Geographical Information Systems (GIS) and Landfill Siting

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Introduction

The siting of a landfill requires diverse geological, geotechnical, and environmental considerations, but must also satisfy legal restrictions and other social and cultural factors. Different types of interests must be weighted against each other, which is ranging from difficult to impossible. The siting procedure also requires the processing of a significant amount of data. Geographical information systems (GIS) can be useful since it provides spatial analysing tools to sort and interpret geo-referenced maps.

Research questions

The following issues are investigated:

- What are the interests that have to be considered when siting a landfill?
- How can GIS be used as a tool for landfill siting?
- How does the GIS impact on the problem analysis?

Experimental

To test GIS as a tool for landfill siting, the county of Norrbotten in northern Sweden has been chosen. There are several regulations and directives about landfilling within the European Union, and the Swedish laws and regulations are successively adapted to these directives. Several of the existing facilities in Norrbotten are substandard to these directives and have to be closed down. There is therefore a need for a new landfill adapted to the high standards required for a landfill in this area today, and especially for a class 1 landfill, i e a landfill designed for hazardous wastes.

The Norrbotten area has three major sources of hazardous waste: ashes from incineration of the burnable MSW-fraction, wastes from the mining industry and wastes from soil cleanup. Of these the mining wastes are excluded from this study.

Factors and interests controlling landfill siting area grouped and considered in three steps:

- Waste patterns
- Natural conditions
- Social factors

On the basis of the steps, siting criteria are made. The analysis is made by using raster overlay analysis. The maps are reclassified so that preferable areas show the value +2 and forbidden/non preferable areas get the value 0. Areas, which cannot be assigned a definite positive or negative value, will be assigned a +1 value. After making selections of suitable areas in the three groups, the maps are multiplied into one map, showing preferable, undefined (or neutral) and unsuitable areas. An environmental impact analysis is then done for each of the selected areas.

Discussion and preliminary conclusions

The project is underway at the moment and results are pending. Issues dealt with at the moment are focussed on the waste and environmental issues. For most of these factors one can either arrive at numbers, e g for transport distances or size of aquifer affected, but even at these steps there are qualitative issued that must be judged by some criteria. A strategy for the selection and expression of such criteria becomes a key problem.

Also the lack of information lends an increased importance to available information, and in particular such information that is readily available in georeferenced data-sources. What bias is likely to occur due to that? The variability and persistence of various impacts is an additional factor to consider. A landfill belongs to the most durable constructions that society will generate: how important is a large short-term impact in comparison with a small long-term impact?

The management of data using a GIS can provide much relevant information and can serve as a good illustrative tool in the landfill siting process. It is clearly useful when ranking issues like hydrogeology, geology, land use and proximity to waste and populations. The illustrative power is also a risk in a democratic process, especially when the data selection and evaluation is not transparent. A strategy is also needed for assessing such aspects.

The quality of the GIS analysis is dependent on the siting criteria, which has to be decided by the user. The effect of this must be further analyzed. This also opens for other questions. Is it possible to use the same approach for landfill siting in other parts of the world?