Factors Influencing water Salinization in South of Iran

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Abstract

Low quality of water groups are that which must be paid attention regarding to the management and usage. All saline surface flows, groundwater and saline agriculture drainage are categorized in this group. The salinity is most important factor affecting quality of irrigation water and there is relationship between irrigation water salinity and farm lands. This research was done due to determine the effective factors on water salinization in south of Iran. At the first the boundaries of this region were characterized using GIS, then for study of water resources some samples were obtained from 30 wells and also from upland runoff, then water sample were analyzed and some parameters such as EC, SAR, Cl- and PH were measured. Finally, according to data base, geological map, topography map, landuse map, soil and water measured data and also field studies, water salinization schedule and region status were investigated. The results showed that important factors influencing water salinization in Homozgan province are geological formations located in aquifer recharge and climate condition.

Keywords: Salinization, Electrical Conductivity (EC), Sodium Absorption Ratio (SAR), Ghaleh Ghazi, Bandar Abbas.

Introduction

All natural waters contain soluble salts. The concentration of the salts determines whether the water is of high quality (drinkable or usable for irrigation without need for special precautions) or of low quality (brackish or saline). Water in the soil also contains soluble salts (sometimes called free or nonattached salts). The amount of salts in the root zone (or the salt concentration in the soil solution) determines whether the soil is "normal" or "salt-affected" (saline, sodic, or salinesodic).

Salinization on the soil surface and irrigation water occurs where the following conditions occur together:

- The presence of soluble salts, such as sulfates of sodium,calcium, and magnesium in the soil
- Naturally present as products of geo-chemical weathering of rocks and parent materials
- derived directly from sea water by flooding, spray, or intrusion into groundwater resources
- caused by irrigation mismanagement, particularly when internal soil drainage is impeded.
- A high water table
- A high rate of evaporation
- Low annual rainfall

In semiarid areas, salinization often occurs on the rims of depressions and edges of drainageways, at the base of hillslopes, and in flat, low-lying areas surrounding sloughs and shallow bodies of water. These areas receive additional water from below the surface, which evaporates, and the salts are left behind on the soil surface.

Summer fallow management practices may cause increased salinization by increasing the soil moisture content to the point that water moves to seeps on hillslopes. Salts accumulate as the water evaporates from these seeps.

Around 34% of Asia soils are influenced by salts. Due to geographical position and arid and semi-arid climate, Iran has the most saline lands in Asia after China, India and Pakistan. Iran has around 25 million ha saline and alkaline lands. These areas cover 15 % of total areas of Iran (Zehtabian and Amiraslani 2006). With the expansion of agriculture into areas without drainage systems, extension of saline and alkaline lands has increased in Iran. Salinity changes are an indicator of increased salinity in most water resources of Iran. This continuous trend has caused an intensive decrease of soil and water quality that in most area has caused decrease or changes of cultivation patterns.

Studies have been conducted to assess and evaluate the status of soil and water resources of desertification sites. The result has highlighted several factors that contribute to the salinization of water resources. For example, one of the important problems in Ghaleh Ghazi region, Bandar Abbas, Hormozgan province is existence of saline soil and this phenomenon had made especial effect on the loss of soil fertility. So, the aim of this research was determination of effective factors on soil and water salinization in Ghaleh Ghazi region.

Materials and Methods

Study area

Ghaleh Ghazi is located in 56° 15' to 57° 03' E and 27° 15' to 28° 15' N and has an arid climate with annual average precipitation of 202.6 mm. This region is located in Hormozgan province and south of Tehran with mean annual temperature of 27.4°C.

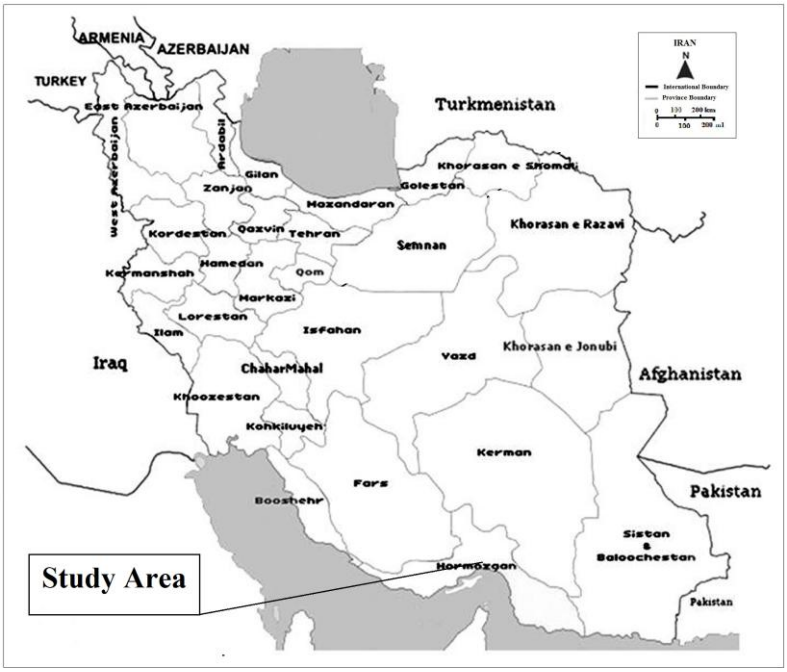

Figure1. Location of the study area in Isfahan province and Iran

Methodology

At the first the boundaries of this region were characterized using GIS, then landuses were determined for field survey and also soil sampling in 9 landuses were done according to both factors of planting pattern and water resources in each unit.

Using GIS

One of the methods of data entry to computer in natural resources studies is digitizing maps with different scale. In this stage, contour maps and other necessary data were digitized, then using Ilwiss Software, the Digital Elevation Model (DEM) was created using interpolation extension, then hypsometric map was created using slicing algorithm and finally slop and aspect maps were provided.

Soil sampling

Salinity can vary considerably throughout an orchard. You should take at least one composite soil sample for several depths in each landuse in the orchard having a similar soil type. USDA soil surveys are good starting points for targeting sampling areas.

The soil profile was prepared and 27 soil samples were obtained (for every landuse 3 samples) from different depths of (0-50cm) and some factors such as soil texture EC, SAR, PH, $CaCo_3$, CL and Potassium were measured.

Water sampling

Sampling irrigation water for salinity assessment is much simpler than sampling soils. First, rinse a plastic container in the water that is to be sampled. Collect a small sample. Completely fill the container with water; this eliminates air, which would otherwise promote calcium carbonate precipitation.

For study of water resources some samples were obtained from 30 wells and also from upland runoff, then soil and water sample were analyzed and some parameters such as EC, SAR, Cl- and PH were measured.

According to data base, geological map, topography map, landuse map, soil and water measured data and also field studies, soil and water salinization schedule and region status were investigated. Finally, collected and measured data analysis with help of MSTATC software.

Vegetation cover in different landuse affected by soil and water salinization has been studied.

Results

The results of soil samples can be presented in 3 stages. At the first, obtained results from test of data have shown that all of data have a normal distribution. Then, variance analysis was done. In this part, it distinguished that there is significant difference among treatments in each factor.

After, comparison of treatment means with comparison test of Duncans mean was done in order to show treatments that have significant difference (table1).

Table1. Soil factor means in different landuse

Factor / Landuse	EC	SAR	PH	P	CaCo3	CL	Sand	Silt	Clay
Forest Planting	1.565c	4.93c	7.9abcd	29.666c	7.8b	24.63c	86a	9.3c	4.66d
Grassland	9.26c	131.22b	7.75cd	440ab	46ab	438b	42.3b	39ab	18abcd
Rangeland	11.7c	36.54c	7.79bcd	164.5bc	88.65ab	352.6bc	45.5b	45.5a	9bcd
Salt Marsh	24.75c	194.4a	7.9abcd	713.33a	81.33ab	1093.5a	35.6b	44a	20abc
Agriculture	37/04bc	53.2c	7.68d	64.75c	38.75ab	238.3bc	29.2b	46a	24.75a
Dunes	38.44bc	24.36c	8.04abc	75.33c	13.4b	88.33bc	77.3a	16bc	6.66bd
Shore	64.55b	142.56b	8.2a	700a	130.5a	1216.5a	27b	59a	14abcd
Mangrove Forest	100.81a	98.9b	8.095ab	35.5c	35.5ab	349.5bc	25b	56a	19abcd
Scarce Forest	110.55a	39.48c	7.81bcd	13c	11.5b	65.23bc	37.3b	40ab	22ab

The analysis of water samples factors has been shown in Table2. The water factors belong to the Sarmaghsam station located on Jamash River.

Table2. The mean of Surface water parameters

Year	Month	TDS	EC	PH	CL	So_4	Ca	Mg	Na	SAR	class
2007	January	1949	3045	7.6	16.5	11.9	8.9	3.31	18.1	7.32	C_4S_2
2007	may	8459	13218	8.2	109	21.5	19	14.2	98.7	24.2	C_4S_4
2007	September	5171	8080	7.8	66.5	12.3	11	7.89	61.6	20	C_4S_4

Conclusion and Discussion

Analysis of soil and water parameters in different landuse shows that in Ghaleh Ghazi region showed that salinity is a major problem in Salt Marsh landuse after that Shore, Rangeland and Mangrove Forest respectively. In Forest Planting and Scarce Forest landuses salinity is not serious problem. In Agriculture landuse because of irrigation mismanagement salinity has increased recently. In Salt Marsh landuse, water table and salinity are high and it seemed that in addition of geologic formations, water table is major factor of salinity.

The results show vegetation cove has been affected by soil and water salinization. The most number of spices there are in Dunes landuse. In Salt Marsh landuse, with very high salinity, *Halognemum strobilaceum* and *Suaeda sp* are dominated. In Forest Planting, with the least salinity, *Prosopis juliflor* is seen.

According to data base, geological map, topography map, landuse map, soil and water measured data and also field studies, soil and water salinization schedule and region status were investigated. The results showed that important factors influencing water salinization in Ghaleh Ghazi region are geological formations located in aquifer recharge and climate condition. Important factors of soil salinization in region are irrigation with saline water, improper irrigation method, unsuitable planting method, climate condition and landform.

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