CLIMATE CHANGE: THREATS TO WATER RESOURCES AND FOOD SECURITY

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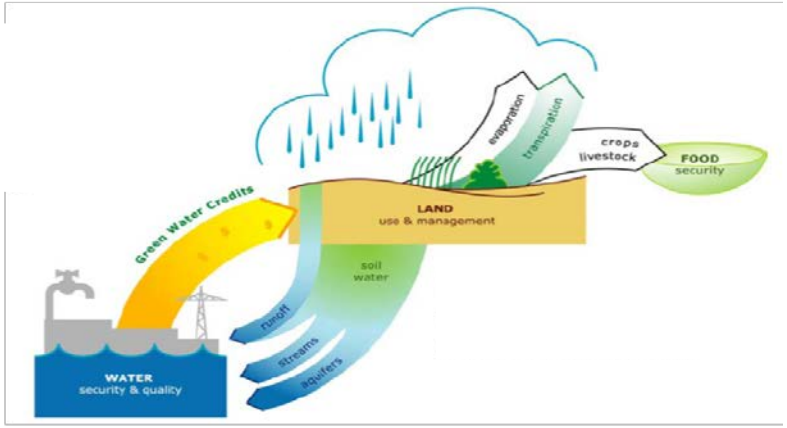
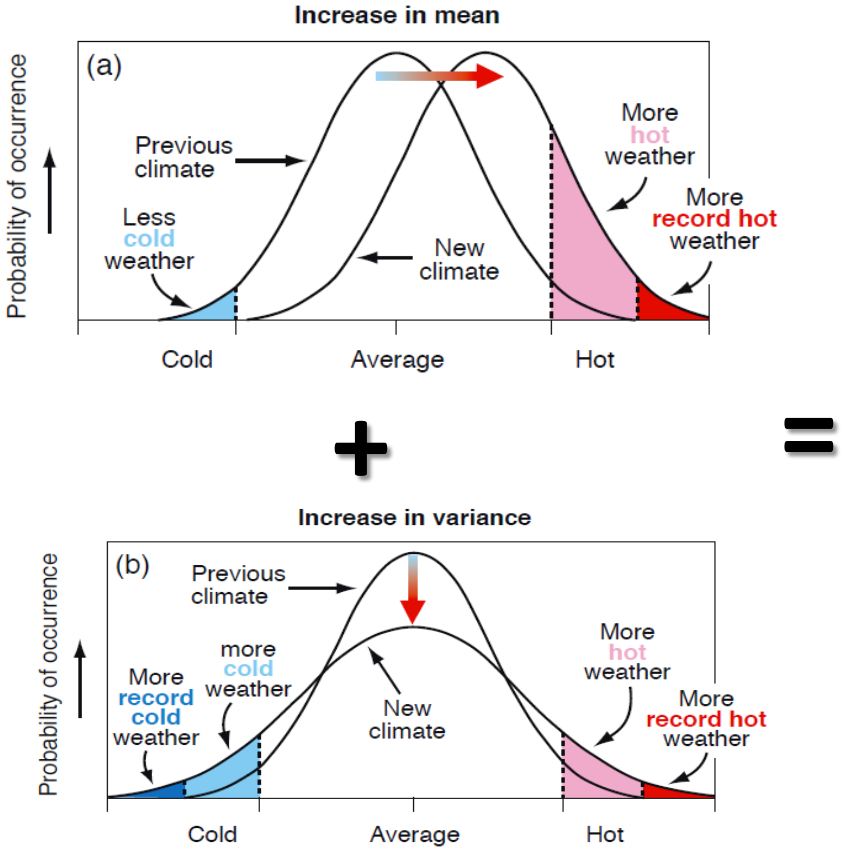
ABU DHABI FOOD CONTROL AUTHORITY (ADFCA)

PRESENTATION OUTLINE

- What is Climate Change?
- Why is Climate Change a Concern in Agriculture?
- World food security situation
- Water and Food Security (Virtual Water)
- Regional Food Self-Sufficiency
- Water Scarcity in Arab Countries
- The Food Security in Arabian Peninsula
- Solutions and Priorities
- UAE, Abu Dhabi Initiatives

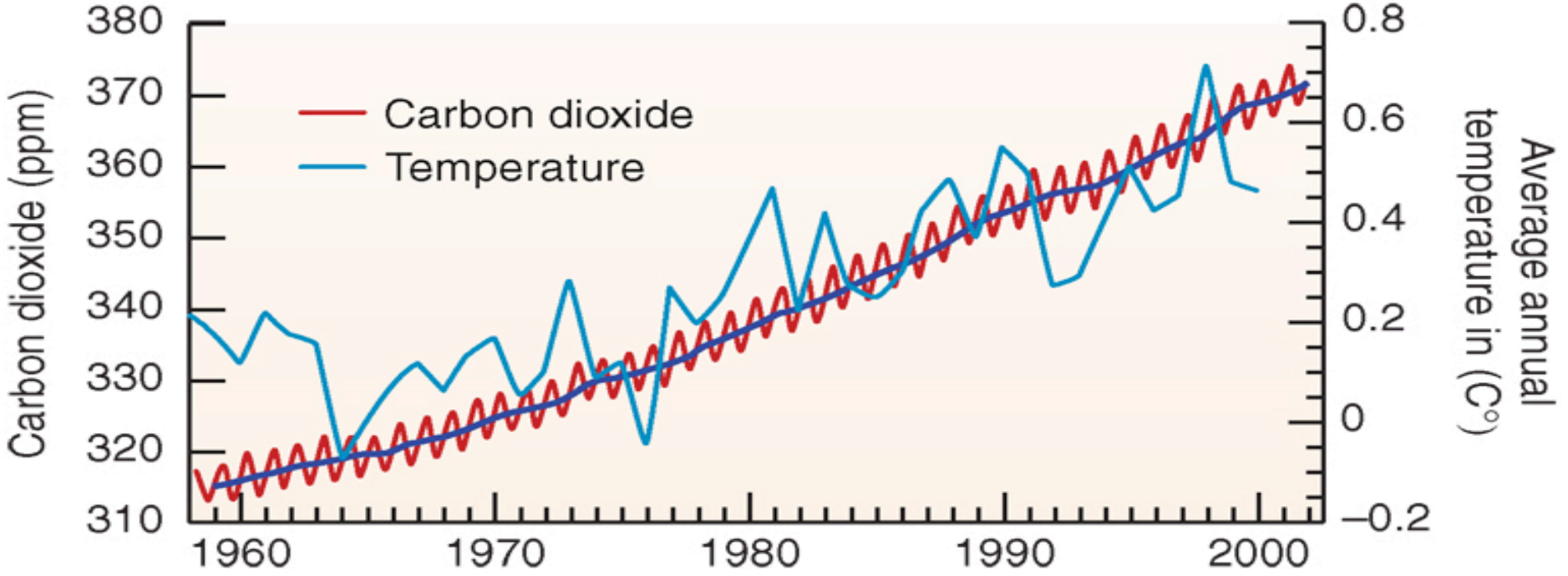


WHAT IS CLIMATE CHANGE?



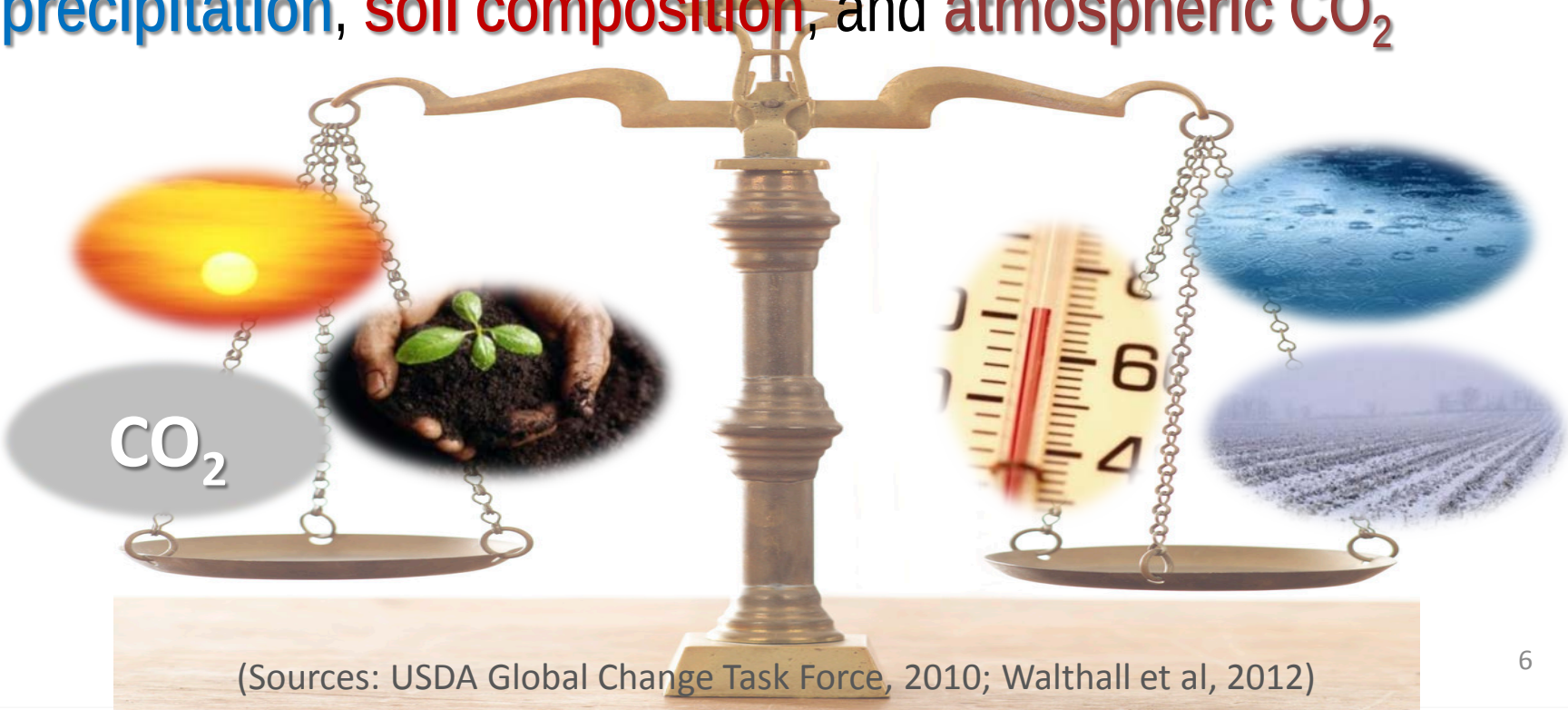
WHAT IS CLIMATE CHANGE?

CLOSED IMAGE



COMPLEX SYSTEM

Crop production relies on a balance of temperature and precipitation, soil composition, and atmospheric CO_2



(Sources: USDA Global Change Task Force, 2010; Walthall et al, 2012)

Direct Impacts of Climate Change

- Increased CO^2 Concentrations in Atmosphere
  - CO^2 fertilization effect may increase crop productivity
  - Ocean productivity could decline due to acidification

- Higher Temperatures
  - Longer growing seasons and increased productivity in high latitudes as long as temperature increases do not exceed 3°
  - Crop losses and declines in productivity in low latitudes
  - Unpredictable effects in lakes and oceans

Direct Impacts of Climate Change (continued)

❑ Changes in Precipitation

- Reduction in arable land in areas with decreased precipitation **(Drought)**
- Challenges capturing water in areas with increased or unchanged precipitation **(Flooding)**
- Declines in aquaculture in areas of decreased precipitation

❑ Pests and Diseases

- Little knowledge at this point
- Earlier spring activity, greater winter survival, and expansion of ranges

Direct Impacts of Climate Change (continued)

- Extreme Events
  - Crop failure or reduced yields
  - Livestock death
- Rising Sea Levels
  - Elimination and salinization of arable land in some coastal regions

INCREASED CO_2 CONCENTRATION

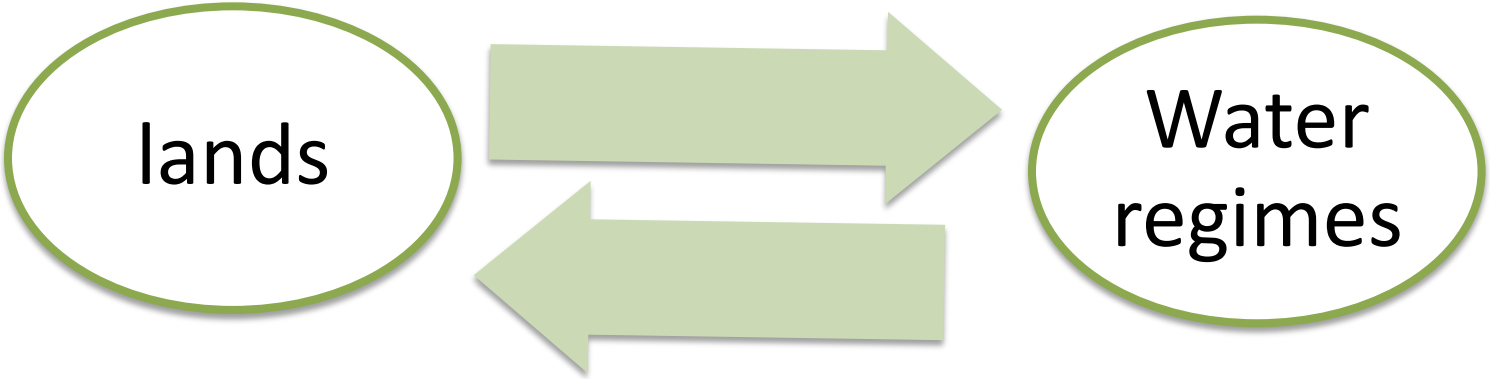
INCREASE THE CO2 GRADIENT BETWEEN THE ATMOSPHERE AND THE INSIDE OF LEAVES,

- INCREASE RATE OF PHOTOSYNTHESIS
- INCREASE GROWTH RATE AND PRODUCTIVITY OF PLANTS
- DECREASE TRANSPIRATION
- INCREASE CROP WATER USE EFFICIENCY AND YIELD

$$6CO_2 \text{ Carbon dioxide} + 6H_2O \text{ Water} \xrightarrow{\text{Light}} C_6H_{12}O_6 \text{ Sugar} + 6O_2 \text{ Oxygen}$$

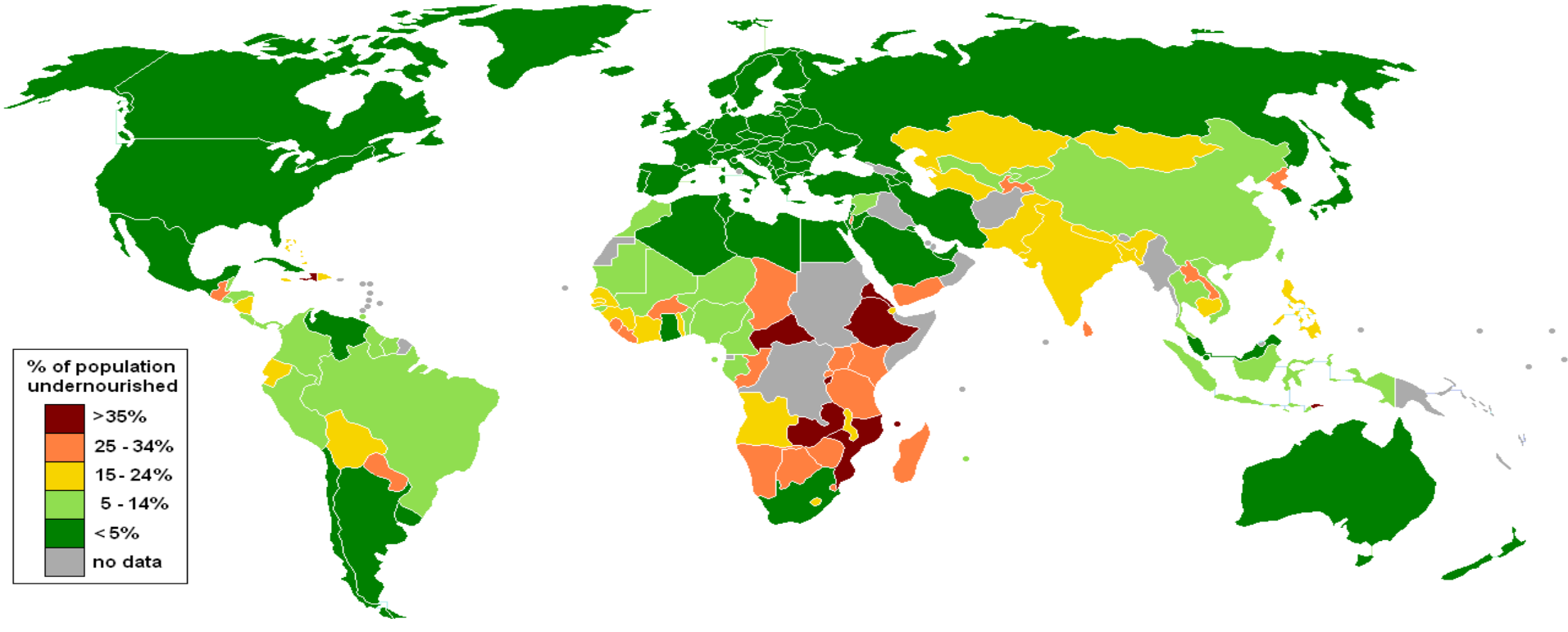
WHY IS CLIMATE CHANGE A CONCERN IN AGRICULTURE?

its projected directly to



- Droughts
- Flooding
- Storm damage
- Desertification
- Disease and pest outbreaks on crops and livestock
- sea-level rise

880 MILLIONS UNDERNOURISHED PEOPLE, 2013



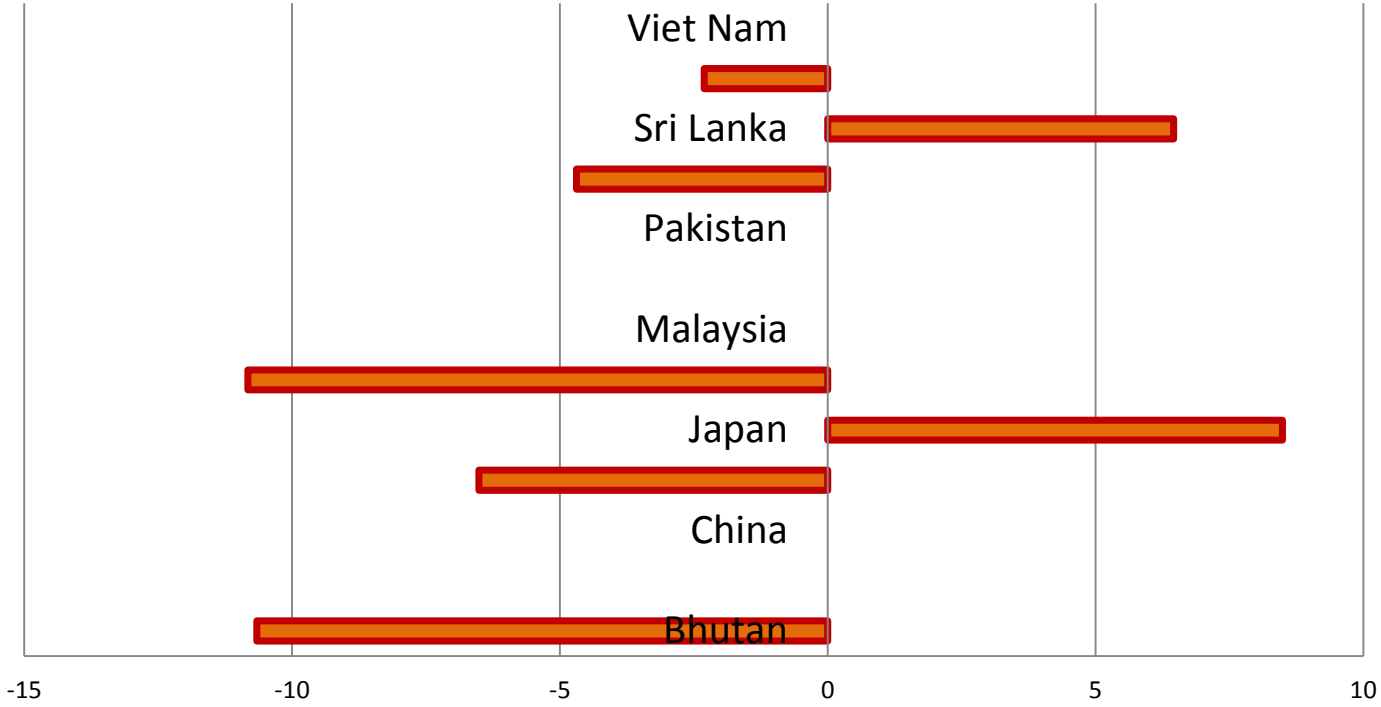
How bad is the world food security situation?

- **Today:** About 1 billion food insecure people (Almost 6 billion are not hungry) *About 17% of the World Population*
- **Future:** How to feed 9 billions in 2050? - Is it possible?
- **Food security drivers:**
  - **Climate change:** decreased production, misguided policies?
  - **Food governance/Food prices**
  - **Scarcity**: Land, water, food scarcity
  - **Bio-economy**: Bioproduction, energy, biofuel

FOOD SECURITY AND CLIMATE CHANGE

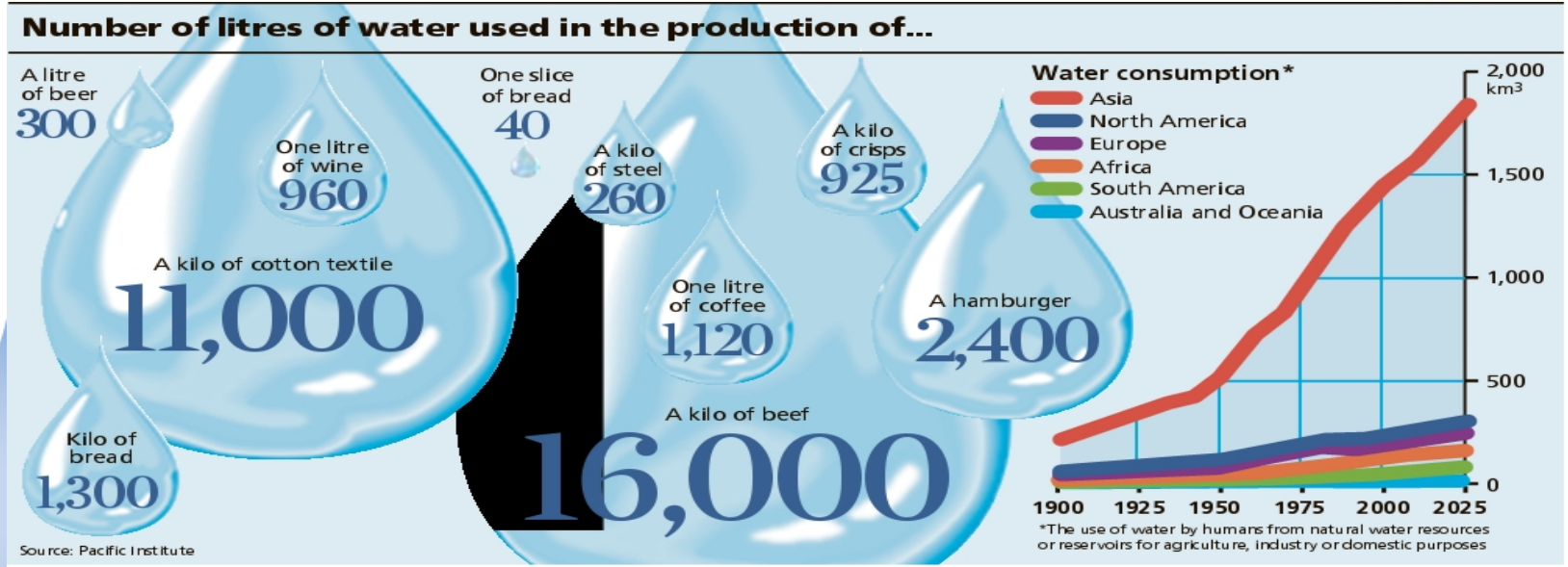
- Food insecurity will increase: 2 degrees warmer world: + 100-400 million hungry people (World Bank, 2009)
- Crops will decrease (African countries: 10-30%, Cline 2007)
- Increased competition over land and water (FAO)
- Increase food prices in 2050 by 90% for wheat, 12% for rice and 35% for maize (IFPRI, 2009)

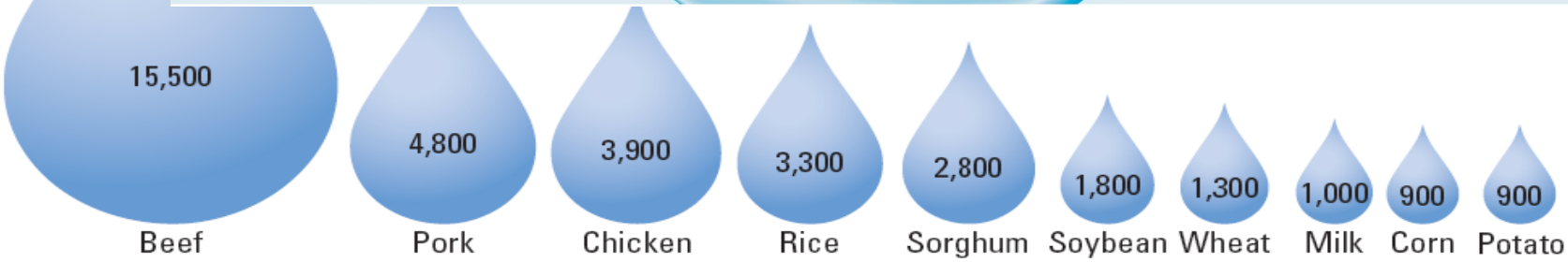
What is the current impact of warming trend on rice yield in Asian counties?



Yield Reduction % for 1961-2009

WATER AND FOOD SECURITY (VIRTUAL WATER)



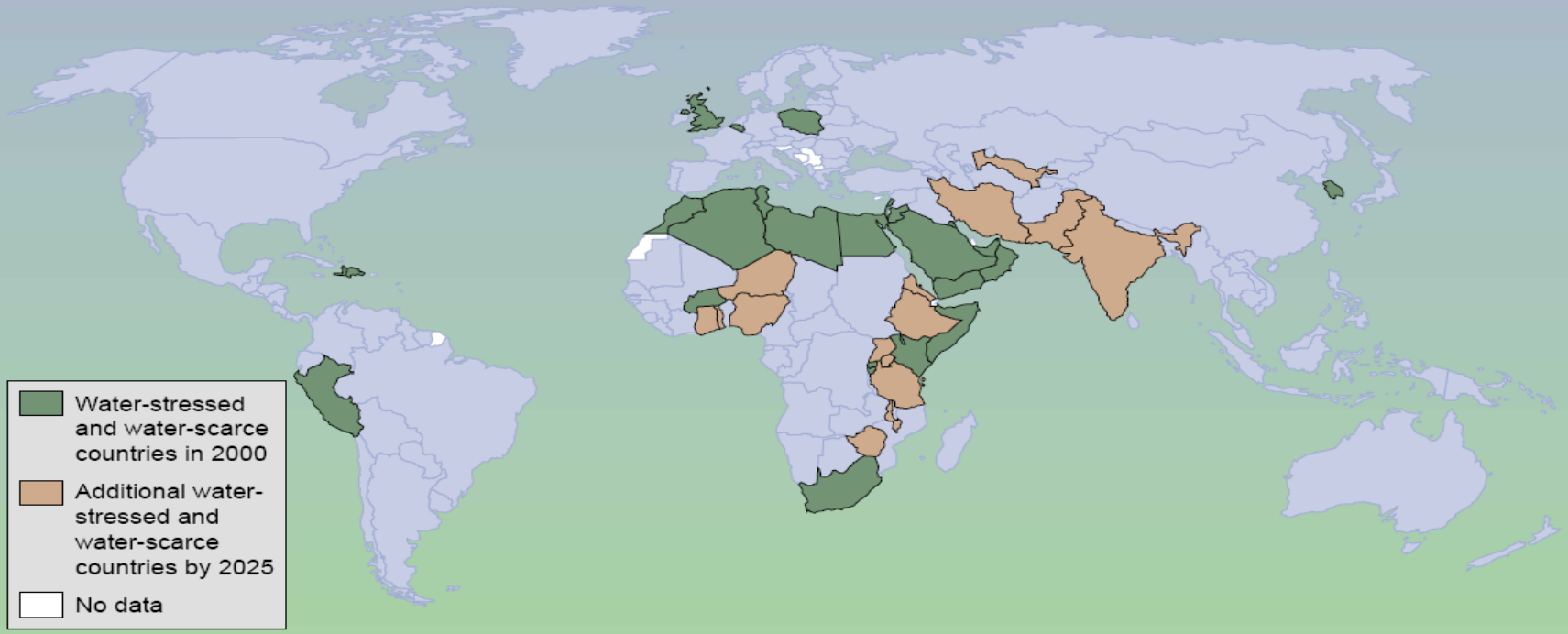


Source: Waterfootprint (https://www.waterfootprint.org), accessed May 15, 2009; Gleick 2008.

Water Shortages Expected to Spread

Water shortages are expected to affect up to 40 nations — mostly in Africa and western Asia — in 2025, compared with 25 nations in 2000. However, because world population growth is slowing significantly — largely due to greater use of family planning — future water shortages are expected to be less severe than earlier projections.

Water Scarcity in 2000 and 2025



REGIONAL FOOD SELF-SUFFICIENCY

The Near East and North Africa, already one of the most water scarce Regions in the world, may be facing over the coming years the most severe intensification of water scarcity in history

Agriculture is the sector using by far the majority of available fresh water resources in the region > 85%

Consequences on:
- food security
- water security
- rural economy

WHY WATER IS VITAL FOR FOOD SECURITY

WATER NEEDS PER PERSON IN LITRES PER DAY

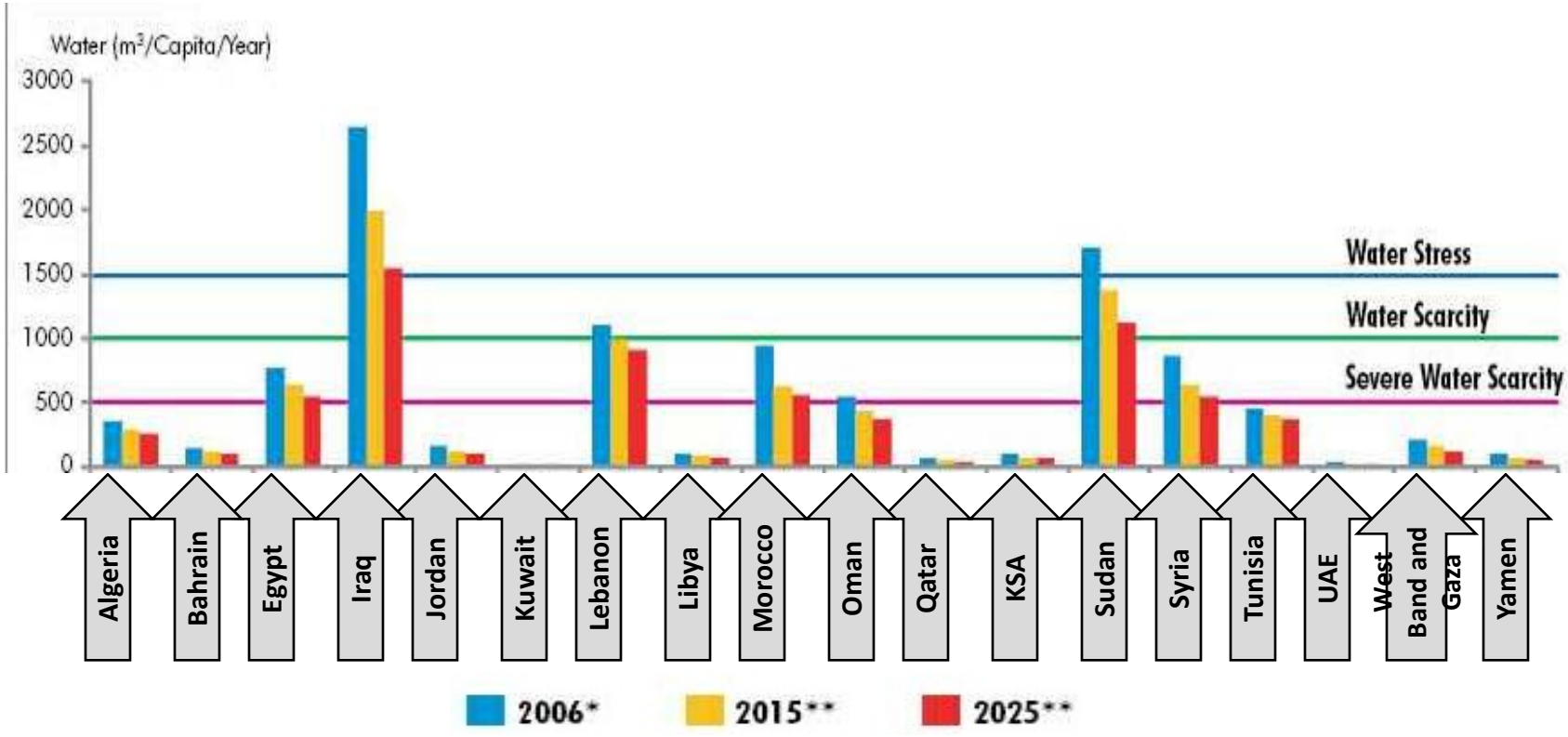
l/day and capita	Essential	Abundant	Quality
Drinking	2	4	***
Domestic	40	400	**
Food (Evapotranspiration)	1000	5000	*

REGIONAL FOOD SELF-SUFFICIENCY

Challenges:

1. Climate change and non-climate change impacts
2. Unclear how much land is irrigated or could be irrigated
3. Land class information is needed
4. Some products could not be produced here
5. Seasonality of growing would be a problem

WATER SCARCITY IN ARAB COUNTRIES

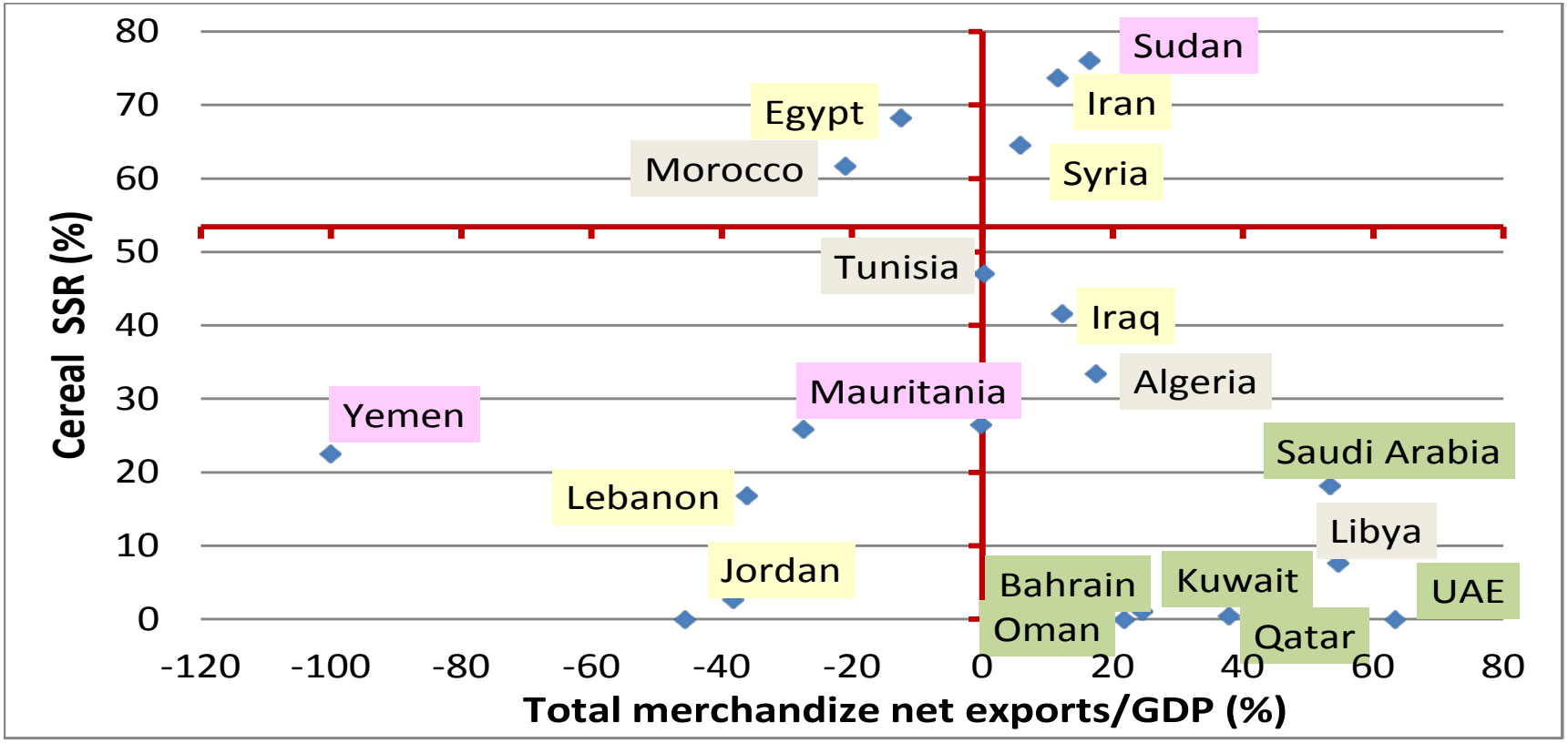


Source :S.A. Shahid from AFED, 2010

The Arabian Peninsula

- Arid and semi-arid climate (where water is the most limiting factor)
- High food-importing
- Abundant marginal-land
- Conditions highly conducive to the use of renewable-energy (solar)

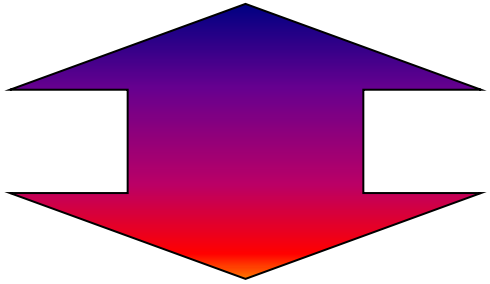
FOOD SECURITY PERSPECTIVE



Source: Based on FAOSTAT and World Bank data

CLIMATE CHANGE FOOD SECURITY NEXUS

Climate Change and Food Security



Climate Change, Food and Security

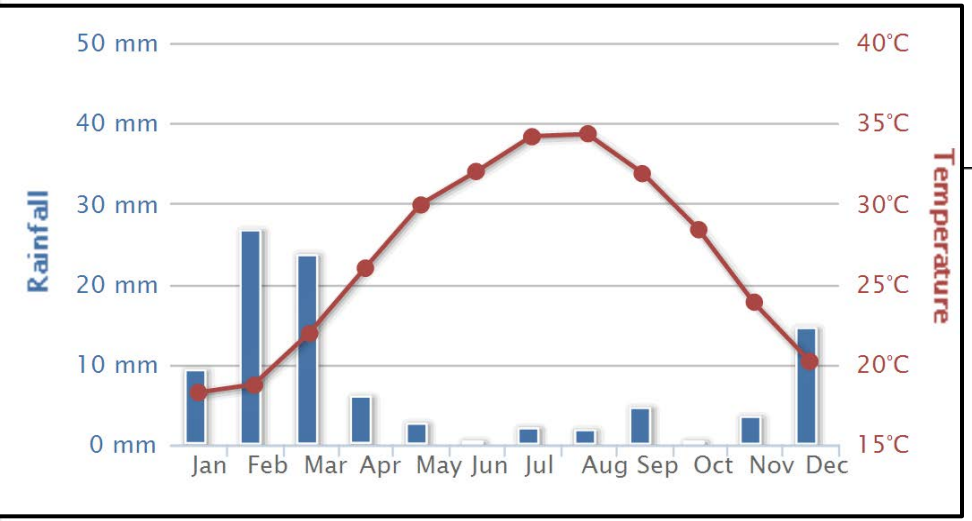
SOLUTIONS AND PRIORITIES

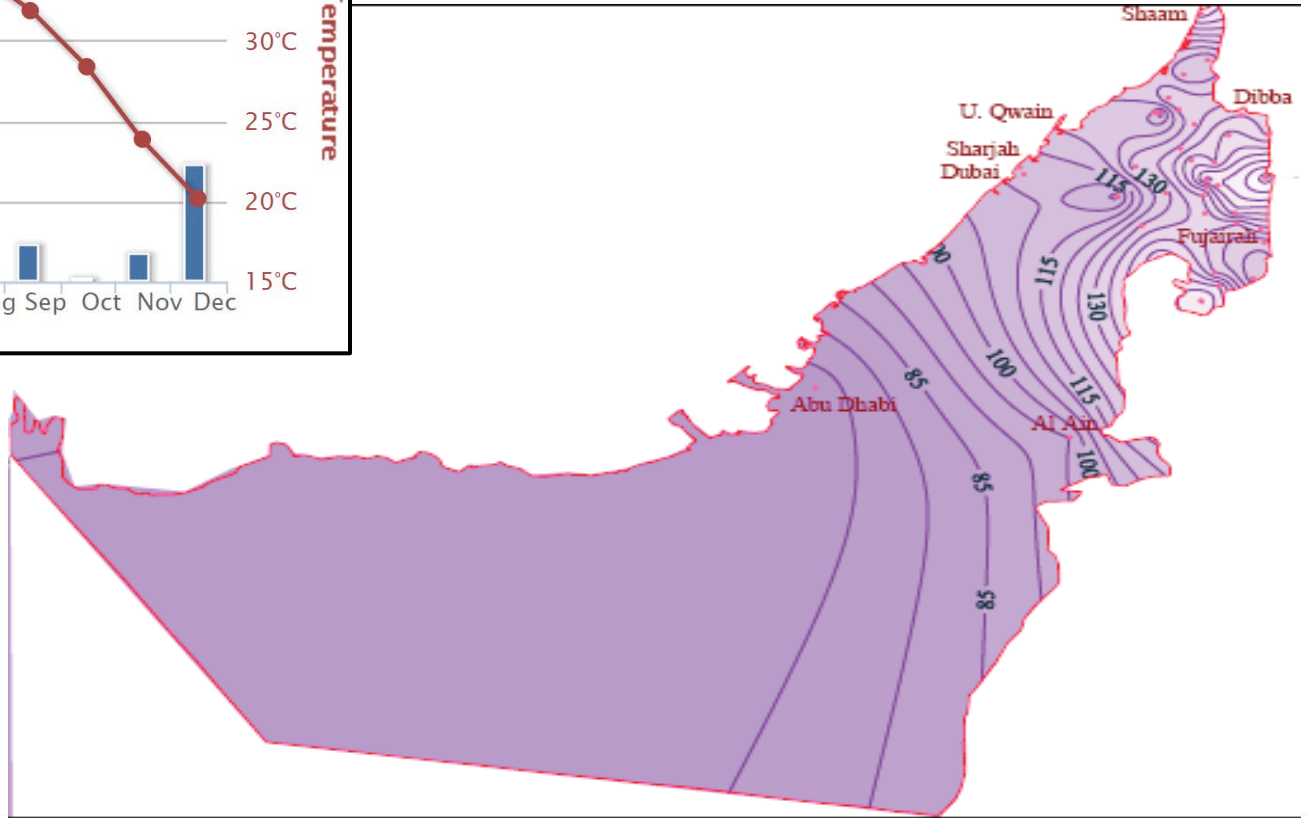
1. Increase water storage in support of irrigated agriculture
2. Promote sustainable groundwater development
3. Promote Safe use of non-conventional waters in agriculture and aquaculture
4. Increase water use efficiency and lower costs of water management
5. Increase water productivity in irrigated agriculture
6. Increase rainfed land productivity
7. Support to small-holders farmers
8. Improve food supply chain efficiency
9. Develop regional visions

ABU DHABI INITIATIVES- AGRICULTURE WATER SAVING

Focus Areas of Work

UAE & WATER


50 mm
40 mm
30 mm
20 mm
10 mm
0 mm
Rainfall
40°C
35°C
30°C
25°C
20°C
15°C
Temperature
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


Shaam
Dibba
U. Qwain
Sharjah
Dubai
Fujairah
Abu Dhabi
Al Ain
85
100
115
130

SKELETAL TOPICS TO INCREASE THE IRRIGATION WATER EFFICIENCY

Main Topics

- Find a new water Resources
- Investment in hi-tech technology
- Improve the Irrigation Efficiency

CLIMATE-SMART AGRICULTURE

Agriculture that sustainably:

- increases productivity
- Increases adaptation
- reduces/removes GHGs

AND

- enhances achievement of national food security and development goals

IMPROVE THE IRRIGATION EFFICIENCY

INVESTMENT IN HI-TECH TECHNOLOGY

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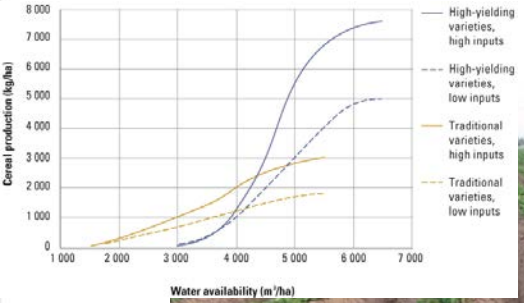
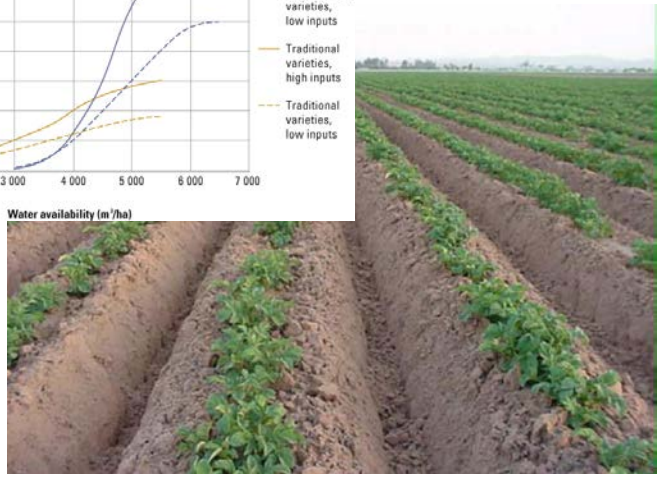
Introduce and evaluate new crop varieties

(e.g. more resilient to heat and drought





Potato with high productivity and short season

Salt tolerant Fodder and less water consuming

INVESTMENT IN HI-TECH TECHNOLOGY

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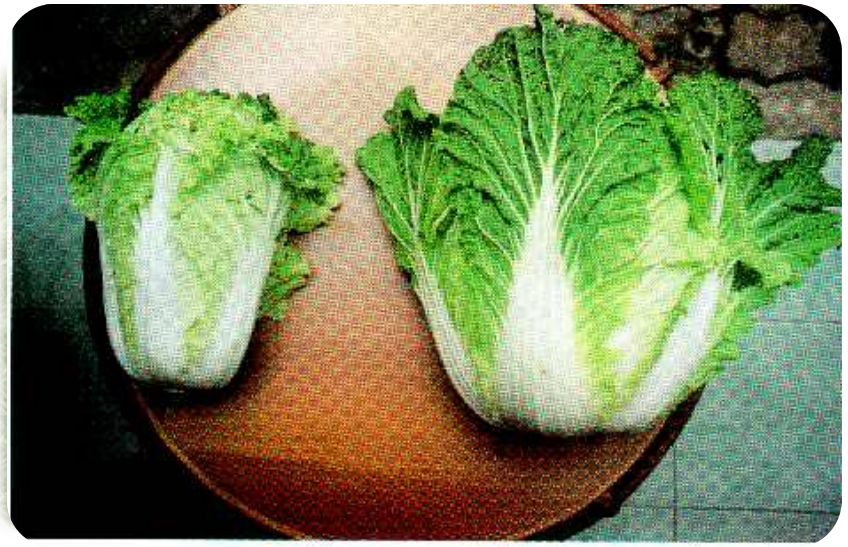
(e.g. more resilient to heat and drought

and short season

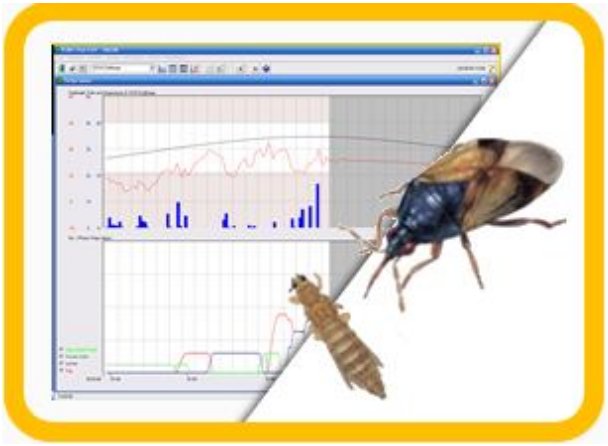
Not Magnetic Magnetic



Salt tolerant Fodder and less water consuming

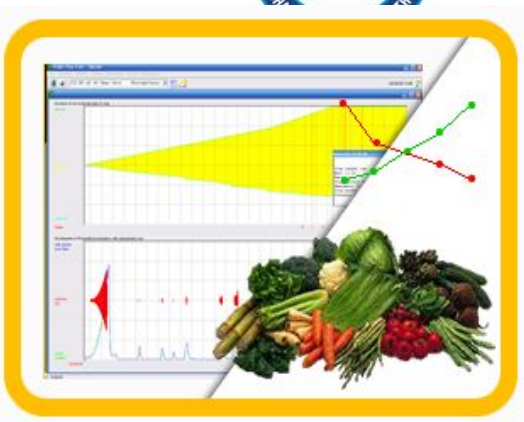
Not Magnetic Magnetic

USES OF THE SMART WEATHER STATIONS



Insects Solutions

Irrigation Solutions



Disease Solutions

Fertilization Solution

USING OF TREATED WASTEWATER AND SALINE WATER

At present, 45 percent of wastewater is either discharged back into the sea or into the desert

Fourth sterilization phase (using filtering technology developed and sterilized with UV), where is this water suitable for agriculture and at lower cost treatment (than the use of the RO..)

The success of any Irrigation Technology needs people

Who design & build it

Who live it

Sleep it

Dream it

Believe it

and build great future plans for it

Thank You