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Author: Ms. Javeria Muneer
Pakistan, javeriamuneer1@hotmail.com

DAM SITE SELECTION USING GIS TECHNIQUES

Abstract

Water has vital resource to support all forms of life. A dam is the cornerstone in the development and management of water resources. Dam sites must be located away from settlements for safety, be on water accumulated area, have gentle slope to avoid any dam failure and have sufficient rainfall. The study leads to site selection of dam in the Northern Areas of Pakistan including some part of Gilgit-Baltistan and Khyber Pakhtunkhwa. Landsat image of study area is acquired from www.glovis.usgs.gov. Aster DEM of 30m is acquired of the study area from gdem.ersdac.jspacesystems.or.jp and tiles are mosaic. Flow direction and flow accumulation has been computed. Slope is calculated. Snap pour points are digitized which are used along with flow accumulation to identify water shed of the study area by which main streams with water accumulation of 10 lac cells of streams from the image has been extracted. Datasets are digitized by using MODIS and Google Earth images in which land use, roads, settlements, soil type and open land are included. Annual snow cover area is also calculated for analysis. Fault lines and historical earth quakes are marked. The multi-criterion parameters for the selection of dam site are flow accumulation, slope, open land, annual snow, settlement and fault lines. Buffers are applied to Main stream 5 km, Earthquakes 10 km, Snow Cover 5 km and fault lines 20 km and converted into raster. Suitability Analysis using Analytical Hierarchy Processing (AHP) is implemented using Saaty's (1980) scale of importance with values 1 to 9 to rate the relative preferences for criteria. Flow accumulation is of equal importance given value 1, slope 2, open land 3, Snow 4, Settlement 7 and faults 9. Weighted Linear Combination Method is used to calculate weights of multi-criterion using pair wise comparison matrix for dam site selection. These averages provide estimates of the relative weights of the criteria being compared. This study aims to select site for dam using GIS techniques. Hence, consistency ratio is estimated to determine consistency of comparison, $CR_i < 0.10$ indicates a reasonable level of consistency in the pair wise comparisons. The consistency ratio value of the analysis is 0.03 which shows better consistency level in the pair wise comparison. It is also observed that analytic hierarchy process is flexible and practical tool for spatial modeling, GIS is a cost effective tool for feasible dam site selection which is free from hazardous earthquake zones, physical and environmental impacts.