Research Paper

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Zoning of the Sensitivity of the Sub-basins of Nekarood Basin to Flooding, Neka-Mazandaran

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1-Introduction

Floods, as a natural and unexpected event, have occurred frequently in recent decades. Floods are natural disasters that cause more damage to humans than other disasters such as drought and famine. A detailed examination of the natural factors that predispose the flood shows that human intervention in the cycle of nature through the destruction of vegetation, unprincipled land use, development of impervious surfaces, human interventions in the catchment, and other factors have increased the possibility of floods in different areas; and sometimes it causes many life and financial damages. To reduce the damages caused by floods and flood management, it is mandatory to assess the possibility of danger and prepare maps of possible danger zones. In recent decades, many destructive floods have occurred in the Nakarod catchment. Due to this, to manage floods, reduce damages, and properly use water resources, the flood potential of the sub-basins of the Nakarod catchment has been studied.

2-Methodology

Neka River is 176 km long, and it is one of the important rivers of Mazandaran province and one of the catchments of the Caspian Sea. The catchment area of this river is about 2590 Km^2 from the heights to the Ablo site (the entrance of the plain), the height of the highest point of the basin is 3500 meters (Shah Kouh Heights), the height of the lowest point of the basin in the outlet area (Ablo station) is about 50 meters, and at the junction with the Caspian Sea is -20 meters. In terms of lithology, marl, calcareous sandstone, sandy limestone, conglomerate, and massive limestone have the largest area in the Neka basin. The basin's upstream vegetation is often pasture. The forest cover is often in the middle of the basin, and in the downstream part, its land uses are mainly agricultural and residential.

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In this research, to prepare a map of the sensitivity of the sub-basins to the flood risk of the basin, 11 influencing parameters have been used, which includes elevation, slope, distance from drainage network, drainage density, flow accumulation, rainfall, land-use, geology, stream power index, topographic wetness index and curvature of the topography. Digital elevation model (DEM) with a resolution of 10 meters, SAGA, ArcGIS, and Expert Choice were used to prepare the above parameters. The layers were weighted using the Analytical Hierarchy Process (AHP) and based on the opinion of experts eventually by using the weighted linear combination method in ArcGIS software, the standardized layers were multiplied by the corresponding weight, and then the results of all the variables were added and accumulated together, and the final sensitivity map was divided into five classes.

3-Results and Discussion

To reduce the damages caused by floods and flood management, it is mandatory to assess the possibility of danger and prepare maps of possible danger zones. Because of the multiple floods in the past years, the Neka basin needs to be investigated and examined for the high-risk areas related to this natural hazard. In this research, by using the factors affecting the flood risk, the flood proneness capacity of the Neka river sub-basins (13 sub-basins) was zoned.

After fuzzification and integration of the layers, the final zoning map of the Neka catchment was prepared based on the weighted linear combination in 4 classes. Then, to determine the sensitivity of sub-basins to flooding in the catchment, the amounts of the lowest, the highest, and the average of the very-high class in each of the basins were calculated separately. According to the data of the area, the different sensitivities of sub-basins to flooding, basins 11, 12, and 13, have the highest sensitivity to flooding.

Sub-basin No. 13, with an area of 366.98 Km^2 and an average of 46.46, has the highest sensitivity to flooding risk in the entire basin. The effective factors in this sub-basin are an elevation with an average of 0.773, stream density (drainage channel density) with an average of 0.627, and geology with an average of 0.351.

Sub-basin No. 12 with an area of 60.53 Km^2 and an average of 20.41 has the second-highest sensitivity risk rating in the entire catchment. One of the significant factors in this sub-basin is the elevation with an average of 0.639, and other effective factors are the stream density (drainage channel density) with an average of 0.631, and the factor of the slope with an average of 0.336.

Sub-basin No. 11, with an area of 156.13 Km^2, has a very high risk of flooding. The effective factors on this matter are the stream density (drainage channel density) with an

average of 0.617, elevation with an average of 0.521, and the third influential factor is rainfall of 0.444.

4- Conclusions

According to the results of the hierarchical analysis methods and studying the 11 effective parameters in the risk of flooding in this research, it indicates that flood sensitivity is different in the sub-basins of the Neka River; and according to the effective factors, in some sub-basins, the flood risk is very high and in some others, the risk of flood occurrence is very low. The results show that in this basin, about 216.34 km^2 has a very high-risk potential, and 476/86 km^2 has the possibility of high risk (approximately 36% of the basin is in the zone of very high and high risk) of flooding.

Among the effective environmental factors in flooding, the elevation and stream density (drainage channel density) were the most influential factors in the flood risk, and the other factors had less effect on the flood sensitivity of the Neka catchment.

Keywords: Flood, Analytical Hierarchy Process (AHP), Zoning of flood, Nekarood.