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INTEGRATION SPACE AND FIELD DATA IN LAND USE STUDIES FOR ENGINEERING SOLUTIONS

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Abstract- Geotechnical works provide wide information related to the soil characteristics. One of the important soil's parameter is its electrical conductivity that allows defining the amount of chemicals dissolved in the soil and groundwater. The values of electrical conductivity are important for designing the earthing system and for defining the corrosive activity of the soil. The study of salt condition of soil has a big importance for agriculture purposes. It relates for Land Use/Land Cover investigations where needed to be conducted appropriate studies as the significant source for decision makers. Determination of amount of salts dissolved in the soils is also important for construction needs. The type of concrete and protection for foundation depend on amount of different chemicals dissolved in the soil and groundwater. Many parameters influence on amount of chemicals the soil. There is no any accurate data for Azerbaijan soils in common. In this article, the corrosive activity of the Abs heron peninsula soils is studied. For the reason of Land Use/Land Cover investigation, it has been suggested to use an advance of space technology. The immediate result of the investigations is the inventory of Land Cover/Land Use of the selected area of the Abs heron peninsula and an output has an essential input to the land characteristics identification for agriculture planning purpose. The use and application of space technology in a huge case in particularly for the case of Land Cover/Land Use studies is a more suitable means due to the covering a large areas, high accuracy, availability of application in the unacceptability areas etc. Moreover, according to the created and developed database there is an advantage to be very sensitive to any available change occurred in the investigated areas. At the same time space, technology creates an excellent environment to conduct and receive appropriate outcomes within a short time period that is highly important issue in soil salt investigations. It is obvious that integration data from the remote sensing method into the geographic information system based on conducted soil investigations with measured soil parameters provide comprehensive information for clarification of the soil condition. Based on processed satellite data with integration of filed studies there is an approach of investigation and identification of the salt degree monitoring divided not less than three categories. It is advantages of development of GIS technology which plays a valuable place in Land Use/Land Cover problem solving an excellent information source especially extremely important directory for the local authority decision makers.

Keywords: Geotechnical Investigations, Soil Contamination, Space Technology, Remote Sensing, Space Image, Image Processing.

I. INTRODUCTION

As a part of geotechnical works electrical resistivity test is one of the easiest ways for definition the amount of chemicals dissolved in the soil and groundwater. The values of electrical conductivity are important for designing the earthing system and defining the corrosive activity of the soil. Besides electrical resistivity test chemical analysis of soil and groundwater, also show the amount of chemicals that influence soil conditions and can be used for determining their corrosive activity. By means of those investigations and parameters, it can be done characteristics of the soil for many of applications and engineering decisions. For this reason, the study of soil is very important issue for many purposes.

II. ELECTRICAL RESISTIVITY MEASUREMENT METHOD

Electrical resistivity testing method is conducted by the use of two test electrodes with the resistances r_2 and r_3 and the third electrode with the resistance r_1. These electrodes should be located at some distance from each other so that test results can be trust worthy. Test consists of measuring the resistances between each pair of electrodes. Final results show the values r_{12}, r_{13}, and r_{23}, where, $r_{12} = r_1 + r_2$ and etc. Value of r_1 may be found from results gained, so, $r_1 = (r_{12}) - (r_{23}) + (r_{13}) / 2$.

III. CHEMICAL ANALYSIS OF SOIL

The main parameter needed to be accepted from chemical analysis is the pH value that shows the level of corrosive activity of soils. For determination of pH level in soil samples it is mixed with deionized water ratio

sample and the pH of the resulting aqueous suspension is measured by pH meter with combination electrode and automatic temperature compensation. In water samples, pH is measured by pH meter with combination electrode and automatic temperature compensation.

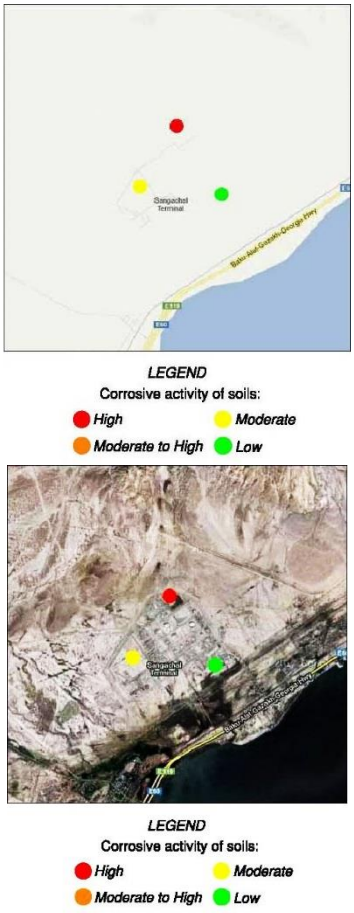

Figure 1. Site one, Sangachal area, Azerbaijan

IV. OUTCOMES

For studying the corrosive activity of Abs heron Peninsula soils it has been taken electrical resistivity test and chemical analysis results for one site of peninsula with further interpolation for other two sites where was used space technology methods. At the same time, results accepted by use of space technology were evidenced by field measurements, (Figures 1 to 3). Figure 1 relates to the results of the tests conducted on the site and processed at the laboratory. Figures 2 and 3 are based on space image processing and integrated into geotechnical tests results.

Table 1. Results of soil condition measurements

Sites	Soil electrical resistance, ohm×m	pH	Corrosive activity
Site 1	676.65		Low
	195-240	7.8-8.1	Moderate
		6.2-6.8	High
Site 2	15.8-76.9		Moderate to high
		7.0-8.4	Moderate to high
		7.1-8.9	Moderate to high
Site 3	240-464	8.6	Moderate to low
		7.2-9.7	Moderate to high
		6.5-8.8	Moderate to high

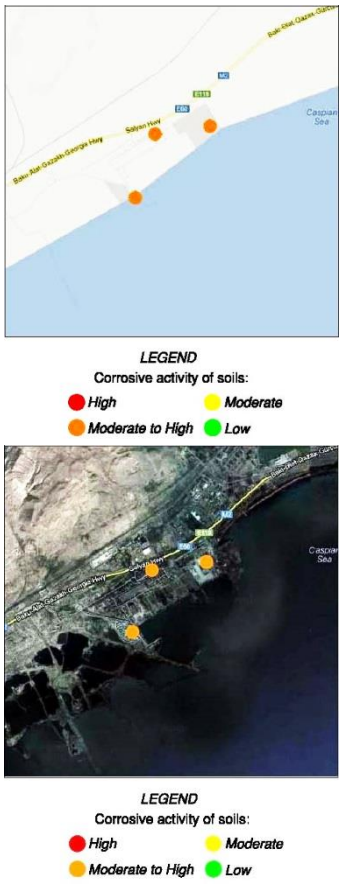

Figure 2. Site two, Garadagh district

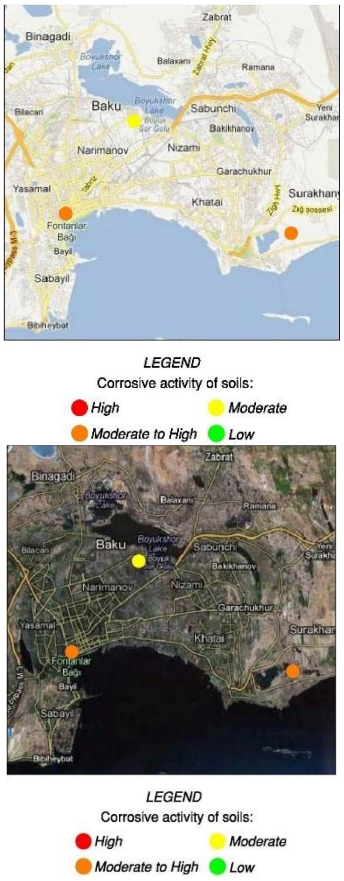

Figure 3. Site three, Baku, Azerbaijan

Results of soil condition measurements are shown in the Table 1. These are excellent results demonstrated successful use of space technology advances for soil salinity investigations.

V. METHODOLOGY

Remote sensing technology in combination with Geographic Information System (GIS) can render reliable information on soil study. The analysis of the spatial extent and temporal change of soil using remotely sensed data is of critical importance for soil monitoring. Change detection is temporal effects as Variation in spectral response involves situations where the spectral characteristics of the soil and other land cover type in the selected time [1].

Change detection and monitoring involve the use of multi-date images to evaluate differences in soil contamination due to environmental conditions and human actions between the acquisition dates of images. For the reason of soil study vegetation was identified as an indicator for change detection. In conformity with this study various change detection techniques, spectral change analysis method with special emphasis on vegetation indices was selected.

The Normalized Difference Vegetation Index (NDVI) was used for vegetation change detection due to its acceptable accuracy and ability to detect the green vegetation. NDVI values that extracted for space images from 2008 and 2012 years were compared statistically. The statistical analysis carried out on the NDVI values in different years showed that the reductions of NDVI values are different.

The application of indices NDVI series of images supported by the results of the classification supervised generated in GIS indicates the vegetation degradation in the investigated area.

A. Study Area

The Garadagh is located between the southern outcrops of the Caucasus Mountain range and the Caspian Sea, some 35 km south of the capital of Azerbaijan Baku (Figure 1).

Figure 4. The map of selected area for study, Azerbaijan

Garadagh semi desert extends on 1080 km² with population 111753 and is characterized by a semi-arid climate with continental influence and humid, cool winters and dry hot summers. The mean July temperature reaches about 26.0 °C and the mean January temperature 2 °C in this area. Average rainfall is 200-400 mm per year but can be 150-200 mm in semi-desert areas when less rain comes.

B. Objectives

The objectives of this study include:

- Analysis of the Spatial-temporal change of vegetation in the selected area
- Vegetation classification
- Performance of NDVI calculation, showing vegetation reflectance in the selected area
- Change detection of vegetation distribution from 2008 and 2012 in the selected area

C. Methodology

High-resolution image was used for processing between years of 2008 and 2012. The methodological approach of this project includes training in the field of identification and census methods and the use of standardized monitoring methods. Remote Sensing (RS) and Geographic Information Systems (GIS) together form a powerful information acquisition and analysis tool for monitoring environmental changes. The steps of developments were following:

1. Space image/classification and NDVI calculation
2. Classification/supervise of maximum likelihood
3. Classification map/NDVI map
4. Classification map/accuracy assessment of image
5. NDVI map/Vegetation change detection
6. Geographical data/Ground truth data-field data

An analyses have been based on the main three methods of data processing as, a) Maximum Likelihood classification, b) NDVI Calculation, c) Vegetation change detection.

From supervised classification (Figure 4) of data four classes can be identified and integrated into the soil salt degree classification. Change detection and monitoring involve use of multi-date images to evaluate differences in vegetation distribution due to environmental conditions and human impacts between the acquisition dates of images [7]. Change detection was taken into the changes which taken place on a period of 2008 to 2012. The Change detection is a thematic image, typically divided into the categories of background, decreased, some decreased, unchanged, some increase, and increased.

VI. CONCLUSIONS

The study of soil salt condition is important for many purposes. Those studies needed to be provided within a short time of period for a large area. Space technology opens an opportunity to speed up the process of land condition as well as soil salt condition. It has been defined an indicators for monitoring soil condition. Vegetation was taken indicator for selected area. A methodology for classification based on remote sensing with further GIS developments.

REFERENCES

[1] R. Hoffer, "Biological and Physical Considerations in Applying Computer Aided Analysis Techniques to Remote Sensor data", In Remote Sensing: The Quantitative Approach, Edited by P.H. Swam and S.M. Davis, McGraw-Hill, USA, 1978.

[2] S. Adia, A. Rabiu, "Change Detection of Vegetation Cover, Using Multi-Temporal Remote Sensing Data and GIS Techniques", Geospatial Application Papers**,** Environment, 2003.

BIOGRAPHIES

Bahar N. Aliyeva was born in Terter, Azerbaijan, 1983. She received her B.Sc. and M.Sc. degrees from Geological and Exploitation Department, Azerbaijan State Oil Academy, Baku, Azerbaijan, in 2004 and 2006, respectively. At the present time she is a Ph.D. student of Institute of Physics, Azerbaijan National Academy of Sciences, Baku, Azerbaijan. Currently she works as Geotechnical Engineer in Encotec Company, Baku, Azerbaijan.

Rustam B. Rustamov was born in Ali Bayramli, Azerbaijan, on May 25, 1955. He is an independent expert on Space Science and Technology. In the past, he was in charging of the Azerbaijan National Aerospace Agency activities as an Acting Director General. He has mainly specialized in space instrumentation and remote sensing and GIS technology. He has graduated in Ph.D. from the Russian Physical-Technical Institute, St. Petersburg, Russia. He was invited for the work at the European Space Agency within the Framework of the United Nations Program on Space Applications at the European Space Research and Technology Center, The Netherlands. He has appointed for the United Nations Office for Outer Space Affairs Action Teams (member, Vienna, Austria), United Nations Economical and Social Commission for Asia and the Pacific (national focal point, Thailand), International Astronautically Federation (Federation's contact, France), Resent Advances in Space Technologies International Conference Program Committee (member, Turkey). He is the author of 11 books published by the European and United States famous publishers and more than 70 scientific papers.