Multivariate analysis and classification for modeling variables affecting the alluvial fan geometry of north BAGHERAN mountain range (south of Birjand)

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Extended abstract
1- Introduction
Extensive studies of geology and geomorphology in arid and semi-arid deserts of Iran have been done so far, but in between the alluvial fan as one of geomorphologic forms has been ignored or less has been studied specifically. In this paper, alluvial fan geometry of BAGHERAN Mountains in the south of BIRJAND city has been studied. In fact the main purpose of this paper is studying the relationship between the morphology of alluvial fans and physiographic characteristics of their composing basins, and comparing these landforms to analyze their geomorphologic evolution.

The study area, Birjand plain, is located between 32°42′N to 33°8′N and 58°41′E to 59°44′E.

This area has composed of meridian topographic elongated and has caused two separate adjacent flat plains with the same trend. The northern one is called Birjand plain drainage basin which is about 3425 square kilometers. Plain covers about 980 square kilometers of this area and the rest are covered by heights.

2- Methodology
Initially, 17 alluvial fans have been identified and mapped. Measurements to determine the parameters of the alluvial fan geometry have been done separately. In the next phase these measurements have been used to evaluate and compare the geometric relationships of this land forms. For this purpose, various models and special software are applied for multivariate analysis such as: factor analysis and cluster analysis and finally fitted regression curves.

3- Discussion
According to calculated Eigen values, factor analysis resulted in determining 4 main factors affecting the alluvial fans geometry. The first factor covers 57% of
variables’ variances; the second factor covers 15.9% of variables’ variances; the third factor covers 9.8% of variables’ variances and the forth factor covers 6.9% of variables’ variance. These 4 factors cover 89.7% of all variables’ variances in total that shows suitability of variables chosen for factor analysis. Correlation matrix between research variables and factors affecting alluvial fans geometry shows that the most important variable affecting the area’s alluvial fans geometry is the area of each alluvial fan’s drainage basin which is about 0.88 correlated with the first chosen factor. Hence, the area of drainage basin of each alluvial fan can be considered as the most important variable affecting alluvial fans geometry.

4- Conclusion

Based on results the most important variable which is affecting the region alluvial fan is drainage basin area upstream of each alluvial fan. This factor shows correlation of about 88 percent with the first factor obtained from factor analysis. Alluvial fans have been classified into five regional groups with the help of cluster analysis. Accordingly, in the first group, 10 alluvial fans are located with a 70.35 percent similarity, three in the second group with a 76.62 percent similarity, two in the third group with a 73.86 percent similarity. Fourth and fifth groups each contain one alluvial fan with a similar rate, respectively 60.45 and 12.76 percent. Various fitting methods between the two main variables affecting the alluvial fan geometric (area of drainage basin and alluvial fan area in the region), according to the coefficient of determination ($R^2$) shows that the exponential model better estimates the relationship between these two variables in the region. According to the studies conducted in this paper, the derived model would be:

$$A_f = 0.1078(A_d)^{1.06}$$

In this model $A_f$ is area of the alluvial fan, $A_d$ is area of drainage basin and $x$ is a fixed coefficient that is obtained empirically. Coefficient $x$ that differs from 0.1 to 2.2 according to geographical conditions of each area, for the study area and its alluvial fans is equal to 0.1078.

**Keywords:** classification and multivariate analysis, modeling, alluvial fan, Bagheran Mountain (Birjand city)

**References**


Denny, C.S., (1965). Alluvial fans in the Death Valley Region, California and
M.S.c, Tarbiyat Modares University, 188pp.
Saghafi, M., (2011). Studies geomorphology bassins slopes northern mountain Bagheran, studies plan research P.N university, 284 PP.