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## Introduction

One of the main factors that affect hydro-ecological processes in a watershed is land use (Ali et al., 2011). In recent decades land use change has been considered as one of the major challenges (Saghafian et al., 2006) and it can be assumed that variation in watershed-scale hydrologic response is primarily due to changes in the type and distribution of land cover (Miller et al., 2002). The objective of this research is prioritization of sub-watersheds in Pol-Doab watershed based on land use changes using hydrological model (HEC-HMS), multivariate analysis (factor analysis) and RS techniques. Prioritization of sub-watersheds can be useful to perform soil and water conservation measures where they are needed and to devote the budget properly.

## Method

Pol-Doab Shazand Watershed (Figure 1) with 1740 km<sup>2</sup> area located in Iran. In this research the area was divided into 24 sub-watersheds (SW) based on hydrographic network and topography. In order to survey land use changes, Landsat MSS and IRS-1C LISS-III images belong to 9<sup>th</sup> August 1973 and 16<sup>th</sup> August 2008 were used. Then based on the land use data and the hydrologic soil groups, CN values for each sub-watershed were generated using GIS software. HEC-HMS model was applied to simulate flood discharge with different return periods using some recorded events (Table 1). In order to determine the best design flood discharge with desired return period and finally to prioritize sub-watersheds based on design flood discharge changes, factor analysis technique was applied. Factor analysis technique was used to reduce multiple variables to a less number of underlying factors that are measured by the variables. Factors are formed by grouping the variables that have a correlation with each other (Ocal et al., 2007). In this study, the variables are discharges with different return periods.

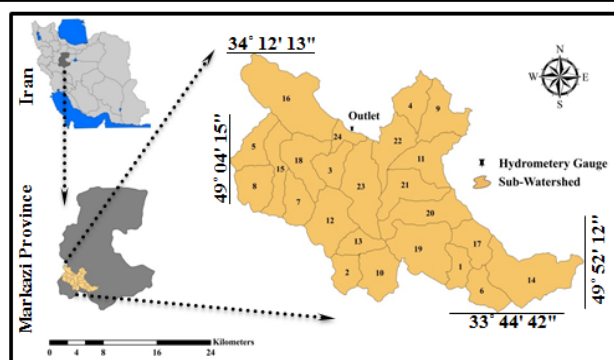


Figure 1. The location of study area in Iran

Table 1. Historical rainstorm events

Date	Antecedent Moisture Condition (AMC)	Observed peak (m <sup>3</sup> /s)	Event ID
06 <sup>th</sup> February 2002	II	12.75	Calibration
02 <sup>th</sup> April 2002	II	18	Calibration
04 <sup>th</sup> May 2004	II	71.5	Calibration
31 <sup>th</sup> March 2004	II	49.7	Validation
24 <sup>th</sup> April 2004	II	63.2	Validation

## Results

The results showed that curve numbers (in AMCII) in sub-watersheds vary from CN=59 (at SW9) to CN=74 (at SW3) in 1973 and from CN=71 (at SW13) to CN=80 (at SW3 & SW8) in 2008. To study the land use changes impact, design flood discharges with different return periods (2, 5, 10, 25, 50, 100, 200, 500 and 1000 years) were used. Then difference between these discharges (belong to 1973 and 2008) were calculated.

The results of factor analysis revealed that 25-yr design flood discharge was chosen as the best variable to explain the changes in discharges since it has the highest variance compared with other design flood discharges.

The chosen factor itself can explain 92.02% of variance of variables. Finally Pol-Doab Shazand sub-watersheds were classified based on the priorities and the results presented in Table 2.

Table 2. Prioritization of sub-watersheds based on Q25- yr

priority	Variation (%)	SW	Priority	Variation (%)	SW	priority	Variation (%)	SW
1	111.54	(22)	9	47.51	(23)	17	31.98	(16)
2	98.14	(11)	10	42.00	(6)	18	31.13	(19)
3	97.22	(4)	11	41.95	(18)	19	31.11	(1)
4	82.61	(9)	12	41.52	(15)	20	26.92	(20)
5	59.14	(7)	13	41.13	(17)	21	21.86	(5)
6	56.65	(8)	14	38.71	(21)	22	20.66	(3)
7	54.42	(14)	15	37.29	(24)	23	06.71	(13)
8	54.17	(10)	16	35.18	(12)	24	06.38	(2)

## Discussion

Evaluation of effective environmental parameters on flood and land use indicates that human intervention in the water cycle act through the destruction of vegetation, unsuitable land use and development of impervious surfaces. The results of this research showed that during the study time period, 6.6% rangelands area converted to rainfed arable lands with low fertility. Almost significant part of this conversion has happened on steep slopes and it has potential to affect runoff increase in the watershed. The research also highlights tangible effect of vegetation change on hydrological response in some sub-watersheds e.g., in SW22 peak flow with 25-yr return period has been increased by 111.5%, while flow with the same return period in SW2 increased by 6.4%. Precise analysis of land use changes in sub-watersheds with high increase in peak flows (i.e., SW22, SW11, SW4 and SW9) indicates that these sub-watersheds experienced high urbanization rate. The results also revealed that effect of vegetation cover for events with low return period and high frequency is more tangible.

## References

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