. 2. Suitable area areas for, removing and burying rubbish, based on AHP model
by considering particular residues on country about 110 KM for discharge site as well as other subsidiary facilities is considered sufficient for country sides as choosing other ways besides residues burial so this seven restriction are thoroughly perfect in sum by considering all condition & expert idea in respect of field situation on cites the hierarchy of sites is suggested 1,2 and 3 respectively and it is notable that number 1 restriction which involve maximum size is suggested the most useful site for removing industrial and chemical residues of Ilam the engineering geology map of region1 is seen(fig.12).
Figure 8. area6

Figure 9. area7

Figure 10. engineering geology map of region1
CONCLUSION

Urban expansion of Ilam during recent years has been due to connection of countries and normal growth of city process of this population stream has been increasing needs and consumption of natural and artificial materials that is apparent as urban useless material (rubbish) on different quality and quantity and daily production with more than 100 ton rubbish on original and natural environment places on a critical conditions and away from desired situation in this study selection spot of solid material burial of Ilam is performed by most of environment properties such as away from fault agricultural lands human statements soil and trend of city expansion based on AHP finally some regions in west is chosen by some collection of standard sub-standards and option and giving weight as the best location for rubbish burial which this septenary regions with regard of environment and various factor of human and environmental involve relatively better conditions in respect to other regions in this survey number 1, 2 and 3 sites is evaluated as the best spot for industrial rubbish burial material due to industrial factories residue such as petro-chemistry and also other sites for removing more appropriate urban residues is evaluated besides these site tracked spot this city needs will be responded in future.
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