Analysis of Hydrogeomorphic Properties of Aland Chai Basin to Prioritize Sub-Basins in terms of Flood Sensitivity

Mohammad Hossein Rezaei Moghaddam [a*], S.Asedolah Hejazi [b], Khalil Valizadeh Kamran [c], Tohid Rahimpour [d]

[a] *Professor of Geomorphology, Department of Geomorphology, University of Tabriz, Tabriz, Iran*
[b] *Associate Professor of Geomorphology, Department of Geomorphology, University of Tabriz, Tabriz, Iran*
[c] *Associate Professor of RS and GIS, Department of GIS and RS, University of Tabriz, Tabriz, Iran*
[d] *PhD Candidate in Geomorphology, Department of Geomorphology, University of Tabriz, Tabriz, Iran*

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1. Introduction

Flood is a disaster which causes a lot of economic damages to farmlands, forests, gas and power transmission lines, roads, engineering structures, and buildings. There are numerous floods in the northwest of the country at the beginning of spring and the start of spring rains, which in most cases results in heavy damage. The purpose of this study is Geographic Information System (GIS)-based analysis of hydrogeomorphic properties of Aland Chai Basin for preparing flood sensitivity map. To this aim, hydrogeomorphic parameters of sub-basins have been studied from three aspects of drainage network characteristics (e.g., stream order, streams number, streams length, stream frequency, bifurcation ratio, length of overland flow, drainage density, drainage texture, texture ratio, infiltration number, constant of channel maintenance, and rho coefficient), basin geometry (e.g., basin area, compactness coefficient, circulatory ratio, elongation ratio, form factor, and shape factor) and relief properties (relief, relief ratio, ruggedness number, and gradient).

2. Study area

Aland Chai basin is located between 38, 30´ and 38, 48´ N and between 44, 15´ and 45, 01´ E in the West Azerbaijan province. It covers an area of 1147.30 km^2 and it is situated in the north-western part of Iran. This basin is one of the sub-basins of the Aras River basin to which surface water flows after joining the grand Qotour River. Basin elevation variations are from 1093m in the Aland Chai River bed to 3638m above sea level in the Avrin Mountain.

*. Corresponding author: Mohammad Hossein Rezaei Moghaddam. E-mail: Rezmogh@tabrizu.ac.ir Tel: +989144142190

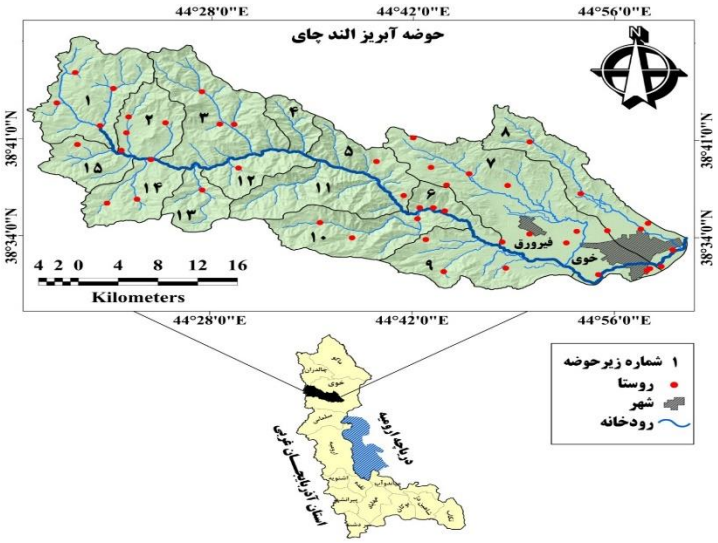

Figure 1. The study area location in the West Azerbaijan province

3. Materials and Methods

The Step-Wise Weight Assessment Ratio Analysis (SWARA) model was introduced to the provided relational database in weighting of data layers. SWARA technique is one of the multi-criteria decision methods which was developed by Keršuliene et al. (2010). In this method, an expert has an important role in evaluating and calculating weights. Based on this method, the most signifcant criterion is ranked as the first, while the least signifcant one is ranked as the last.

4. Results and Discussion

Hydrogeomorphic analysis plays an important role in the analysis of hydrological behavior of the basins. In the present study, 22 hydrogeomorphic parameters were analyzed from three aspects of drainage network characteristics, shape parameters, and relief properties in order to investigate the role of these parameters in flood sensitivity of Aland Chai basin. Digital Elevation Model (DEM) with 12.5m spatial resolution and ArcGIS software were used to generate the data layers maps. In the next step, all necessary weights were calculated for factors and Sub-basins using SWARA model. According to a comparison between factors for each sub-basin, it was specified that sub-basins 3, 1, 4, and 2 (weighted as 0.142, 0.122, 0.091, and 0.087) have the highest impacts on Flood occurrence in study area. On the contrary, sub-basins 13 and 6 (weighted as 0.018 and 0.020) show the lowest weight.

5. Conclusion

In this study, an attempt was investigated to identify sub-basins with high potential for flood occurrence in Aland Chai basin. Based on the effective parameters, flood occurrence inside of Aland Chai basin could be separated into 5 distinguished classes from very high to very low flood susceptibility. According to the SWARA-based flood susceptibility map, sub-basins 3, 1, 4, and 2 of the study area have very high potential,

sub-basin 7, 15 and 11 have high susceptibility, sub-basin 12, 5, and 9 have moderate susceptibility, sub-basins 8, 10, and 14 have low susceptibility, and sub-basins 6 and 13 have very low susceptibility toward flood occurrence. The total area of sub-basins in the high and very high class of flood is 656.72 km2, which comprises 57.24% of the total Aland Chai basin. Therefore, according to the results of the study, it is necessary to take protective measures such as watershed planning and dam construction in the sub-basins that are highly sensitive to prevent flood or reduce potential damages in case of flooding.

Keywords: Flood, Hydrogeomorphic analysis, Prioritization, GIS, SWARA, Aland Chai Basin

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