APPLICATION OF REMOTE SENSING IN THE AGRICULTURAL LAND-USE ASSESSMENT

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ABSTRACT

The calculation of Normalized Difference Vegetation Indices (NDVI) can be very useful in the generation of a land-use/land-cover classification. Calculation of a vegetative index (VI) from remotely sensed data can be used to quantify the amount of vegetation on the Earth's land surface. Numerous VI's exist, however the most commonly used VI is the NDVI. To detect the land- use and land- cover, the long term monitoring by the satellite images is useful as a big heritage. In this paper, the land-use assessment was investigated by using of the satellite images. After processing and exploitation of the data, the relation between bands was estimation and NDVI index were calculated. Then NDVI index with ground-related information was compared. Results showed that satellite images could detect the land-use changes in the local scale and vegetation index was suitable to estimate the land-use classification.

Keywords: *Satellite images, Soil, NDVI, Remote sensing, Land-use, Land-cover.*

1. INTRODUCTION

The use of sophisticated Information technologies such as Geographic Information Systems (GIS), Remote Sensing (RS) and Global Positioning Systems (GPS) offers many advantages. Rapid advances are being made in these technologies, and they are becoming available at ever more reasonable costs [1-2].

Local land-use and land-cover change can influence environmental and ecological changes and furthermore contribute to global changes [3]. All of these changes, especially the loss of agricultural land, have the potential to undermine the long-term harmony of humans and their environment and threaten the food security. There is a pressing need for knowledge about the magnitude, pattern and type of land-use and land-cover changes and for projecting future land development. The further integration of remote sensing and GIS technologies with Markov model and regression model was found to be useful for describing, analyzing, and predicting the process of land-use change. Satellite remote sensing and geographic information systems (GIS) have been widely applied in identifying and analyzing the land-use and land-cover change [4-8]. Satellite remote sensing provides multi-spectral and multi-temporal data that can be used to quantify the type, amount and location of land-use change. GIS provides a flexible environment for displaying, storing and analyzing digital data necessary for change detection. The most widely used change detection methods are post-classification comparison and multi-date composite image change detection [9]. Satellite remote sensing and GIS technology have been increasingly used in the examination of land-use and land-cover change. The calculation of Normalized Difference Vegetation Indices (NDVI) can be very useful in the generation of a land-use/land-cover classification. Calculation of a vegetative index (VI) from remotely sensed data can be used to quantify the amount of vegetation on the Earth's land surface. Numerous VI's exist, however the most commonly used VI is the NDVI. The NDVI is a ratio of the detected energy in the red and near infrared portions of the electromagnetic spectrum, since they are the most affected by the absorption of chlorophyll in green leafy vegetation. To detect the land-use and land-cover, the long term monitoring by the satellite images is useful as a big heritage [5, 8].

NDVI index is one of the best-known and also best-working indices ever which were first performed in 1974 by Rouse et al. One of the functions of this method is to detect the vegetation and plant refreshment and is capable to monitor those levels in different ages. In order to exploitation of vegetation from satellite images, existence or non - existence of satellite band are important. In other words, more correlation between satellite image bands can show more information about satellite image [10].

Chewab and Murdock [11] applied the NDVI method for gathering amount of nitrogen fertilizer. In another research, using vegetation index from satellite images, cultivated area of soybean and corn were calculated [10].

The objective of this study was to detect the different agricultural land-use of Dasht-e-Naz agri-industrial Company by satellites images and maps based on the local survey.

2. MATERIALS AND METHODS

For NDVI interpretation and understanding the accumulation and vegetation populace, first the information geographical of subjected area was studied. Satellite images of Dasht-e-Naz Agri-industrial were captured. Some samples were taken from that area and geographical region was determined. Dasht-e-Naze is about 3200 hectares and this area is located between 36˚37˝ latitude and 53˚07˝ longitude. This research was done between years 2005 and 2006. The time of information gathering from the field was obtained by using Orbitron software. Software showed that passing time of IRS satellite was in 2006/09/05 and data were gathered at this time.

Geographical positions of field were determined by using GPS and then land-use was investigated by the satellite images. The satellite images of the Dasht-e- Naz area were captured by IRS-1C, 1D satellite. The LISS-III and PAN Images of subjected are shown in Figures 1 and 2, respectively.

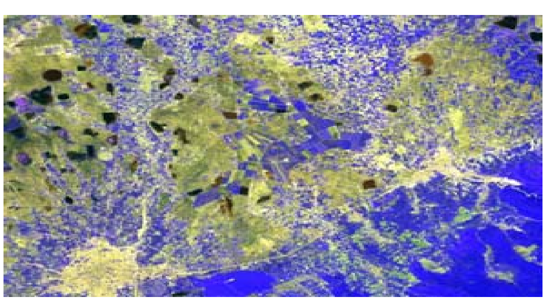

Figure 1. LISS-III image of Dasht-e-Naz

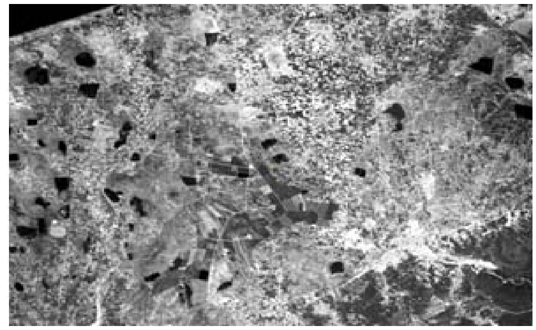

Figure 2. PAN image of Dasht-e-naz

The raw images were captured from satellite then were processed by PCI-GEOMATICA software. LISS-III images were containing visible bands and their resolutions were about 23.5 meter. For increasing the resolution of images, the PAN and LISS-III images were processed and merged by PCI-GEOMATIC software. Final processed image is shown in the Figure 3. Then the pixel values were exploited in the image in the final process by PCI-GEOMATIC software.

NDVI index was exploited through the below formula [12]:

$$NDVI = \frac{B3 - B2}{B3 + B2}$$

where B3 and B2 are spectral reflectance in the near-infrared band and reflectance in the red band, respectively. This is a less measure unit that their range usually is between -1 to 1. Water, snow, clouds or any other non-vegetated scene is represented by a negative number. Low positive numbers near zero indicate rock and bare soil, which reflect near infrared and red at the same level. Increasingly positive numbers indicate greener vegetation [12].

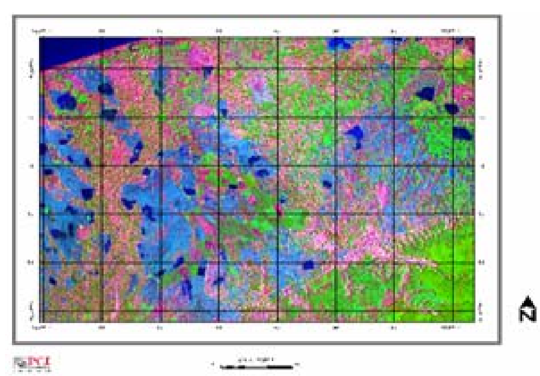

Figure 3. Merged image of Dasht-e-Naz

3. RESULTS AND DISCUSSIONS

The NDVI value of the three types of land was recorded according to the Table 1. This table shows the NDVI values of rice land, plowed land, and sappy land. According to the results, all NDVI values were negative.

Table 1. NDVI for three plots of Dasht-e-Naz field

NDVI of rice land															
-0.17	-0.16	-0.16	-0.17	-0.17	-0.17	-0.19	-0.2	-0.17	-0.18	-0.18	-0.18	-0.19	-0.19	-0.2	-0.21
-0.18	-0.16	-0.16	-0.17	-0.17	-0.17	-0.19	-0.2	-0.17	-0.17	-0.16	-0.17	-0.18	-0.19	-0.2	-0.2
-0.17	-0.17	-0.17	-0.17	-0.17	-0.18	-0.19	-0.19	-0.17	-0.16	-0.16	-0.17	-0.17	-0.17	-0.19	-0.2
-0.18	-0.18	-0.17	-0.17	-0.17	-0.18	-0.19	-0.19	-0.17	-0.16	-0.16	-0.17	-0.16	-0.18	-0.19	-0.19
NDVI of plowed field															
-0.21	-0.21	-0.2	-0.2	-0.2	-0.2	-0.18	-0.17	-0.2	-0.2	-0.18	-0.18	-0.17	-0.17	-0.17	-0.16
-0.2	-0.2	-0.2	-0.21	-0.2	-0.19	-0.19	-0.18	-0.21	-0.2	-0.19	-0.18	-0.17	-0.17	-0.16	-0.16
-0.2	-0.2	-0.21	-0.19	-0.18	-0.19	-0.18	-0.17	-0.21	-0.21	-0.19	-0.19	-0.19	-0.18	-0.18	-0.16
-0.21	-0.2	-0.19	-0.19	-0.18	-0.18	-0.17	-0.16	-0.21	-0.22	-0.19	-0.19	-0.2	-0.19	-0.18	-0.17
NDVI of sappy field															
-0.38	-0.37	-0.35	-0.36	-0.36	-0.37	-0.37	-0.35	-0.41	-0.39	-0.4	-0.37	-0.36	-0.36	-0.37	-0.38
-0.36	-0.38	-0.37	-0.35	-0.36	-0.36	-0.36	-0.34	-0.42	-0.39	-0.37	-0.34	-0.36	-0.38	-0.36	-0.36
-0.39	-0.37	-0.36	-0.35	-0.33	-0.33	-0.33	-0.36	-0.41	-0.38	-0.36	-0.36	-0.38	-0.35	-0.36	-0.36
-0.39	-0.36	-0.34	-0.33	-0.3	-0.32	-0.34	-0.36	-0.39	-0.38	-0.36	-0.38	-0.37	-0.36	-0.35	-0.36

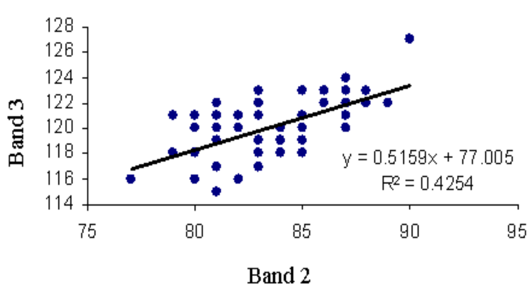

Figure4. Relationship between band 2 and 3 for rice land

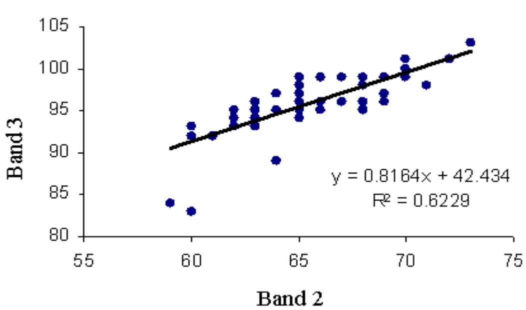

Figure 5. Relationship between band 2 and 3 for plowed land

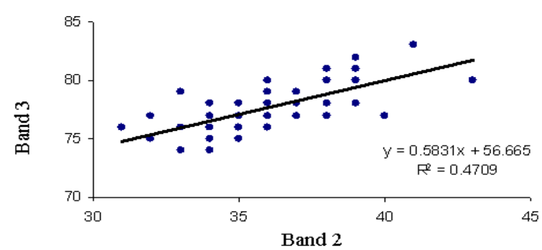

Figure 6. Relationship between band 2 and 3 for sappy land

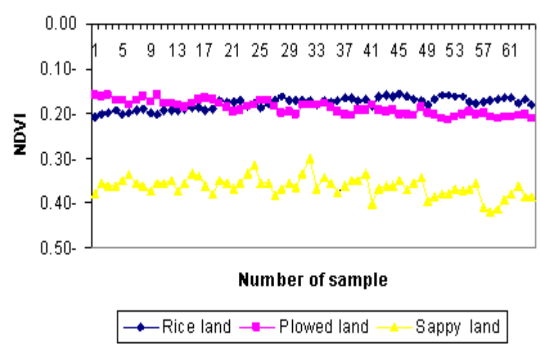

Figure 7: Relationship between the NDVI of the rice, plowed, and sappy land

Results show that for determination of land-use, after receipt the remote sensing data and satellite images, primary calculation of the statistical indices is necessary. Investigation and evaluation of earthly data for NDVI was done. Results showed that trend of pixel value variation of satellite image bands was depended on the type of the land-use and variation in the reflection of bands 2 and 3 is acknowledged this theme. The correlation between the pixel quality of bands 2 and 3 in three types of land-use is shown in figures 4 to 7.

In order to increase the accuracy of correlation between bands, number of samples from a one geographical region was calculated. This leads to the proper show of the information between bands. Figure 7 shows the NDVI of each type of the land-use via the number of samples. Based on the results, NDVI index about - 0.2 showed rice land and plowed land and we could not distinguish these lands only from the NDVI value. The NDVI value of sappy land was about -0.4 and completely was different from the NDVI of the rice land and plowed land.

4. CONCLUSION

The relationship between bands 2 and 3 for getting best results from the NDVI index was calculated. Also the relationship between the NDVI and the rice, plowed, and sappy land was calculated. Results showed that the rice and plowed land had the same NDVI value at that time and we could not distinguish these lands only by the NDVI values. Main conclusions can be summarized as follows: (1) High positive tendency of the NDVI could express the land-use in the filed. (2) The change pattern of the NDVI was different depending on the pattern of land - cover or land - use change. (3) Satellite images could detect the land-use changes in the local scale. (4) Vegetation index is suitable to estimate the land-use classification.

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