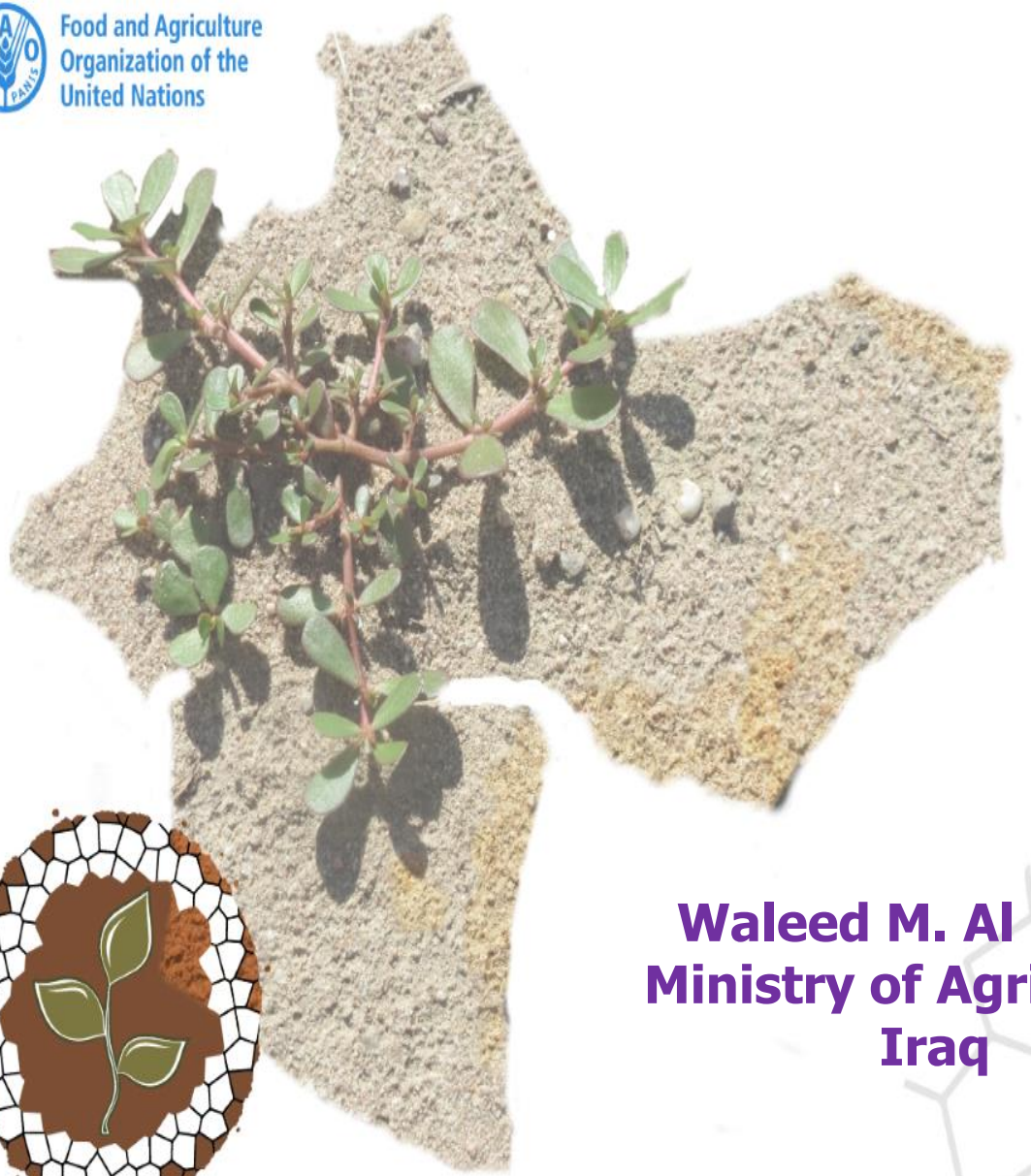
Food and Agriculture Organization of the United Nations

GLOBAL SYMPOSIUM ON SALT-AFFECTED SOILS

20 - 22
October, 2021
Virtual meeting



Waleed M. Al Shafie
Ministry of Agriculture
Iraq

GLOBAL SOIL PARTNERSHIP

IRAQ - Republic of Iraq

Region: Western Asia

Capital: Baghdad

Population: 40,217,031

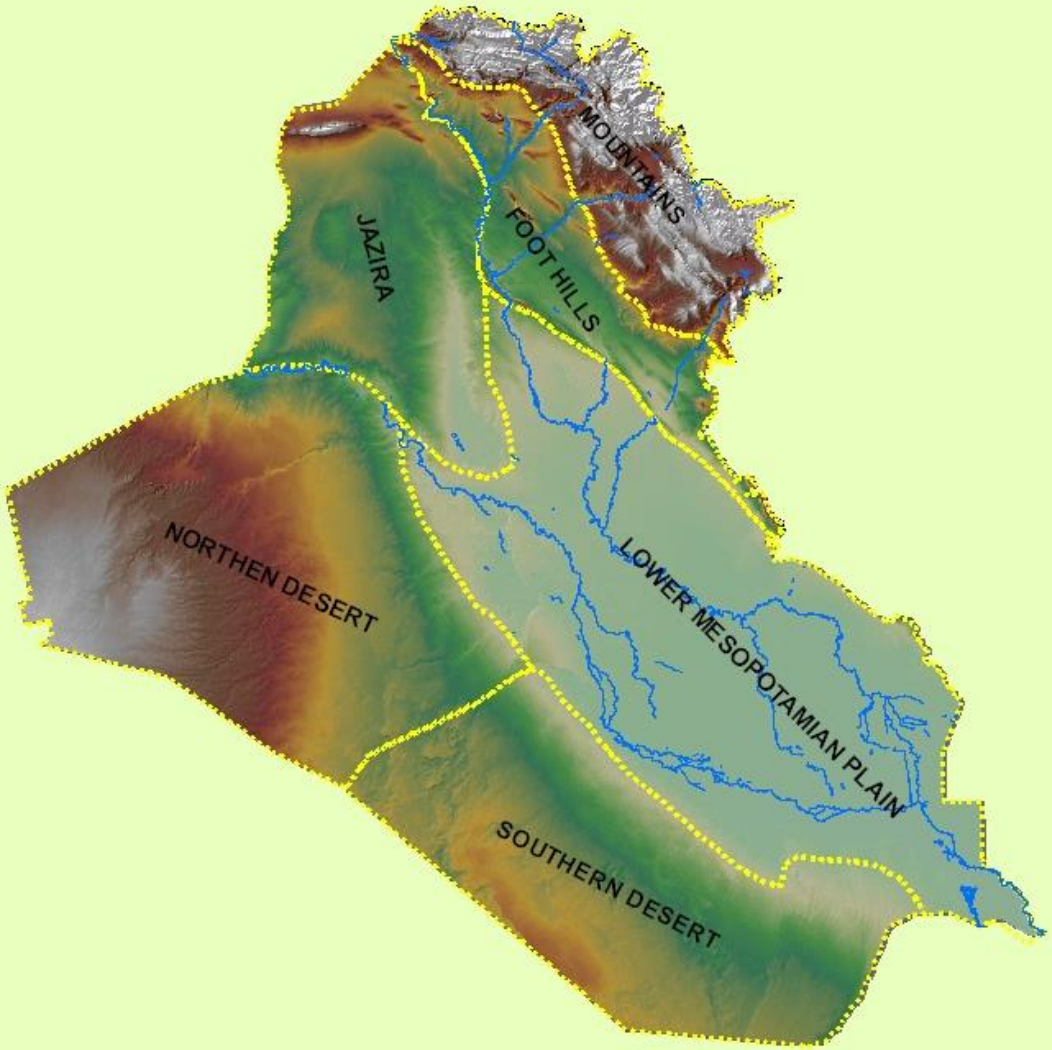
Area: 438,320 km2 (0.98% of continental Asia

Climate: Arid and semi-arid

Preface:

Iraq is lies between 29° 15′N, and 38° 15′N, 38° 45′ and 48° 45′E with a total area of 438,320 km2 including 924 km2 of inland waters bodies. It has common borders with the following countries: Iran, 1,458 kilometers; Jordan, 181 kilometers; Kuwait, 240 kilometers; Saudi Arabia, 814 kilometers; Syria, 605 kilometers; and Turkey, 352 kilometers. Iraq consisting of the Great Mesopotamian alluvial plain of the Tigris and Euphrates, it has surrounded by mountains in the north and the east, which can reach altitudes of 3,550 m above sea level, and by desert areas in the south and west, which account for over 40% of the land area. The climate of Iraq is mainly of the continental, subtropical semi-arid type. , quantity and locations, and ranges from less than 100 mm in the south and southwest to about 1,000 mm/year in the north and northeast.

MAP OF PHYSOIGRAPHIC UNITS OF IRAQ



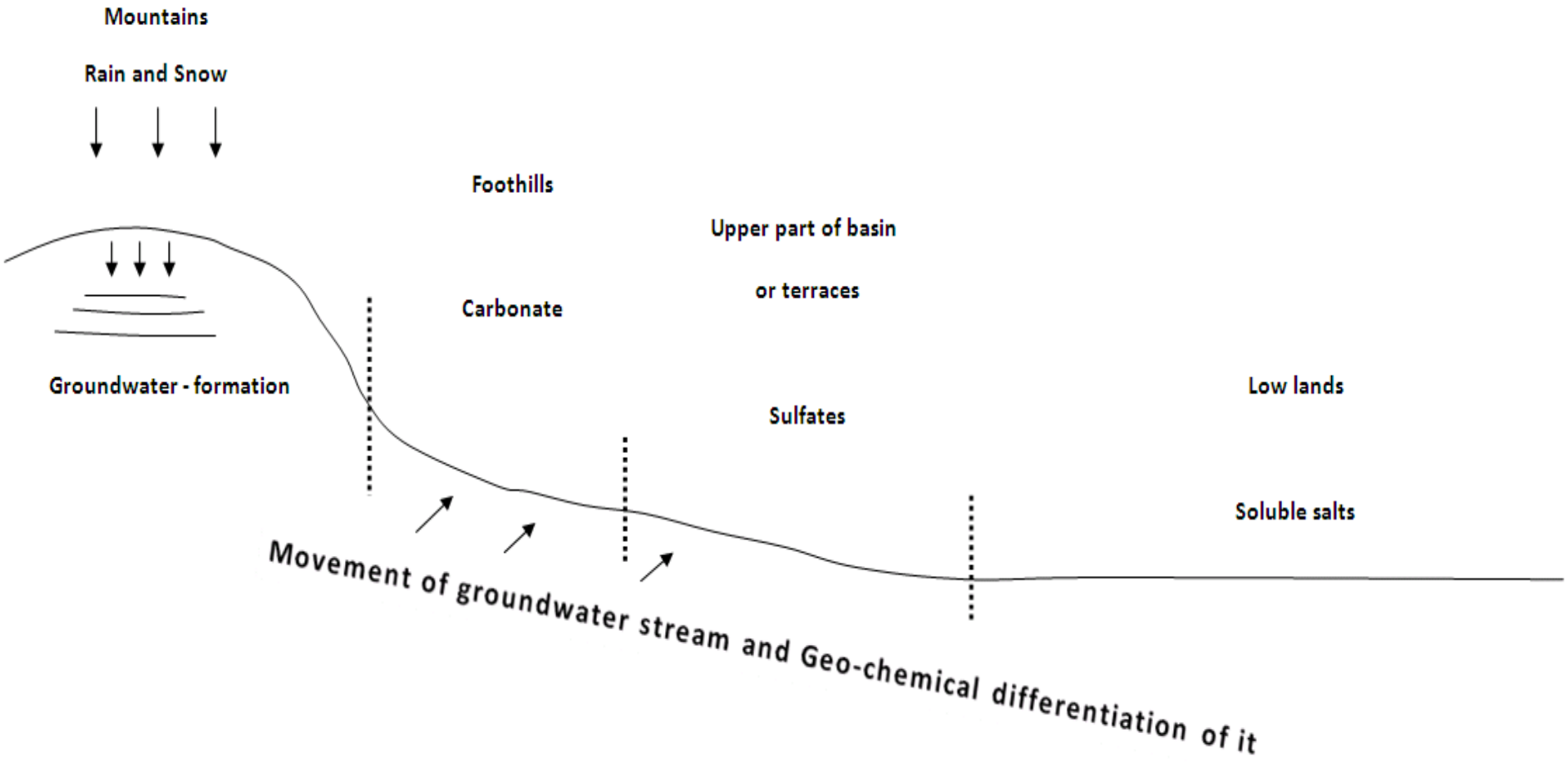
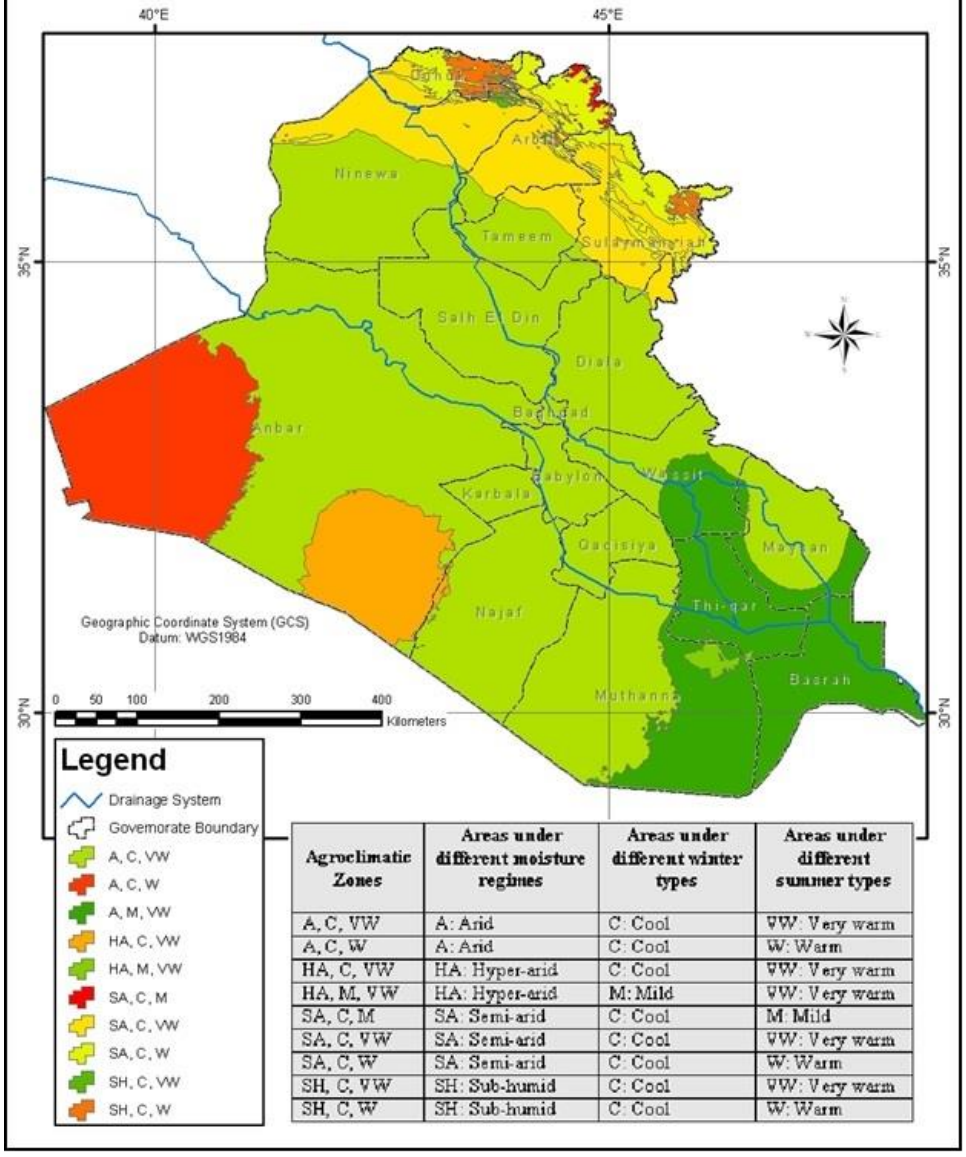
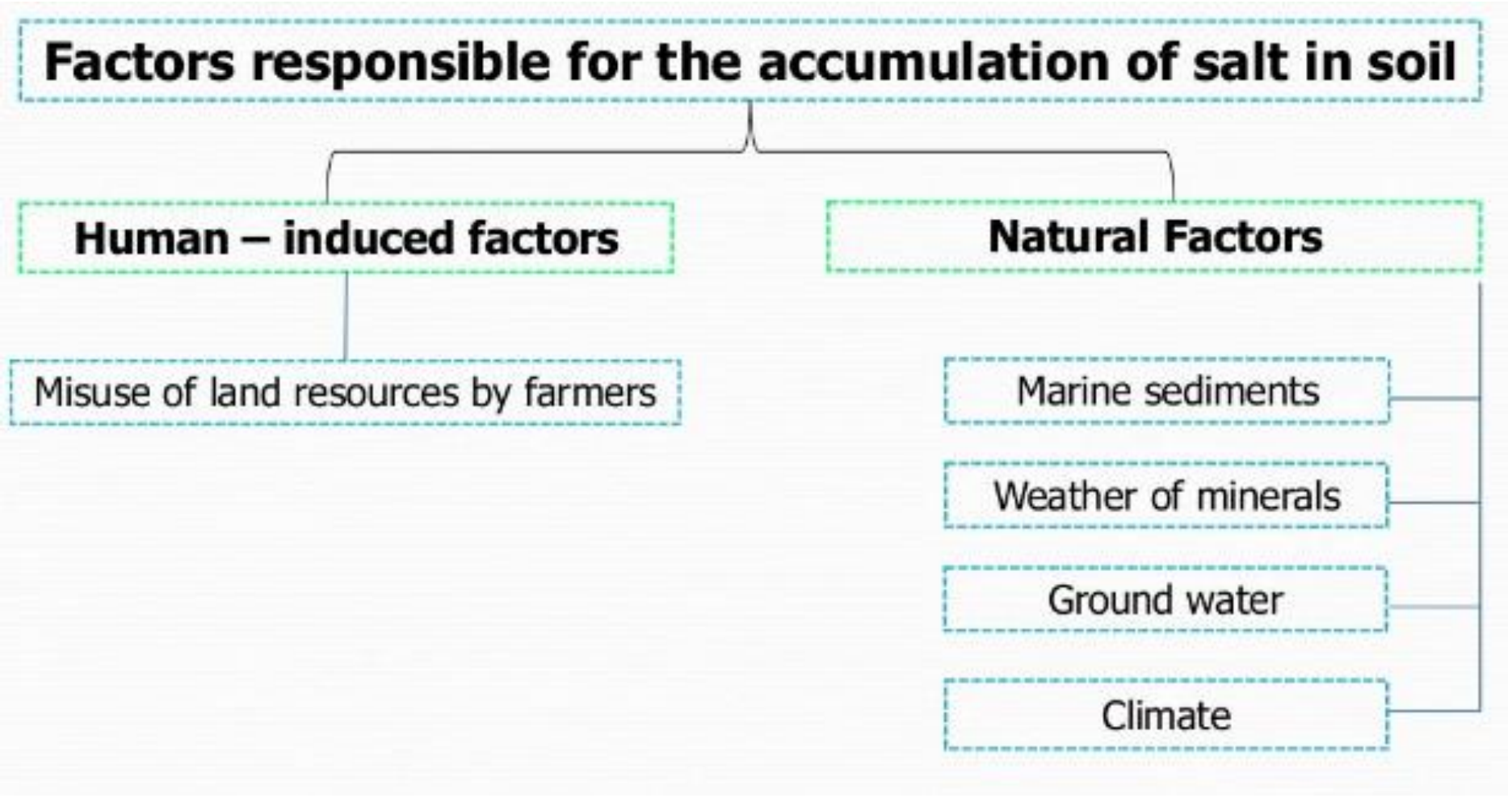


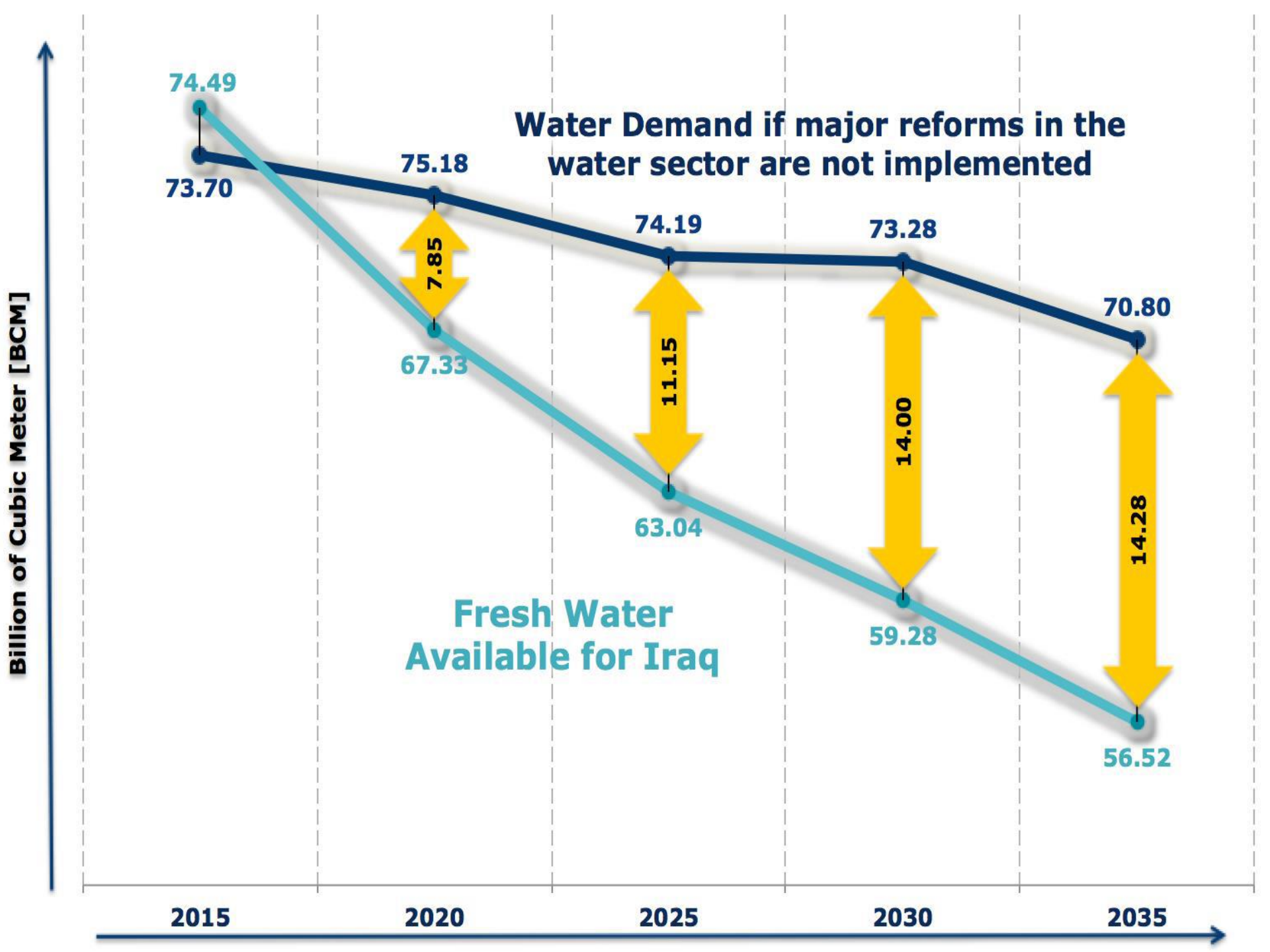
Figure #. General relation between groundwater stream and main physiographic units in Iraq.

Agroclimatic Zones of Iraq (classified according to UNESCO, 1979)

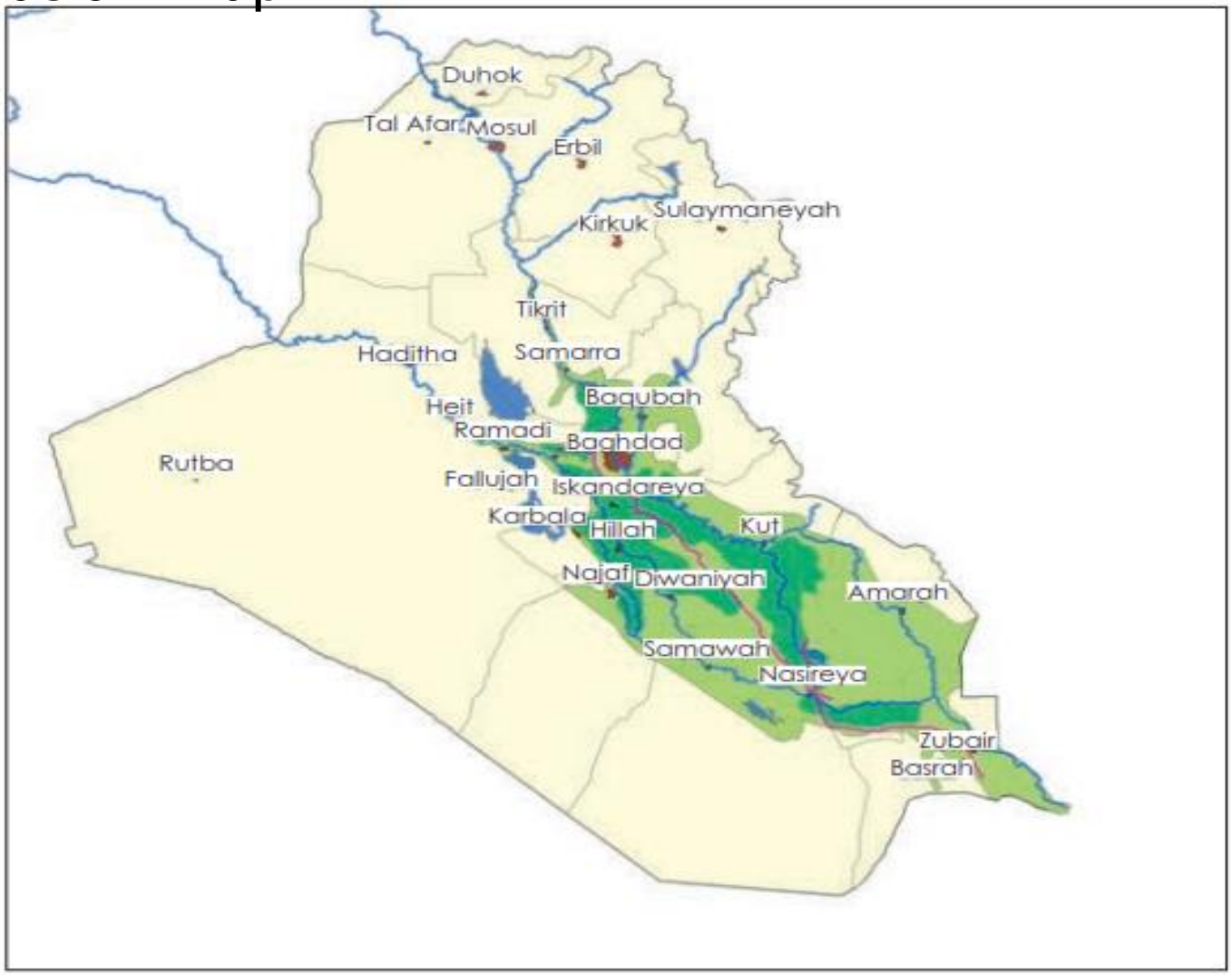


Agroclimatic Zones	Areas under different moisture regimes	Areas under different winter types	Areas under different summer types
A, C, VW	A: Arid	C: Cool	VW: Very warm
A, C, W	A: Arid	C: Cool	W: Warm
HA, C, VW	HA: Hyper-arid	C: Cool	VW: Very warm
HA, M, VW	HA: Hyper-arid	M: Mild	VW: Very warm
SA, C, M	SA: Semi-arid	C: Cool	M: Mild
SA, C, VW	SA: Semi-arid	C: Cool	VW: Very warm
SA, C, W	SA: Semi-arid	C: Cool	W: Warm
SH, C, VW	SH: Sub-humid	C: Cool	VW: Very warm
SH, C, W	SH: Sub-humid	C: Cool	W: Warm


Factors responsible for the accumulation of salt in soil
Human – induced factors
Natural Factors
Misuse of land resources by farmers
Marine sediments
Weather of minerals
Ground water
Climate


Billion of Cubic Meter [BCM]
Water Demand if major reforms in the water sector are not implemented
74.49
73.70
75.18
74.19
73.28
70.80
7.85
11.15
14.00
14.28
67.33
63.04
59.28
56.52
Fresh Water Available for Iraq
2015
2020
2025
2030
2035

The majority of agricultural land in the sedimentary plain depends on irrigation (irrigated) and as shown in the below map.



irrigated land in the sedimentary plain

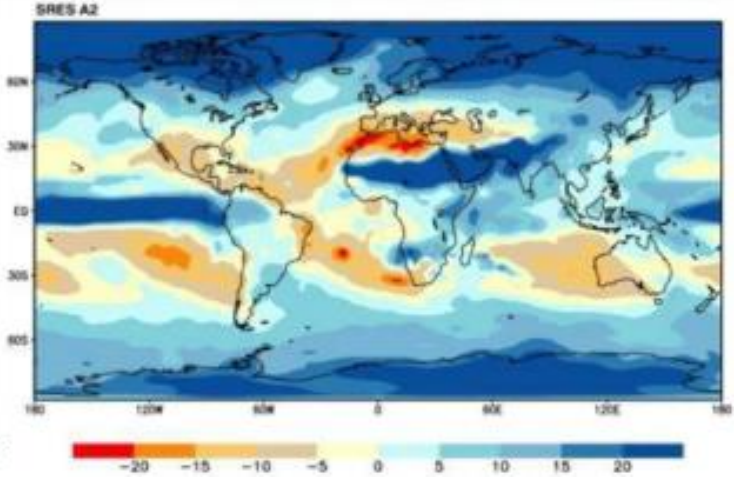
Irrigation with
Drainage Water

Wrong Water Transfer

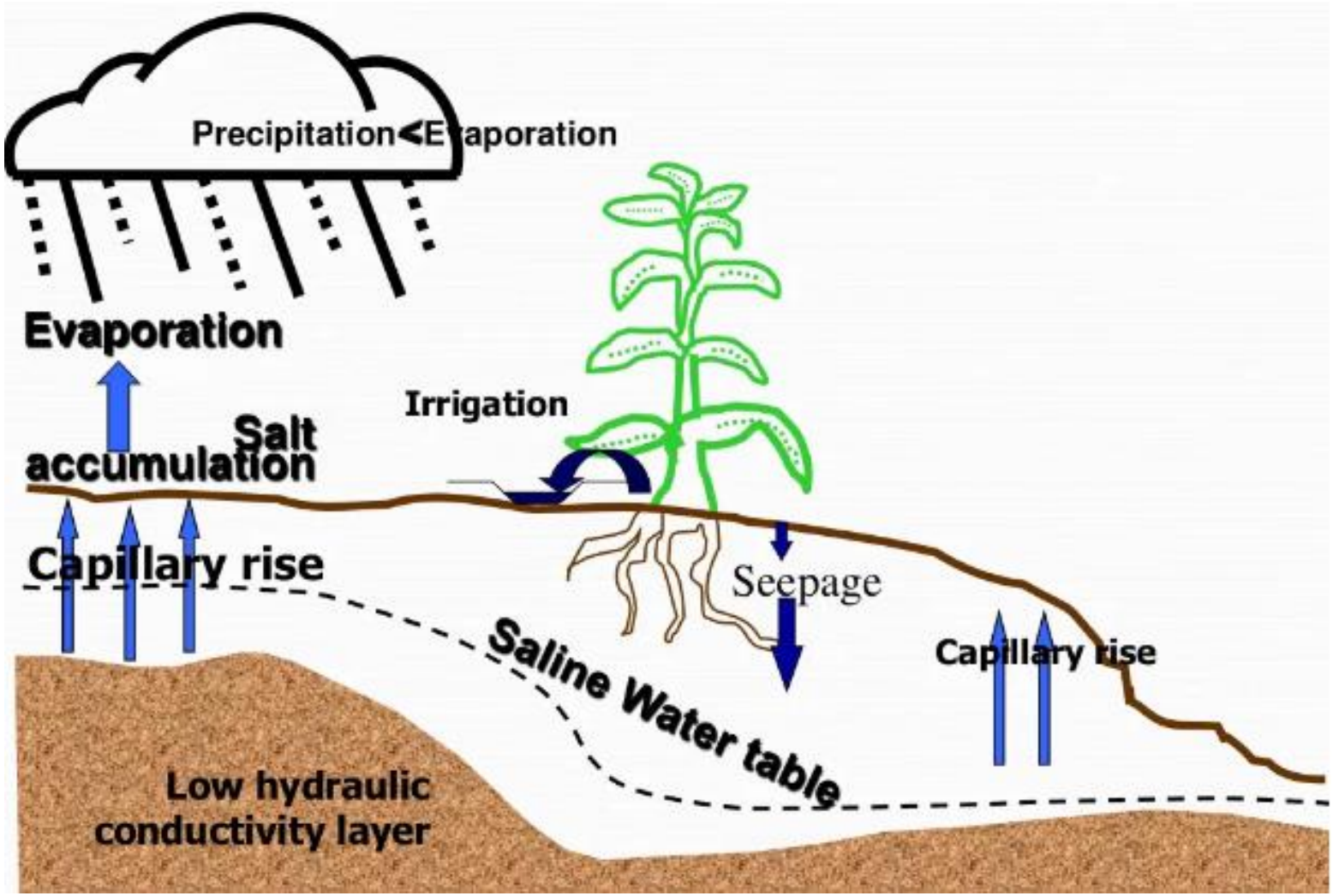
Irrigation with
Saline Well Water

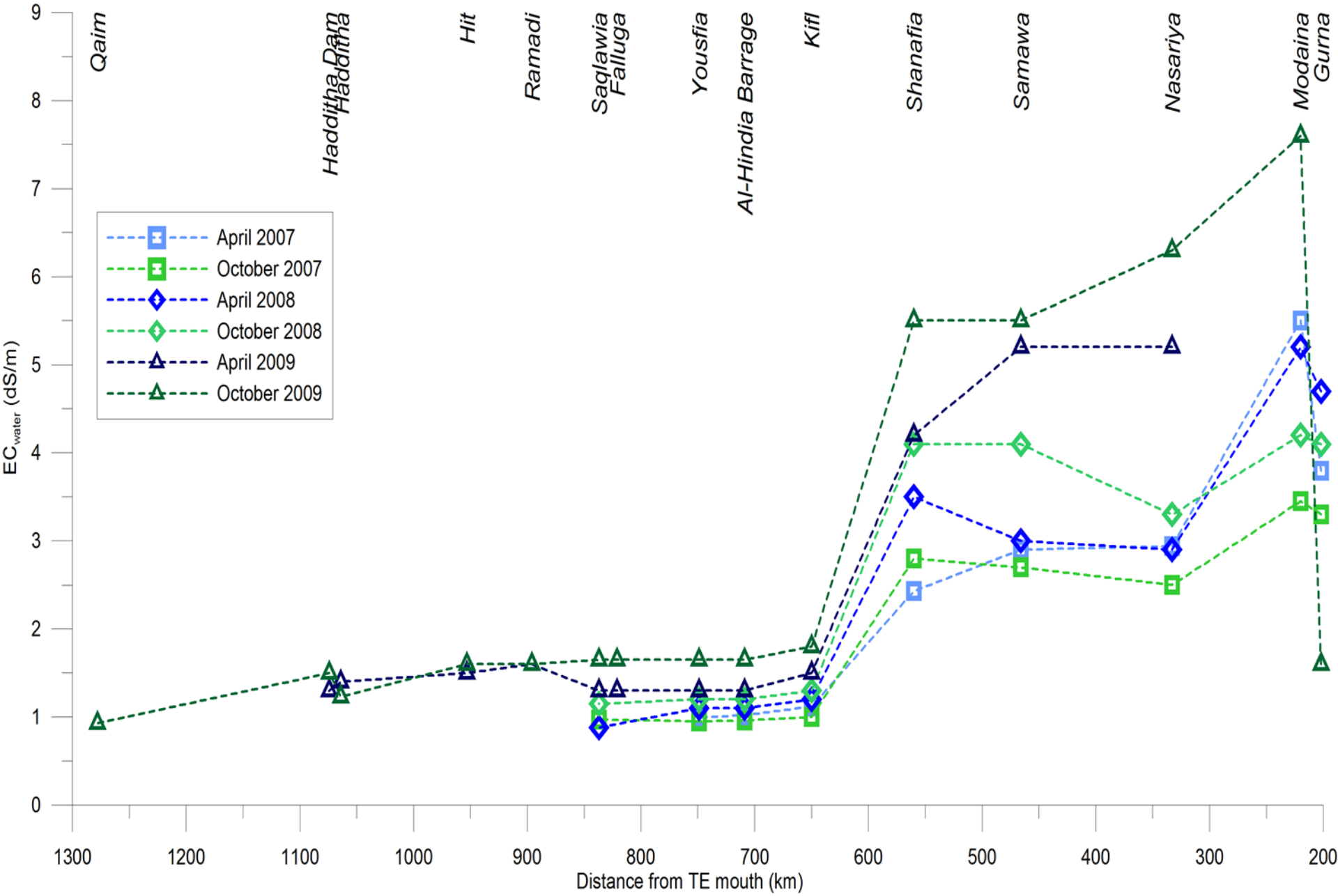
Closed Drainage Canal

Leaching Requirement (LR):
Fraction of infiltrated irrigation water that must be leached through the root zone to remove the excess salts which accumulation from the irrigation water.

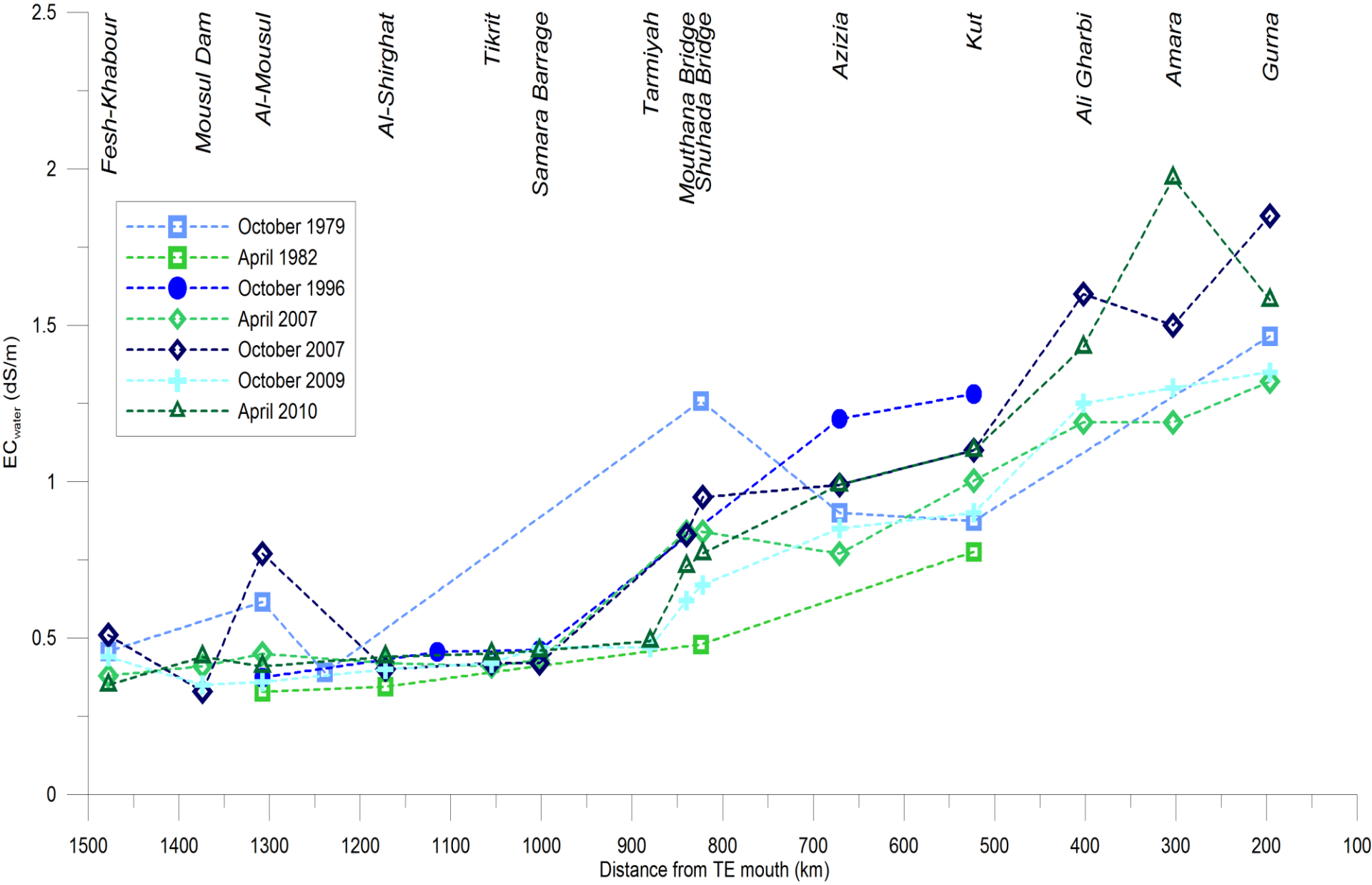


Salt accumulation processing in Iraq





Euphrates River salinity over time (source: data provided by Ministry of Agriculture and Ministry of Water Resources data)



Tigris River Salinity. (source: data provided by Ministry of Agriculture and Ministry of Water Resources data)

Reasons for salinization of soils in Iraq:

First: Natural factors

1- Marine sediments

2 - mineral weathering

3. High level and salinity of ground water

4. Climate (Dry - Semi Dry)

5. Heavy soil texture

6. Climate change

Second: Human factors:

1- Traditional irrigation methods

2 - the uncontinuous maintenance of drainage networks in the reclaimed land

3. Traditional methods of transporting water through uncoated channels

4 - deterioration of the quality of irrigation water represented by the Tigris and Euphrates rivers.

5. Economic and social factors.

Install an informal water pumping station to withdraw water from the main canal

Traditional irrigation methods (surface irrigation)

Loss of the formal shape of a major irrigation channel in the Musayyib irrigation project

Impact of Salt-affected soils on productivity

Effect of salinity levels on most crops yield	
Soil salinity level	% yield
Non saline	100
Slightly saline	70-80
Moderately saline	40-70
Sever saline	O-40
Very sever saline	0

Crop	ECe ($dS.m^{-1}$)				Reference
	Relative yield decrease				
	0%	10%	25%	50%	
Barley	8.0	10.0	13.0	18.0	Hassan et al., 1970
Cotton	7.7	9.6	13.0	17.0	Maas & Grattan,1999
Wheat	4.0	7.4	9.5	13.0	Francois et al., 1985
Sunflower	5.3	6.2	7.6	9.9	Francois , 1996
Sorghum	4.0	5.1	7.2	11.0	Francois , 1984
Corn	1.7	2.5	3.8	5.9	Hassan et al., 1970

Soil salinity risks in land degradation:

The salinity of the soil has a significant negative impact on the productivity of agricultural crops because of its direct and indirect effects on the soil characteristics then on the productivity of soils. The saline accumulation has a toxic effect on the plant, especially at high levels of some elements as chloride and sulphate.

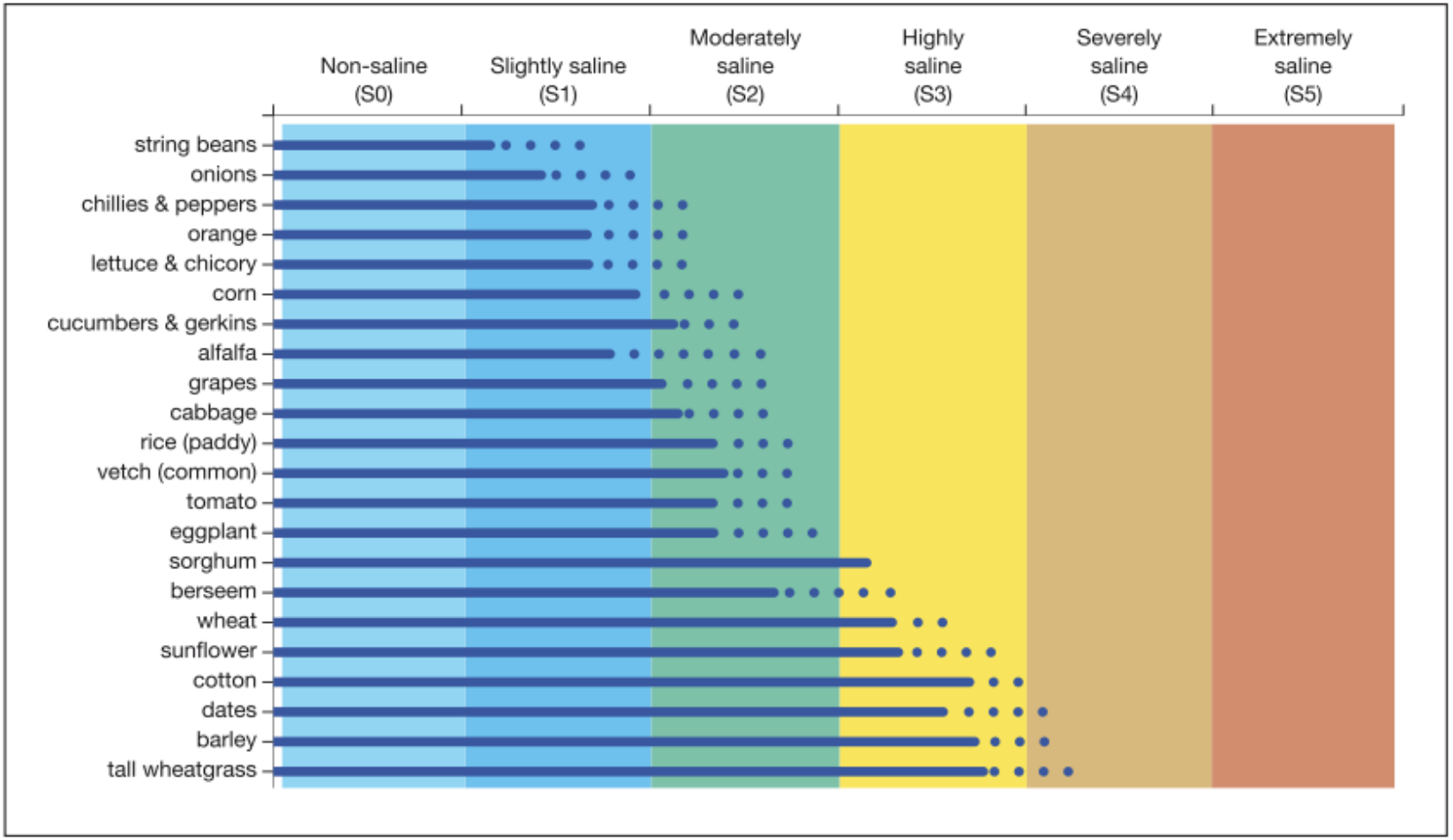
There are two types of soils affected by salinity in Iraq depending on the quality of salts:

Salinity negatively impacts soil formation, which affects the availability and movement of both water and nutrients, as well as their direct impact on osmotic pressure and then on the absorption of water and nutrients by the plant. Thus, all these negative conditions have a significant impact on soil degradation and productivity, then food security. Studies have shown that crop productivity decreases with increasing of soil salinity as shown in Table below.

The relationship between soil salinity and crop productivity

Soil salinity level	% yield
Non saline	100
Slightly saline	70-80
Moderately saline	40-70
Sever saline	0-40
Very sever saline	0

the continuous line indicates that 100% of productivity can be reached at the level of salinity (S0) and 75% of productivity at S1, S2, S3, the dotted line shows a decrease in productivity of up to 50% according to the type of crop.



The total irrigated area that needs to reclamation 3230 million ha has been reclamation 1369 million ha but needs to be rehabilitated, so the remaining area that needs to reclamation 1862 million ha, the average of primary and secondary drains in the semi-reclaimed areas is 50-60%, as well as the wrong agricultural practices (traditional) such as surface irrigation, which led to the accumulation of salts due to the high level and salinity of the ground water as well as the heavy soil texture, clay to clay loam and the increase in temperature, high evaporation all these factors lead to accumulation of salts on the surface of the soil because there are no effective drainage network as well as the instability of the prices of agricultural products leds to the reluctance of farmers to use their land in agriculture and left it (Bore), change arable land with high production to non-productive land so, salinity in some of the sites reached much more than 16dsm^{-1}, especially in the south of Iraq.

the levels of salinity in irrigated lands in general as follows:

4% Highly saline (>16dsm^{-1})
50% moderate salinity (>4dsm^{-1})
20% Low salinity >2dsm^{-1}
Thus, 75% of the total irrigated soil in Iraq was affected by salinity (more than 2 million hectares), 25% of it converted from productive to nonproductive lands, so the soil in the Mesopotamia plain was deteriorated in various levels according to the salinity levels.

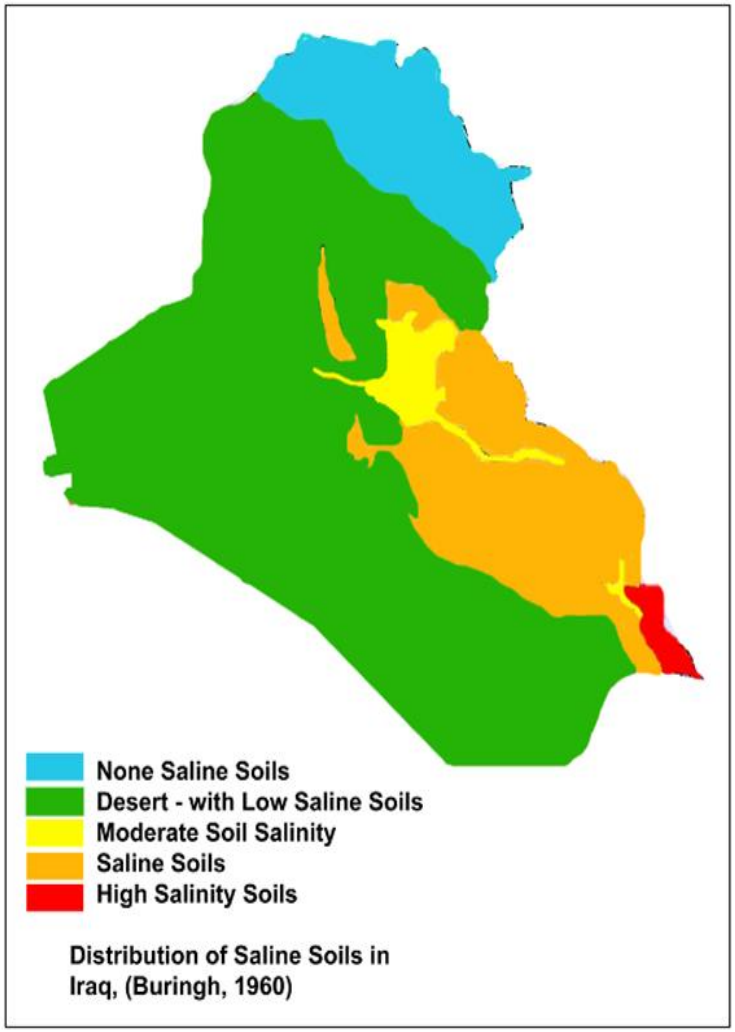
- Virtually no areas are left unaffected by soil salinity and a large amount of agricultural land is lost to salinity each year. Irrigation efficiency is very low mainly because of the degraded irrigation and drainage infrastructure. Farmers of saline soils are using only 30% of their land for cropping and are achieving only 50% of the expected yields leading to losses of approximately USD 300 million per year as a result of salinity

- Salinity in Iraq is a complicated and ongoing issue and short-term projects (for two to three years) will not solve the problem in the long term. No comprehensive study has been undertaken to assess the extent of irrigation-induced salinity. The monitoring network to record spatial and temporal changes and characterize the salt-affected soils in the different parts of the country is almost non-existent.
- Irrigation delivery and drainage infrastructure need to be modernized at the irrigation command level and integrated into a broader regional framework. The water allocation requirements for different crops should be revised so that the amount of water applied by farmers is based on crop needs, not infrastructure capacity.

Final report: Soil salinity management central and southern Iraq, 2012

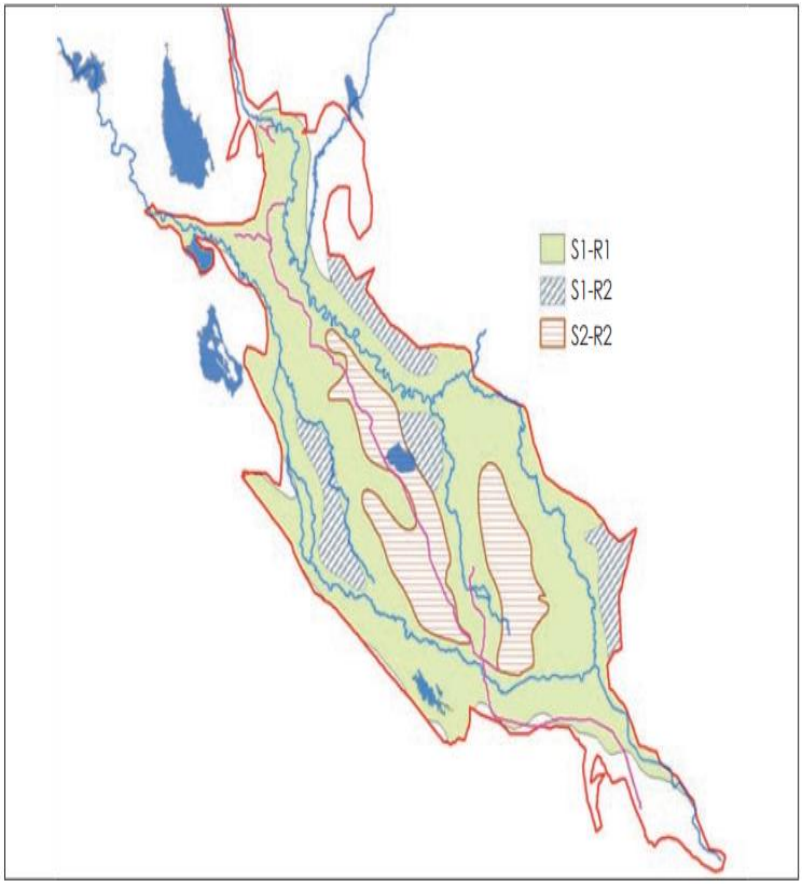
The reality of salinity in Iraq:

The problem of salinity in Iraq is the main determinant of land degradation and is the limiting factor for agricultural production,food security as well as for environment. Buring (1960) found that most of Iraq's soil is affected by salinity.(Map 2) through the survey was conducted in duration 1955-1958, which showed an increase in the concentration of soluble salts, concentrated in the surface layer of soil and may penetrate the subsurface layers, al-Taie (1970) illustrated that about 70-60% of land in central and southern Iraq are affected by salinity.



Distribution of Saline Soils in Iraq, (Buringh, 1960)

(FAO, 1980) showed that the salinity of the soil increases by about 2-5 $dS.m^{-1}$ every year in most of the sedimentary plain and the salinity of the soil in most of it is higher than 15 $dS.m^{-1}$, which is concentrated in the center and south of Iraq, which illustrates the saline boundary in central and southern Iraq and the annual increase in soil salinity and salinity limits in some of the projects, therefore the area affected by salinity is more than 3.75 million hectares annually.

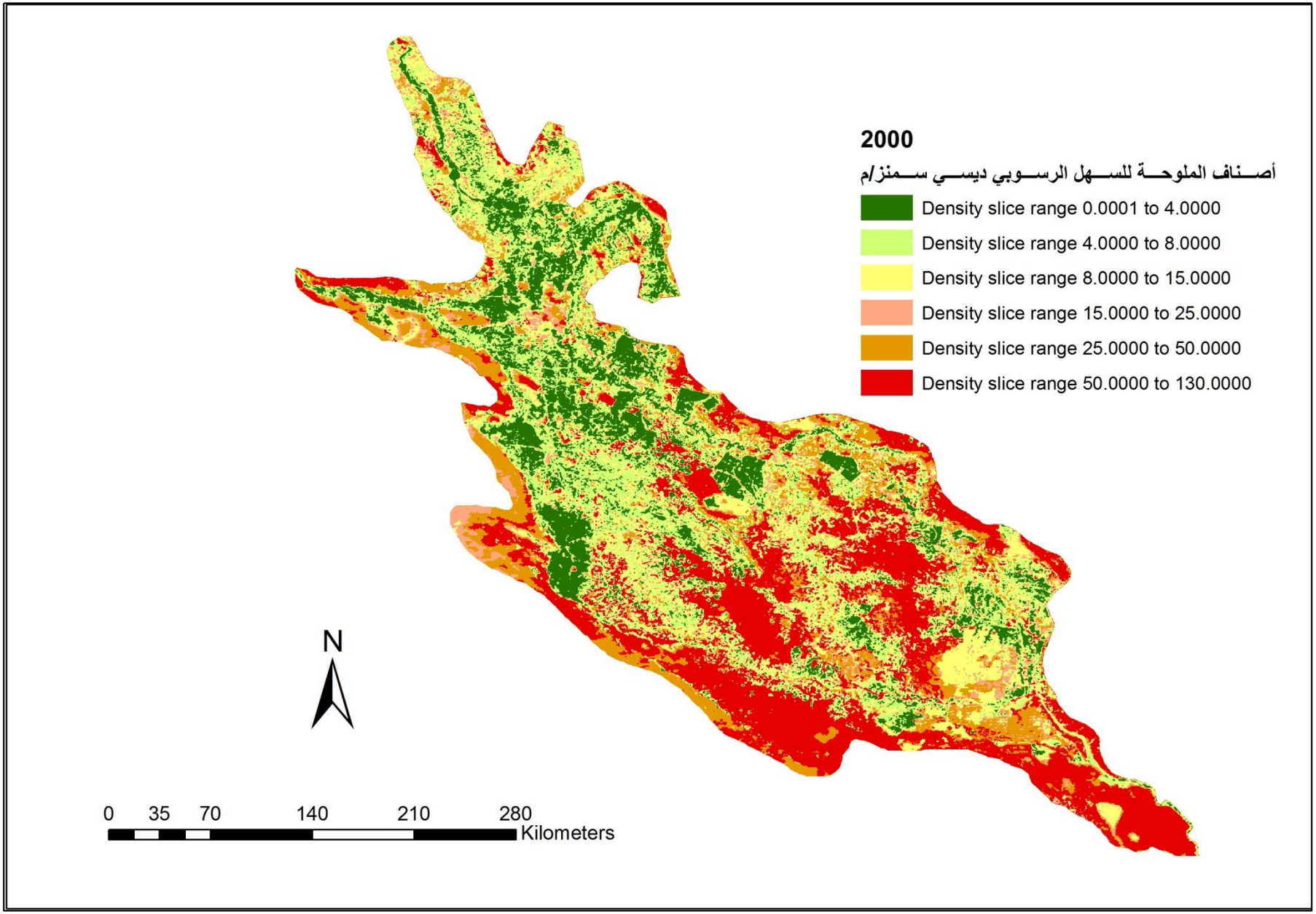


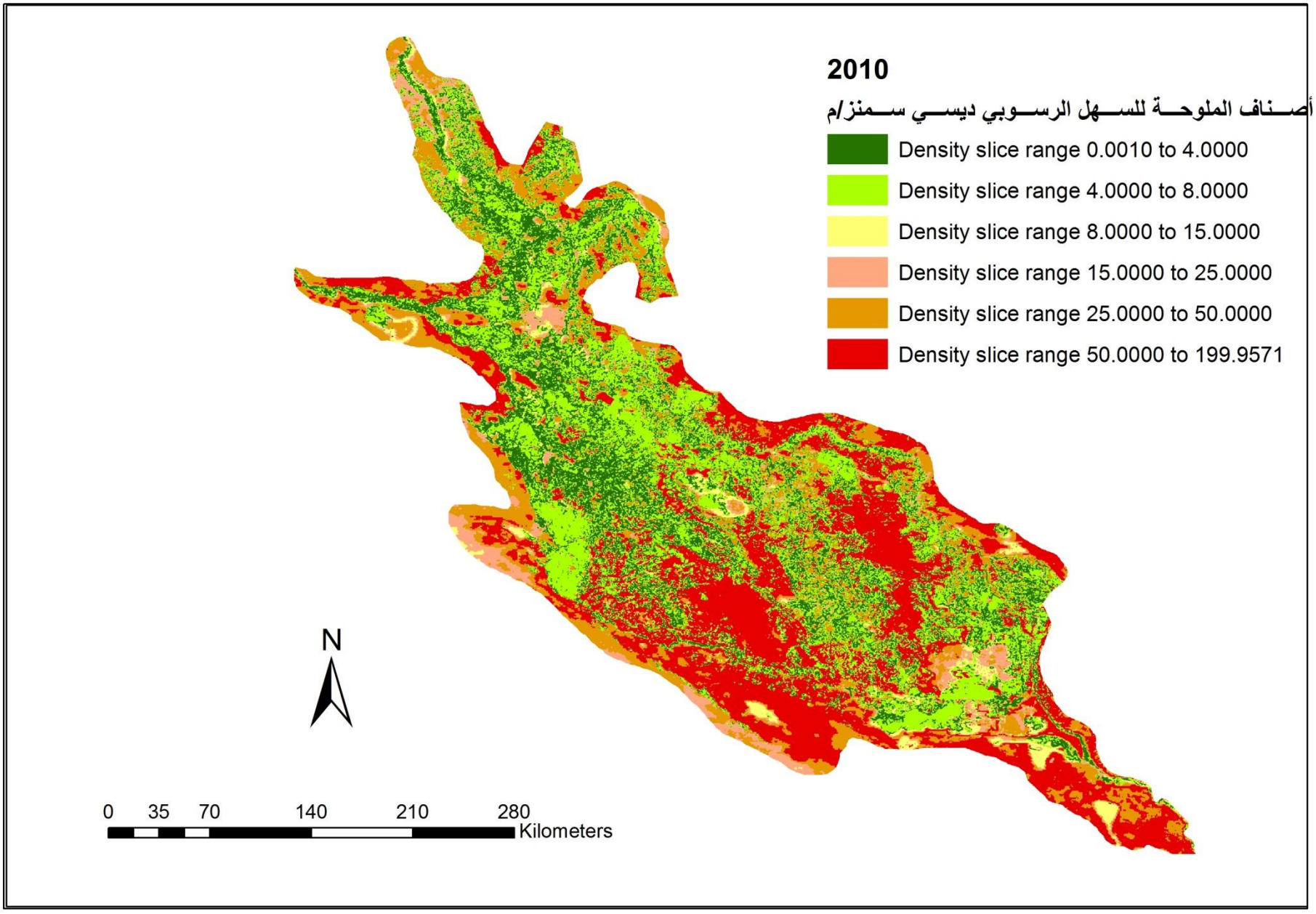
S1: Soil salinity 4-15 dsm^{-1}

S2: Soil salinity > 15 dsm^{-1}

R1: increasing of soil salinity 2-3 dsm^{-1} each year

R2: increasing of soil salinity 3-5 dsm^{-1} and ESP 2-3 per year


2000
أصـــناف الملوحـــة للســـهل الرســـوبي ديســـي ســـمنز/م
Density slice range 0.0001 to 4.0000
Density slice range 4.0000 to 8.0000
Density slice range 8.0000 to 15.0000
Density slice range 15.0000 to 25.0000
Density slice range 25.0000 to 50.0000
Density slice range 50.0000 to 130.0000
N
0 35 70 140 210 280
Kilometers


2010
أصـــناف الملوحـــة للســـهل الرســـوبي ديســـي ســـمنز/م
Density slice range 0.0010 to 4.0000
Density slice range 4.0000 to 8.0000
Density slice range 8.0000 to 15.0000
Density slice range 15.0000 to 25.0000
Density slice range 25.0000 to 50.0000
Density slice range 50.0000 to 199.9571
N
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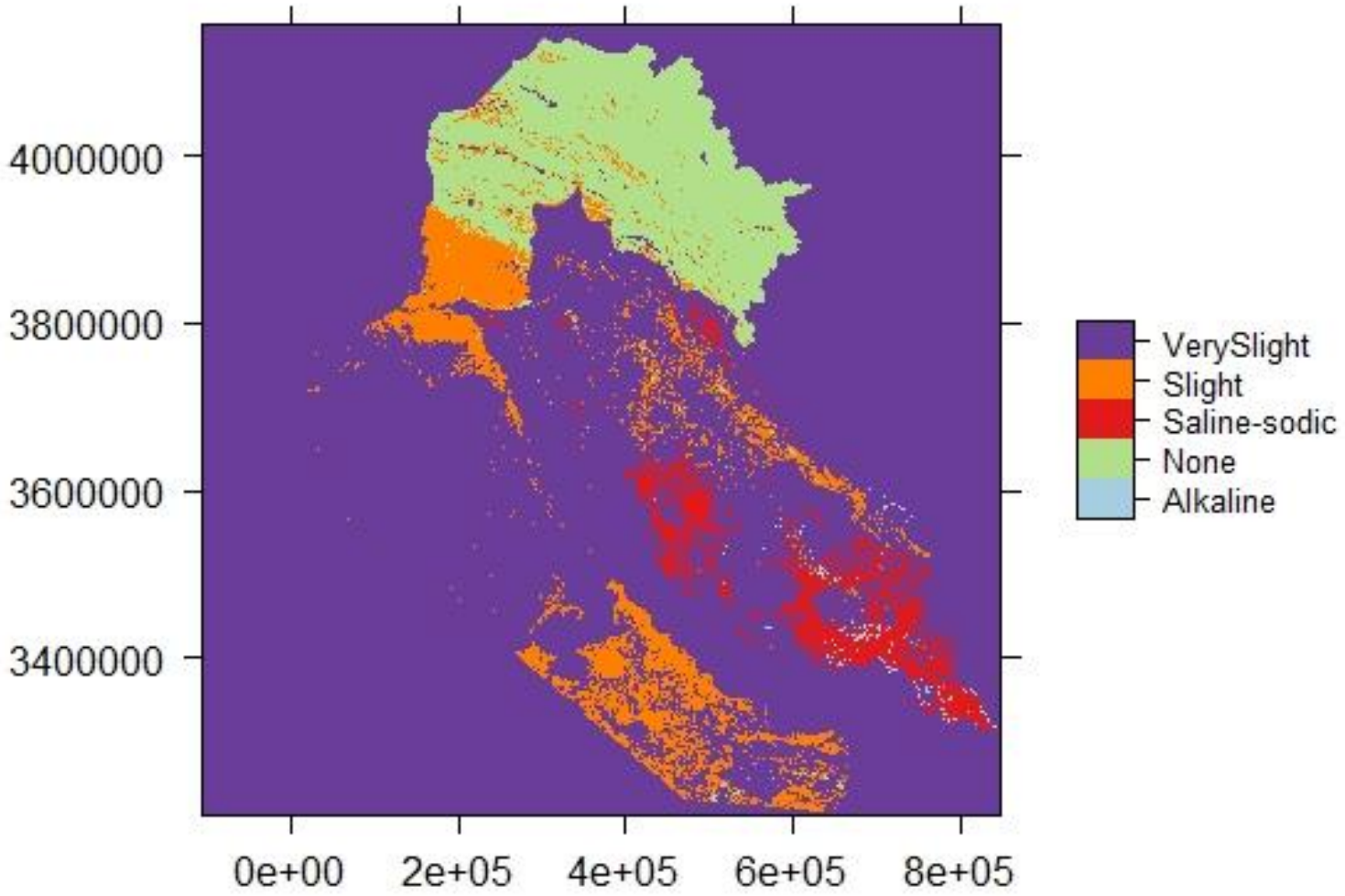
Kilometers

2019


4000000
3800000
3600000
3400000
0e+00
2e+05
4e+05
6e+05
8e+05
VerySlight
Slight
Saline-sodic
None
Alkaline

Thanks a lots