

Application of Remote Sensing for Studying Natural Recourses

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ABSTRACT

Natural resource areas are exposed to excessive use due to economic and social problems. Systematic exploitation of these resources requires patterns and models compatible to the area realities. In this way, remote sensing technique has a significant importance due to its particular properties. In present study, IRS-P6 satellite data related to July 2007 was used. After preprocessing, geometric, topographic and atmospheric corrections and after post-processing of fusion, main components analysis and applying vegetative parameters, residential region, stony outcrop and orchard lands were extracted with 91% precision by using controlled classification of land uses, irrigated agriculture, dry agriculture, bare soil, residential region. Results indicate that 35% of land surfaces are covered by outcrop, 25.7% are covered by rangeland, 12.7% are covered by agriculture and lowest percentage belongs to orchard usage class (0.5%).

Keywords: remote sensing, IRS-P6, rangeland.

INTRODUCTION

Natural resource areas are exposed to excessive use due to economic and social problems. Systematic exploitation of these resources requires patterns and models compatible to the area realities (Adamchuk *et al.*, 2004). So that sustainable usage being considered as well as compliance of ecologic models directions (Jenson *et al.*, 1996). In addition, developing trend of low yield lands of dry agriculture in forest lands and range lands demonstrates lack of correct planning for this area and the necessity of paying attention to planning and conservation of these areas according to available realities (Drysdale *et al.*, 2003).

Understanding all kinds of land surface coverage and human activities on different parts of the land, in other word, method of land use, are among basic information for different planning and are of special importance. Maps displaying such activities on different land surface are called land use maps (Lunetta, 1999). Various techniques are available for extracting land use maps, among remote sensing technique has an especial importance due to its particular properties including wide view, consistency, using difference parts of electro magnetic energy spectrum to record phenomenon properties, short reversion time, the possibility to use software and hardware, low cost, rapid survey as well as providing the ability to watch the region in the past. In present study IRS-P6 satellite data was used to study and extract various land uses and it was used as management basis in different areas of natural resources. After geometric and radiometric corrections, percentage of important land use surface in the study area was extracted.

MATERIALS AND METHODS

Study area

Study area is one of sub districts of Takestan and is located in Qazvin province surrounding.

Satellite image selection

Surveyor selection depends on study goals, area characteristics and given temporal and spatial scale. Satellite surveyors with high spatial magnification, permit coverage and land use classification with suitable and acceptable precision. In present study IRS-P6 satellite image was used. Selected image corresponds to July 2007. This date was selected because in this time dry lands lack vegetation and so their recognition is more straight forward than irrigated lands.

Satellite images pre-processing 1

Correction of topography effect

In present study, to correct topography effect and its influence on numerical values of satellite images, commands available at ENVI software called Topographic Normalization was used by using

DEM and sun height and angle available in image ultra data. Geometric correction in this software is performed by UTM model. Additionally, since area was dusty when photographing, atmospheric correction also was applied on the image.

Satellite image processing

Combining different bands to panchromatic band (fusion)

Fusion operation was performed by introduction of panchromatic band as high resolution band in ENVI

Primary components Analysis (PCA)

Primary components analysis in other reconstruction method which helps to better interpretation of satellite data by compressing information available in the image. This analysis is performed in ENVI.

Using vegetative index

NDVI and CTVI vegetation indexes are used to better detection of vegetation (5).

$$NDVI = \frac{NIR - R}{NIR + R} \quad CTVI = \frac{NDVI - 0.5}{|NDVI + 0.5| \sqrt{NDVI + 0.5}}$$

Image classification

According to the primary goal of remote sensing technology, classification of given surveyors images can be considered as most important part of satellite data interpretation (Drysdale, 2003). Classification was performed in a supervised method. So that, firstly, land use classes available in the area were recognized by performing field operation and review of pervious studies and using topographic maps. So , classes of land use and vegetation were defined and described in the region .After land use and vegetation definition , pixels really representing related land use or vegetation were used to provide training areas .

In this step , land reality map was performed by field surveying by using random classified sampling technique .After adjustment of created map to land reality the points were defined randomly on it and coordination of all the points were noted using by GPS performing field operation . Error matrice table was performed and qualitative precision and kappa coefficient which describes producer correctness and user correctness were studied.

RESULTS

Image processing

Geometric correction of satellite image was performed. Firstly panchromatic band was recorded with total RMSE of 0.46 pixel and in next step, other bands were recorded in panchromatic band with total RMSE of 0.32. According to performed studies topographic normalization is effective when variance value is fixed while maintaining the differences between minimum and maximum numeral value of pixels (Oncalves *et al.*,2007).But when performing this correction , according to change of minimum and maximum value of pixels which is normal matter , variance was not fixed and indicated large difference , thus topographic normalization was not so effective .Because topographic effect in mountainous regions has greatest effect. Since the region was covered with a halo of dust in imaging time, it had influenced or clarity and lucidity of picture.

Vegetation index

Vegetation indexes applied on images, permitted clarification of different objects in studied area. Range lands and irrigated agricultural lands were distinguishable after applying these indexes. After Tassled cap analysis by using Brightness factor of abandoned lands free of vegetation and greenness factor, differentiated the orchards thoroughly, but other object lack the clarity required for differentiation. After tasseled cap analysis, dry agricultural lands permit good differentiations.

Performing controlled classification and extraction of land use maps

After above mentioned processing, land classification was performed in a controlled fusion and land use was extracted in classes including range land, bare land stony outcrop, orchard, dry agriculture, irrigated agriculture and residential areas. According to the results, bare land class perceived highest percent and orchard class perceived lowest percent of land surface.

Kappa coefficient was used to review the accuracy of produced maps. Results indicate that total Kappa coefficient for land use map is 0.91. This coefficient shows high accuracy of provided map. Error matrices table related to land use map is given in the following (Table 1).

Table 1: Error matrices relevant to land use classification

	Range land	soil	outcrop	dry	residential	error
Range land	360	29	10	2	10	0.11
Soil	15	200	20	10	10	0.33
outcrop	3	0	290	0	0	0.01
Dry	10	4	0	250	0	0.1
residential	0	0	0	0	300	0
Error	0.053	0.053	0.055	0.076	0.044	0.033

Total kappa :0.91

DISCUSSION AND CONCLUSION

Understanding the kind and percentage of land use in basins as management parameter can help the planners of different executive sectors in managing and development (Srivastava ,2003). IRS images and surveyors were used in present study to extract various land uses in Takestan . And after recording these data with high precision, radiometric and atmospheric corrections were performed by using techniques called dark pixels decrease on stretched bands. Then multi-spectrum bands fusion and PAN band of IRS satellite to increase the information in different bands. Then, by using vegetation indexes and applying various analysis, soil, outcrop, land uses in rangeland, residential region stony outcrop and orchard lands were extracted by using controlled classifying algorithm with 91% precision. Results indicated the kind and percent of various land uses with high precision with lowest energy and time to study the effect of managerial parameters in an individual year or different years.

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