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برنامج إدارة الموارد المائية

Water Resources Management Programme

## Session II: Focus session - Sustainable water management, including integrated watershed management strategies, to ensure food security

June 2<sup>nd</sup>, 2021, Towards UNFCCC Cop 26

Koronivia Joint Work on Agriculture Intersessional  
workshop on sustainable land and water  
management, including integrated watershed  
management strategies, to ensure food security

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## Water Security & Food Security in the Context of Climate Change

**Khaled M. AbuZeid, PhD, PE, PMP**

Regional Director, Water Resources Programme,  
Center for Environment & Development for the Arab Region & Europe  
(CEDARE)

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How can more sustainable water management, including integrated watershed management strategies, ensure food security in the context of climate change?

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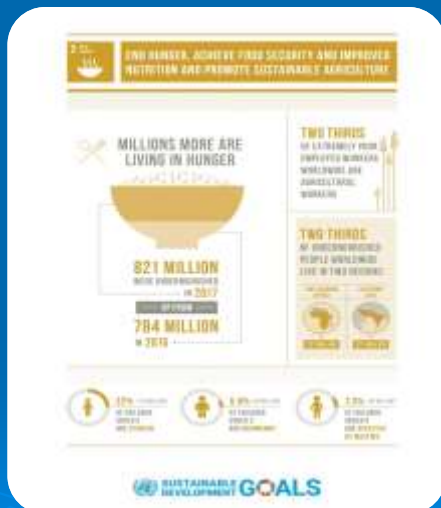
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## SDG 2 : Zero Hunger

END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE



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## SDG2 : Zero Hunger Targets & Indicators



**2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers**, in particular women, indigenous people, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

**2.4 By 2030, ensure sustainable food production systems** and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size

2.3.2 Average income of small-scale food producers, by sex and indigenous status

2.4.1 Proportion of agricultural area under productive and sustainable agriculture

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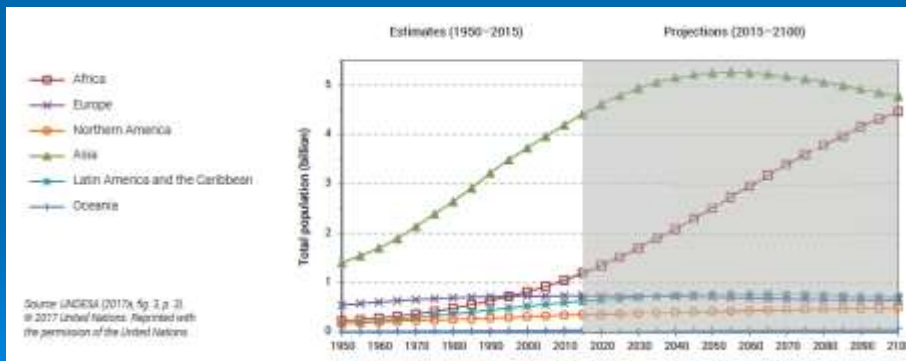
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## Population in Africa

- **Total Population is 1.3 billion (2016), about 17 percent of the world's population**
- **Africa's population will nearly double by 2050 and quadruple by 2100**



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## Factors threatening Food Security

- Food security is threatened by land degradation, water scarcity, increased population, climate change, food market volatility, transboundary water conflicts, and political instability.

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## Water SDG6 is at the Center of all SDGs



Source: UN Water

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## 6.3 By 2030 Improve water quality, wastewater and safe reuse

By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and at least doubling recycling and safe reuse globally

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## 6.4 Increase water-use efficiency and address water scarcity

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## 6.5 Implement integrated water resources management

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How can policies create incentives for implementing sustainable water management to ensure food security while maximizing synergies and co-benefits?

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## Reduction of Food Losses for Food Security

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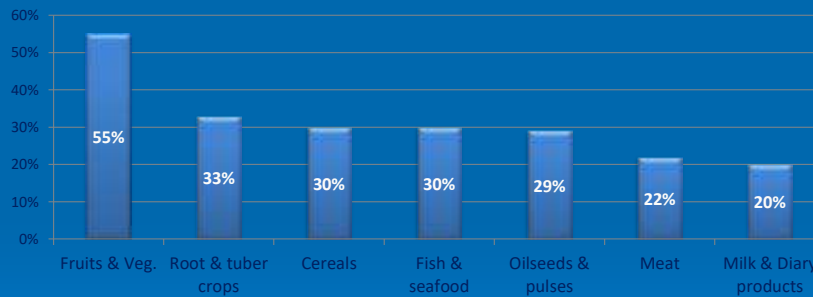


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## Food Losses as a Percent % of Food Production in North Africa, West & Central Asia



(Source: K. AbuZeid, 2013)

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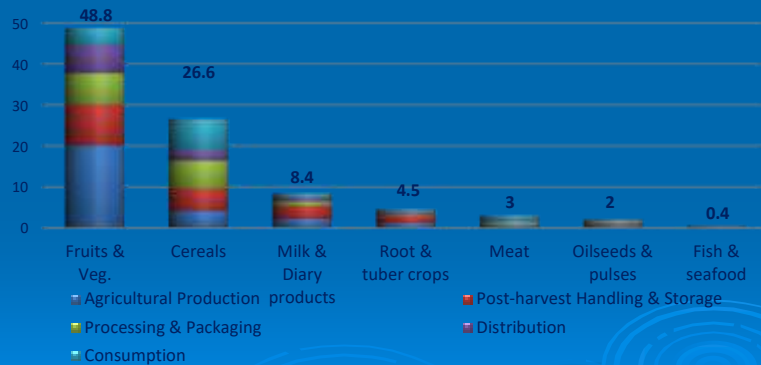


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## Food Losses in North Africa, Central and Western Asia (93.7 Million Tons)



Source: FAO, 2011

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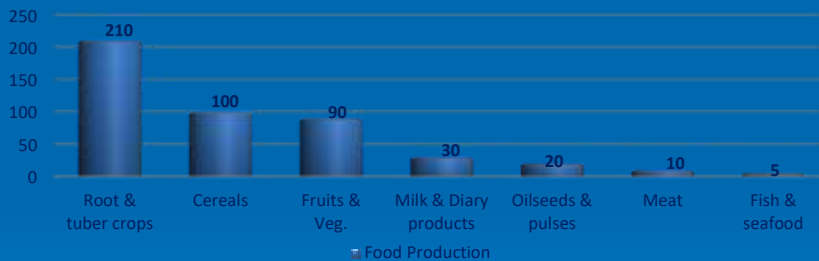


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## Food Production in Sub-Sahara Africa (465 Million Tons)



Source: FAO, 2011. Global food losses and food waste – Extent, causes and prevention

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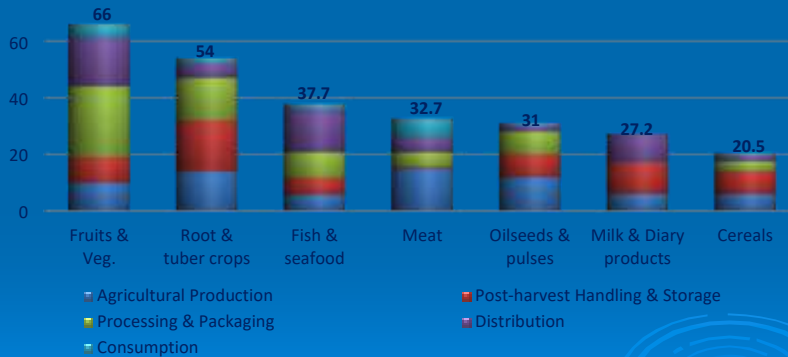


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## Food Losses as a Percent % of Food Production in Sub-Sahara Africa



Source FAO. 2011. Global food losses and food waste – Extent, causes and prevention

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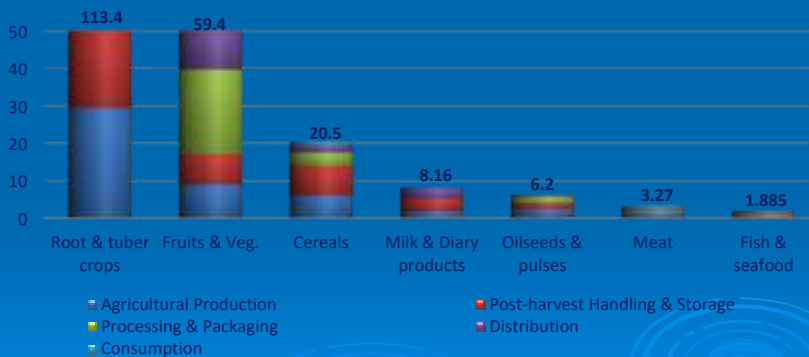


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## Food Losses in Sub-Sahara Africa (212.82 Million Tons)



Source FAO. 2011. Global food losses and food waste – Extent, causes and prevention

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## Africa Food Savings !! End Hunger & Achieve SDG2

(2011) Food Losses in Africa is about 250 Million Tons / Year  
Equivalent to  
Water Losses of about 150 Billion Cubic Meters (BCM)/Year



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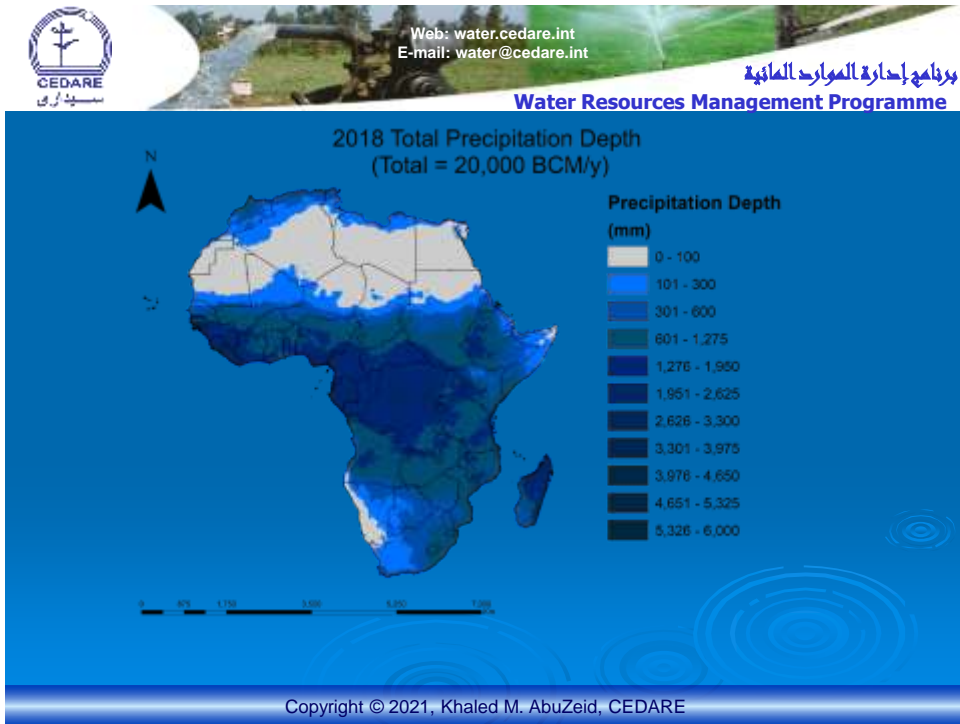
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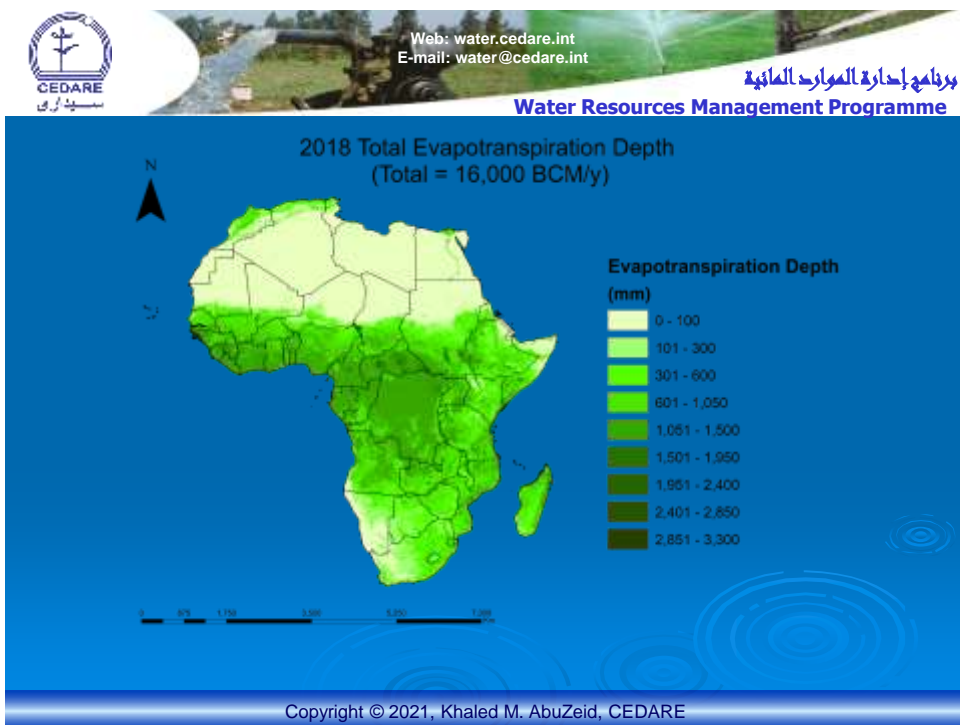
## Africa has 9% of the world's freshwater resources & 17% of the world's population

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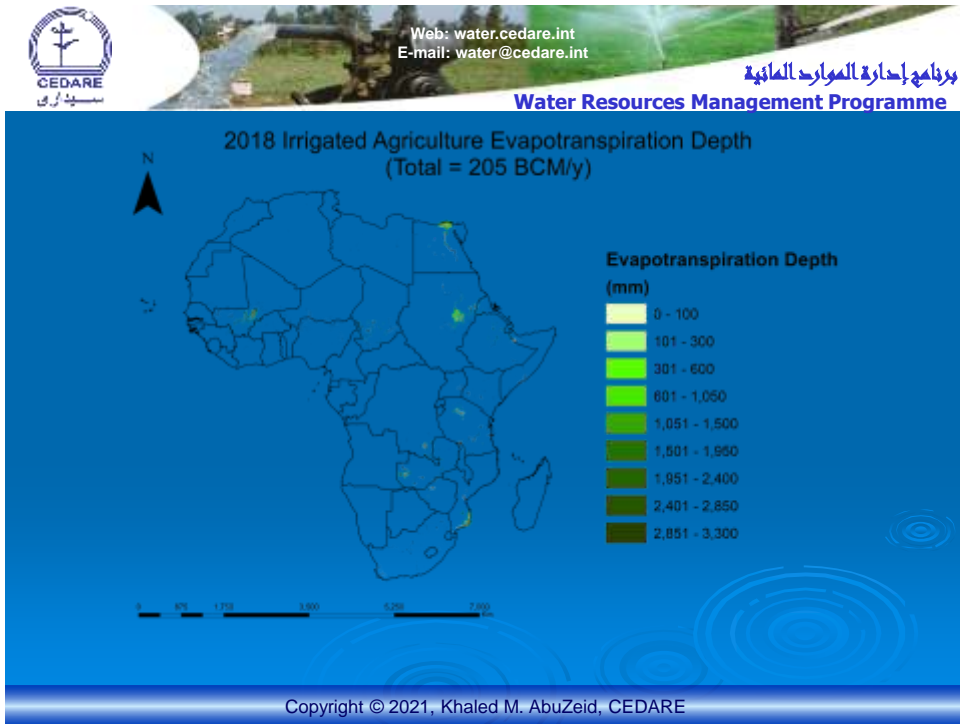
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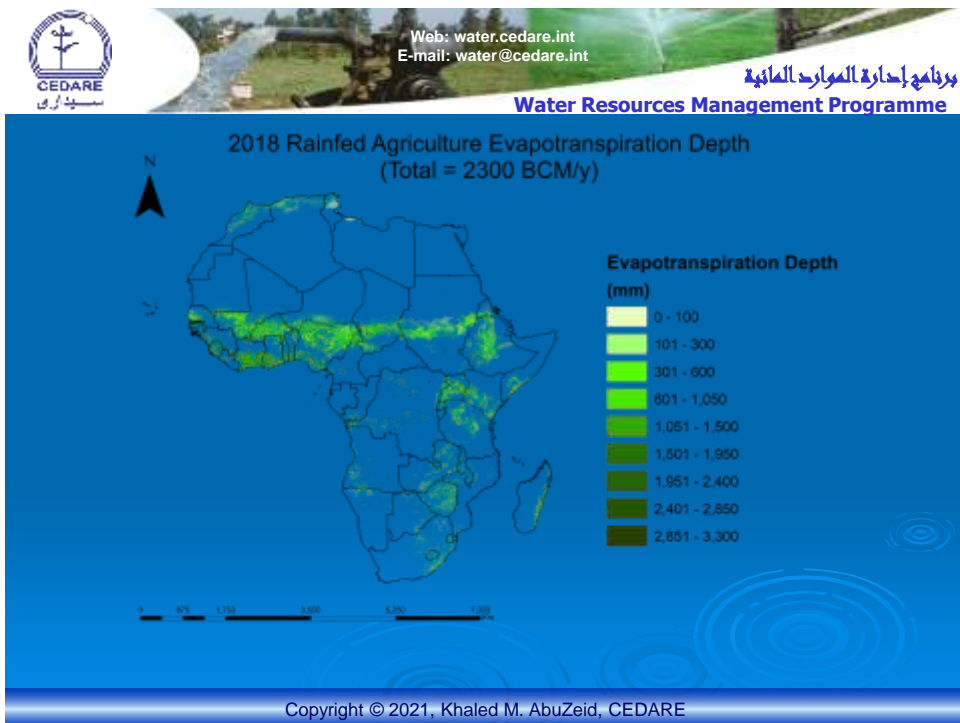
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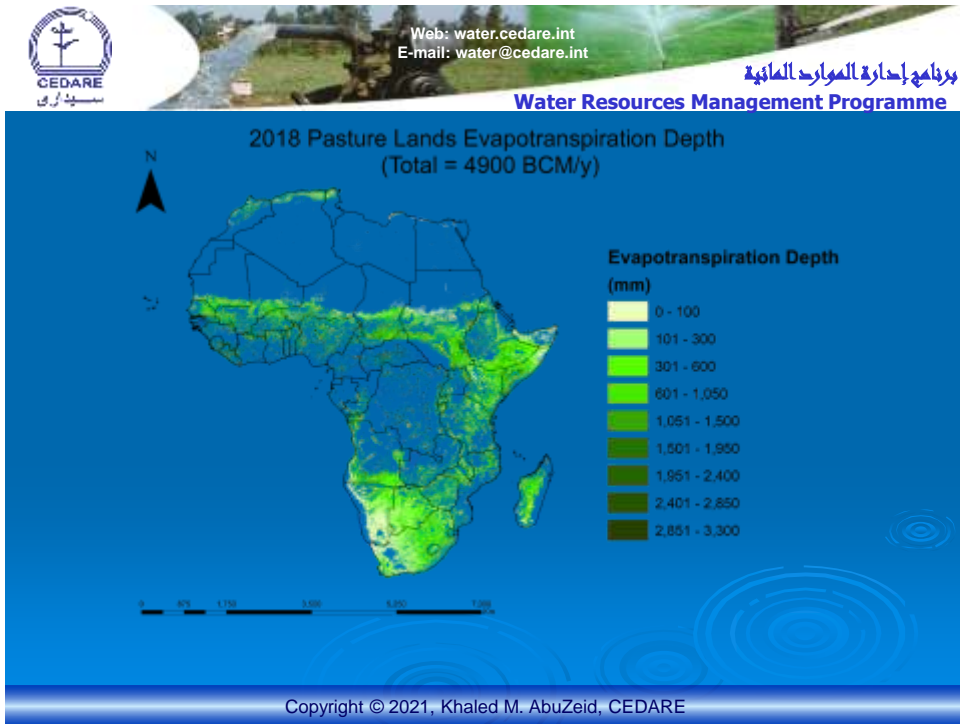
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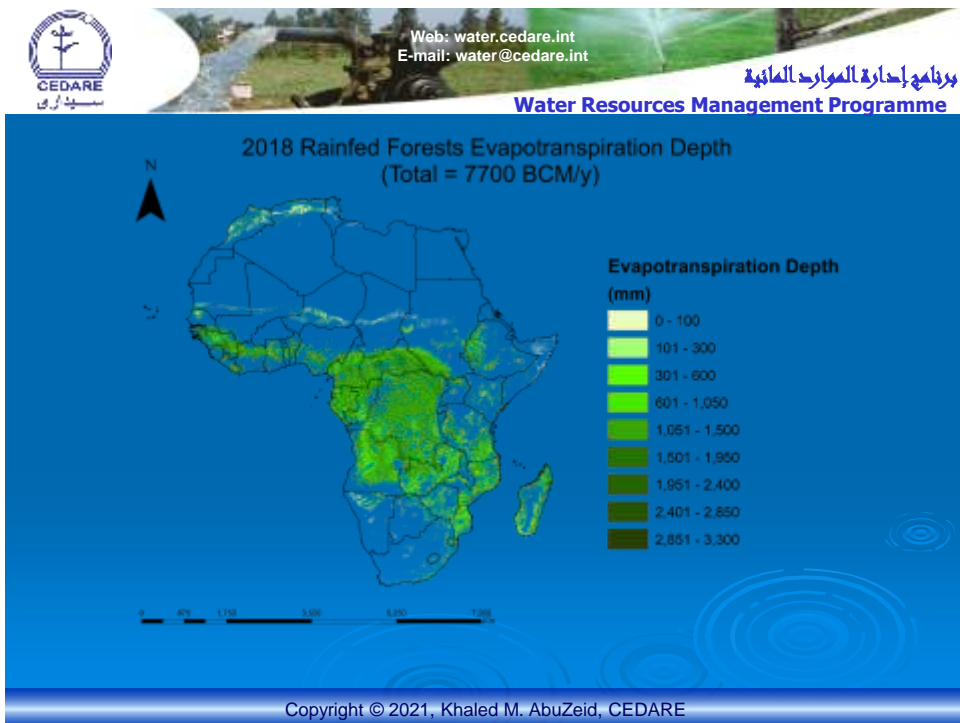
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## Agriculture in Africa



- Over the last three decades, increases in agricultural output in Africa have come largely through extending rain-fed crop cultivation
- Agriculture Farming is largely rain-fed in Sub-Saharan Africa, where 96 percent of the cropland is rain-fed
- Sub-Saharan Africa, has seen very low levels of yield growth in its rain-fed agriculture
- Rain-fed agriculture has a large untapped potential for increased food production
- The primary way to unlock the potential of rain-fed agriculture in dry areas is by increasing the effectiveness of rainfall and improving watershed management especially through supplemental groundwater
- Recycled agriculture drainage and treated wastewater is a major source of water for food production in North Africa

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How can international cooperation support the implementation, upscaling and measuring of impacts and benefits of sustainable water management, including integrated watershed management strategies, to ensure food security?

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# At the Global Level

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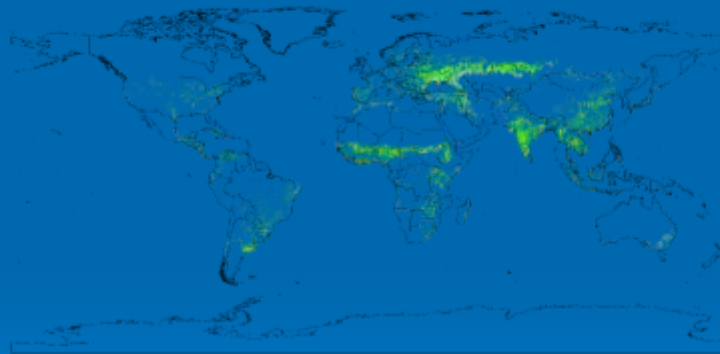
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2018 Global Rainfed Agriculture Evapotranspiration Depth  
(Total = 8550 BCM)

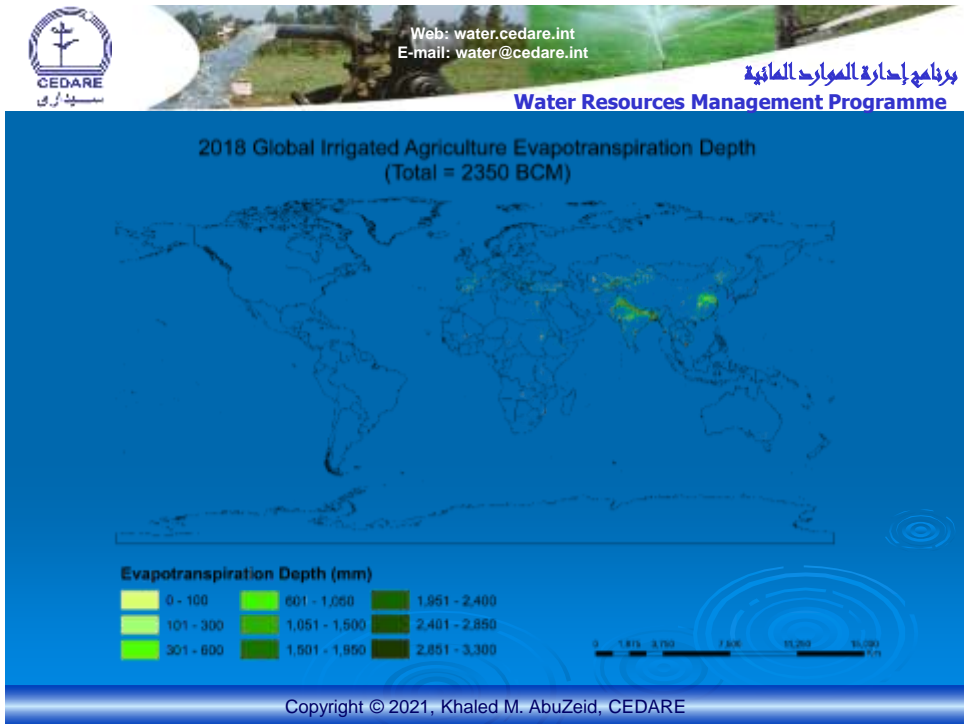


Evapotranspiration Depth (mm)	
0 - 100	601 - 1,000
101 - 300	1,051 - 1,500
301 - 600	1,501 - 1,950
	1,951 - 2,400
	2,401 - 2,850
	2,851 - 3,300

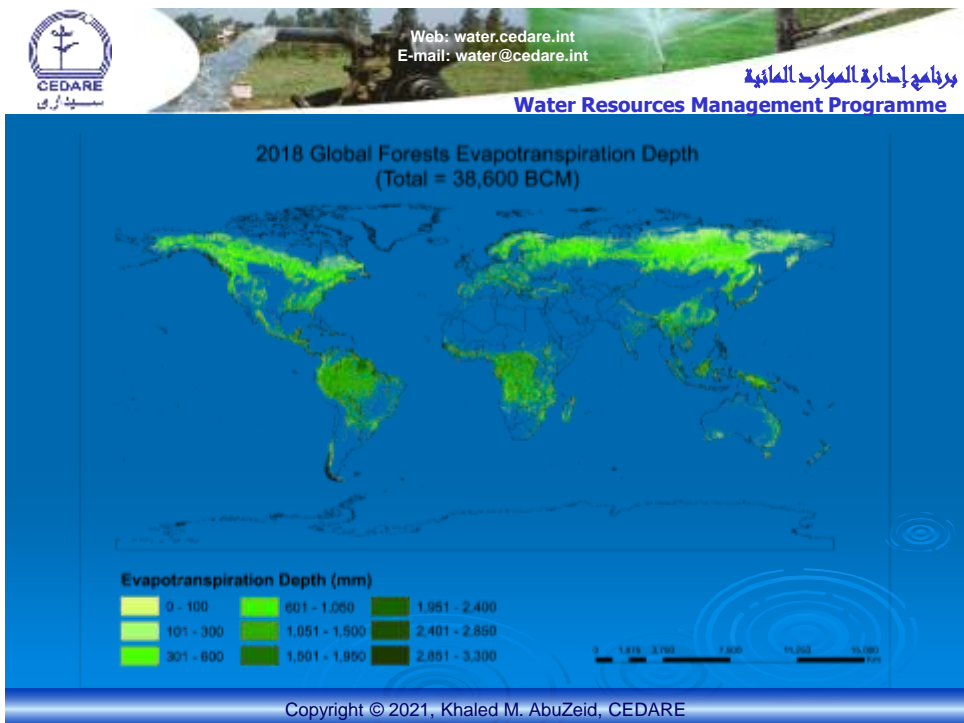


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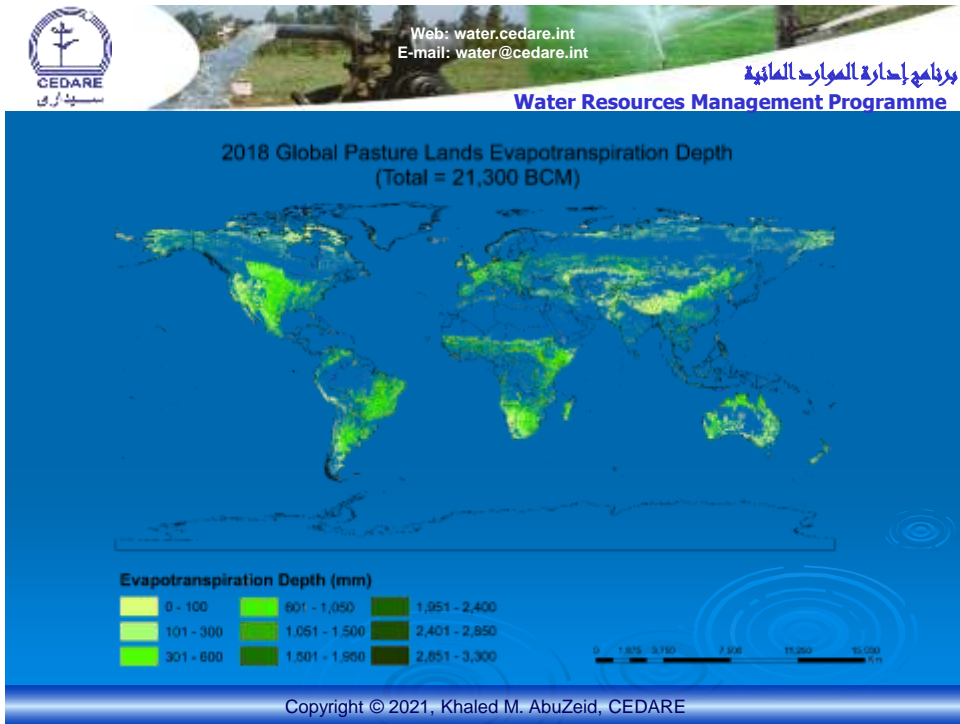
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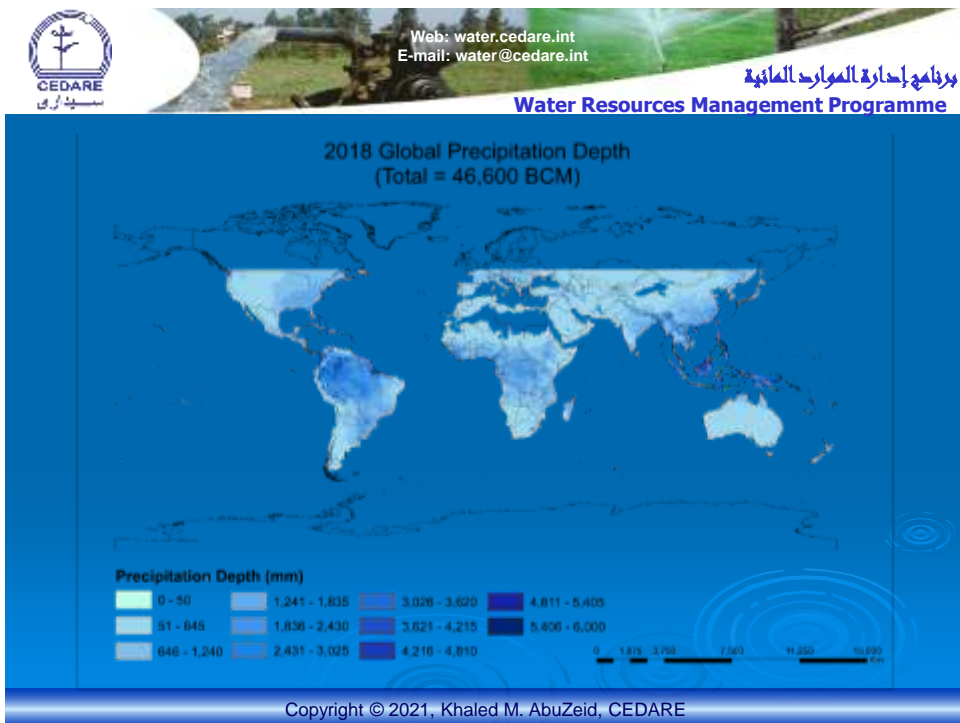
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## Virtual Water Trade for Food Security

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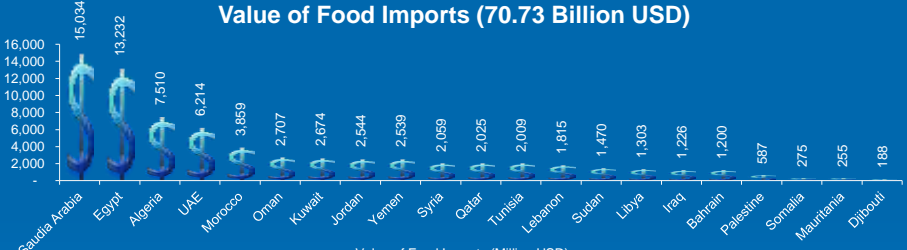


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## 2015 Arab Region Value of Food Imports (70.73 Billion USD)

### Value of Food Imports (70.73 Billion USD)



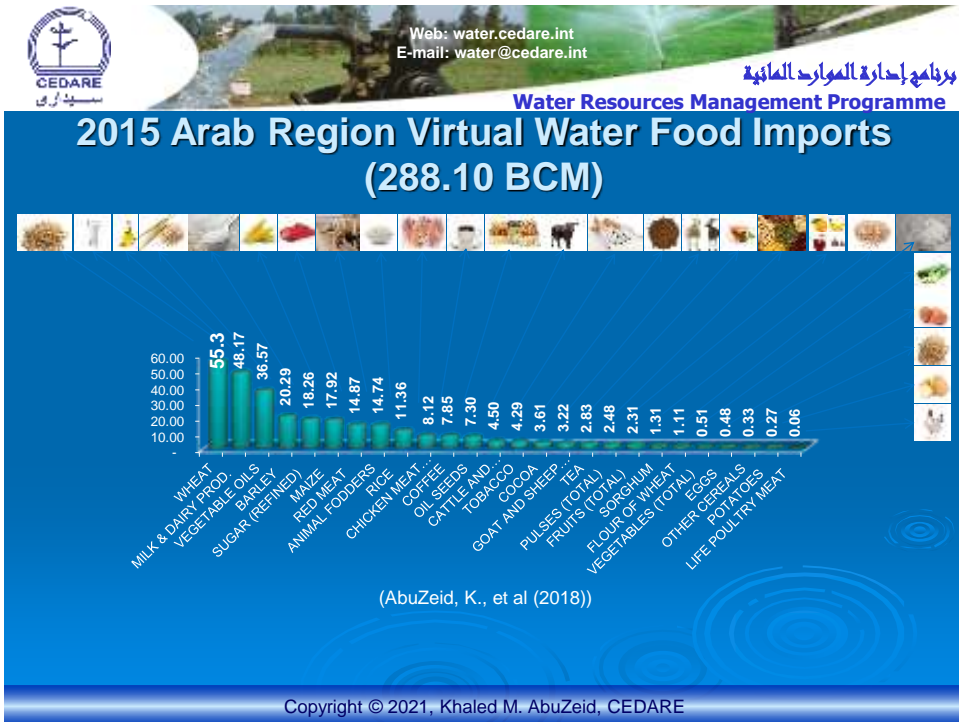
Country	Value (Million USD)
Saudia Arabia	15,034
Egypt	13,232
Algeria	7,510
UAE	6,214
Morocco	3,859
Oman	2,707
Kuwait	2,674
Jordan	2,544
Yemen	2,539
Syria	2,059
Catar	2,025
Tunisia	2,009
Lebanon	1,815
Sudan	1,470
Libya	1,303
Iraq	1,226
Bahrain	1,200
Palestine	587
Somalia	275
Mauritania	255
Djibouti	188

\* Value of Food Imports (Million USD)

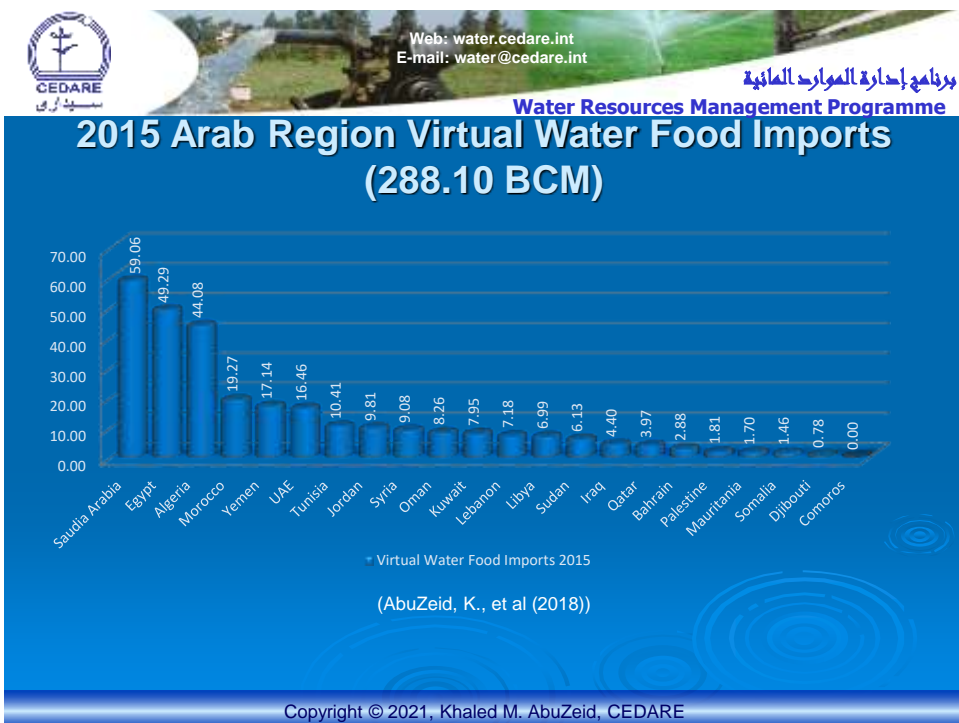
(AbuZeid, K., et al (2018))

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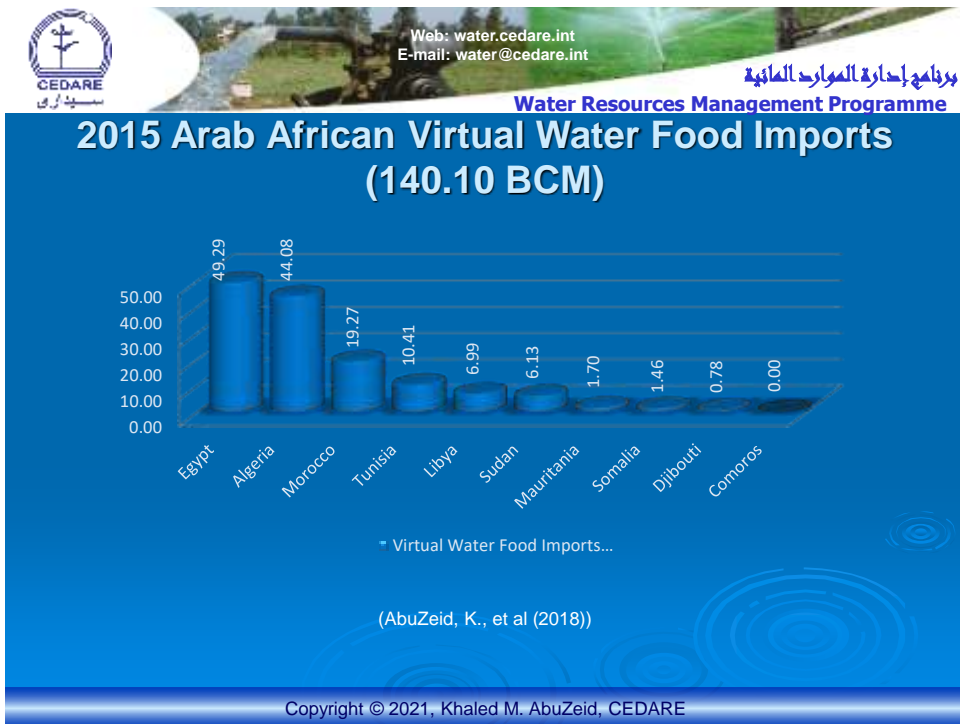
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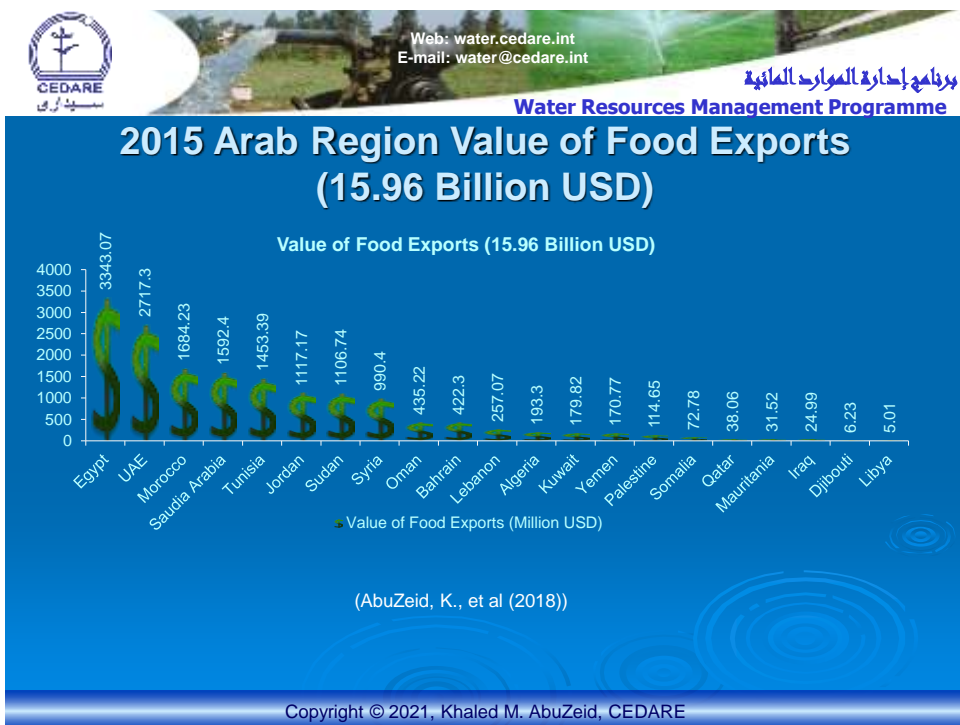
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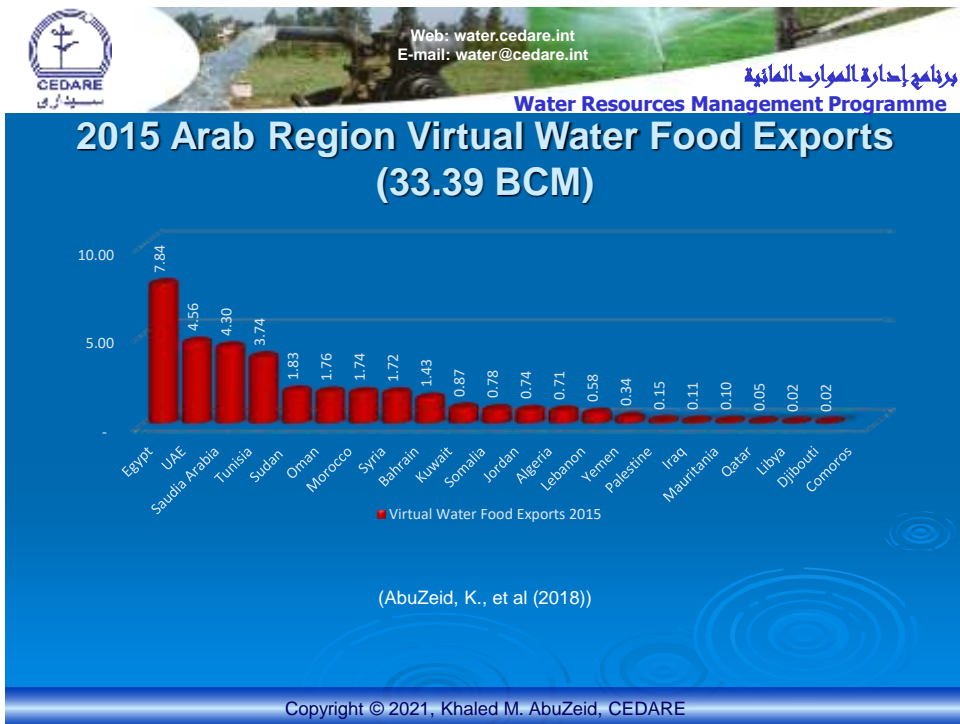
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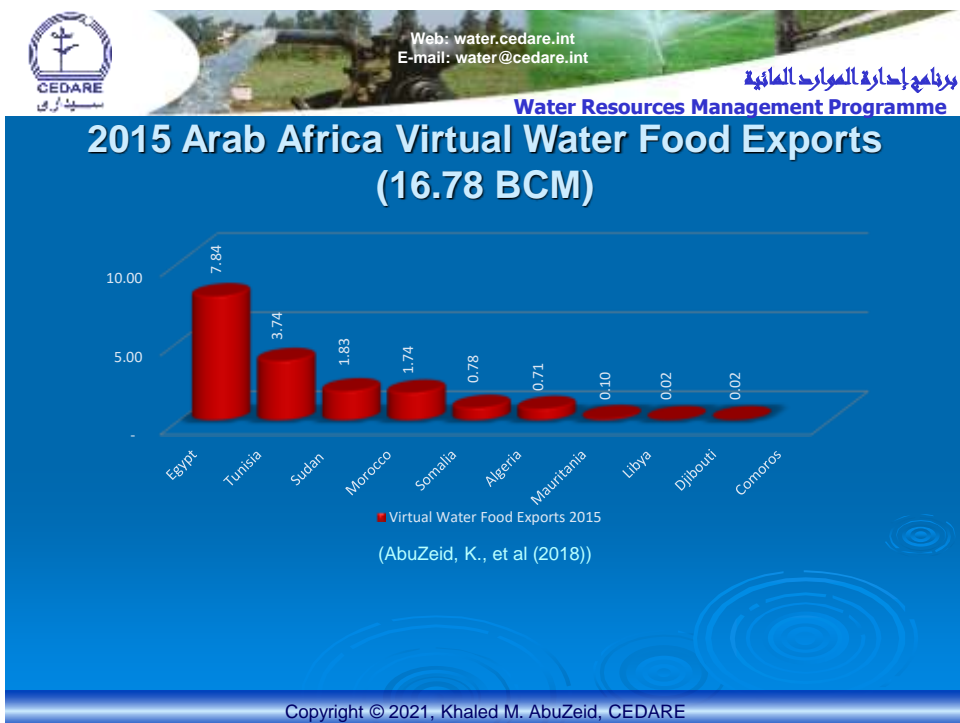
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# The Importance of Green Water in Food Production

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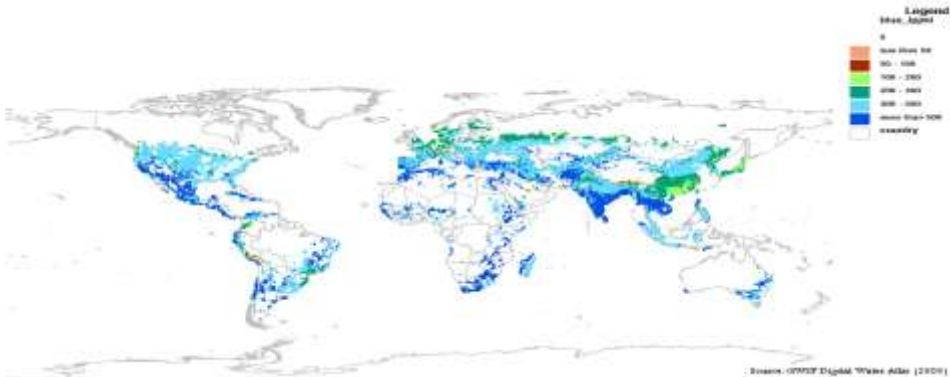
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# Blue Water for Crop Production



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## Green Water: Major contributor to Livestock Production

- In the Nile Basin, Green Water contributes about 150 Billion Cubic Meters (BCM) per year to livestock production in Ethiopia and Sudan only which host about 2/3 of **livestock** heads in Africa
- This 150 BCM is about 3 times Egypt's total annual water consumption for **Irrigated Agriculture**, Industry, Municipal and other Uses
- Although there is an abundance of **green water** contributing to **rain-fed agriculture and livestock** production in upstream countries, conflicts often arise over the little available **blue water** contributing to **irrigated agriculture** and domestic use in downstream countries !!!!!

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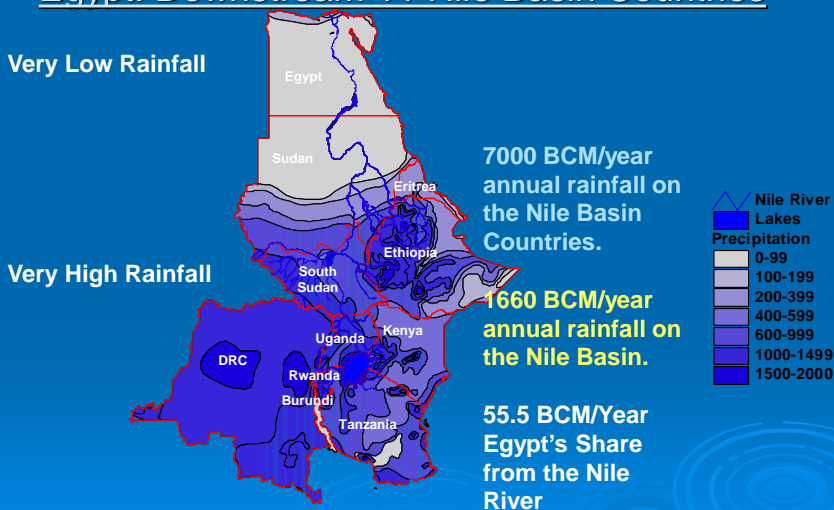


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## Egypt: Downstream 11 Nile Basin Countries



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# Transboundary Water-Energy-Food-Climate Security Nexus

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# Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile



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# First Stage GERD Filling



21-07-2020

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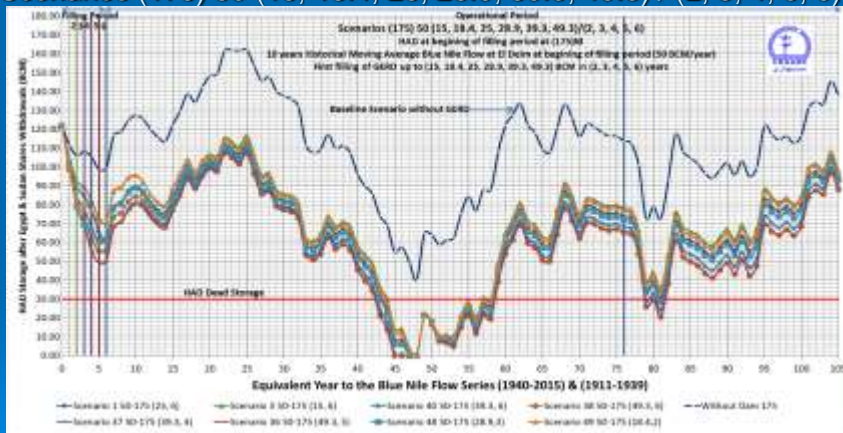
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## Impacts of Ethiopia's GERD Filling & Hydropower Operation on Egypt & Sudan Water for Food & Energy

### Scenarios (175) 50 (15, 18.4, 25, 28.9, 39.3, 49.3) / (2, 3, 4, 5, 6)



Source: (AbuZeid, K. 2020)

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## The River Basin (Watershed) Approach versus the Watercourse Approach for Water & Food Security in Transboundary Waters

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## Share “Green & Blue” Water in a “River Basin” rather than compete over “Blue” Water in “River”



➤ Competing over Blue Water



➤ Sharing Blue and Green Water

- 261 worldwide transboundary river basins, 60 of them in Africa
- 318 worldwide transboundary groundwater aquifers, 50 of them in Africa

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# The Green/Blue Water Basin/Watercourse Upstream / Downstream Sustainability Balance for Water Security, Food Security & Energy Security

Rainfed Agriculture  
for Upstream

Blue Water For  
Hydropower Upstream

Green Water for  
Upstream

Renewable  
Groundwater  
for Upstream

River Basin Water



Irrigated  
Agriculture  
for Downstream

Blue Water  
For Downstream

Surface Water  
for Downstream

Watercourse /  
River Water

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# Climate Change & Sea Water Rise



## Nile Delta - Current Situation

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# Climate Change & Sea Water Rise



## Nile Delta – 1 Metre Sea Level Rise

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# Climate Change & Sea Water Rise



## Nile Delta – 2 Metre Sea Level Rise

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Sand Dunes at Middle Delta Coast and coastal protection works

11/28/2007

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Mohammed Ali Sea Wall Protected Cultivated Low Lands (1.5m - 2.5m Below Sea Level)



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## Key Messages

- Water Security is essential for Food Security
- Treated wastewater is the increasing & renewable water resource for Sustainable Agriculture under water scarcity
- More 'crop per drop' by improving water & crop productivity is vital under water scarcity.
- Avoid transboundary waters' related impacts on existing agriculture lands in transboundary water basins.
- Implement food security plans through rain-fed agricultural expansion
- Maximize the role of Green water in rain-fed agriculture and livestock production
- Make use of Renewable groundwater in supplemental irrigated agriculture
- Reduce food losses and wastes through all chain processes from food production to consumption
- Remove market barriers on food trade and make use of the comparative advantages in growing the most suitable cropping patterns
- Get accurate estimate of climate change impacts on water availability
- Sharing information on climate upstream in transboundary basins is important

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