Mapping saline soils evolution in arid areas using RS and GIS. case study sabkhat Atarafiya northeast of Buraydah in Qassim (central KSA)

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***Abstract*—** Al Qassim region is located in the center of KSA, between the Arabian shield and the Arabian platform in arid desert climate. the surface water is seldom extinguished, except at the saliferous depressions fermented or sabkha. These are deserted salt marsh or salt wetlands, these Saharan wetlands are influenced by deferent factors: natural factors, both climatic and anthropogenic, which are due to the degradation of this particular areas. The objective of the present work is to follow the spatio-temporal evolution of humid zones, and map the change of surfaces state in sabkhat Atarafiyah. to achieve this objective, we are using three satellite images of Landsat. Which are 2 images of Landsat 5 (TM) dated 22/02/1986 and 06/02/2000, and one image of Landsat 8 (OLI) dated 18/02/2016. the obtained results show significantly important change in the states of surfaces of the sabkha. a decrease in wet salt soil is observed, followed by an increase in dry salty soil. also, the vegetation is diminishing. all these changes have resulted of climatic factor but don't neglect the anthropic effect which is also present.

Key-Words: Al Qassim, mapping change, Landsat, Remote sensing, Sabkhat Atarafiya.

I. INTRODUCTION

There are a lot of studies that are concerned with studying wetlands, especially those that are constantly flooded with water such as lakes. Few studies are interested in studying of humid zones that are flooded by water for limited periods (during the rainy season or during the flow of valleys). A study of mapping the diachronic evolution of wetlands in the Arid Regions (sabkha Safione in region of Ouargla in Algeria and the Salt Lake Al aushaziya on Al Qassim in KSA) was realized with the use of Landsat 8 images. The results have shown a spatial evolution of surface stats in these zones. This evolution is due to climatic factors and the anthropic activities [6].

The province Al Qassim is located in central Saudi Arabia, it is located between the Arab shield and the Arab platform. it is characterized by arid desert climate. the essential water resource is presenting in the groundwater. the surface waters are rarely extinguished, except in salty depression, these are saliferous wetlands, or sabkhas. this word is used by geomorphologists to refer to a flat-bottomed, generally floodable depression where salty soils limit vegetation. The sabkha can be lacustrine: the waters evaporate and leave salts or, in communication with the sea (now or in the past). All the hot desert regions present sabkhas. they play a very important ecological, hydrological and economic role in the Saharan region. but because of the

anthropic effect these zones of weak extension know a general degradation. it is necessary to create methods of control for these environments to adapt an efficient protection and gestion. The objective of this work is to map the spatio-temporal evolution of sabkhat Atarafiyah northwest of Buraydah.

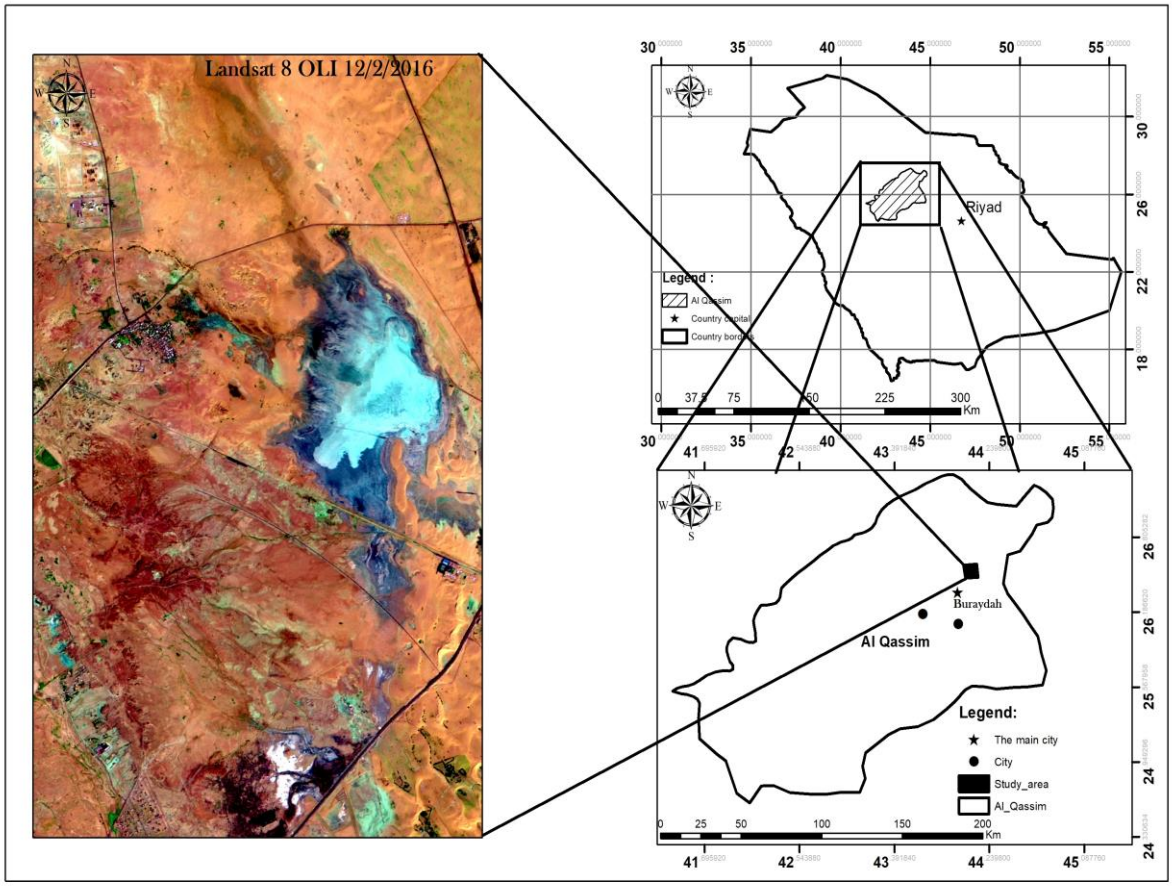

Fig. 1 Geographic situation map of the study area

Study area:

Sabkhat Atarafiya it located on east of the village of Atarafiya at 4 km away (fig. 1), the last is northeast of Buraydah (350 km away from the capital of country Riyad) the capital of province Al Qassim in the center of Saudi Arabia. The village of Atarafiya and its surroundings is at an average altitude varies between 600 m to 580 meters on the Sabkha. This study area characterized by a hyper arid climate, it is drier, temperatures in summer, and cold in winter (The most temperate day was recorded Wednesday, August 3, 2011 with a value of 49°C. and the cold record of -4°C recorded on Sunday, January 22, 2012.). The average annual rainfall is of the order of 100 mm/year and rarely exceeds 160 mm/year. It is characterized by rare but violent rainfall. In the period from June to September the average rainfall is 0.3 mm/month, July is the driest month in the year. from October to January, average rainfall is 20 mm/month. In December, rainfall is the most important of the year with an average of 52.7mm. for example at 2008 86 mm in one day at Qassim airport. In

addition, the precipitation is more regular in the study area. The average potential of evaporation varies between 100 mm/month from December to January, and 350 mm/month in July, an average annual of evaporation is 3000 mm/year (BRGM/ATC 2008a). this saline depression closed, it is essentially feeding by the valley of Atrafiya. the latter was a tributary of Wadi Arummah. at the last quaternary geological time, the valley course is separated with sand dunes. the result was internal drainage of the water in the basin. Geologically the dominating outcrops are the Mesozoic formations of Triassic (Sudair shale according to the SSC classification), with an alluvial deposit of Quaternary [8].

II MATH

Our work based on the processing of satellite scenes of Landsat 5 and 8 imagery of different dates on the study area, topographic, geological data and also field measurements and observations. To detect and map the changes in surface states. We analyzed 3 images multiband, two of Landsat-5 (TM) dated 1986 and 2000, with 6 multispectral bands, and one image OLI of Landsat-8 of the years 2016 with seven multispectral bands. The resolution of each images is 30 m in the pixel for each. for the production of the land use maps of the study area, the supervised classification (maximum likelihood) will be used. After the classification, a filter 3*3 was applied to remove the isolated pixels.

Table I Summary for the accuracy of classification

Classification	Global accuracy	Coefficient Kappa
22 February 1986	99.48 %	0.99
06 February 2000	97.81 %	0.96
18 February 2016	98.92%	0.98

ENVI 5.1 software was used for the processing of satellite data (Landsat images) to produce the land use maps of study area.
The statistic of class and to calculate the overall accuracy of classification and Kappa coefficient from the matrices of confusion. Following the classification of the scenes of the different dates. A post-classification algorithm multi-date change detection has been used to determine diachronic evolution of the sabkha. Finally, a vectorization and extraction of surfaces to create a database in a geographic information system (GIS) under ArcGis-10.3.

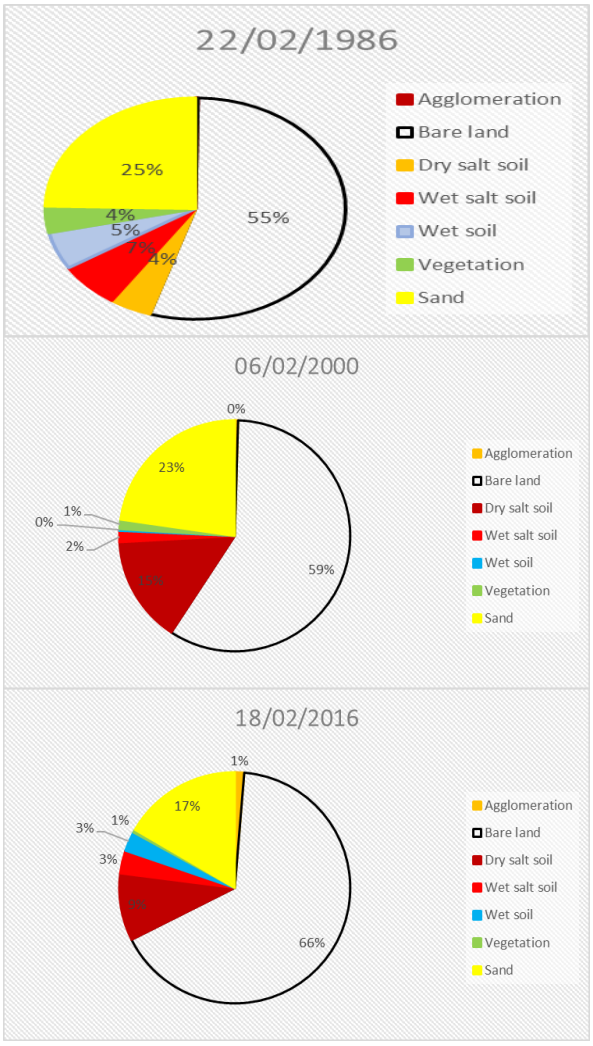

Fig. 2 surfaces distribution of land cover the study area

III. RESULTS AND DISCUSSION

The visual interpretation of the three Landsat scenes resulted in 7 classes. The resulting maps were validated using the confusion matrices of three dates (table I), having an accuracy of 99.48%, 97.81% and 98.92% on the dates 1986, 2000 and 2016, respectively. After the control of classification, there is corresponding between the mapping and the fields observations. About the evolution, there is some classes have lost part of their size, and others have gained new areas. In general, the surfaces that have undergone significant changes are represented in vegetation surface that knew diminution by 89.09% of total surface in 1986, this is can be happing because the population left the agriculture activities on the area. The wet salt soil and wet soil show decreased by 51.29% and 49.49% respectively, but the dry salt soil show increased by 110%. this evolution was the result of the climatic factors. All this evolution can be observed in (Fig. 3).

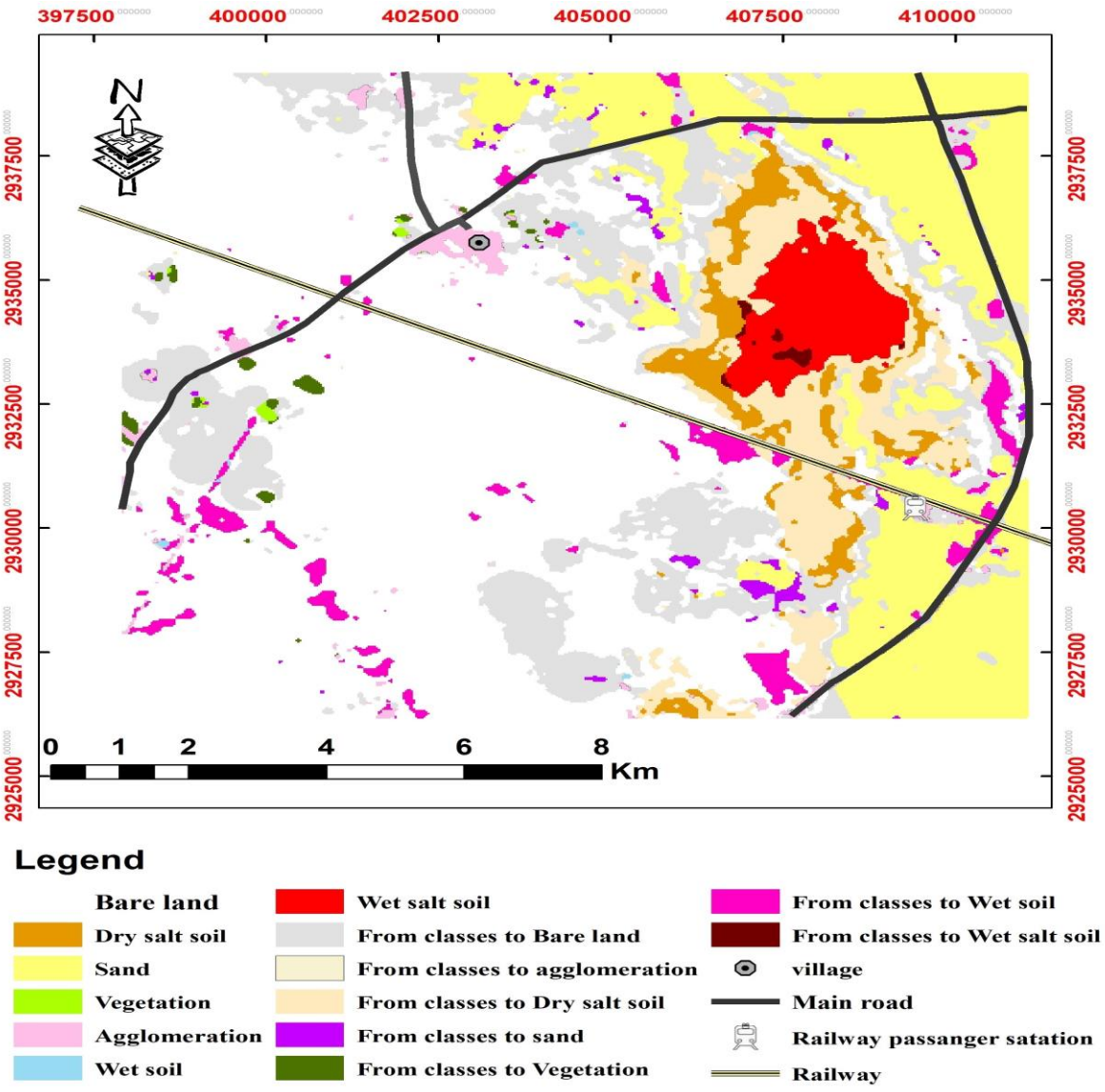

Fig. 3 change map of the study area (from 1986 to 2016).

IV. Conclusion

The results obtained showed that there are very important changes on soil occupations in the Sabkha during the period 1986 to 2016. This is due to the influence of several factors so such climatic, hydrogeologic and anthropogenic. The images of Landsat have a high spectral potential, allows to analyze different land occupations at different bands, but their spatial resolution is average. We recommend for the future work, it is necessary to use images with very high spatial resolution (Ikonos, Quickbird, Alsat ...), then other hand, it is necessary to make a regular monitoring of the quality of water on these zones.

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CO_2 capture modeling in aqueous solution of Methyldiethanolamine +Hexylamine

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Abstract— The aim of this work is to establish a thermodynamic model using NRTL Electrolyte Aspen Plus ™ model, this model allows to simulate the CO_2 capture by an aqueous mixture of Methyldiethanolamine (MDEA) and Hexylamine (HA), CO_2 solubility data in the mixture of Methyldiethanolamine and Hexylamine were obtained by our experiment and were introduced in Aspen Plus™, the binary interaction parameters and electrolyte pairs as well as the parameters of the kinetic constants reaction between CO_2 and aqueous solution with mass concentration MDEA 37wt% + HA 3wt% + H_2O have been regressed. The results obtained shows that our model represents the experimental data with an error of 17%.

Key-Words: Carbon dioxyde capture, modeling, Methyldiethanolamine, Hexylamine

I. INTRODUCTION

The main source of CO_2 (greenhouse gas) is the burning of fossil fuels such as coal, oil and gas in power plants, for transportation, in homes, offices and industry. Fossil fuels provide more than 80% of all energy demands in the world. These large amounts of carbon dioxide are released into the atmosphere by many Major industries around the globe (power generation, manufacturing in steel, cement manufacturing, etc.). These energies currently emit 29 billion tons per year of carbon dioxide [1].

Current trends are leading to temperatures well above 2 ° C by the end of the century. The acceleration of the phenomena with the observation of a greater speed of degradation and change calls for courageous decisions by governments, parliaments and the international community, which together face one of the most serious challenges known for the planet and for humanity. In this context, it is necessary to reduce global greenhouse gas emissions and limit the increase in global average temperature to less than 2 ° C above pre-industrial levels, as stated in the target of the United Nations Framework Convention on Climate Change (UNFCCC). Increasing the temperature of the earth has a negative effect on the environment. For this