# Land systems planning for Sustainable Ecotourism (case study: Kerman - Iran)

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*Abstract:* Land system units can contribute to sustainable solutions by an integrated analysis of land availability and the assessment of the tradeoffs associated with any activity Including Ecotourism and land use intensification. Land systems should be designed so that are adapted to the local context and framed within the global socio-ecological system. Tourism activities are one of the human activities that can generally create various negative impacts on the surrounding environment. Ecotourism is a new concept in the tourism industry. Cultural and natural potential of arid lands for ecotourism is well established. The study is based on data related to environmental and natural features of the land (land system) and ecotourism suitability data. Land data were a set of criteria and indicators including physiography, geology (lithology), pedology and vegetation cover. Based on this study, 29 land system units were identified in the area. Finally, according to the characteristics of each unit of the land system, the priorities of the units were evaluated for the suitability of ecotourism. Land system integrated approach may have many practical applications in landscape management, monitoring and planning for the development of tourism facilities and ecotourism resource utilization.

*Key-Words:* Land system, Ecotourism, environmental features, integrated approach, pedology, homogeneous units

## 1 Introduction

Tourism is a very complex activity and therefore tools are needed to design this activity [2]. Tourism activities generally can create various negative impacts on the surrounding environment. Increased human interference in ecologically fragile areas can cause irreversible change in the existing ecological processes [8]. Ecotourism is considered as the synonyms for nature based tourism, adventure tourism, wildlife tourism, culture tourism, food tourism and so on [4]. Hence, establishing a set of homogeneous units with indicators and criteria is necessary for ecotourism management [5].

The present-day characteristic of any land system unit is the reflection of anthropogenic transformation in natural structures (physiographic, climatology, vegetation cover, geology and pedology) [6]. Both empirical and theoretical approaches have been developed to identify and understand the role of drivers or mechanisms responsible for the observed patterns and changes [1]. In order to understand better the linkages between geographical, demographic and ecological processes, increased attention has been paid to the study and analysis of various landscapes attributes [7].

The purpose of the survey is to describe the natural environments based on land system units within an arid zone. The information of the obtained units will be used to evaluate and Planning ecotourism in arid environments.

## 2 Material and methods

The study area is focused on the landscape of part of Kerman province in the center of Iran as a typical cold arid landscape, which covers an area of 10735 ha (Figure 1). The study area was located around Kerman city and its boundary is in coordinate's 57°.20′.4″ to 57°.27′.4″ eastern longitudes and 29°.45′.24″ to 29°.55′.17″northern latitudes. At Kerman, the average annual rainfall is 139.9 mm. Records of average daily temperatures for Kerman have shown 15.5 ° c.

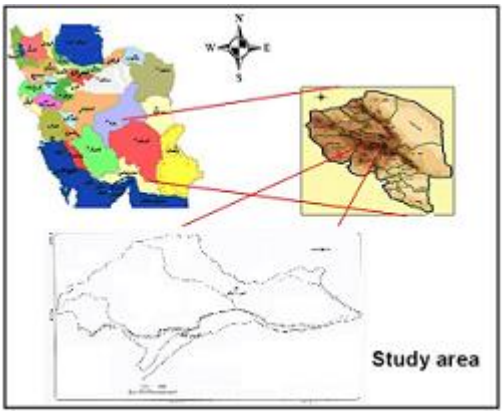

Fig.1. Location of the study area.

In order to analyses the concept of tourism within the ecosystem, the primary data of the land use is derived from the satellite image Interpretation. The thematic maps including topographic, geology, pedology, climatology, geomorphology and vegetation cover are created and edited at the scale of 1:50,000. Therefore, the area of the survey described by discussing each feature of the natural environment (land system), and by considering the results of man activity of the area. The combination of these data (natural and economic components) and their close interaction gives birth to spatially distinct territorial systems in a dynamic equilibrium (land system).

Physical environment and socio-economic parameters for each Land system unit were the main agents to produce land suitability map for ecotourism.

# 3 Results

## 3.1 Land units

### 3.1.1 Slope

Slope is the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. The study area was studied in four slope categories. Gentle and low slopes are related to landforms of river terrace and plain and steep slopes belong to mountainous areas (Figure 2).

### 3.1.2 Hypsometry

Basin hypsometry is usually based on the percentage hypsometric curve (area-altitude curve) which relates the horizontal cross- sectional area of a drainage basin to its relative elevation above the basin mouth. Basin hypsometry was applied to characterize the topographic state in study area (Figure.3).

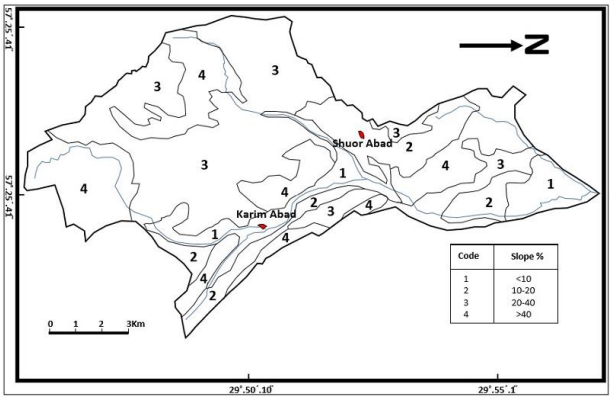

Fig.2. Slope map

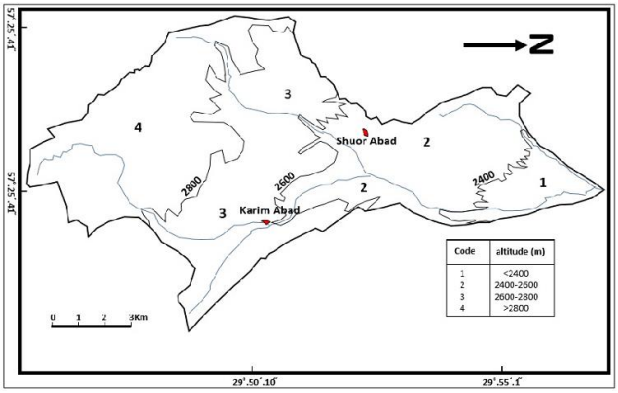

Fig.3. Hypsometric map

### 3.1.3 Geographic aspects

Aspect is the compass direction that a slope faces (Figure.4).

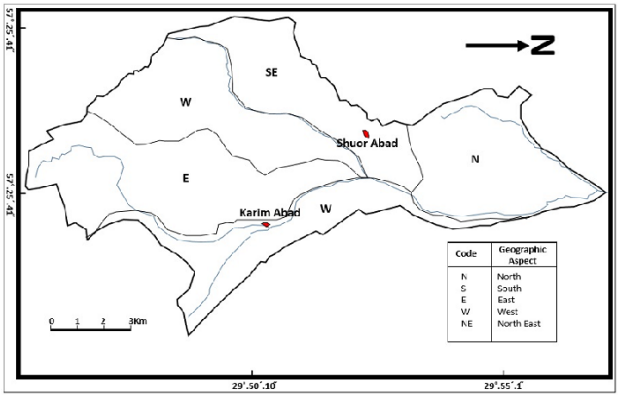

Fig.4. Geographic aspects map

### 3.1.4 Vegetation cover

Current vegetation conditions were measured and mapped (Figure.5).

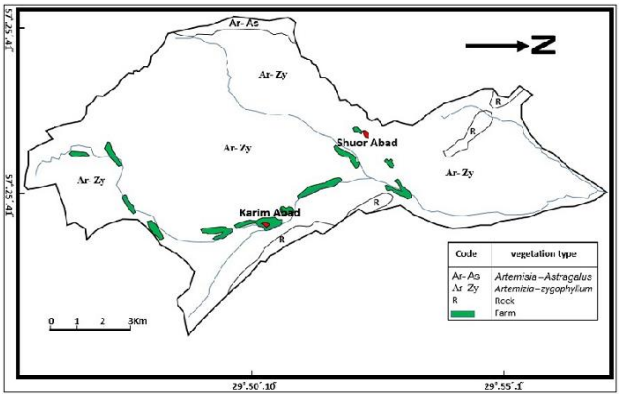


Fig.5. Vegetation cover map

### 3.1.5 Geology

Studies in the area show that all the rocks that appear and crop out are sedimentary. They are of two types: clastic and non-clastic sedimentary rocks. Clastic sedimentary rocks cover more than 99% of the studied area and are represented by different types of conglomerate, sandstone, siltstone and claystone (Figure.6).

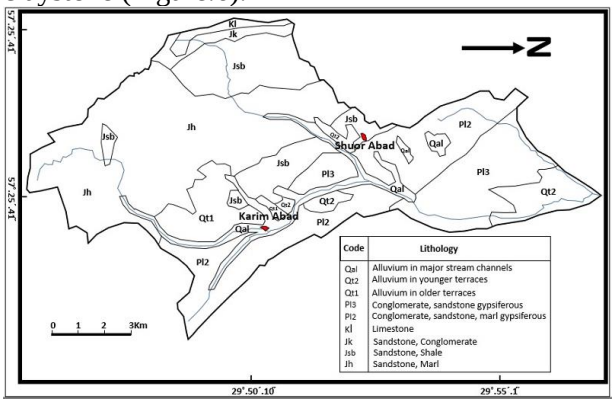


Fig.6. Vegetation cover map

### 3.1.6 Pedology

Pedology is defined as the science that studies the genesis, nature, distribution and use potentiality of soil resources. The region pedological coverage results in figure 7.

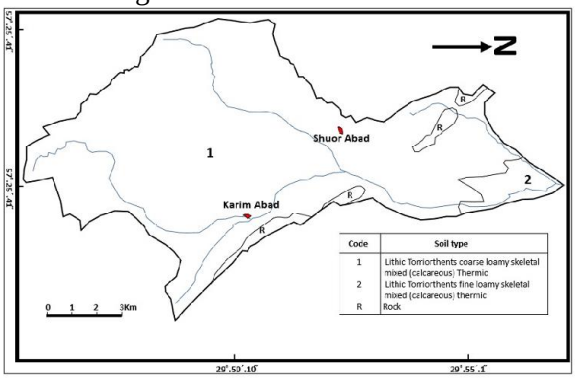


Fig.7. Vegetation cover map

## 3.2 Land use

There were 5 land uses classes determined in this study (Figure.8). The definition and characteristics of each Land use class is described as follows:

-Agricultural land, includes field crops and horticulture.

-Orchard is an agricultural land which consists of mixed orchard and orchard.

-Range land includes pasture, grass.

-Industrial area.

- Residential area is composed of towns, villages and commercial, residential houses.

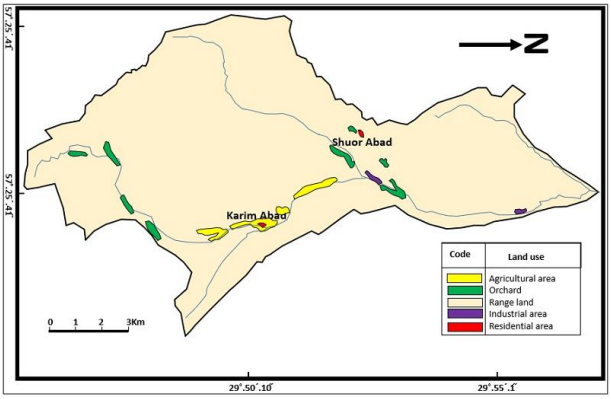


Fig.8. land use (type of activity) map

## 3.3 Land systems units

The land system concept is more popularly used in geographic studied because of its reconnaissance type of mapping based on the recurring pattern of geography, soil, vegetation, erosion hazard and land use types including geological setup. It provides an organizing ground for various environmental approaches.

Based on the above principles, in this section was prepared to generate land system map for ecotourism development focuses in land ecosystems.

The prepared map showed that there are 29 land system units in the area, which is presented in Figure 9. The characteristics of the land systems of the area are shown in Table 1.

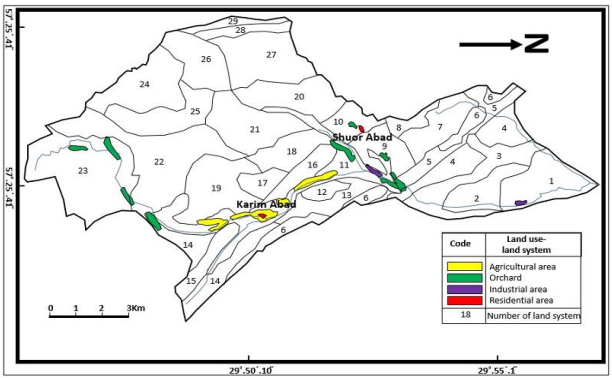


Fig.9. land systems units map

Table 1: summarized land systems in study area

| Unit code | geology | vegetation | pedology | slope | hypsometry | aspect | Land use |
|---|---|---|---|---|---|---|---|
| 1 | Qt2 | Ar-Zy | 2 | 1 | 1 | N | Range land |
| 2 | Pl3 | Ar-Zy | 1 | 2 | 2 | N | Range land |
| 3 | Pl3 | Ar-Zy | 1 | 3 | 2 | N | Range land |
| 4 | Pl3 | Ar-Zy | 1 | 4 | 2 | N | Range land |
| 5 | Pl2 | Ar-Zy | 1 | 4 | 2 | N | Range land |
| 6 | Pl2 | R | R | 4 | 2 | N | R |
| 7 | Pl2 | Ar-Zy | 1 | 2 | 2 | N | Range land |
| 8 | Pl2 | Ar-Zy | 1 | 3 | 2 | N | Range land |
| 9 | Pl2 | Ar-Zy | 1 | 2 | 2 | SE | Range land |
| 10 | Jsb | Ar-Zy | 1 | 2 | 2 | SE | Range land |
| 11 | Qal | Mix | 1 | 1 | 2 | P | Mix |
| 12 | Qt2 | Ar-Zy | 1 | 2 | 2 | W | Range land |
| 13 | Pl2 | Ar-Zy | 1 | 2 | 2 | W | Range land |
| 14 | Pl2 | Ar-Zy | 1 | 2 | 3 | W | Range land |
| 15 | Pl2 | Ar-Zy | 1 | 4 | 3 | W | Range land |
| 16 | Pl3 | Ar-Zy | 1 | 4 | 3 | E | Range land |
| 17 | Jsb | Ar-Zy | 1 | 4 | 3 | E | Range land |
| 18 | Jsb | Ar-Zy | 1 | 3 | 3 | W | Range land |
| 19 | Jsb | Ar-Zy | 1 | 3 | 3 | E | Range land |
| 20 | Jh | Ar-Zy | 1 | 3 | 3 | SE | Range land |
| 21 | Jh | Ar-Zy | 1 | 3 | 3 | W | Range land |
| 22 | Jh | Ar-Zy | 1 | 3 | 4 | E | Range land |
| 23 | Jh | Ar-Zy | 1 | 4 | 4 | E | Range land |
| 24 | Jh | Ar-Zy | 1 | 3 | 4 | W | Range land |
| 25 | Jh | Ar-Zy | 1 | 4 | 4 | W | Range land |
| 26 | Jsb | Ar-Zy | 1 | 4 | 4 | W | Range land |
| 27 | Jsb | Ar-Zy | 1 | 3 | 3 | SE | Range land |
| 28 | Jk | Ar-Zy | 1 | 3 | 4 | SE | Range land |
| 29 | Jl | Ar-As | 1 | 3 | 4 | SE | Range land |

### 3.4 Land suitability for Ecotourism

This study was organized upon the criteria: climate, land system characteristics (In order of priority: lithology, vegetation, soil science, slope, direction and altitude) and Land use.

The suitability map for ecotourism was produced using above agents. The degree of suitability of each land system unit classified as suitable (S1), moderately suitable (S2), marginally suitable (S3) and not suitable (N). Map 10 shows the land suitability for ecotourism.

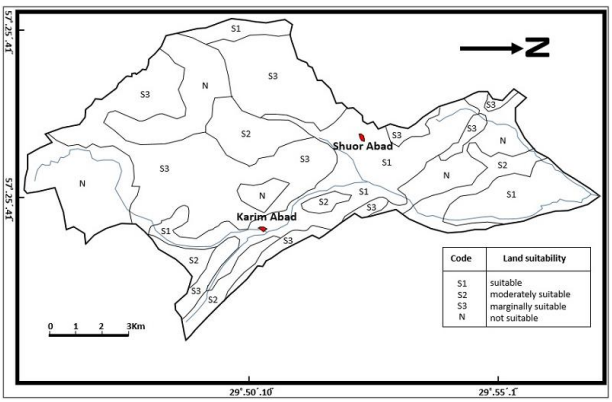


Fig.10. Land suitability map for ecotourism map

## 4 Conclusion

Realistic understanding of Land capability can only be achieved through an integrated approach to terrestrial environment.

This study was carried out to assess the land for the development of sustainable ecotourism sites.

The study was conducted from the perspective of natural resource management and sustainable ecotourism development in the future.

According to finding of this study, the 29 land systems units are identified. This study result appears practically useful for the development of tourism facilities and ecotourism resource utilization. Studies identified four land categories for ecotourism;

-Suitable lands class are lands that have all the natural factors for ecotourism no restriction. The class could serve as major attractions for ecotourism.

-The moderately suitable class includes lands that have slight restrictions on some factors such as slope and lithology.

-The majority of the marginally suitable lands are with more restrictions, which can be considered for ecotourism by incorporating appropriate infrastructures and services under the policy guidelines. Finally,

- Areas unsuitable for ecotourism include areas with erosion-sensitive lithology on steep slopes and northern geography directions with degraded pastures. Thus, it should be strictly restricted from tourism and any activities.

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