Opportunities for Woody Crop Production Using Treated Wastewater in Egypt

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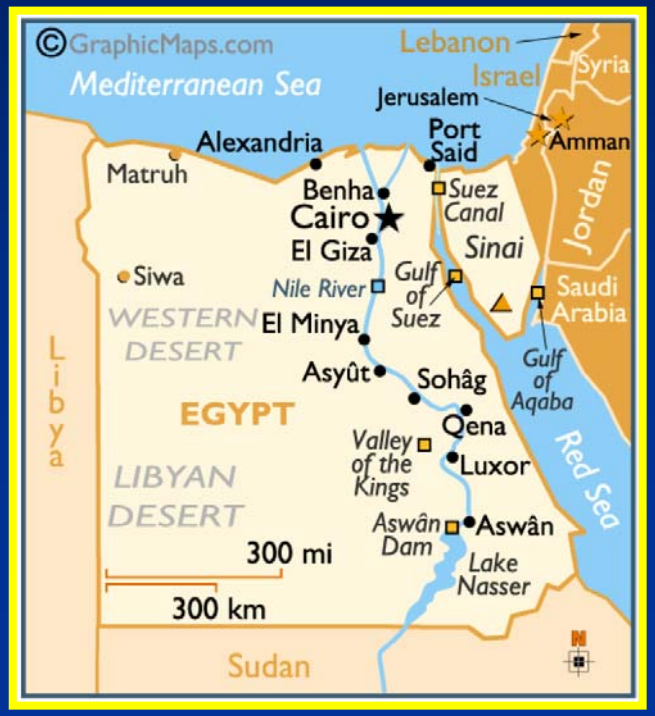
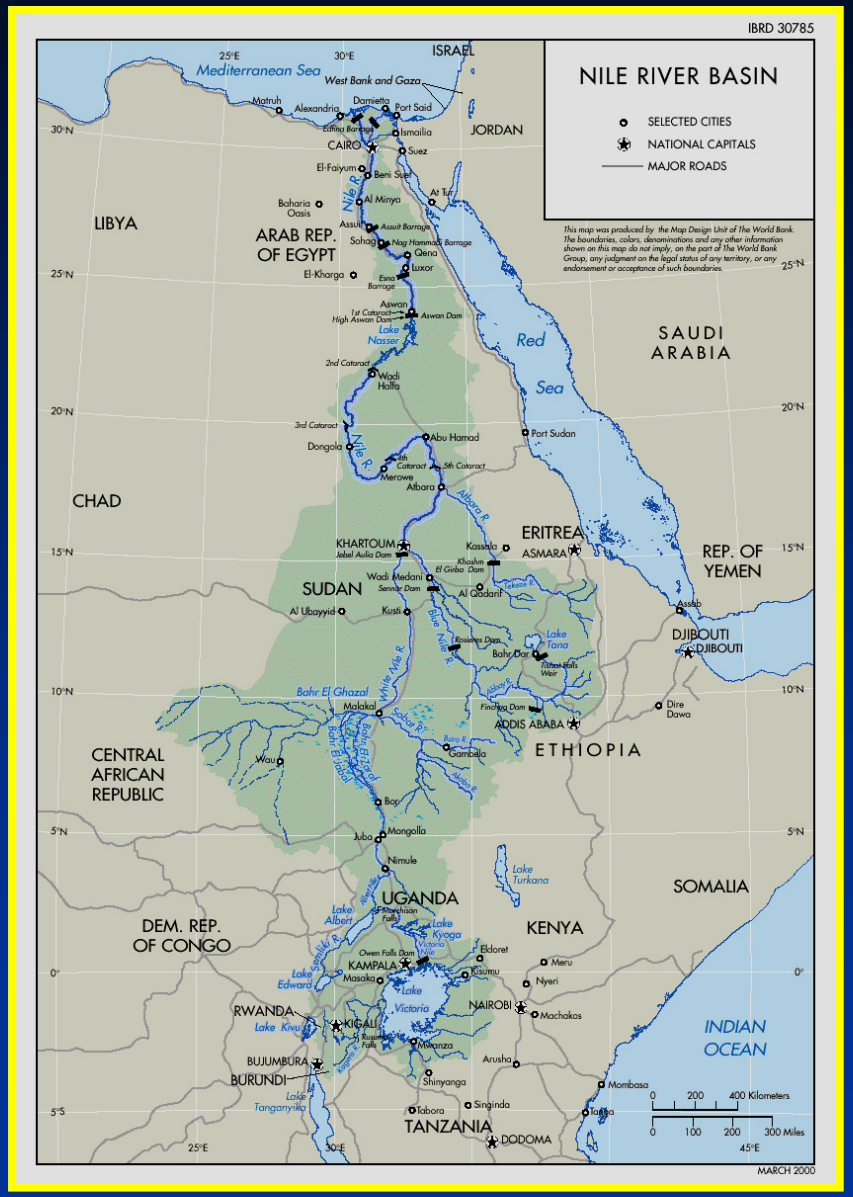
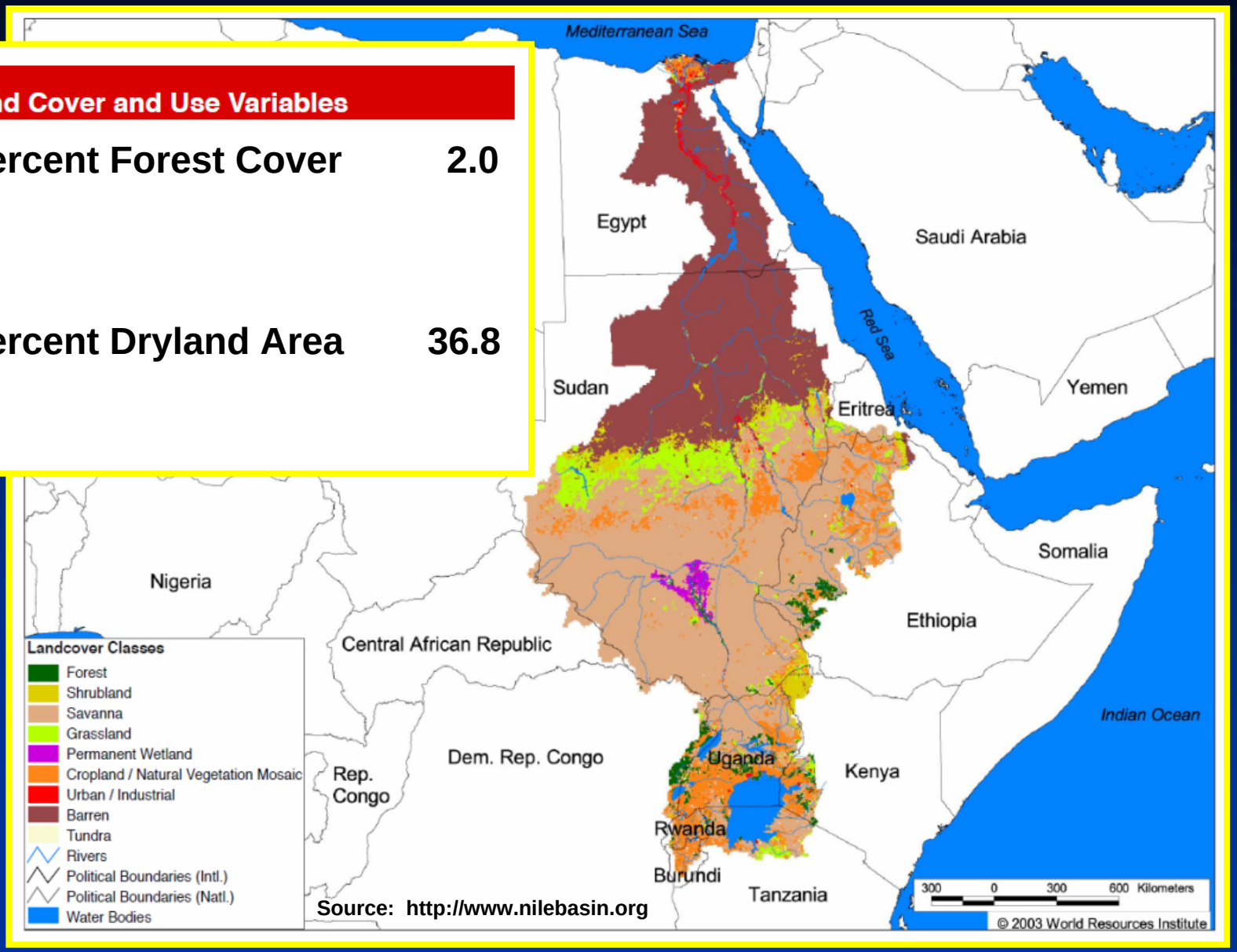
Egypt & Nile River Basin





Nile River Basin Land Cover

Land Cover and Use Variables	
Percent Forest Cover	2.0
Percent Dryland Area	36.8



Source: http://www.nilebasin.org

Nile Waters

- Nile River provides ~97% of Egypt's freshwater, of which >80% is utilized for agriculture
- Egypt's share of Nile waters is allocated to international treaty obligations (Sudan 1959); fixed at 55.5 billion m^3 annually
- Egypt will not be able to meet increasing freshwater demand & has been developing wastewater reuse strategies

Primary Pollution Sources

- Industrial wastes
- Pesticides
- Fertilizers
- Pharmaceuticals
- Field crop wastes
- Acid rain
- Untreated sewage wastes

Source: Prof. Nabil Kandil, Soils, Water, & Environment Research Institute, Agricultural Research Center, El-Giza, Egypt

Sewage Water History

- Historically, both treated & untreated sewage water was simply pumped into the sea or main drains, disposed of in the desert or allowed to seep into the ground.
  - Environmental pollution & human health hazards
- Today, treated effluent generated from sewage treatment plants in cities are used in forest plantations in the desert & bordering areas.

Source: Prof. Nabil Kandil, Soils, Water, & Environment Research Institute, Agricultural Research Center, El-Giza, Egypt

Environmental Parameters

1. pH, EC, cations, anions, SAR
2. NO_3- N, NH_4-N, NO_2-N, total N
3. Zn, Fe, Mn, Cu, B, P, Ca, Mg
4. Th , Si, Pb, Cd, Mo, Cr, Se, As, Co, Ni
5. Petroleum hydrocarbons
6. Phenolic compounds
7. Hormones
8. Pesticides residue
   - Organic: Aldrin, Dieldrin, Lindane, Endrin, Malathion
   - Inorganic: Fl, Cl, As, P, Hg
9. Pathogenic indicators
   - Total coliform, Feacal coliforms, *Salmonella*, *Shigella*
10. COD
11. BOD
12. DO
13. Total suspended & dissolved solids

Source: Prof. Nabil Kandil, Soils, Water, & Environment Research Institute, Agricultural Research Center, El-Giza, Egypt

Water Conservation Strategies

- Cooperate internationally (10 African countries of Nile basin)
- Improve irrigation capacity
- Reuse agricultural drainage water
- Increase capacity of water management
- Maintain renewable ground water aquifer in Nile Basin & Delta
- Desalinate sea water
- Build capacity via integrated water resources management
- Exercise precaution during fishing & Navigation
- Reuse treated sewage water

Source: Prof. Nabil Kandil, Soils, Water, & Environment Research Institute, Agricultural Research Center, El-Giza, Egypt

Action Steps

- **Monitor sewage water quality**

  (e.g., salinity, heavy metals, pathogenic indicators, public health hazards)

- **Characterize soil properties**

  (i.e., chemical, physical, hydrological)

- **Cultivate:**
  - **Trees in the desert as windbreaks & green belts**
  - **Artificial forests in selected demonstration fields**
  - **Fiber crops for industrial purposes (e.g., flax, jute)**
  - **Oil crops (e.g., *Jojoba*, *Jatropha*)**

Source: Prof. Nabil Kandil, Soils, Water, & Environment Research Institute, Agricultural Research Center, El-Giza, Egypt

U.S. Agency for International Development (USAID)

- **USAID is an independent agency that provides economic, development & humanitarian assistance around the world in support of the foreign policy goals of the United States.**
- **USAID promotes peace & stability in 100 developing countries by:**
  - **providing emergency humanitarian assistance,**
  - **fostering economic growth,**
  - **protecting human health, &**
  - **enhancing democracy.**

USAID
FROM THE AMERICAN PEOPLE

Source: http://www.usaid.gov

USAID Assistance

- Technical assistance & capacity building
- Training & scholarships
- Food aid & disaster relief
- Infrastructure construction
- Small-enterprise loans
- Budget support
- Enterprise funds
- Credit guarantees

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LIFE – IWRM (I) Project
(2004 – 2008)

- **Livelihood & Income from the Environment – Integrated Water Resources Management Project**
- **USAID Cairo / Egyptian Ministry of Water Resources & Irrigation**
  - **Provide technical assistance, training, commodities, & small grants to support decentralization of water management**
  - **Increase water use efficiency & productivity**

USAID | EGYPT
FROM THE AMERICAN PEOPLE

MINISTRY OF WATER RESOURCES AND IRRIGATION

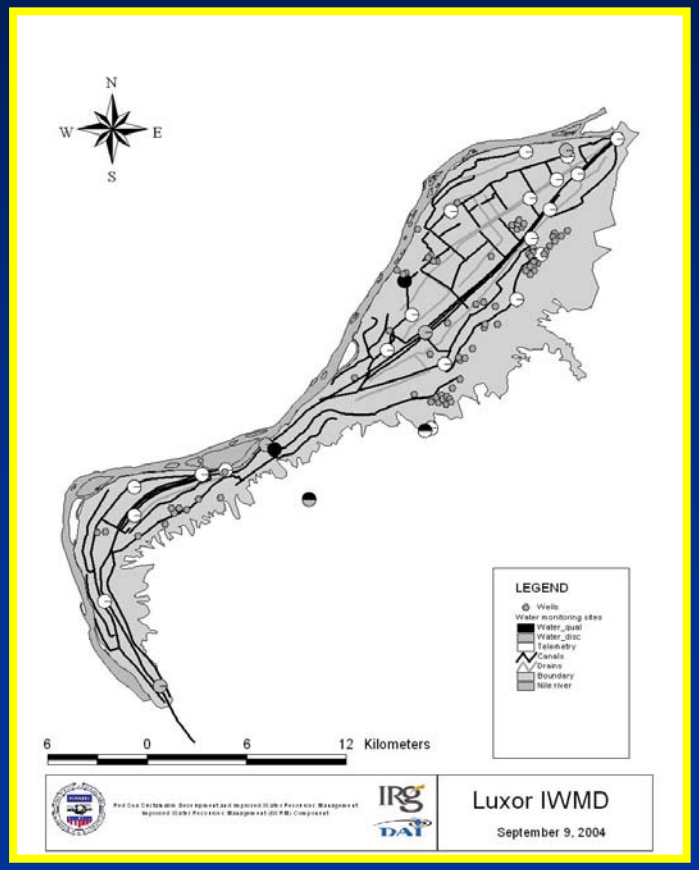
Source: http://egypt.usaid.gov

Project Activities
LIFE – IWRM (I)

1. Decentralized Management of Water Resources
Formation of Integrated Water Management Districts (IWMD)
Formation of Branch Canal Water User Associations
Equitable Allocation of Water Resources

2. Stakeholder Engagement in Water Resources Management
Improved Maintenance & Upgrading of Water Management Equipment
Environmental Services for Improving Water Quality Management
Improved Wastewater Reuse Practices

3. Capacity Building for MWRI Staff
Graduate Degree Training for MWRI staff



Project Outcomes
LIFE – IWRM (I)

- **Egyptian government has developed & approved guidelines for the reuse of treated wastewater for agricultural purposes**

These guidelines represent the legal foundation for farmers to begin cultivating with irrigated wastewater

Egyptian Wastewater Reuse Code (2005)

Grade	Agricultural Group	
A	G1-1: Plants and trees grown for greenery at tourist villages and hotels.	Grass, Saint Augustine grass, cactaceous plants, ornamental palm trees, climbing plants, fencing bushes and trees, wood trees and shade trees.
	G1-2: Plants and trees grown for greenery inside residential areas at the new cities.	Grass, Saint Augustine grass, cactaceous plants, ornamental palm trees, climbing plants, fencing bushes and trees, wood trees and shade trees.
	G2-1: Fodder/ Feed Crops	Sorghum ss
B	cities and afforestation of high ways or roads	oleander, fruit-producing trees, date palm and olive trees.
	G2-4: Nursery Plants	Nursery plants of wood trees, ornamental plants and fruit trees
	G2-5: Roses & Cut Flowers	Local rose, eagle rose, onions (e.g. gladiolus)
	G2-6: Fiber Crops	Flax, jute, hibiscus, sisal
	G2-7: Mulberry for the production of silk	Japanese mulberry
C	G3-1: Industrial Oil Crops	Jojoba, castor-oil plant, and Jatropa
	G3-2: Wood Trees	K[illegible], camphor and other wood trees.

G3-2: Wood Trees

Source: The Egyptian Code for the Reuse of Treated Municipal Wastewater in Agriculture. Ministerial Decree Nos. 288 of 2000 & 329 of 2001. The Code was Approved by Ministerial Decree No. 171/2005, Ministry of Housing.

Wastewater Treatment Plants in Egypt

Establishment of Man-made Forests

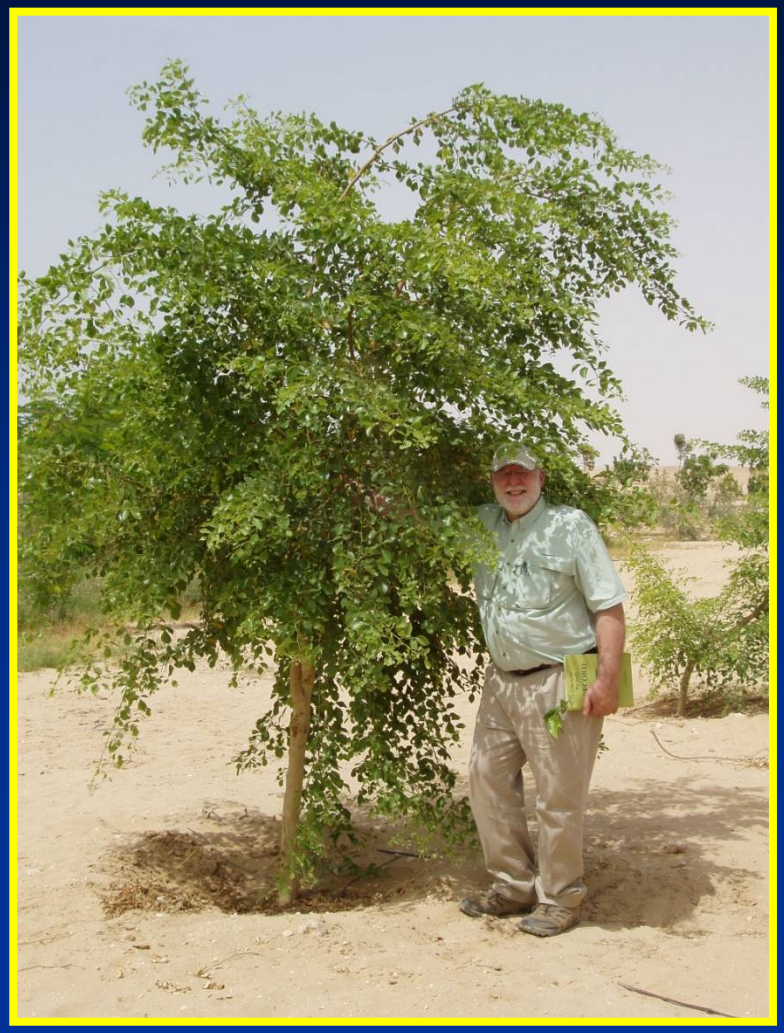
28 Total; 21 Irrigated with Treated Sewage Water

- Ismailia
- Luxor (2)
- Aswan (4)
- Menofia
- Dakahlia
- Qena
- Sohag (2)
- North Sinai
- South Sinai
- Asyout
- Giza
- Red Sea
- New valley (4)

Source: Egyptian Ministry of Agriculutre & Land Reclamation

LIFE – IWRM (II) Project
(2008 – present)

- Dispose of treated wastewater & produce product with economic value
- Evaluate the feasibility of scaling up afforestation efforts throughout Egypt
  - 67,200 ha available



Technical Assistance Team

USDA

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

ARS

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US Forest Service, Department of Agriculture

Chris Soriano
(Project Manager)

SRS Southern Research Station
Science you can use!

Dr. John Stanturf

Northern RESEARCH STATION
USDA Forest Service

Dr. Ron Zalesny

Mission Objectives

1. Identify tree species suitable for afforestation based on local soil characteristics, water quality, & water quantity
2. Define the benefits & consequences of using these species
3. Provide recommendations for irrigation based on potential tree species & local conditions
4. Identify strategies to maximize the potential of afforestation efforts with regard to: improving water quality, maximizing resource production, increasing biodiversity, & limiting commercial inputs
5. Identify potential long-term impacts on the natural resource base from afforestation & strategies to mitigate these impacts

Three Species Classes

- **Pulpwood & sawnwood**

  Pinus*, *Eucalyptus*, *Populus **(spp)**

- **High-value**

  Khaya ivorensis **(mahogany),**

  Tectona grandis **(teak)**

- **Pulpwood**

  Gmelina arborea **(beechwood)**

Khaya ivorensis

Shoot borer?
(*Hypsipyla robusta*)

Populus spp.

Ismailia, Egypt

Pacific Northwest, USA

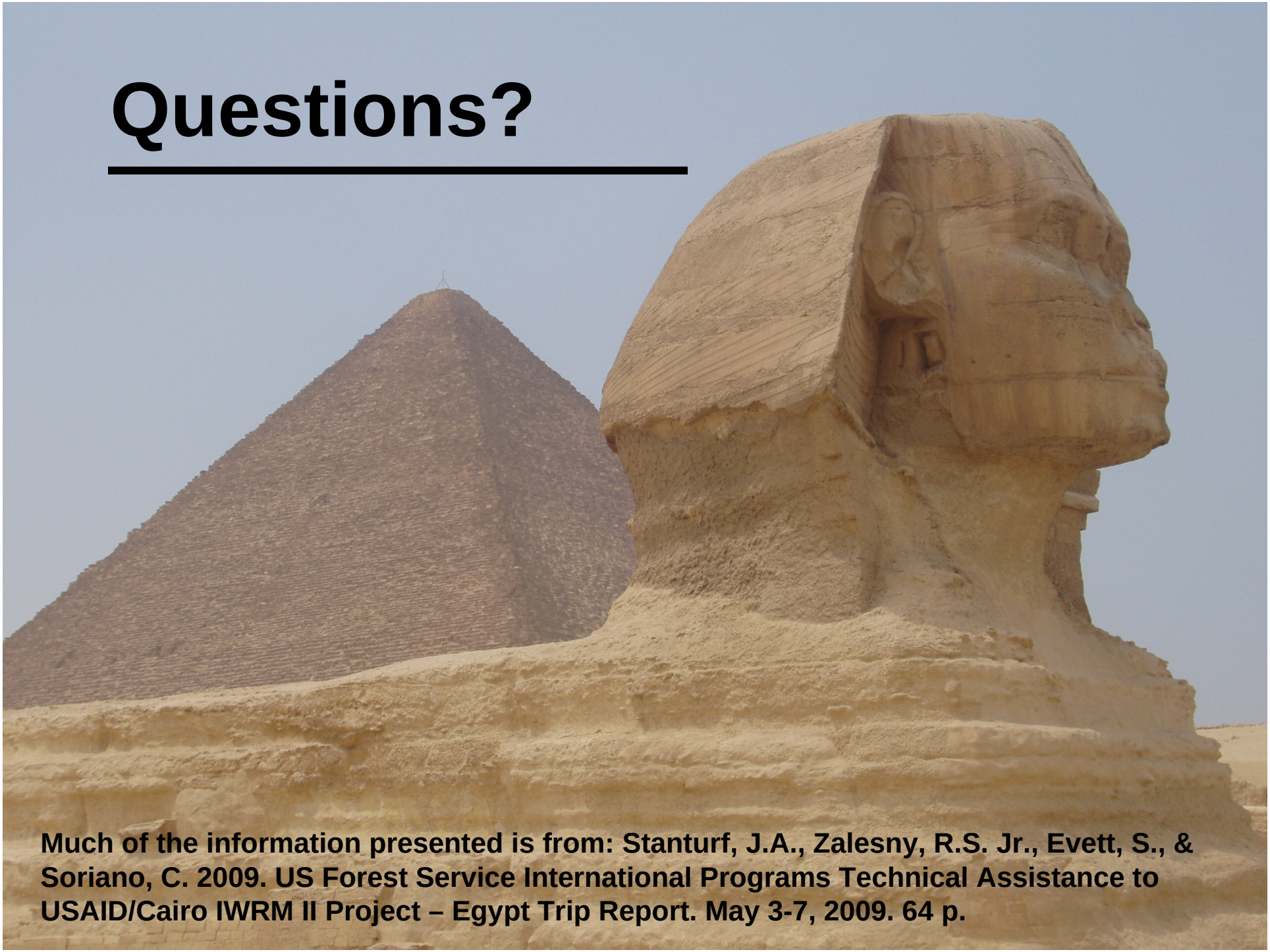
Irrigation
vs
Crop Requirements

Midwest, USA

Great Potential

- Irrigation water is available
- Land is available
- Trees will grow, despite conditions
- Proper management, guidance

Questions?



Much of the information presented is from: Stanturf, J.A., Zalesny, R.S. Jr., Evett, S., & Soriano, C. 2009. US Forest Service International Programs Technical Assistance to USAID/Cairo IWRM II Project – Egypt Trip Report. May 3-7, 2009. 64 p.

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