Zoning the Lands of Gonabad City by Analytic Network Process (ANP) for Burying Rural Waste

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1. Introduction

Preserving the environment is one of the basic requirements of sustainable development, especially in rural areas. An issue which is a threat to the environment of rural areas is the lack of attention to collecting and burying wastes in the environment. In order to ensure that environmental regulations and the aims of sustainable development are observed and to prevent environmental pollution, the zoning of lands for hygienic burying of wastes and reaching the goals of sustainable development seemto be necessary. The current study aims to investigate the lands of Gonabad city for the burial of rural wastes. Hence, the main indices used for zoning in this study are: distance from water resources, plant coverage, soil texture, altitude, inclination, distance from road, distance from faults and distance from populated areas. The layers and data were weighted using ANP and the suitable locations for the burial of rural wastes were determined using Geographical Information System (GIS). The research methodology is descriptive-analytic in nature and functional-experimental regarding its purpose. In order to collect the data, documentary and field-survey data collection methods were used. The results of the study show that among the eight existing rurallocations for burial of wastes, only three locations match the environmental criteria and are located in exactly the right zone, one location is in an acceptable zone, three in a fairly acceptable zone and one location is in an unacceptable zone.

Lack of control of and inattention to the appropriate management of wastes regarding their collection and keeping, transportation and hygienic disposal causes disasters and results in the spread of different diseases and regional epidemics which in addition to threatening the health of the society and environment, impose heavy costs on the government (Costa, 2010). Currently, there is not a coherent management regarding rural wastes which over time, convert into irresolvable wastes with a long retention period, a fact which indicates the importance of waste management (Anabestani, 2013). Hence, protecting the rural environment is one of the necessities of rural development and one of the issues which threatens the rural environments in this regard is inattention to the management of wastes in rural environments (Farmohammadi et al., 2007). "There are different methods for the disposal of waste, but in today's world, recycling

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and reusing non-recyclable waste materials is the only solution for sanitary disposal in intensive care" (Elimelech, 2011, p. 626). The aim of this study is to present optimal locations for burial of the wastes from rural settlements in Gonabad city.

2. Study area

Gonabad is located between the northern latitude of 34° and 2 minutes to 34°and 46 minutes, and the eastern longitude of 58°and 17 minutes to 58°and 27 minutes in the south of Khorasan Razavi Province, Iran. This city is restricted from the north to Mahvelat, from northeast to Roshtkhar, from east to Khaf, from the south to Gha'en and from the west to Bajestan. The area of Gonabadregion is 5767.79 km^2 and its center is Gonabad. Gonabad region has two sectors (Markazi and Kakhk), three urban points (Gonabad, Bidokht, and Kakhk), four rural districts (Pas Kalut, Zibad, Kakhk, and the Gonabad's suburbs) and 430 villages. According to the census report in 2013, the total population of the region is estimated to be 80783 from which 34655 have settled in rural areas.

3. Material and Methods

Recognizing and determining the suitability or capability of the region for waste burial is one of the first actions in environmental planning. The aim of this study is to identify the suitable rural areas of Gonabad city for waste burial based on natural and human factors. This zoning was done through environmental, topographic and land coverage criteria and distance from dangerous phenomena. Each of the indices were classified by environmental regulations and experts' opinions. Spatial analyses were done using the ANP model and the layers were overlapped and analyzed accordingly. The action of weighting was performed and the final weight of each index was applied to each of the layers in the GIS environment. In the next stage, the layers were assembled and the zoning map was created through overlapping.

4. Results and Discussion

In order to create the ANP network for the issue under study, first the more important and basic criteria and indices with regard to the issue were determined based on the available resources and experts' opinions and then, these criteria and indices were weighted and their importance regarding the issue under study were compared to one another. The investigated criteria were placed in three dimensions and then, a questionnaire was designed based on the criteria and indices. The importance of each criterion was estimated on the basis of the mean of responses of experts and the relationship among purpose, criteria and indices were demonstrated by using Super Decision software. The sort of layout and connection of criteria and indices is such that the direction of the arrow not only determines the outer relationship, it also indicates the inner relationship. Weighting and comparing the importance of criteria and indices was done at this stage. In this prioritization, the highest numerical value accrued to the criterion of distance from underground water resources. According to the experts, underground water resources are very important and it is necessary to keep distance from them due to the contaminations resulting from wastes.

5. Conclusion

In case the location for burying rural wastes is selected without observing environmental regulations, the health of human beings and the environment would be endangered and this would have outcomes which hinder sustainable development. Since the purpose of this study was to reach sustainable development and prevent environmental pollutions, the basic information of Gonabad city were first analyzed and then,the Arc GIS software was used to perform the different stages of valuing at the level of indices, criteria and options by ANP. Finally, the importance of each of these items was determined at its own level. After performing these stages, the weighted maps of each criterion were created. The weighted maps were created based on the comments of experts and the given values pertaining to the aims of this study, such that in each map, the locations which were suitable for the purpose of the study received the highest value. Afterwards, the results of each map and its condition were analyzed. At the final stage, overlapping was done and the final map which demonstrates the optimal zoning for waste burial was created and presented. The existing locations were also identified and based on environmental issues and considering the criteria of this study, it was concluded that among the eight existing places for the burial of rural wastes, only three locations are in accordance with environmental criteria. Due to the size and population growth of rural areas, it is necessary to replace the existing burial places with more optimal ones.

Key Words: Zoning, Waste burial, Sustainable development, Geographical information system, Gonabad city

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