

## Spatial Prioritizing of Pastures Using Spatial Multi Criteria Evaluation (Case study: Yoosef Abad watershed – Iran)

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**Abstract.** Pastures are national resources for each country. Appropriate planning regarding proper distribution of domestic animals leads to correct usage of such resources and destructing plant species in pastures. Prioritizing of pastures in watershed is one of main actions in planning for optimal use of pastures. In this research, spatial prioritizing of pastures in Yoosef Abad region is specified using Spatial Multi Criteria Evaluation (SMCE). The input was a number of raster maps of a certain area (range capacity, range trend, range production), spatial factors (proximity to village, to spring, to well, to river, to Qanat) and spatial limitations (slope, geomorphology, roads, river, height classes), and a criteria tree that contains the way criteria was grouped and standardized. All factors were taken weight by Fuzzy method between 0 and 1. Then they were incorporated and composite index map was developed. Finally the composite index maps was sliced and classified where pastures in research area were prioritized in terms of priority and the best location for grazing in the region was specified.

**Keywords:** Spatial prioritizing, Spatial Multi Criteria Evaluation, pasture, Yoosef Abad watershed.

### 1. Introduction

Pastures are considered as natural resources which are not used appropriately in some countries because of lack of suitable planning regarding proper distribution of domestic animals. Its consequence is destroying plant species in over grazing regions. Spatial multi criteria evaluation (SMCE) method is a useful tool for identification and comparison of solutions for locating based on combining multiple factors, which can be shown by information layers in minimum time. SMCE is a method for specifying and providing analogical solutions in local problems based on combination of multiple factors which is shown finally by map [1]. This has been widely applied in various fields such as financial management, international relations, political development, participation discussion and natural resource management [2, 3]. Different factors and various spatial limitations should be involved so as to accurate and correct planning in pastures, and it cannot be accomplished via traditional skills because of increased complexity of planning.

Application of new methods in GIS and decision making for quick planning in pastures with high amount of spatial data shows necessity of this study. On the other hand, finding such regions and their classification in terms of grazing priority considering various spatial factors and limitations using new methods and techniques is inevitable, which is considered in this study. Thus the main objective for the work is pastures classification in Yoosef Abad watershed in priority form using GIS method and spatial multi criteria evaluation model.

### 2. Material and methods

#### 2.1. Research Area

Yoosef Abad watershed is located between 57° 12' 15" and 58° 57' 12" eastern longitude and 34° 17' 35" and 34° 25' 30" northern latitude (fig. 1). Its area is 142.7 km<sup>2</sup>. The average rainfall of study area is 119.12 mm. Its average annual temperature is 18.9 C and its climate is semi arid.

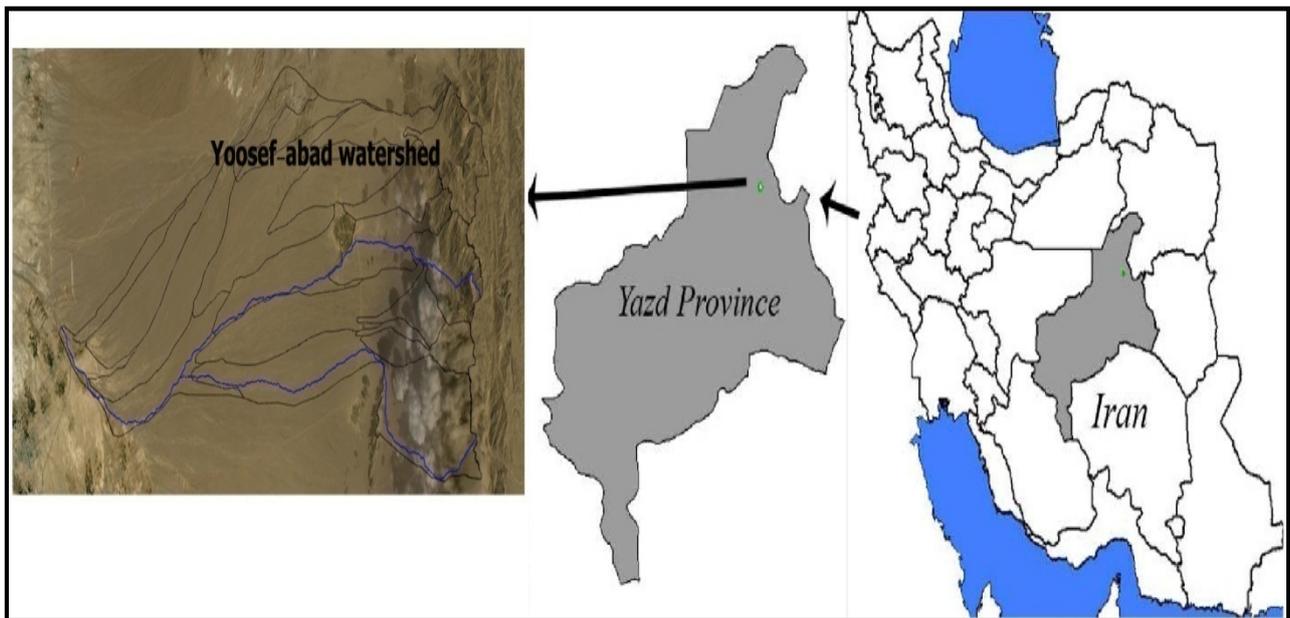


Fig. 1: Location of Yoosef Abad watershed on Yazd province and Iran map.

## 2.2. Research method

Firstly required data including maps and information tables were gathered and prepared. Slope map was developed using topographic map and digital elevation model (DEM). Geomorphology faces were distinguished based on geological maps and ETM+ satellite images as well as by field observation. Then geomorphologic map was developed for region. Four factor method was used for specifying plant types and balance method was used for accurate specification of range trend. Then non-capable locations for grazing and in fact, limiting factors were determined and their raster maps were developed. Thus, slope over 100%, mountain unit and agricultural lands, 10m buffer of road, 15m buffer of river and 100m buffer of village were considered as limiting factors. Spatial factor maps including range capacity or monthly domestic animal unit, range trend and were constructed as surface maps. Buffer of vector and point data were prepared. For example, the buffer map of village to 5km and buffer map of water sources including well, spring, river and aqueduct to 3km were developed. In the next step, spatial multi criteria evaluation was designed in tree model in SMCE Menu of ILWIS software (fig. 2).

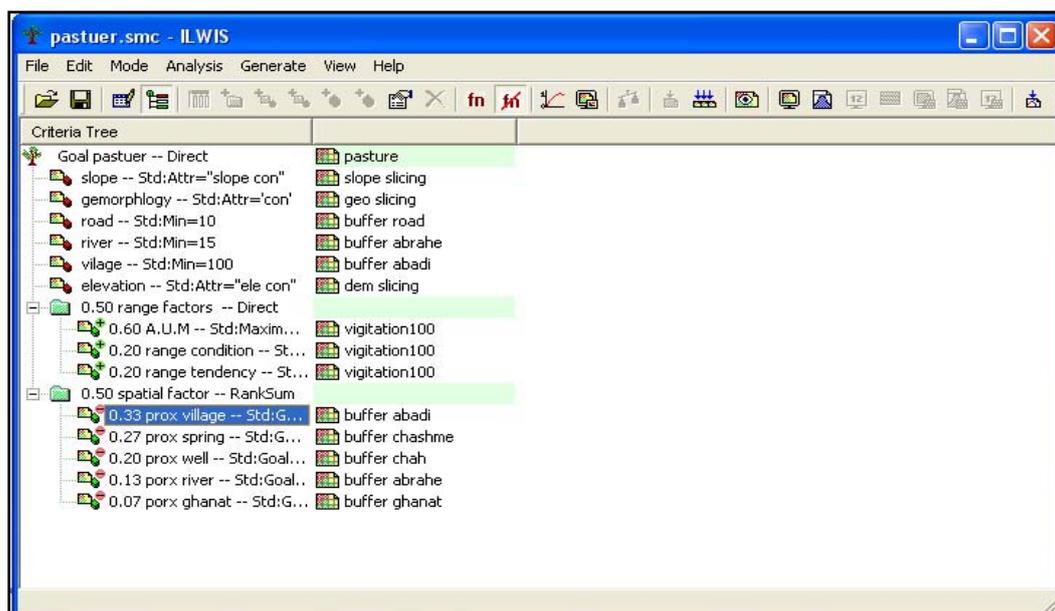


Fig. 2: Designed criteria tree model in SMCE.

Input data are various maps or attribute columns with a value domain, a class domain, or the Bool domain. The values in these input maps or columns have a meaning and express different measurement units (e.g. distance, cost, age etc.). In order to compare criteria with each other in a way that makes sense, they have to be standardized, i.e. transformed to the same unit. In this system, all characteristics of maps are standardized to values between 0 and 1. In order to standardize input maps in SMCE environment, one of standardization methods such as numerical method, Boolean method or qualitative characteristic method can be used. In this research, numerical maps standardization method is used because input maps are numeral. In this method, standardization is carried out by a linear function using minimum and maximum values. Values between minimum and maximum are between 0 and 1. Pair-wise comparison and direct weighting methods were used for weighting standardized maps. The intention for weighting (objective goal or attribute) is expressing importance of each criterion compared to other criteria. Direct and pair-wise comparison methods from analytical hierarchy process (AHP) in factor weighting were used. In hierarchical analysis, factors are compared in pair-wise form, and relative importance of factors in determining suitability of one pixel for specific kind of decisions is evaluated for decision maker, and only two criteria are compared at one time, relative importance of which is given as a continuous scale in 1 to 9. Categorization is done in a mutual square matrix. Analysis is done by software and weights are obtained from matrix with highest compatibility. One should be careful that incompatibility rate in weights should not exceed 0.1 [4]. Incompatibility rate of weighted factors in this research is 0.0377 which shows compatibility and acceptability of proposed method.

### 3. Conclusion

Following factors weighting, combined index map was developed by combining input maps. Pixel value of index map varies between 0 and 1; suitability of regions for grazing increases by going toward 1 from 0. Composite index map was shown in figure 3.

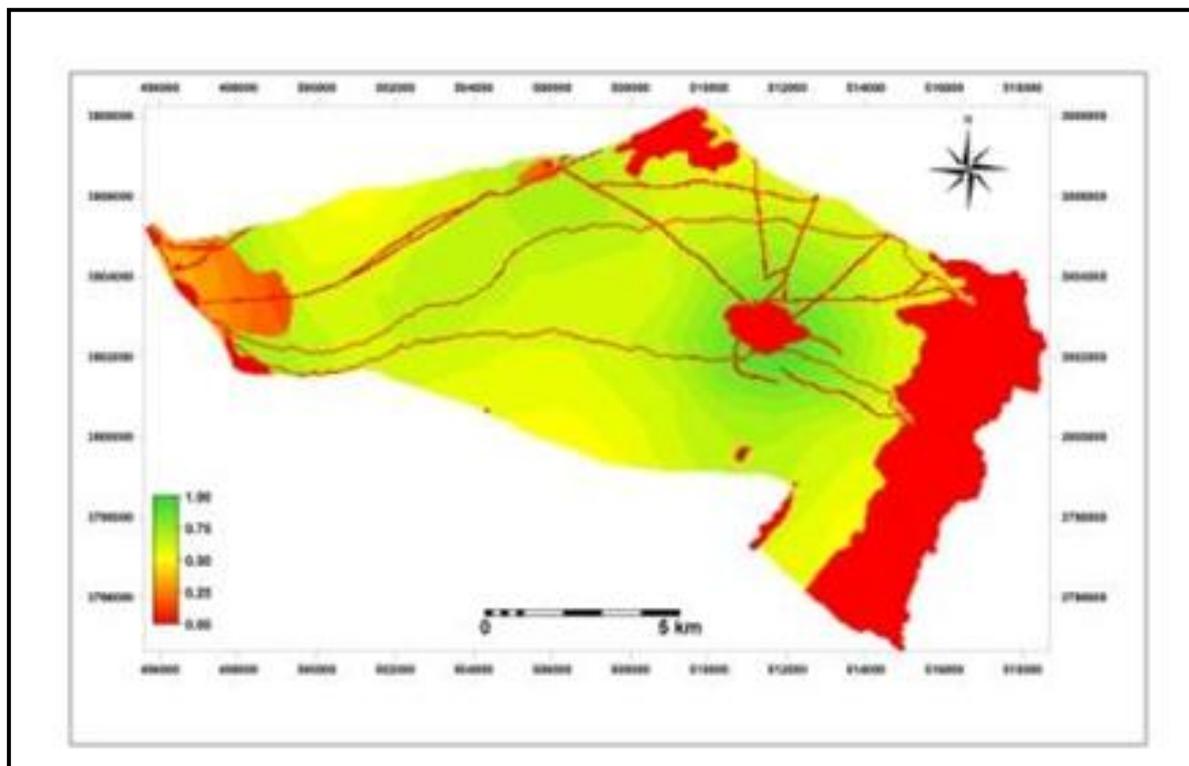


Fig. 3: Composite index map.

After categorizing regions for grazing, combined index map was categorized into four statuses: not suitable, moderate, good, very good (figure 4)

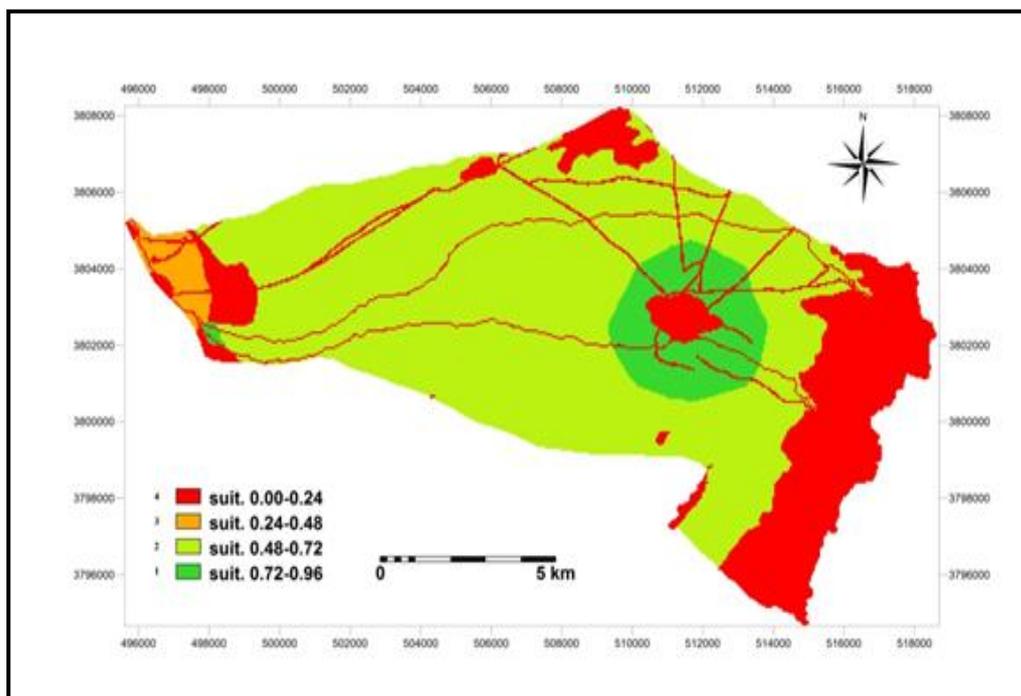


Fig. 4: map of priorities of pastures in Yoosef Abad watershed.

Considering field studies and examination of vegetation, accuracy of output map was approved which shows suitability of used factors and limitations in SMCE model for categorizing pastures in regions under study. Area for each region is given in table 1.

Table1. Area of priorities of pastures in Yoosef Abad watershed

Priority code	Priority condition	Area (ha)
1	Very good	3595.9
2	good	268.7
3	moderate	9237.5
4	Non suitable	1144.2

Spatial multi criteria evaluation is a useful tool for identification and categorization of capable an incapable area for grazing and can influenced in preventing over grazing. The method used in this study compared Jamali' s research [5] which areas with high grazing rates were identified, is more practical for the planning because it can be avoided over grazing in pastures.

#### 4. References

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