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ORIGINAL ARTICLE

Landform Classification and its Comparison with Mapping of Soil in Zagros Mountain

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ABSTRACT
Information on landforms are based on digital elevation models (DEM) and field research. The information on other landscape components was taken from existing resources (pedological map, forestry typological map). Based on algorithms of Wood (1996) classified landform. Algorithms were calibrated in areas with different types of terrain.Preliminary results show that the evaluated methods can be helpful in the predictive mapping of soils and land use types. The correlations between classified landforms and soil types showed that the Canyons, Deeply Incised Streams have most of the area in anti-soil and ansepty-soil. But plains small is lowest of the area in ansepty-soil and anti-soil. The algorithms of landforms classification proposed by Wood seem to be the most applicable methods from the pedological. The Wood's approach uses a multi-scale approach by fitting a bivariate quadratic polynomial to a given window size using least squares. The future development of classification methods can bring new possibilities for predictive soil mapping.
Keywords: *landform classification, soil characteristics, digital elevation model.*

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INTRODUCTION

landforms are defined as specific geomorphic features on the earth`s surface, ranging from large-scale features such as plains and mountain ranges to minor features such as individual hills and valleys. A topographic position such as a hilltop, flat plain, valley, etc., is intuitively important for physical processes acting on the landscape. Natural habitats of plants, erosion potential and solar radiation are directly related to landform patterns and the relative position with a landform [1].

In the past, geomorphometric properties have been measured by calculating the geometry of the landscape manually that can be time consuming [2-4]. In the 1960s and early 1970s, the generally availability of computers made possible more complex, statistically-based methods to identify landscape features [5-6]. Recently, advances in computer technology, new spatial analytical methods and the increasing availability of digital elevation data have re-oriented geomorphometry [7]] and promoted the development of computer algorithms for calculating geomorphometric properties of the Earth`s surface. Several papers document applicability of landform classification and relationship with mapping of soil especially in steep land areas [8]. There are new opportunities in this field, resulting from existence of relatively precise global and regional digital elevation models [9]. However, the terms and methods used in different fields of science vary in detail [10-13].

The aims of in the paper is preparing landform map and relationship with mapping soil in the Zagros mountains, Iran.

MATERIALS AND METHODS

Several digital elevation models were used during research. The global products include SRTM DEM and ASTER GDEM (30 m resolution); at regional scale a DEM with resolution 15 m. The DEM downloaded from http://usgs.gov was used.

ASTER Global DEM (ASTER GDEM) is a product of METI and NASA that were downloaded using of NASA. The missing values and values for pixels with apparently wrong elevation (e.g. pixels with elevation below sea level) were interpolated from surrounding pixels, using regularized spline with tension [14].

Methods of classification

Estimation of topographic position index (TPI) [15] at different scales can classify the landscape into both slope position (i.e. ridge top, valley bottom, mid-slope, etc.) and a landform category (i.e. steep narrow valleys, gentle valleys, plains, open slopes, etc.). This method was further developed by Weiss [16] and Jenness [17]. Classification of landforms is based on analyses of TPI index and slope at two different scales; therefore it requires 2 values of radius size. Topographic position index maps with radius size between 50 and 1000 m with 50 m step were computed and used for landform classifications [14].

The magnitude of the TPI and the area's slope were used to classify the slope position according to Weiss [18], based on the TPI score standard deviations and slope values. Slope position classes were valley, lower slope, flat slope, middle slope, upper slope and ridge. Ten landform classes (deep streams, shallow valleys and mid-slope drainage pathways, upland drainage areas, U-shaped valleys, plains, open slopes, upper slopes and mesas, local ridges and hills in large valleys, mid-slope of ridges and small hills in plains, and high ridges) were generated by comparing standardized TPI values (standardized TPI = [TPI - TPI mean]/[TPI standard deviation]) for TPI values at 500 m (TPI500), 2 km (TPI2,000) and slope [19].

Study Area

The study area is Zagros Mountain in Iran. This area is located in 34o 25′ 12′′ to 34o 41′ 24′′- N and 47o 34′ ′′to 47o 55′ 48′′ E with an area of 714.48 Km2 (Fig.1).The highest elevation in this area is 3249 meters that is located in the South of the basin and lowest point is 1294 meters that located in the north of basin.

Dataset for cases are originating from 1/25000 topographical elevation contours of 90 m vertical interval. Case study is in Zagros mountains, Iran. Land use and soil map of the study area is showed in Fig.2 and Fig.3.

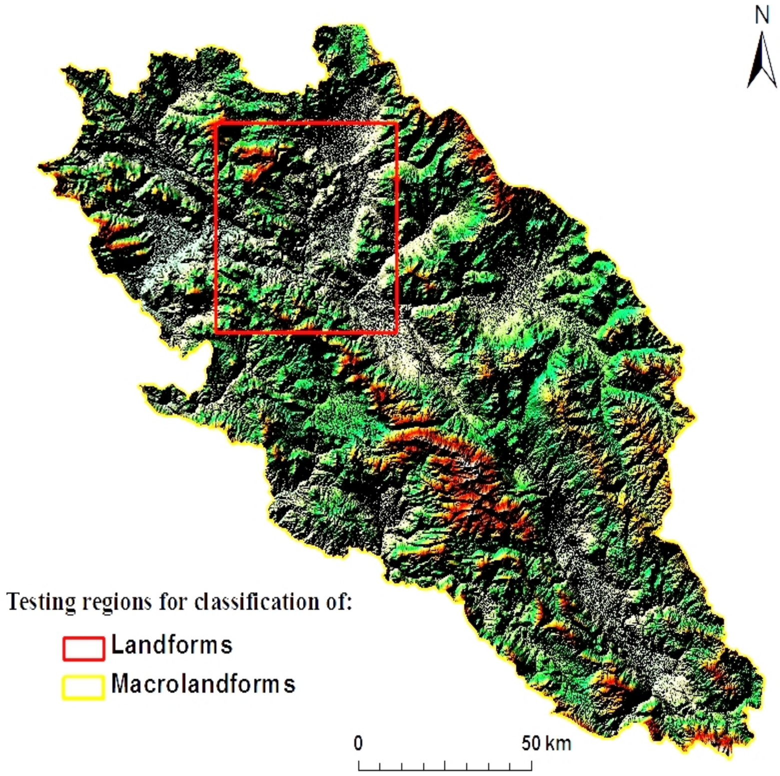

Figure 1: Location map of case study

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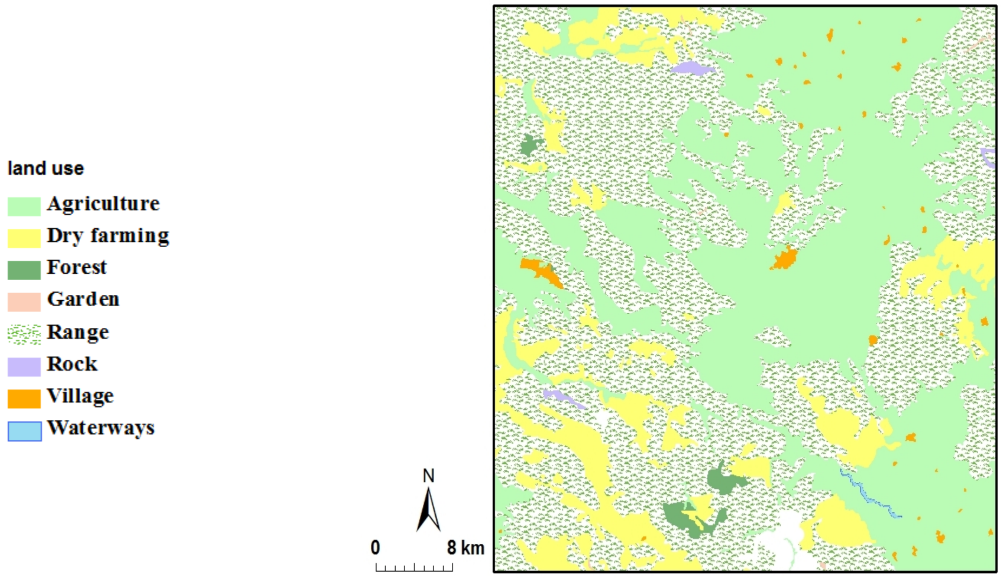

Fig. 2. Land use map of the study area

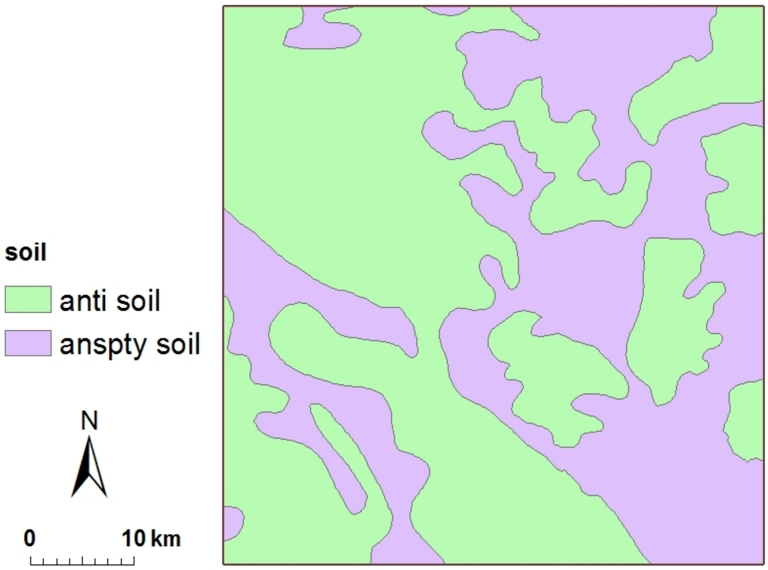

Fig. 3. Soil map of the study area

RESULTS

Different values of input parameters (slope, curvature, plan, profile, elevation) used for preparing landform classification. According to Fig. 4, landforms classified in ten classes.

The Fig. 5 shows results with 8 landform classes.

In the Fig. 6 , Fig.7 and Fig. 8 landform map and soil map were overlay.

Soil of the study area consist of two type: anti-soil and ansepti-soil that show in Fig. 9 and Fig.10.

DISCUSSION

Maps of soil types can be improved using more detailed information on environment. The map of landforms, based on DEM, can significantly help in predictive mapping of soil and forest types. The presented paper is the introductory study of future research and application of landform classification in soil mapping. The future research will concern on detailed specification of input parameters of selected methods suitable for predictive mapping of specific soil.

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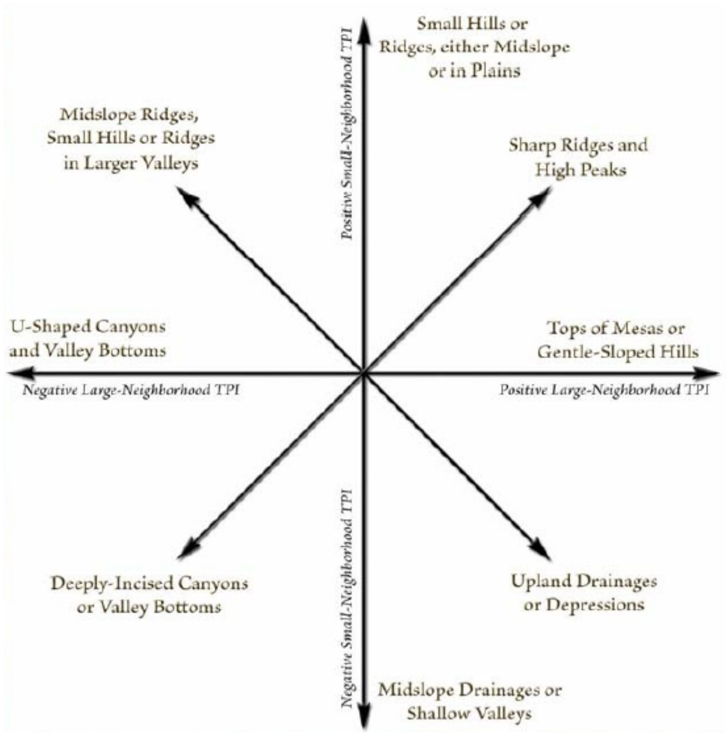

Fig. 4 Classes of landforms (Jenness, 2006)

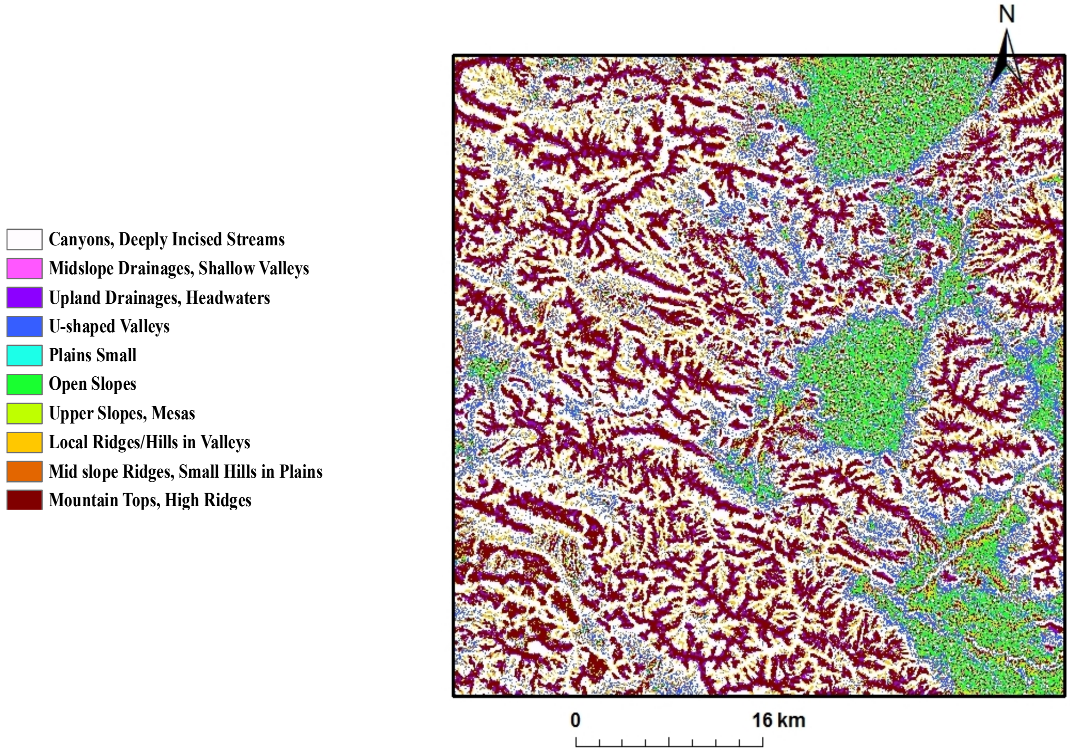

Fig.5. landform map in the study area

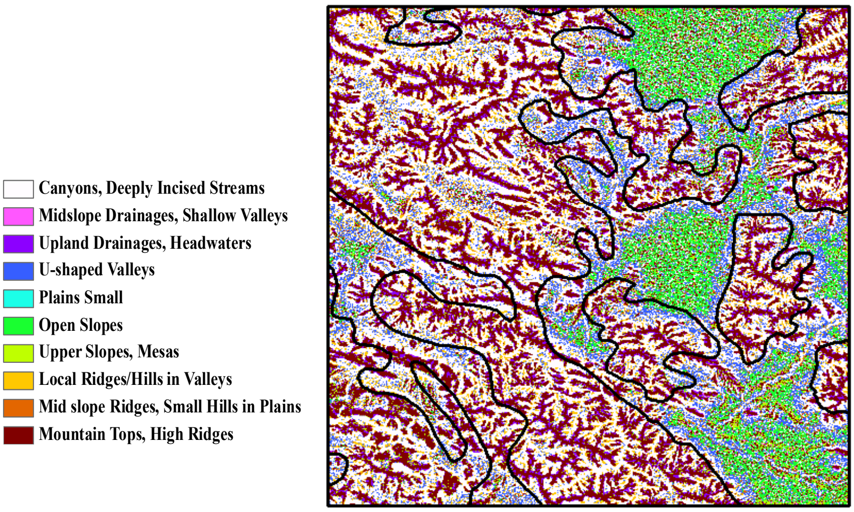

Fig. 6 landform map and soil map in the study area

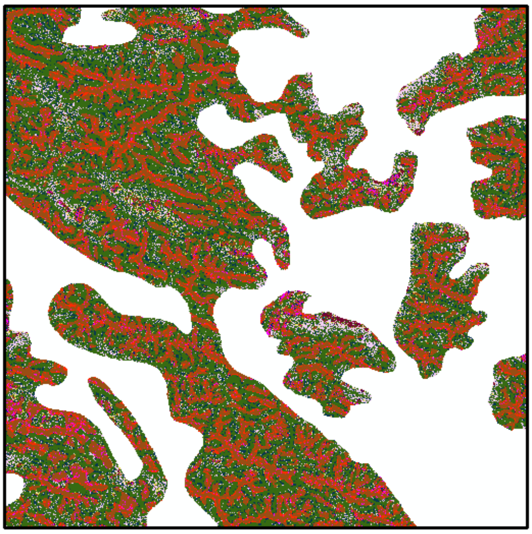

Fig.7. Anti-soil and landform in the study area

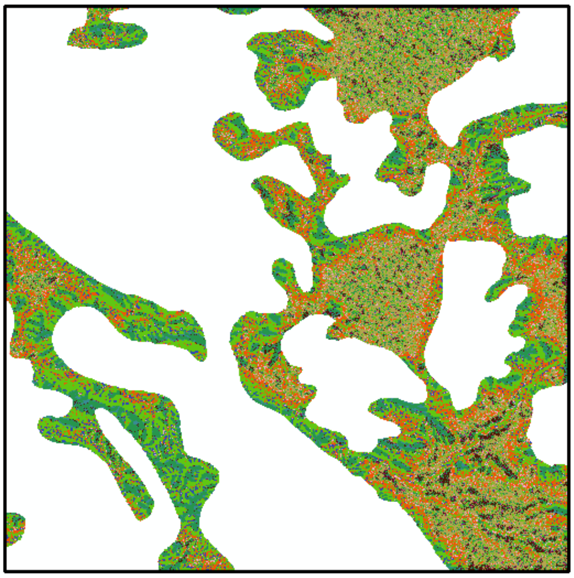

Fig.8. Ansepty-soil and landform in the study area

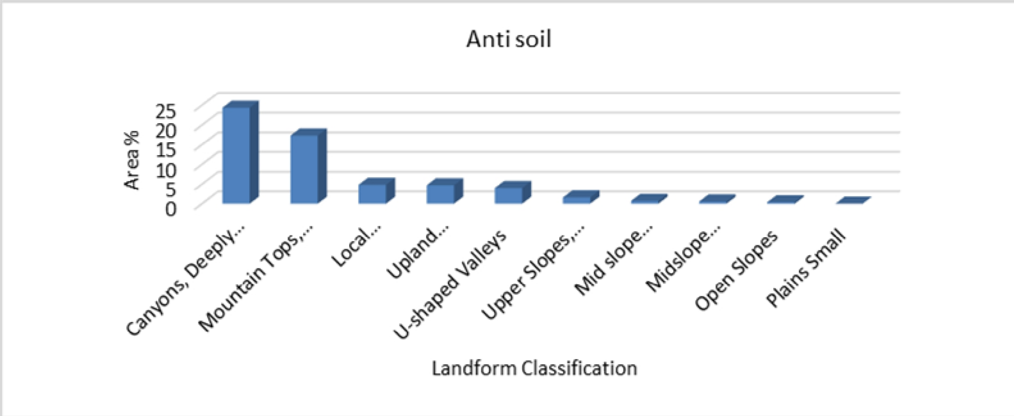

Fig.9. Anti-soil and classes of landform in the study area

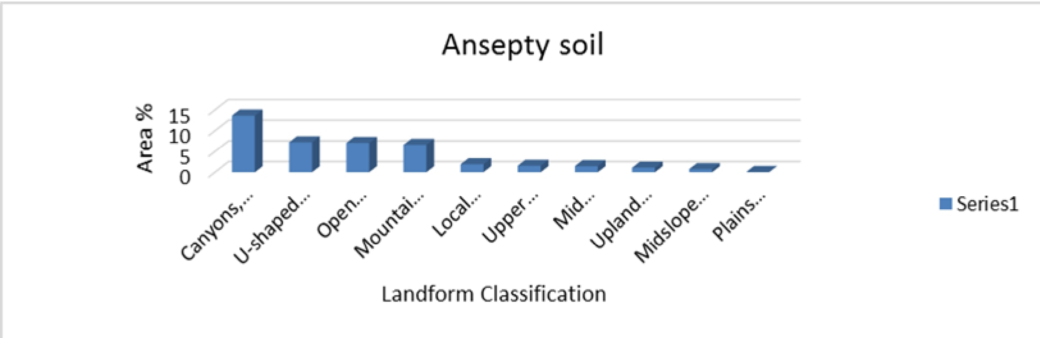

Fig.10. Ansepty-soil and classes of landform in the study area

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