Land Suitability Assessment for Agricultural Activities Based on Hydrogeomorphological Parameters
(Case Study: Sanandaj, Iran)

Mojtaba Yamani*[1], Hamid Ganjaeian[2], Lila Garosi[3], Mahnaz Javedani[4]

1- Professor of Geomorphology, Tehran University
2- Ph.D. Studend of Geomorphology, Tehran University
3- Ph.D. Studend of Geomorphologhy, Tarbiat Modares University
4- M.A. Geomorphology, Mashhad Azad University

Abstract

1-Introduction

Today, geomorphic studies are considered as the base of studies on natural resources. Recognizing the processes and active mechanisms on these landforms and their characteristics, as well as understanding the type of use of these units in using the natural environment and sustainable development is important. Many of Iranian towns and villages are on plains and alluvialfans and as a result, exploitation of the plains has become diverse and growing; but there are problems and limitations in the use of these areas. For a successful farming, consideration of climatic and environmental conditions is of tremendous importance. Therefore, the designation of geomorphic units is a suitable method for detailed studies of natural resources planning and management and environmental hazards. According to some experts, the assessment of environmental power is an instrument for identifying a land for activities such as agriculture and forestry (Quang minh et al, 2003). The agricultural sector of Sanandaj Province is especially important among the economic sectors of the province since in terms of production and employment, it is ranked second after the services sector. The geographical and climatic conditions and abundant water resources provide the potential benefits of agricultural production in the city. In

---

* (Corresponding Author), **E-mail**: myamani@ut.ac.ir

recent years, with the adoption of new software and hardware methods, many efforts have been made to determine the capability and management of land leading to fruitful results.

2-Methodology

The purpose of this study is to assess land suitability for agricultural activities in Sanandaj based on hydrogeomorphological parameters. To this end, the research method is based on descriptive-analytic methods. Research data includes statistical information (information on the status of groundwater and climate parameters), information layers, information extracted from satellite imagery (land use), as well as library information. Software used in the research includes ARCGIS (providing information layers, fuzzy, final output), IDRISI (implementation of the OWA model), Google Earth (validation of results), and SuperDecisione (weighting to criteria). The data layers of this research are soil, land type, geology, slope, altitude, precipitation, river, temperature, groundwater status, and groundwater chemical quality. Since the value and importance of the parameters are not the same for the desired purposes, the parameters were evaluated using expert opinion (5 geomorphic experts) by the ANP method and fuzzy by using the fuzzy function in ArcGIS software. Afterwards, standardized layers are entered into the IDRISI software and then combined with the ANP model using the OWA model based on the obtained values. Finally, the final map is made. After drawing up the final map to verify the results, 50 random samples were used to validate the result.

3-Results and Discussion

In this research, ten parameters have been used for the development of agricultural lands in Sanandaj. The parameters are assigned in three clusters: Geomorphologic parameters (elevation, slope and geomorphology units), hydroclamite (river, underground water, chemical water quality, temperature and precipitation), and land cover (soil and lithology). In this research, after providing information layers, these layers are standardized using ARCGIS software. The

geomorphological parameters are standardized in such a way that the altitude, the lower height means that the pixel is worth more And also in terms of slope, areas with a lower slope are worth more. In terms of geomorphology units, the lake and mountain units are of the lowest value. In terms of hydro-climatic parameters, regions with higher rainfall and temperatures near the river have lower groundwater depths and areas with lower EC values are of higher value. In addition, the areas with inspetisol are of higher value and lithologically, the areas with alluvial lithology are more valuable. The value of the criteria was then calculated using the ANP model. Finally, the obtained value was applied to the layers and in the end, using the OWA model, the final map is obtained.

4- Conclusion(S)

Since agriculture makes a major contribution to the economy of Sanandaj, and given the great potential of the city in terms of water resources, it is necessary to make proper planning and location in this area. In the present study, according to studies conducted and hydrogeomorphological survey related to the study area regarding zoning the area for the development of agricultural lands, it has been attempted to identify suitable areas for the desired purposes. The results of zoning using integrated network analysis and sequential weighted averaging model have been verified using integrated network analysis model and random sampling method is verified. The confirmed results indicate that the final map has 86 percent accuracy. The results of the present study indicate that the major part of Sanandaj does not have the proper level of agricultural activities so 1587 km2 of the city area is in the inappropriate class and the relatively suitable and suitable class area is 801 and 579 square kilometers, respectively. According to the results, about 53% of Sanandaj area is not suitable for agricultural activities, especially for water crops.

Keywords: Agriculture, Geomorphology, Sanandaj, ANP, OWA

5-References

Abdelkader, M., Amina, D. (2012). Integration of multiCriteria decision analysis in GIS to develop land suitability for agriculture: Application to durum wheat cultivation in the region of Mleta in Algeria. *Computers and Electronics in Agriculture*. 1(83): 117-126.

Ahmad, M. (2004). National Development Policy Issues, A Review of the Iran Region, Agriculture and National Economy, *Conference on Agriculture and National Development of the Ministry of Jihad Agriculture*, 1(1). (In Persian).

Amini, A., Bagheri, M., Salehi, M. H., Hadinejad, A. (2013). Improving Resource Management and Quality of Land Suitability Assessment Maps with Fuzzy Approach (Case Study: Farrokhshahr Chaharmahal and Bakhtiari), *Geography and Environmental Planning*, 24(22): 195-204. (In Persian).

Darvishzadeh, A. (1991). Geology of Iran, First Edition, *Environmental Protection Agency Publications*, Tehran. (In Persian).

El Baroudy, A. A. (2016). Mapping and evaluating land suitability using a GIS-based model. *Catena,* 1(140): 96–104.

Farajzadeh, M. (2007). Climatological Techniques, *Samt Publications*, Tehran, 287 p. (In Persian).

Hanafi, A., Hatami, I. (2013). Preparation of Climate Map of Kurdistan Province Using Geographic Information Systems, *Sepehr Magazine*, 22(87): 24-28. (In Persian).

Maram, F., Zarafshan, K., Mirkzadeh, A. A., Maleki, A. (2014). Evaluation and ranking of agricultural development potential villages (Case study: Kermanshah city), *Geography and Environmental Planning*, 27(1): 146-131. (In Persian).

Mokhtari, D., Moazez, S., Mohammadzadeh Golani, F. (2017). *Journal of Hydrogeomorphology*, 3(10): 1-19. (In Persian).

Nasrallah, N., Kazemi, H., Kamkar, B., Sadeghi, S., (2016). Ecological agronomic evaluation of lands of Aq Qala city (Golestan province) for dryland wheat cultivation using Geographic Information System (GIS),

Journal of Agriculture (Research and Construction), 29(110): 83-94. (In Persian).

Oli, p.p. (2001). Spatial data for landuse planinig in Nepal, *International Conference on spatial information for sustainable development*, Nairobi, Kenya, 2-5 october, p 9.

Pakpur Rabti, A., Jafarzadeh, A. A., Shahbazi, F., Amari, P. (2013). Evaluation of potential lands for a number of agricultural products using GIS in some areas of West Azerbaijan province, *Journal of Soil and Water Science*; 23(1): 165-176. (In Persian).

Parvin, N., Karami, M. R., Bozorgmanesh, A. (1396). Land potential assessment of South West Azerbaijan for agricultural development and sustainable rural development management using AHP and GIS and Aster images, *Journal of Urban Management*, 16(47): 107-118. (In Persian).

Qanavati, E., Delfani Goodarzi, F. (2013). Optimal location of agricultural development with emphasis on natural parameters of Boroujerd city, *Quarterly Journal of Space Economics and Rural Development*, 2(2): 15-31. (In Persian).

Quangminh, V., Quang tri, L., yamada, A. (2003). Delination and incorpotation of socio-infrastructure database into GIS for landuse planinig: A case study of Tan Phu Thanh village, chauthanh district, Cantho Province, *Map Asia Conference,Gisdevelopment*, p 14.

Rahnama, M. R., Aghajani, H., Fattahi, M. (2012). Location of landfill by combining sequential weighted averaging (OWA) and GIS methods in Mashhad, *Journal of Geography and Environmental Hazards*, 1(3): 87-105. (In Persian).

Rajendra, B. Z., Vijay, S. B. (2015). Multi-criteria landsuitability analysis for agriculture in hilly zone:Remote sensing and GIS approach. *Computers and Electronics in Agriculture*, 1(118): 300–321.

Reshmidevi, T. V., Eldho, T. I., Jana. J. (2009). A GIS-integrated fuzzy rule-based inference system for land suitability evaluation in agricultural watersheds, *Agricultural Systems,* 1 (101): 101-109.

Saaty, T. L., Vargas, L. G. (2006). Decision Making with the Analytic Network Process: Economic, Political, Social and Technological Applications with

Benefits, Opportunities, Costs and Risks, *International Series in Operations Research & Management Science*. P 360.

Tale Jankanlu, A., Talei, M., Karimi, M. (2015). Assessment of residential land suitability by FUZZY, OWA and TOPSIS methods, *Journal of Surveying Science and Technology*, 4(4): 29-45. (In Persian).

Talei, M., Soleimani, H., Farajzadeh Asl, M. (2014). Land Suitability Assessment for Rainfed Cultivation Based on FAO Model and Using Combined OWA-AHP and FUZZY Techniques in ARCGIS Environment (Case Study: Miyaneh County), *Journal of Water and Soil*, 28(1): 139-156. (In Persian).

Yamani, M. (2014). Handbook of Field and Laboratory Techniques in Geomorphology, *Center for Environmental Studies in Geography.* (In Persian).

Yari, M., Soltani Gerdfaramarzi, S., Ghasemi, M., Taghizadeh, R. (2009).The effect of land use change on runoff in a part of Gharasoo Ardabil watershed, *Journal of Hydrogeomorphology*, 21(6): 203-225. (In Persian).

Zebardast, E. (2010). Application of Network Analysis Process (ANP) in Urban and Regional Planning, *Arts-Architecture and Urban Planning*, 2(41): 79-90. (In Persian).