Status, priorities and needs for sustainable soil management in Iraq

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Ministry of Agriculture
Iraq/Baghdad

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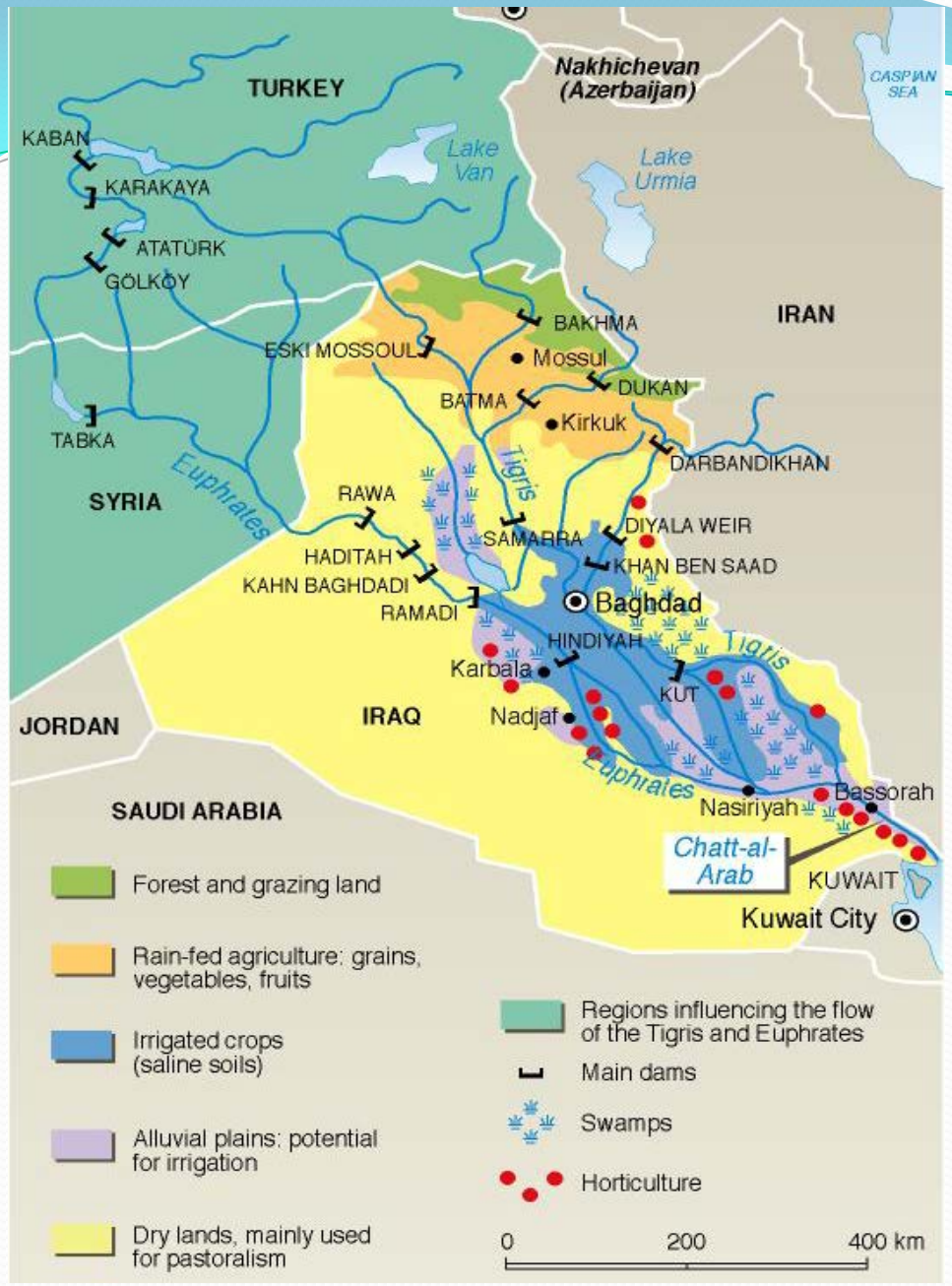
Amman, Jordan 17-19 June 2014

preface



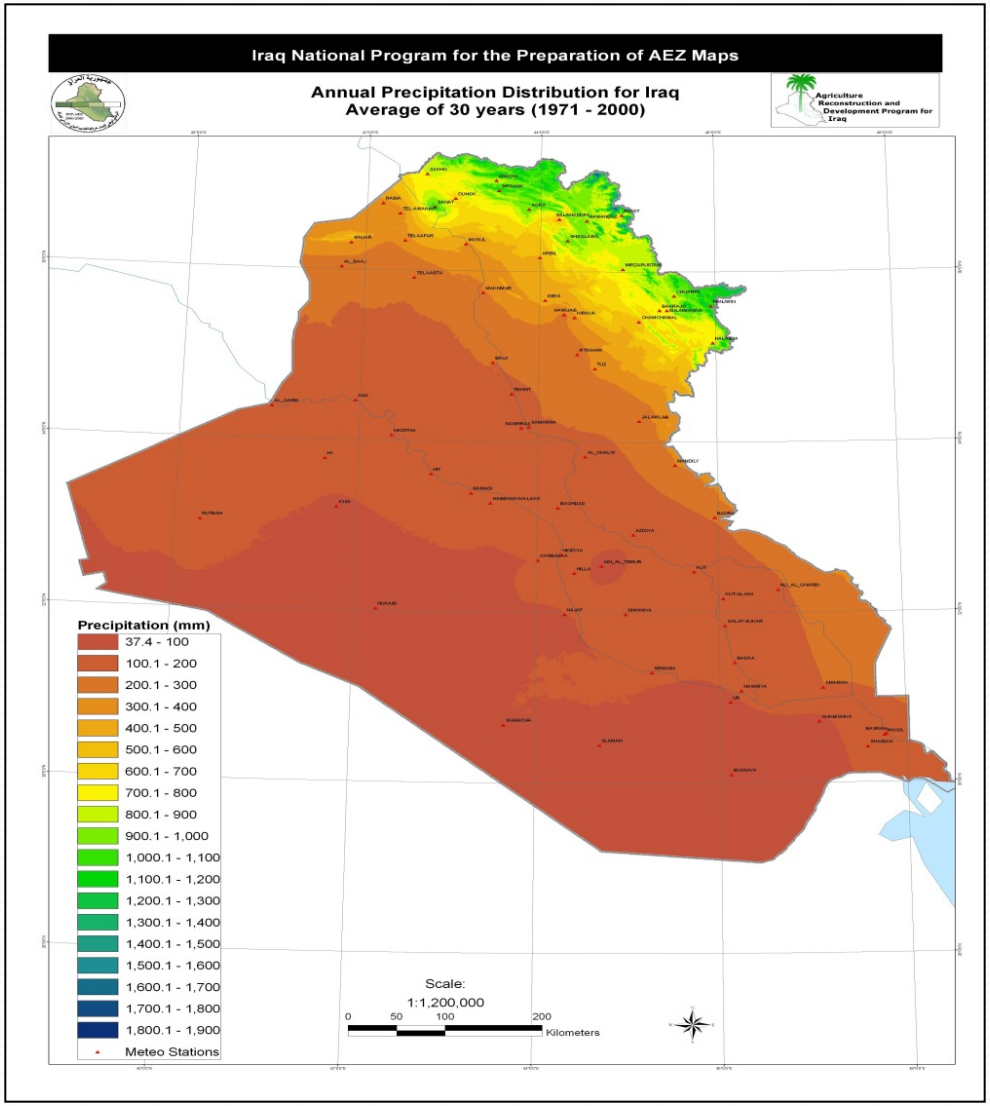
- Both the Tigris and Euphrates Rivers originate in the mountains of eastern Turkey with the majority of their headwaters generated from annual rainfall and snowmelt. Approximately 98% of the waters of the Euphrates are generated within Turkey.

- significant portion of the waters of the river actually evaporate due to the extreme desert heat.

- The Tigris receives almost half of its waters initially from Turkey, a negligible amount as it forms borders between both Turkey and Syria, many of which originate in the mountains of western Iran.

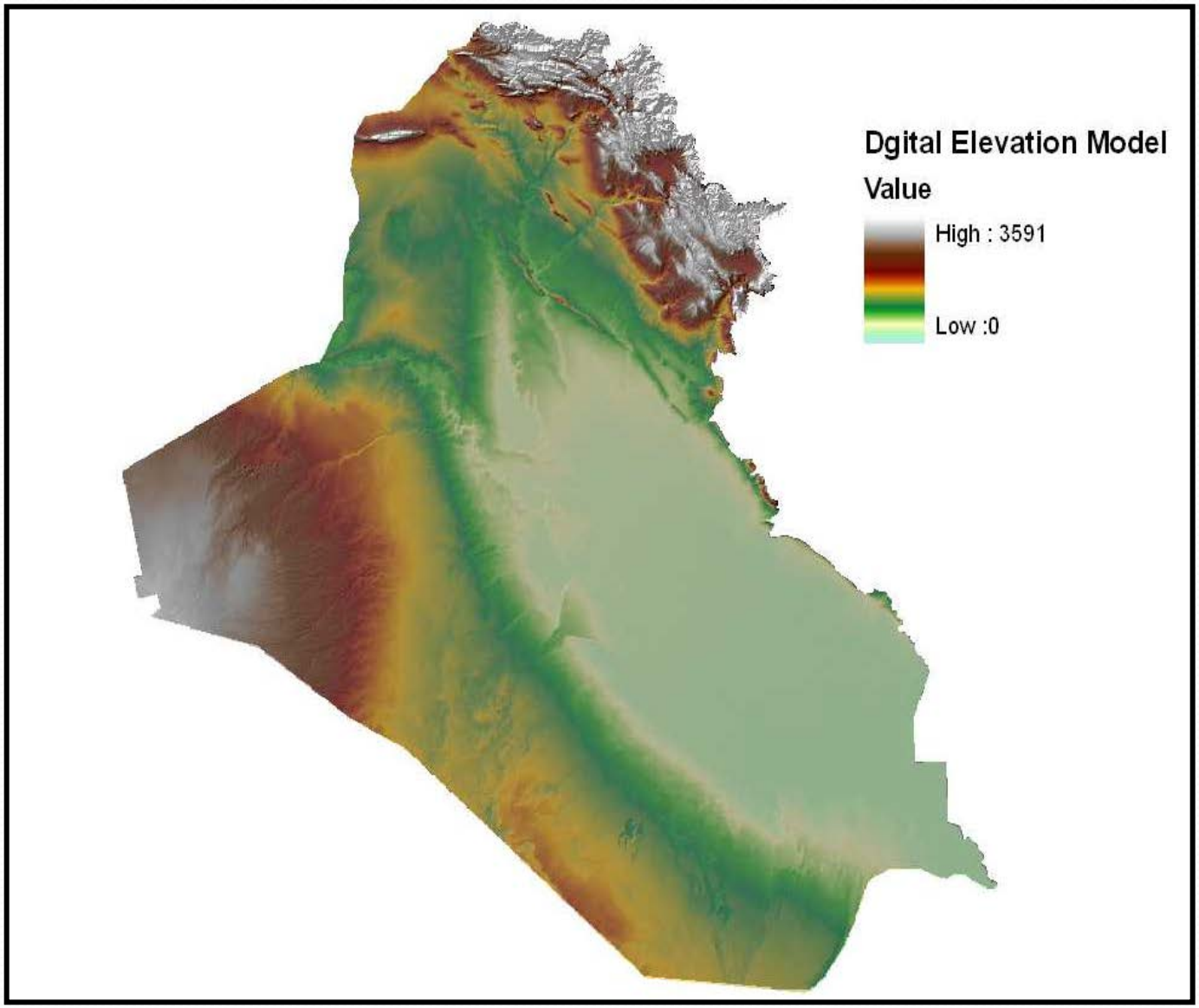
- The rivers join at the Shatt al-'Arab north of Basra and flow together for a little more than 100 miles to the Arab Gulf.

Environment



- Iraq is characterized by an arid to semi-arid climate, being arid in the Eastern part and less so in Mesopotamia.
- annual means varying from 150 to 400 mm. Almost all rain falls during winter, December to February.
- potential evaporation rates are high at >2000mm in summer because the high net solar radiation.
- Ambient temperatures range from 7 to 20 C in winter and 30 to 50 C or more in summer.

Digital Elevation Model

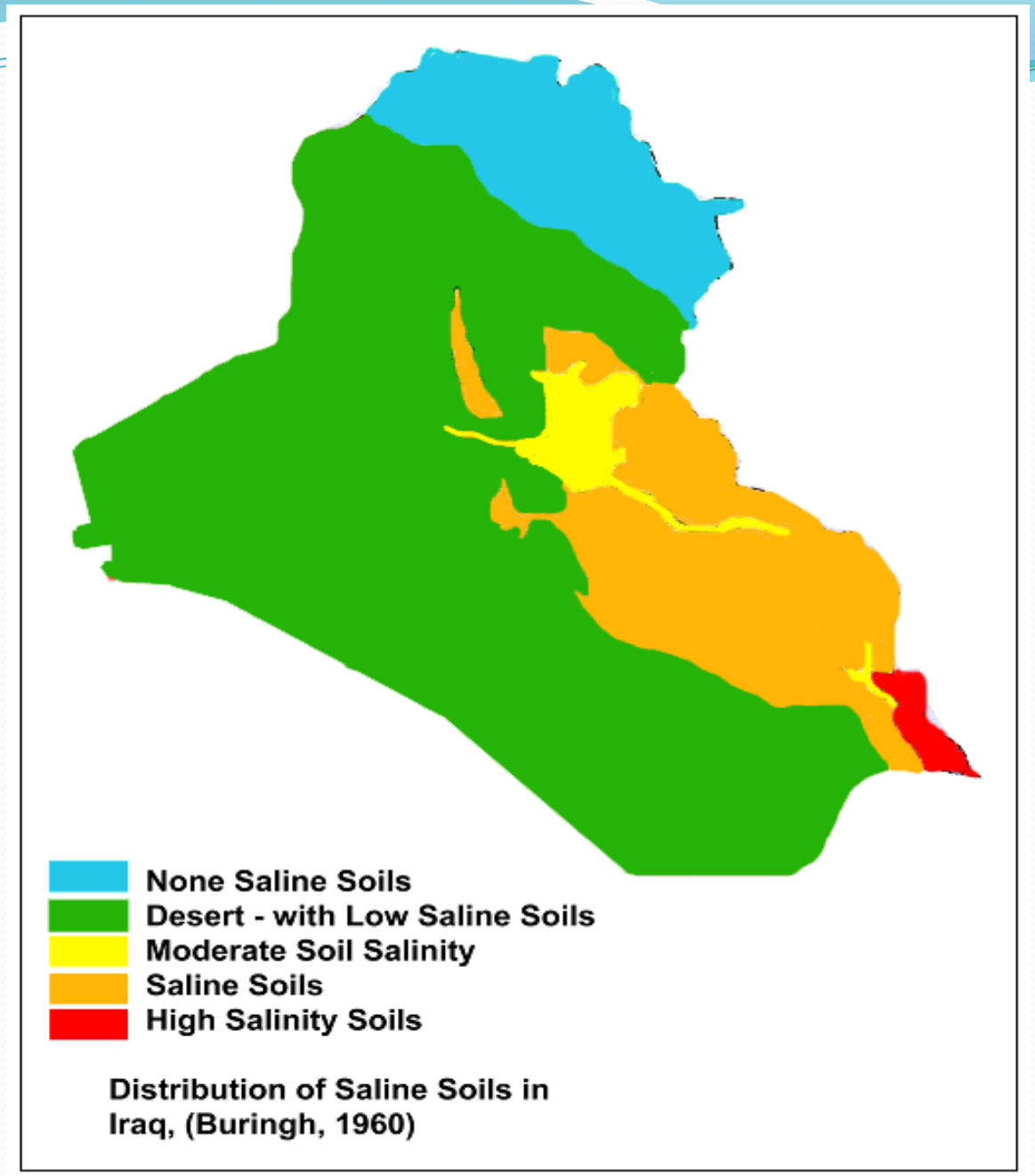


According to above
the dominate type of soil especially in central and south of Iraq is saline soil

Accumulation of free salt at the soil surface and / or soil profile affecting plant growth and / or land use.

Salinity Problem in Iraq

Is the Salinity Problem a present phenomenon ?



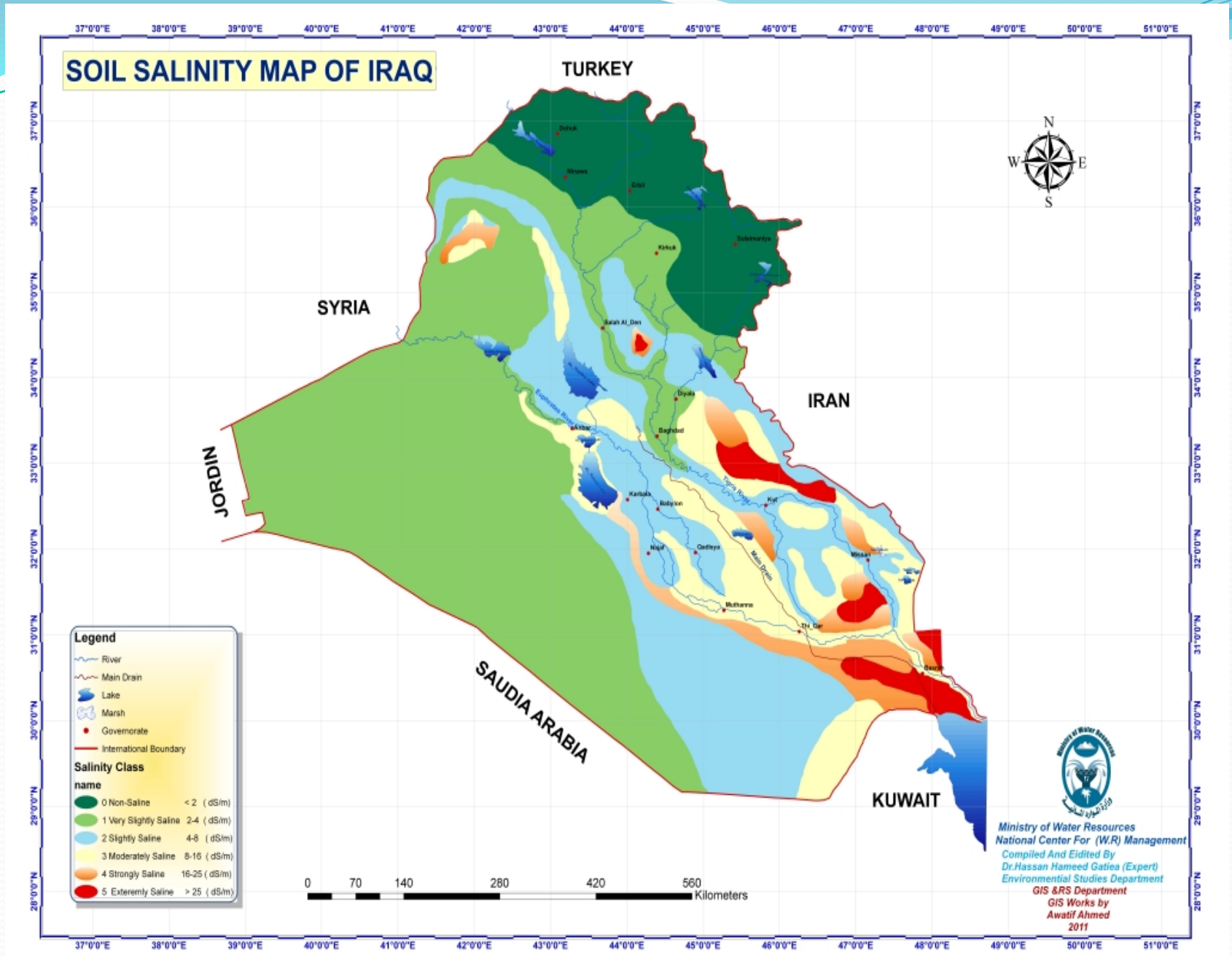
Distribution of Saline Soils in Iraq, (Buringh, 1960)

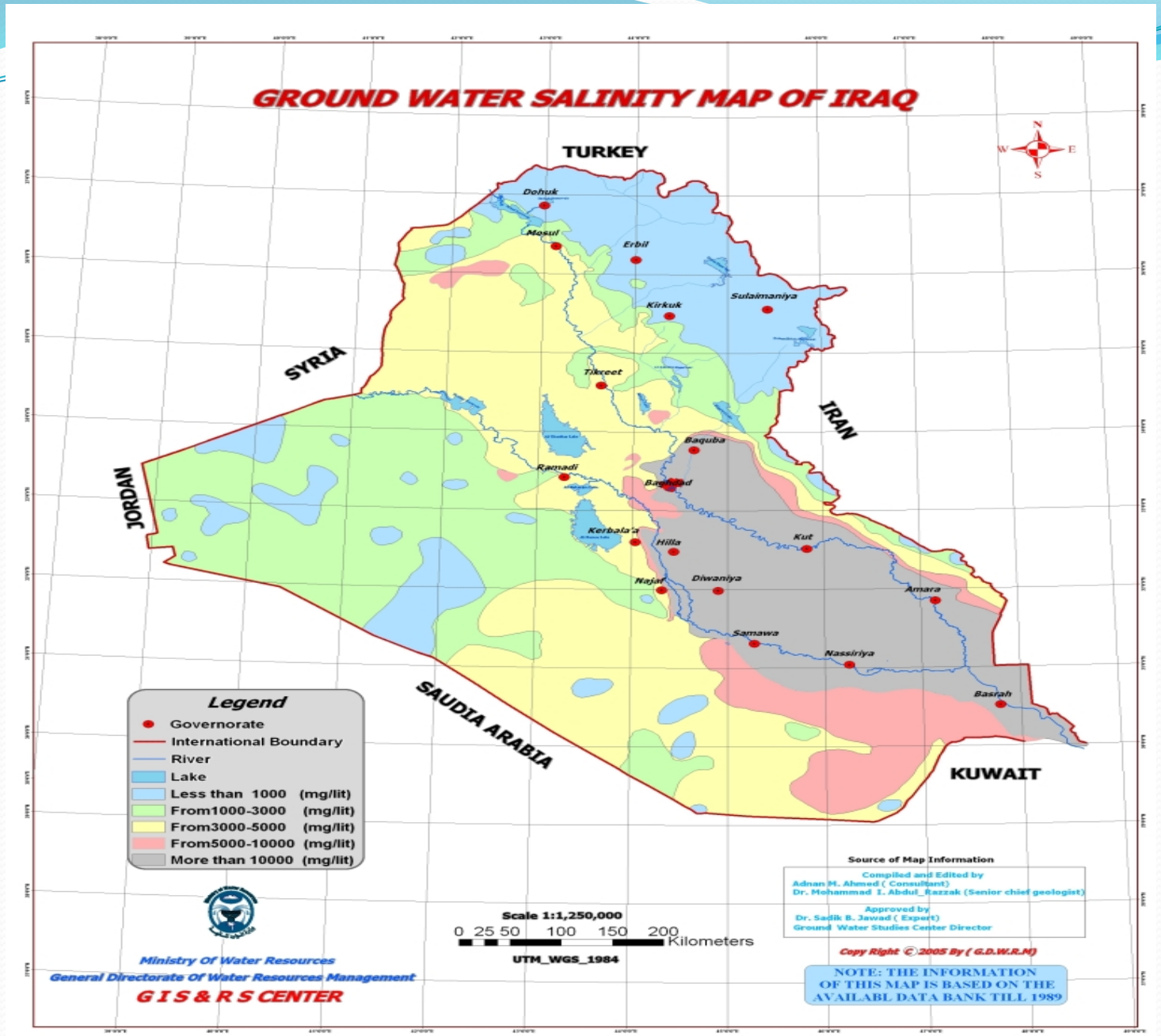
Al-Taie,1970

About 60-70 % of the soils in mid and southern part of Iraq are saline

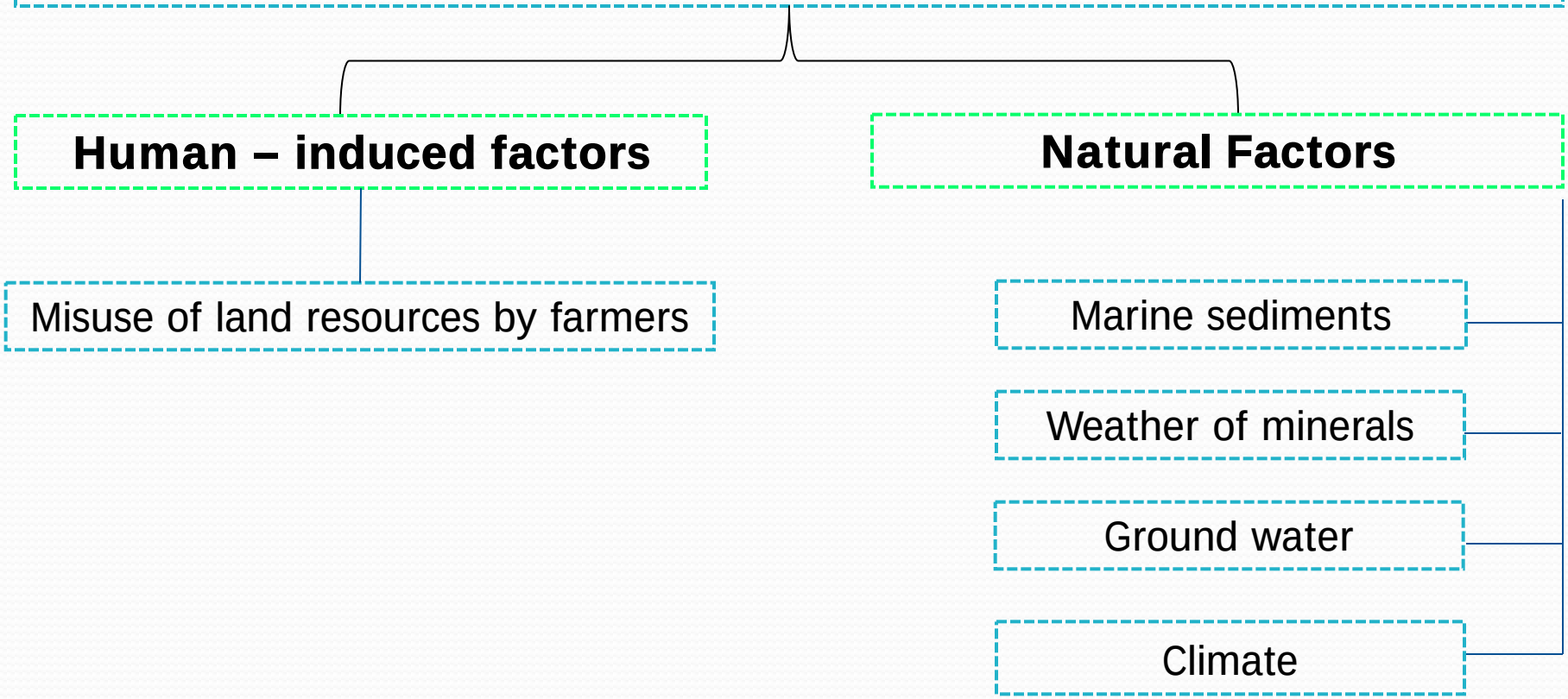
Rebecca et.al, 2007

The principal process in the soil of central and southern Iraq is Salinization


SOIL SALINITY MAP OF IRAQ
TURKEY
SYRIA
IRAN
JORDIN
SAUDIA ARABIA
KUWAIT
N
W
E
S
Legend
River
Main Drain
Lake
Marsh
Governorate
International Boundary
Salinity Class
name
0 Non-Saline < 2 (dS/m)
1 Very Slightly Saline 2-4 (dS/m)
2 Slightly Saline 4-8 (dS/m)
3 Moderately Saline 8-16 (dS/m)
4 Strongly Saline 16-25 (dS/m)
5 Exteremly Saline > 25 (dS/m)
0 70 140 280 420 560
Kilometers
Ministry of Water Resources
National Center For (W.R) Management
Compiled And Eidited By
Dr.Hassan Hameed Gatiea (Expert)
Environmental Studies Department
GIS &RS Department
GIS Works by
Awatif Ahmed
2011


GROUND WATER SALINITY MAP OF IRAQ
TURKEY
SYRIA
IRAN
JORDAN
SAUDIA ARABIA
KUWAIT
Dohuk
Mosul
Erbil
Sulaimaniya
Kirkuk
Tikreet
Baquba
Ramadi
Baghdad
Kerbala'a
Hilla
Kut
Najaf
Diwaniya
Amara
Samawa
Nassiriya
Basrah
Legend
Governorate
International Boundary
River
Lake
Less than 1000 (mg/lit)
From1000-3000 (mg/lit)
From3000-5000 (mg/lit)
From5000-10000 (mg/lit)
More than 10000 (mg/lit)
Scale 1:1,250,000
0 25 50 100 150 200 Kilometers
UTM_WGS_1984
Source of Map Information
Compiled and Edited by
Adnan M. Ahmed (Consultant)
Dr. Mohammad I. Abdul_Razzak (Senior chief geologist)
Approved by
Dr. Sadik B. Jawad (Expert)
Ground Water Studies Center Director
Copy Right © 2005 By (G.D.W.R.M)
NOTE: THE INFORMATION OF THIS MAP IS BASED ON THE AVAILABL DATA BANK TILL 1989
Ministry Of Water Resources
General Directorate Of Water Resources Management
G I S & R S CENTER

Factors responsible for the accumulation of salt in soil



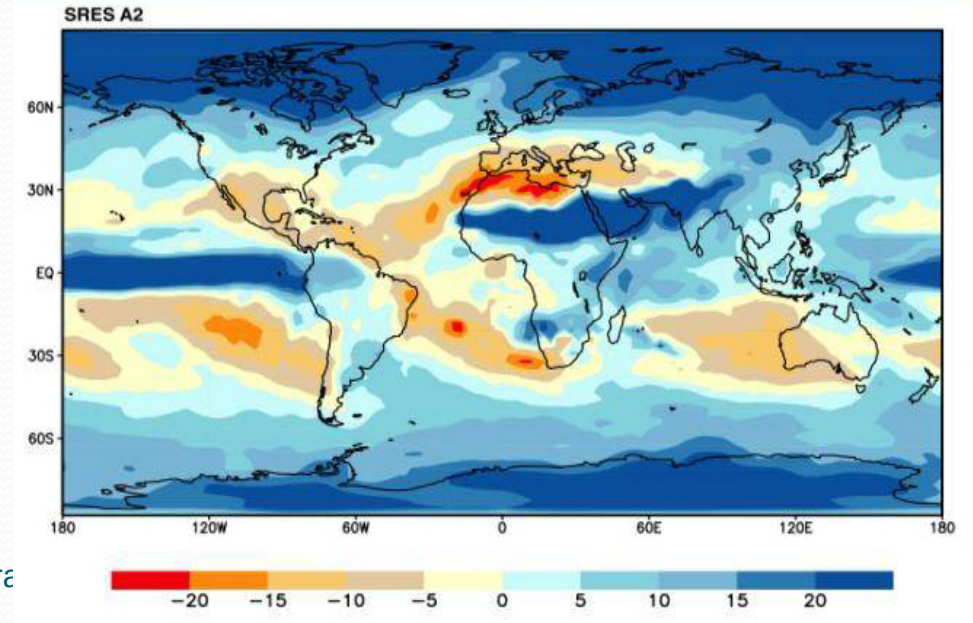
Irrigation with
Drainage Water

Wrong Water Transfer

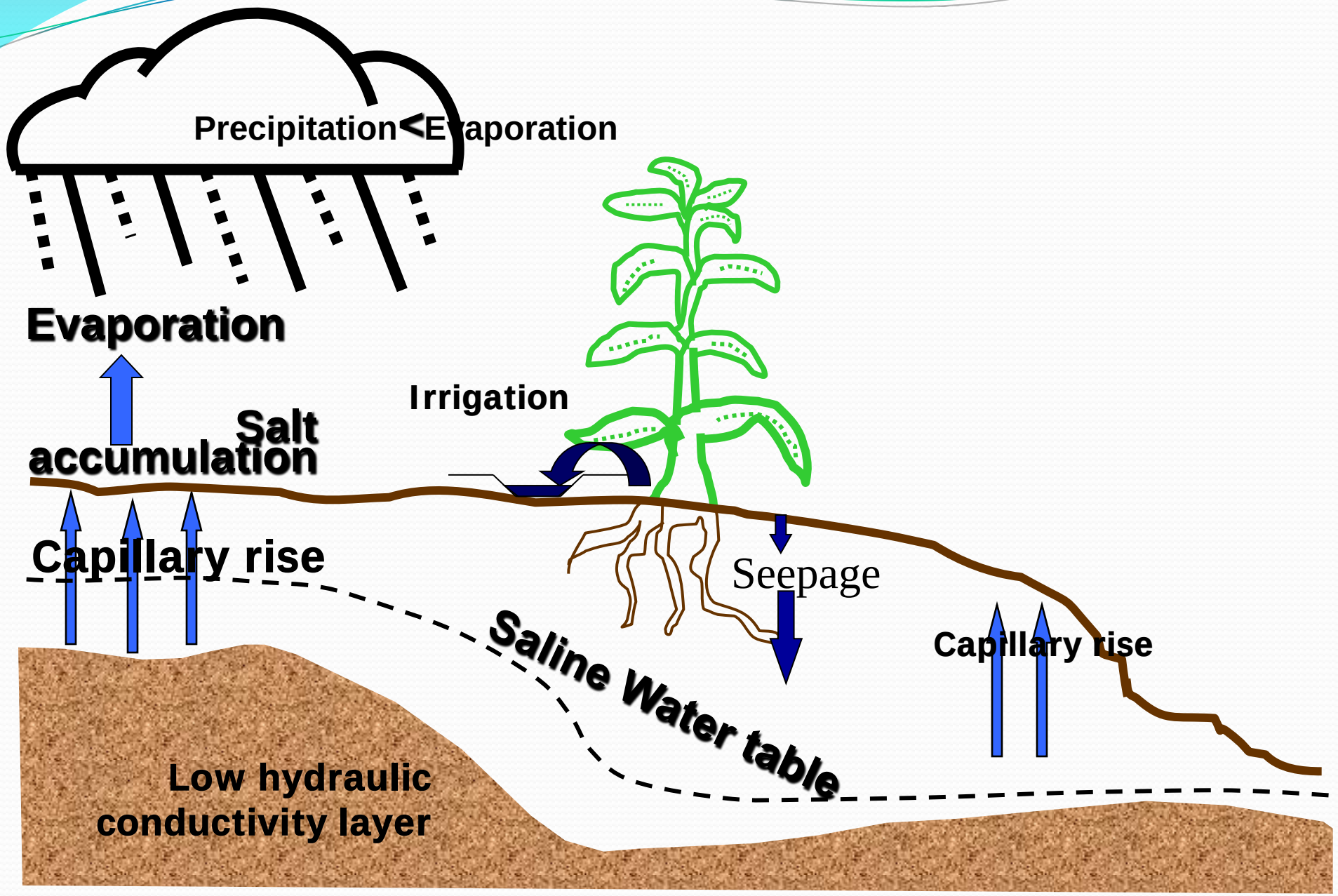
Irrigation with
Saline Well Water

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 Processes In Iraq



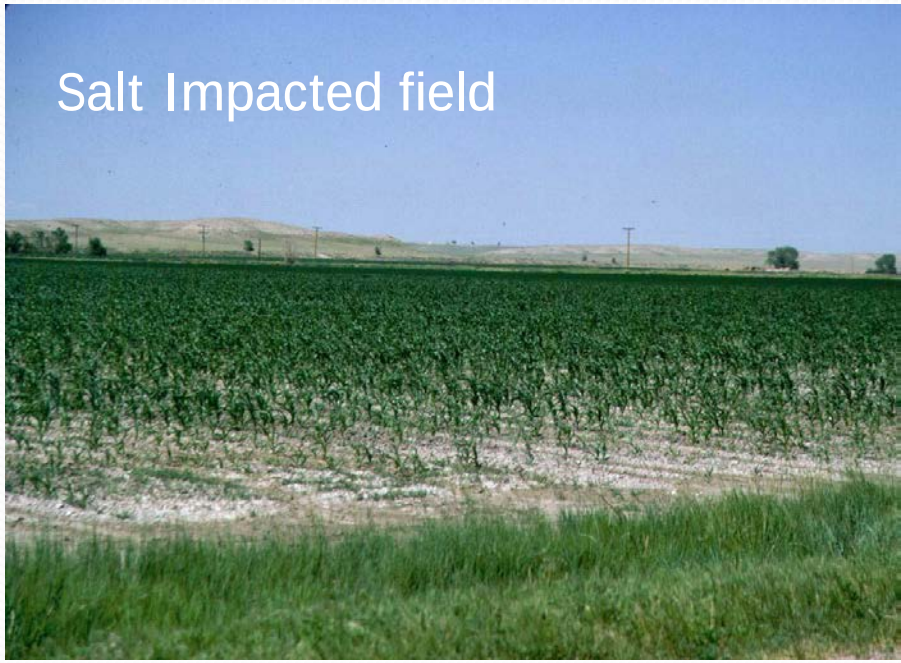
So:

Problem → **Result**

- **Problem** → saline Soil
- **Result** → Low productivity of Agricultural land
- **Result** → Desertification Dusty storm

Impact of Salinity on Yield and Plant Growth

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



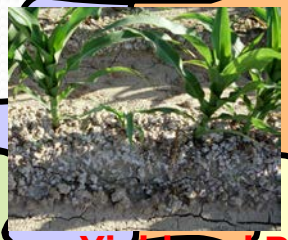
Cont..... Impact of Salinity on Yield and Plant Growth

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

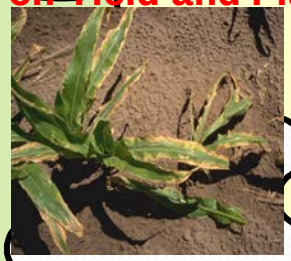
Direct Effect

Toxic Effect

Osmotic Pressure of External Solution



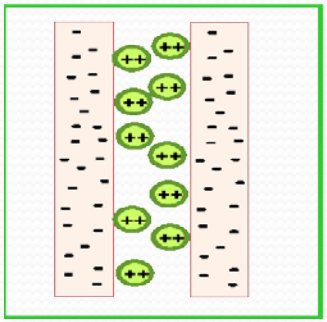
Impact of Salinity on Yield and Plant Growth

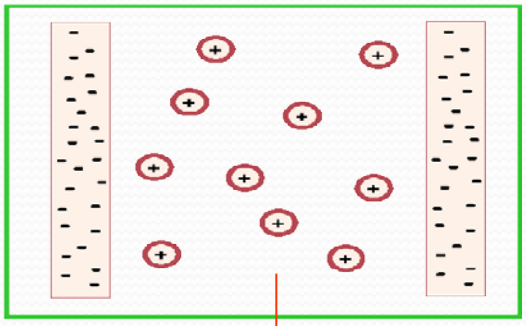


Nutrient Balance Effect

Physiological Effect

Indirect Effect





Attraction

Repulsion

Ca++ & Mg^{++}

Na^{+}

Classification of Salt-Affected soil in Iraq

- Shura soil

  NaCl – Shure

  Na_2SO_4 - Shure

  $MgSO_4$ - Shure

- Sabash soil

  $CaCl_2$ + $MgCl_2$+$MgSO_4$

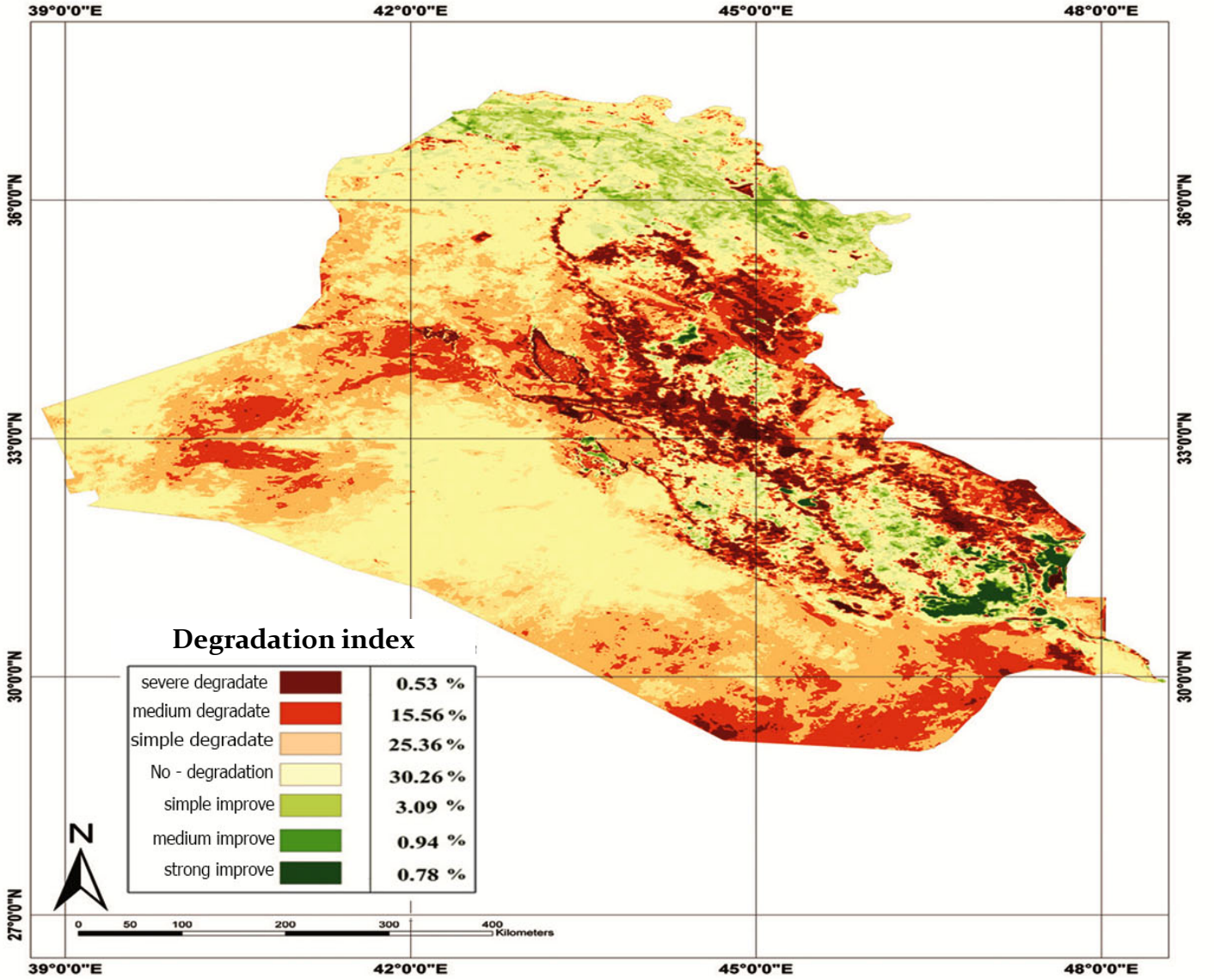
Saline Sodic Soil

EC > 4 dS/m

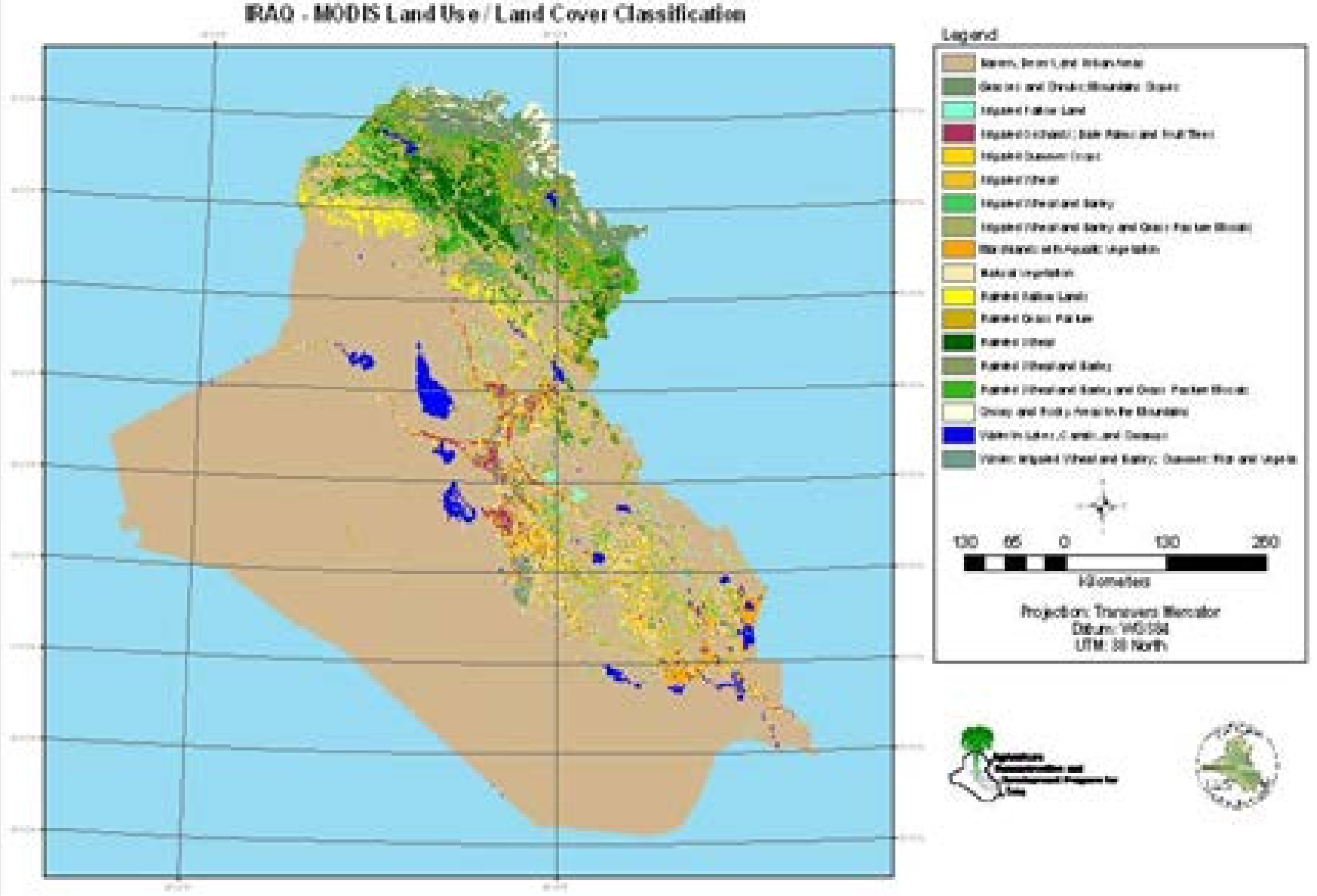
pH < 8.5

ESR ≥ 13

خارطة مرئية فضائية
توضح تغيرات الغطاء النباتي في العراق
للسنوات 2007-1999

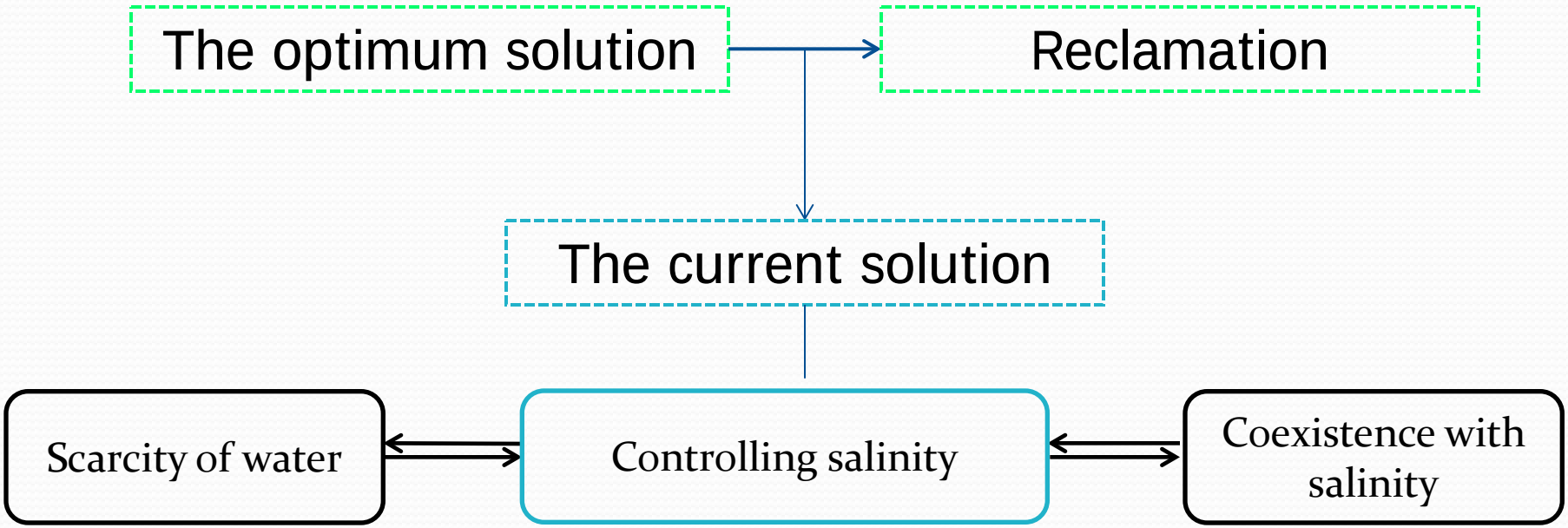


Agroecological Zones Program for Iraq



So:

the most challenges in Iraqi Soil is the **"salinity"**



First

Project of modern irrigation technologies

Covering 750ha through 6-8 years

Saving 3.6 billion m^3

- Irrigation new lands
- Agriculture density
- Leaching for reclamation of saline soil in central & south Iraq

Second

Project of soil salinity management in central and south of Iraq

Australian Government

Italian Government

Australian Government
Australian Centre for International Agricultural Research

Cooperazione Italiana allo Sviluppo
Ministero degli Affari Esteri

International center for Agricultural Research in the Dry Areas

ICARDA

A B C D E F G

A- Quantifying of the spatial distribution of salt affected land.

B-Qualitative and quantitative trends in river/drainage water and agricultural productivity.

C- Quantify and describe the relationship between ground water levels, ground water salinity and irrigation salinity.

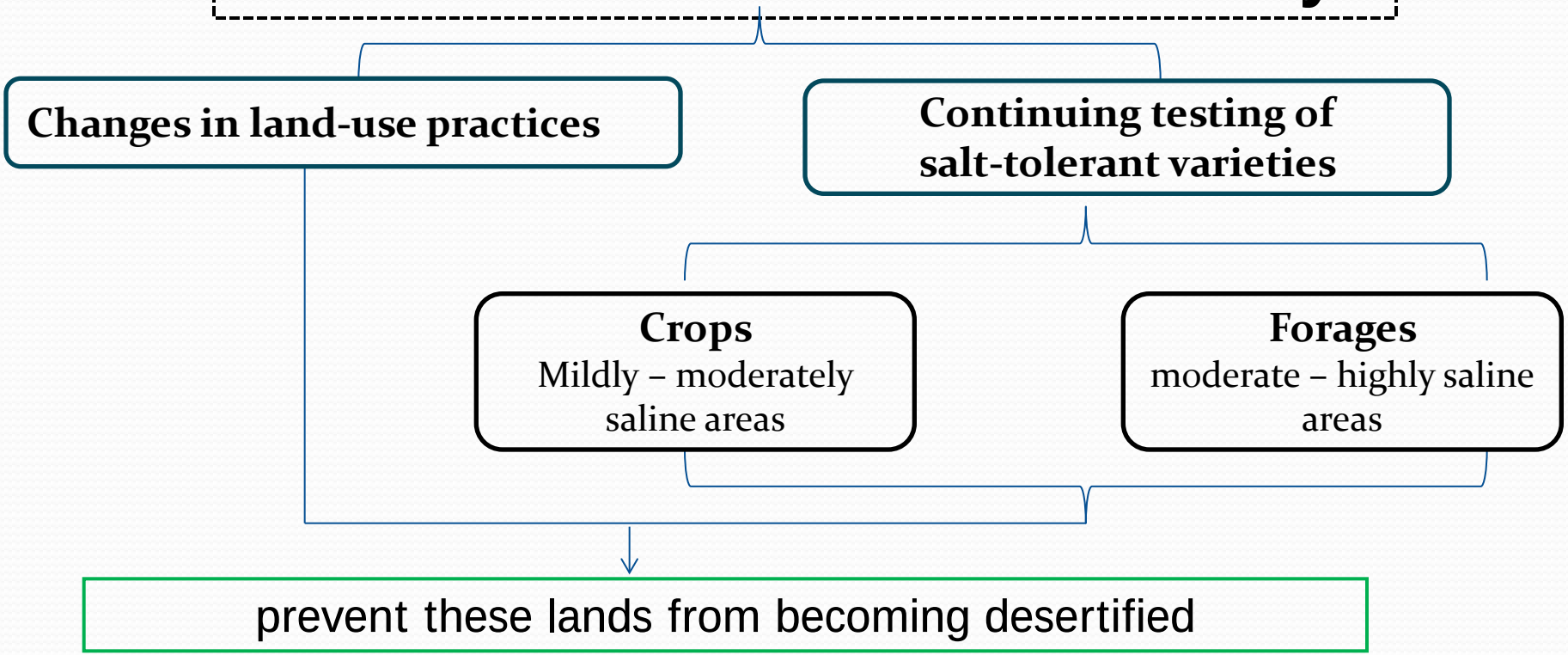
D- Assessment of current state of irrigation and drainage infrastructure.

E-Demonstrate the best bet practices for different salt tolerant crops, crop varieties and fodders.

F- Develop approaches to improve soil, agronomic, irrigation water and drainage management for salinity control.

G- Asocio – Economic impacts of salinity in Iraq.

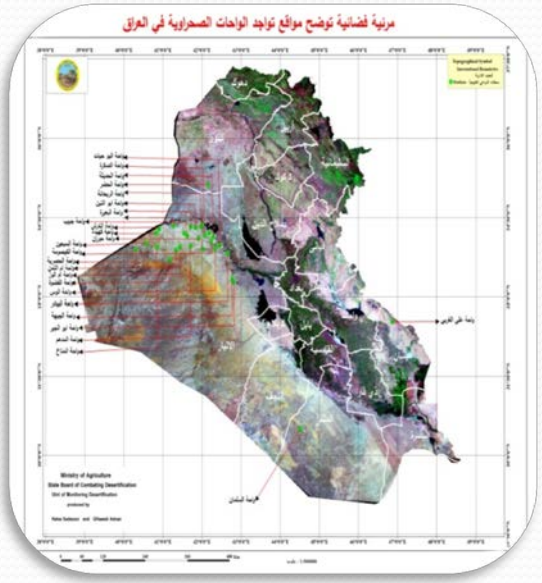
Effective solutions to soil salinity



On going:-

Salt tolerant varieties

- **Trees**
- **Fodders (forages)**
- **Crops**



Trees :

Tamarix spp. Prosopis spp. Acacia spp. Atriplex ssp.

Fodders

entrance varieties (under experiment)

Sporobolus arabicus

Panicum turgidum

Passpalum vaginatum

ICBA

Pennisetum clandestinum (Kikuyu)

(Australia)

locals

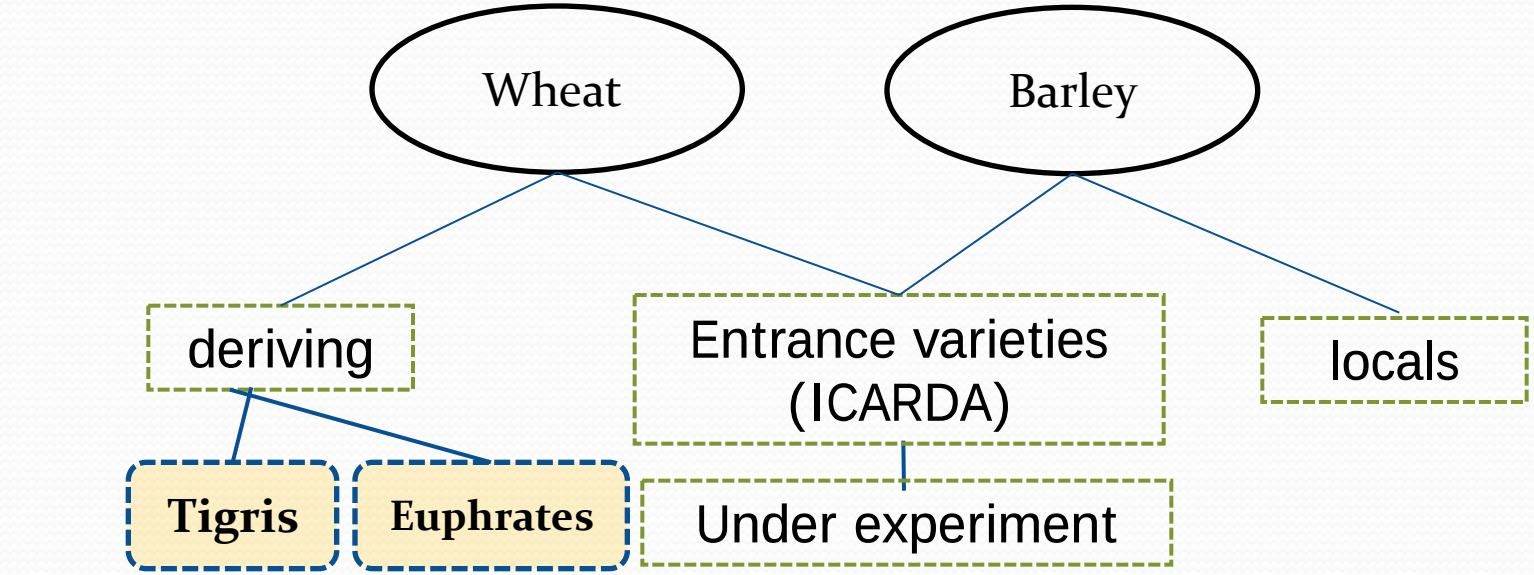
- Alfalfa

- Triticale

- Barseem

- purmuda grass

Crops


Wheat
Barley
deriving
Entrance varieties (ICARDA)
locals
Tigris
Euphrates
Under experiment

Other varieties

- Millet
- Sorghum
- Guar
- Sesbania
- Cowpea

ICBA

Third

Expansion of drip irrigation in plastic houses for vegetables

- reduce :
  - quantity of irrigation ⟶ water use efficiency.
  - labor & bushes.
- Simplifying adding fertilizes ⟶ fertigation .
- maintenance suitable moisture in Rhizospher .

Conclusions and Recommendations

- The development of the agricultural sector is dependent on the extent of the availability of sufficient quantities of fresh water as well as reclaimed lands.

- the priority of challenges in Agricultural sectors is the low productivity lands which caused through many interaction factors and the major ones are soil salinity and desertification.

- Salinity is a serious problem with multiple effects and negative results. But, through continuing research and studies and the development of adequate scientific management methods, some effects and results of this problem can be minimized and contracted to the minimum degree possible. Basically, this requires working to accomplish a number of procedures, some of which are:

- Paying attention to land reclamation in accordance to the comprehensive reclamation concept.

- The necessity of developing soil and water appropriate management methods, especially modern irrigation methods and techniques.

- Continuing in developing local types, or those that have been created and are tolerant to salinity, and spreading their cultivation and showing their benefits to farmers.

- changing type of Agriculture:
  - conservation agriculture (Zero-tillage).
  - Crop consuming less quantities of water.

- conservation of water resources :
  - water harvesting
  - other water resources.
  - drainage water.
  - treated water.

- Developing the available information about the gauges of water usage and saline water, the necessity of finding local indicators and schedules that suit our environmental conditions, marking the limits between the importance of reducing the salt levels in soil and the possibility of tolerating it, and determining the factors with most impact (soil/water/plants/weather/management methods, etc…)

- Precise and firm application of the conservation standards of the environmental elements, specially soil and water, and protecting them from all kinds of pollutants.

So:-

we and look forward to any scientific work **– biological-** in order to deal with and reduce salinity problems and limit their impact.

Thank you with respect for your kind attention