

From sewage water to plantation forests in desert lands of Egypt

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Establishment of Plantation Forests and Development of Sustainable
Forestry in Desert Lands of Egypt Using Sewage Water
Education and Research



Egypt



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Desert lands in Egypt



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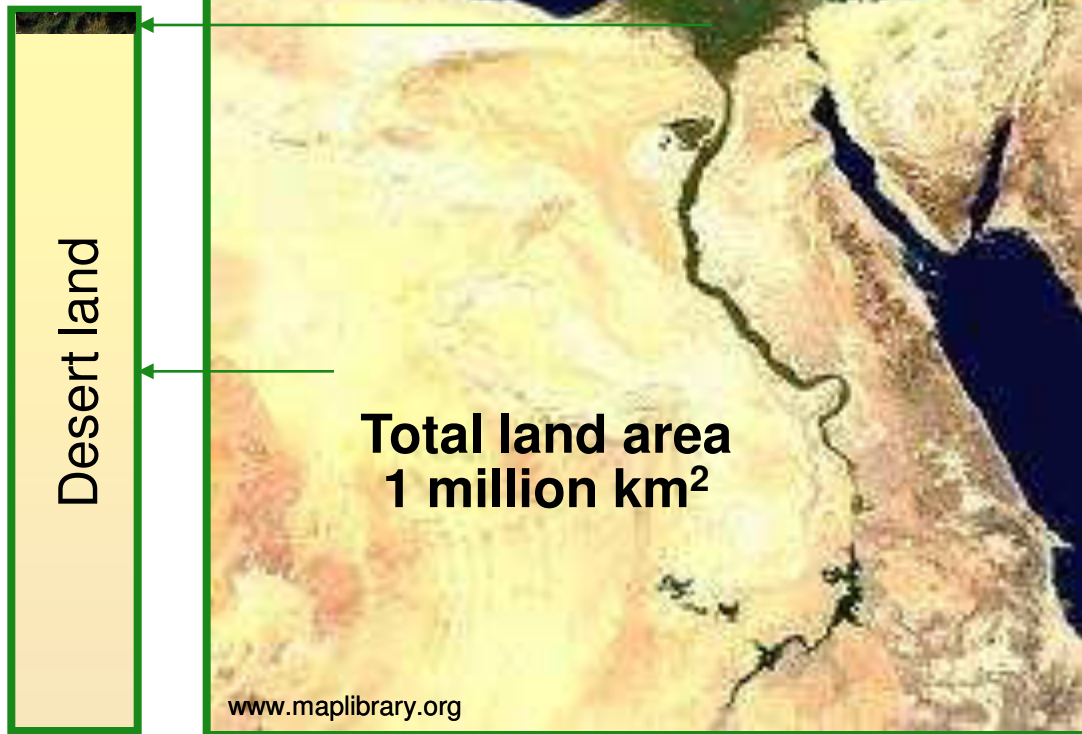


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Satellite image of Egypt

Arable land
3.6%



Climate: Mediterranean in north (hot-dry summer 27 °C, and a warm winter 15 °C), and continental in south (40 °C in summer and 13 °C in winter)

Annual average precipitation: 10 mm (150-200 mm in north and 2 mm in south)

Humidity: High in the north with 70% during summer, and low in the south with 13%.

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The Nile and Nile Delta



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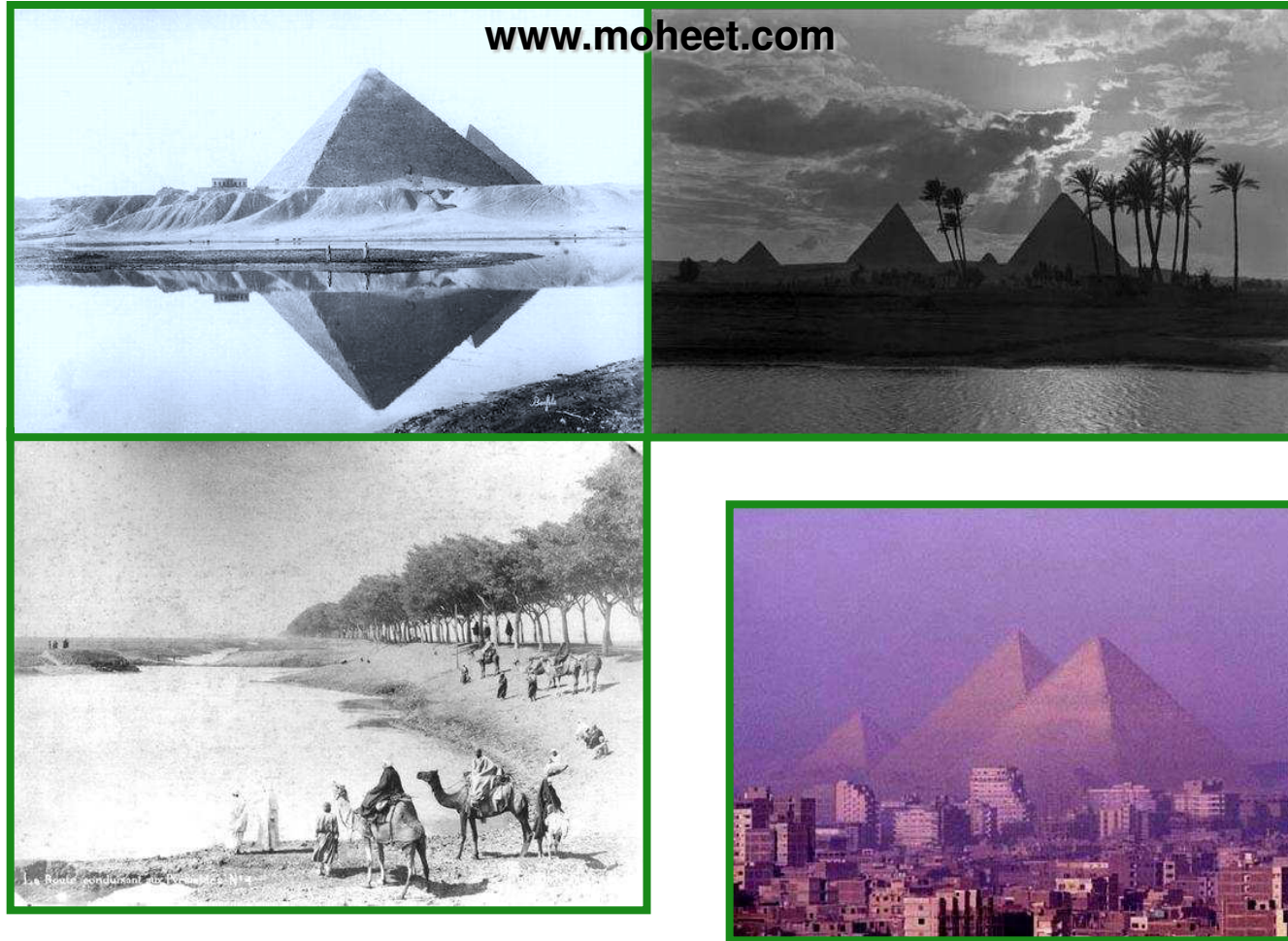
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The pyramids: 100 years ago and today



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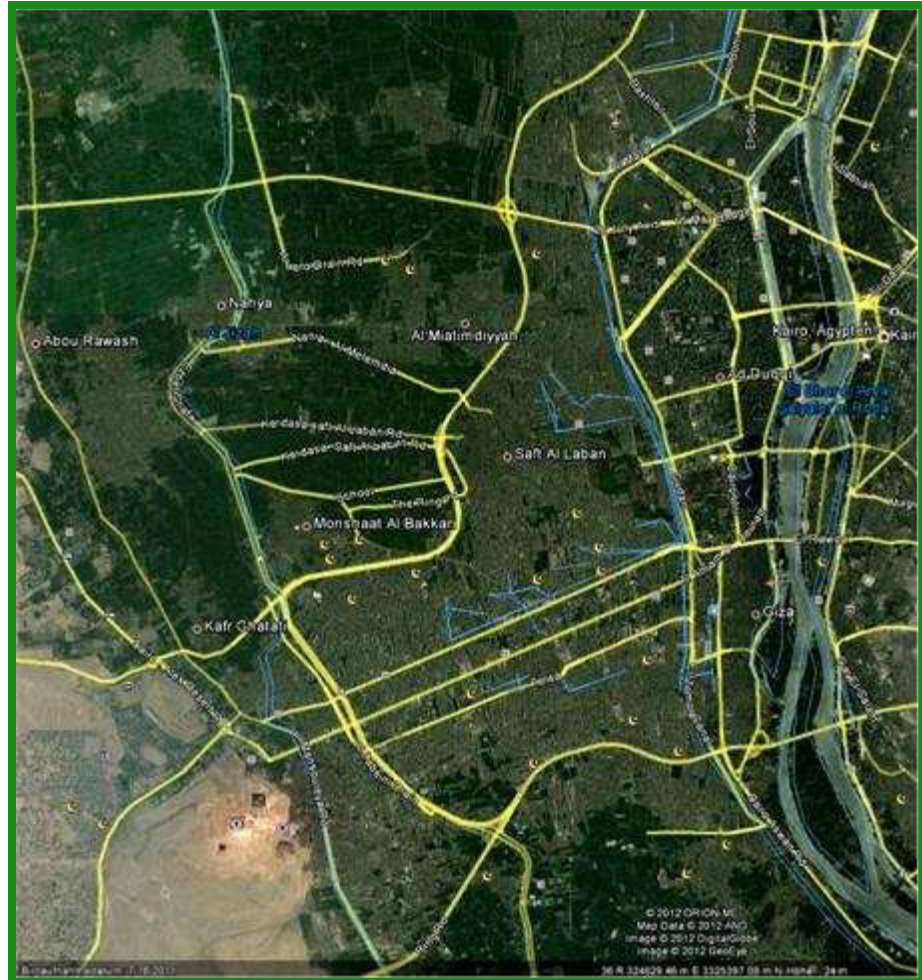
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The Nile delta on the outskirts of Cairo



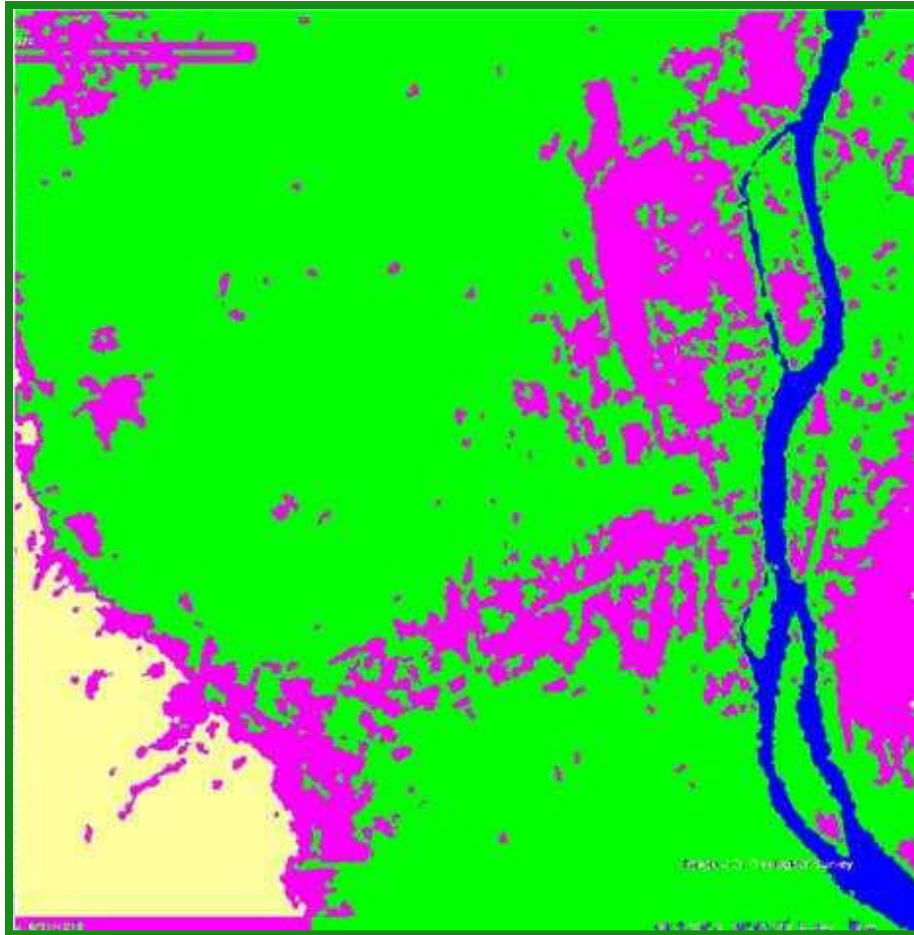
Satellite image 1972



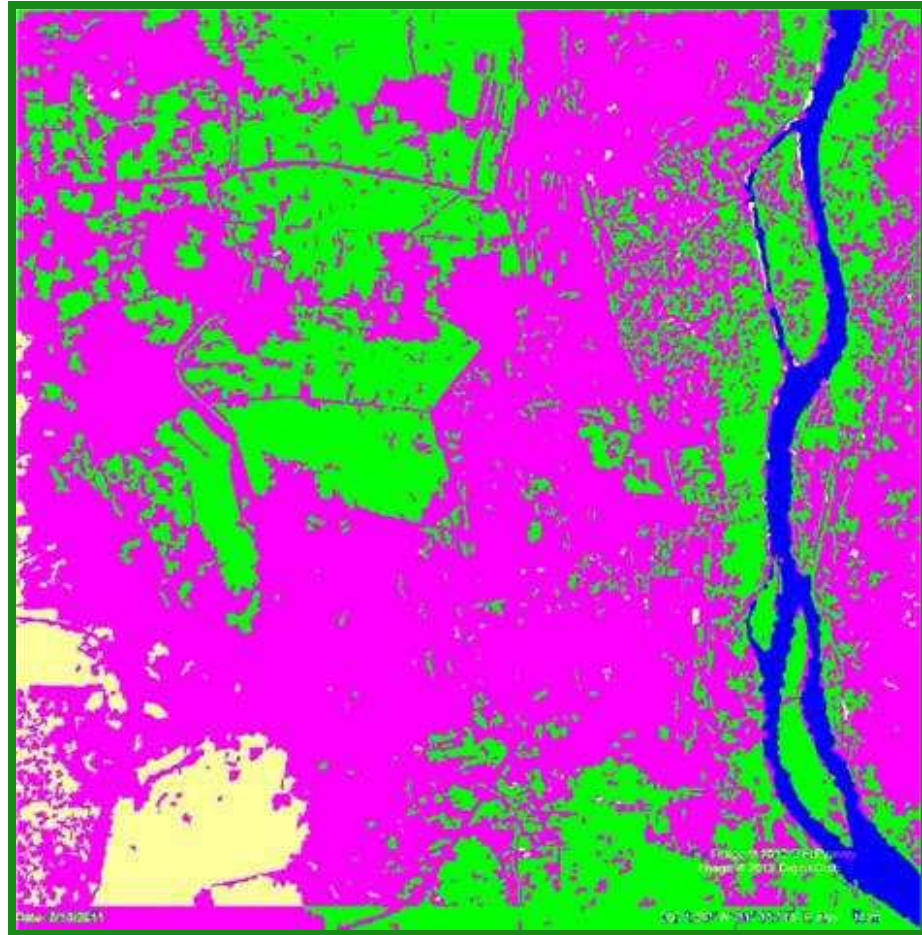
Satellite image 2011



The Nile delta on the outskirts of Cairo (continued)



Land cover 1972



Land cover 2011

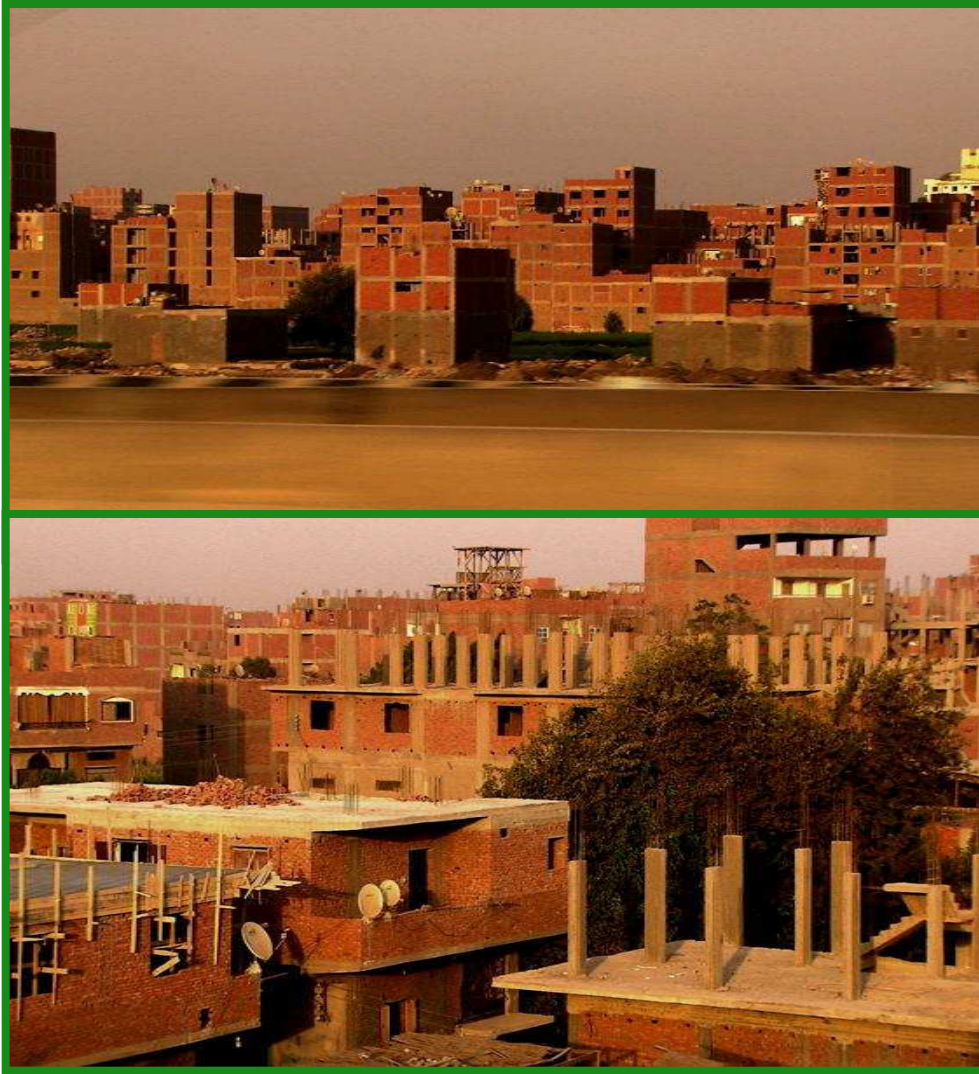
	400 km ²	1972	2011
 Urban		32%	61%
 Vegetation		42%	21%
 Desert		24%	16%
 River		2%	2%



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The Nile delta today



According to the Executive Secretariat of the United Nations Convention to Combat Desertification, Egypt lost 9% of its arable lands to constructions over the past 36 years. The country is ranked first in the rate of desertification with a loss rate of **3.5 acres per hour (35 ha daily)** of fertile Delta agricultural land, which is an incomparable rate in the world statistics.



Greatest challenges facing Egypt

“The current situation in Egypt is alarming: Modern Egyptians are directly heading towards the certain extermination of their children and grandchildren, and thus the destruction of an ancient civilisation, unless urgent actions are immediately undertaken” (El Kateb, 2012).

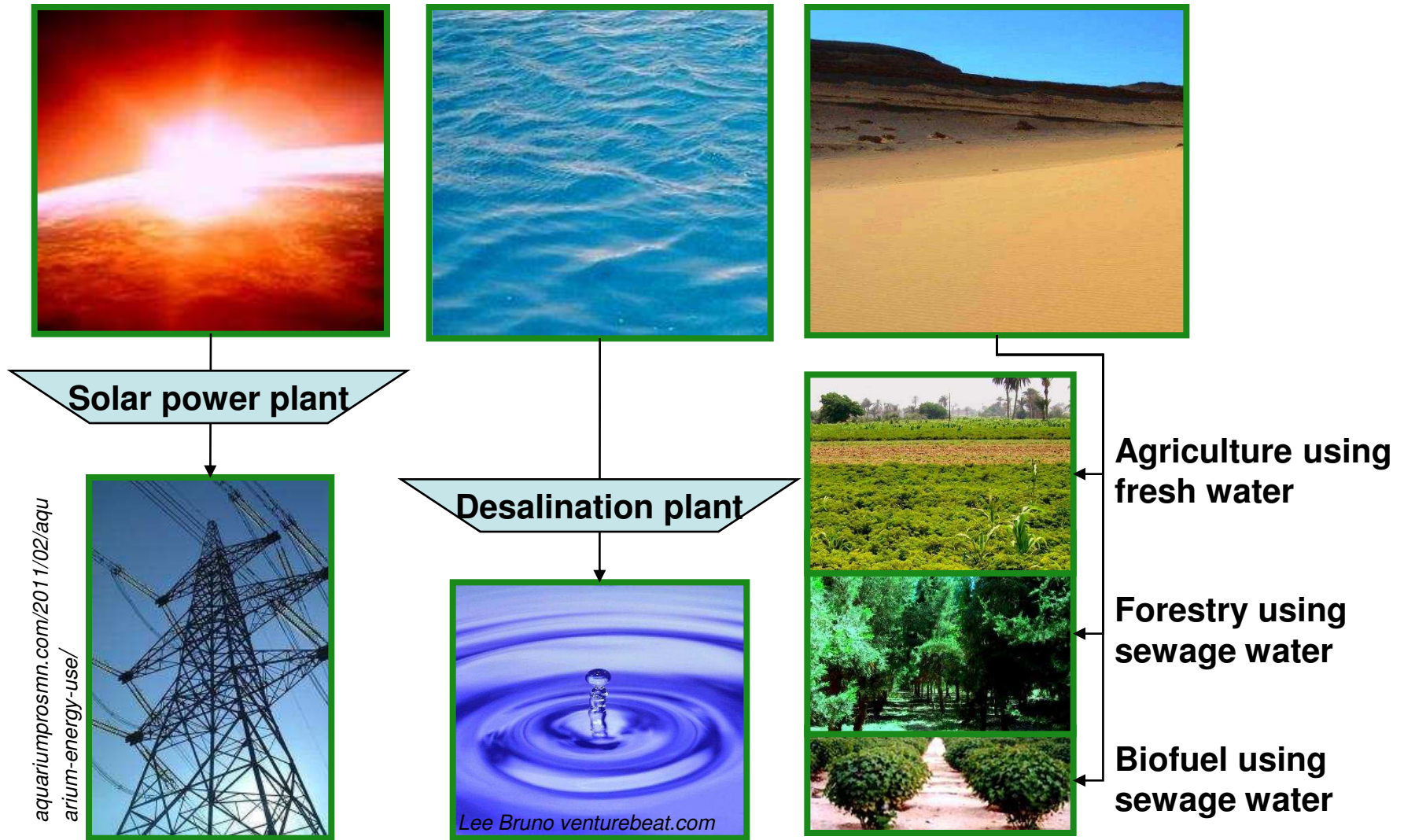
- Arid/desert climate
- Water scarcity
- Misuse of the limited fertile land to secure food for the increasing population (89 million)
- High susceptibility to climate change: Egypt is ranked 3rd in rising sea levels after all low-lying Island States and Vietnam (World Bank, 2009)
- Mismanagement of resources
- Absence of innovative, environmentally-friendly solutions.



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Resources with high potential in Egypt



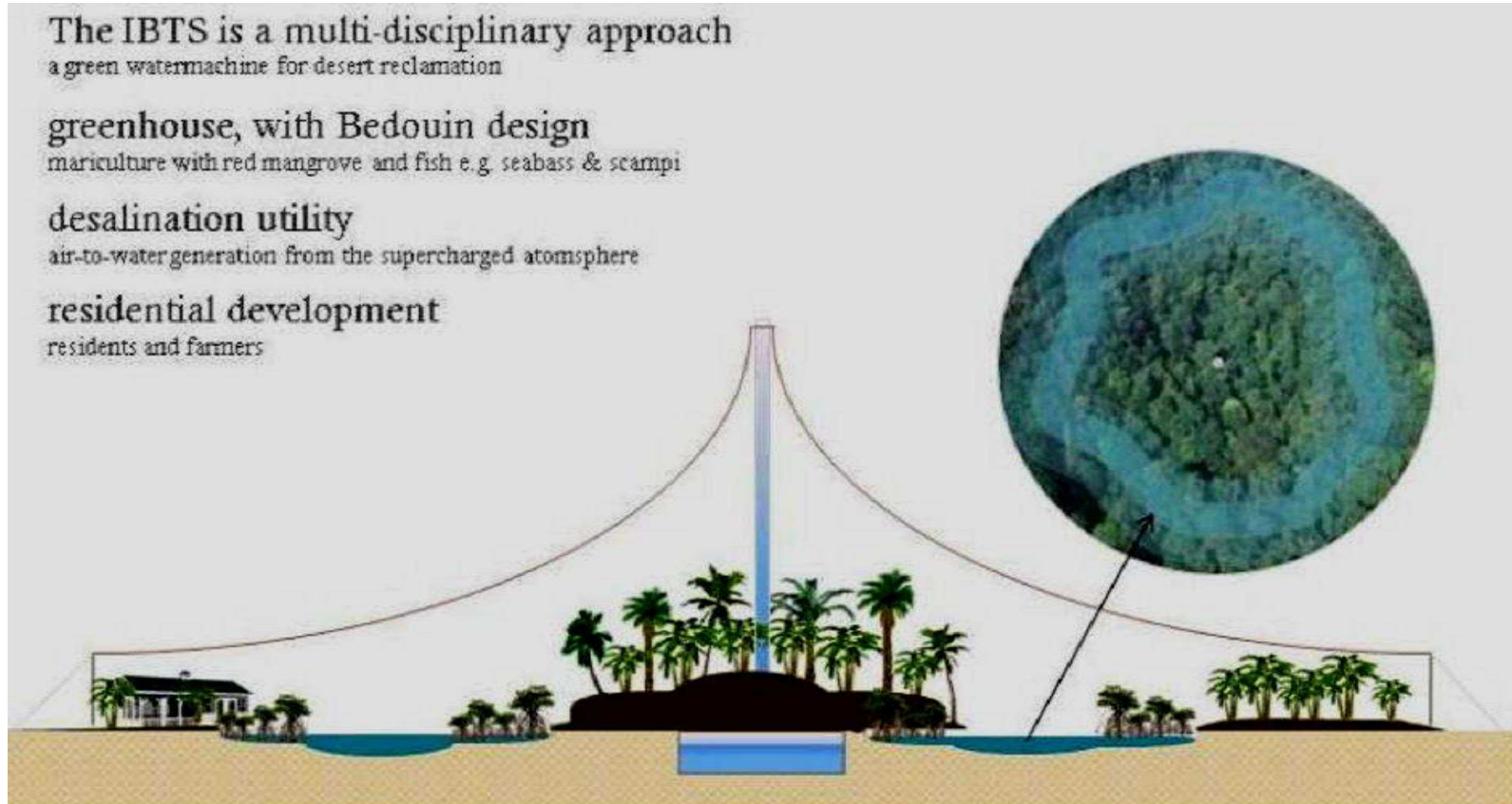
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Use of resources with high potential in Egypt



Outline of simplified version of an IBTS, Integrated Biotechnural System (Berdellé and El Kateb)

Objective: Management of resources in a sustainable way to secure water and food by steady supply.

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Forestry in Egypt

Egypt has almost no natural forests. We can find:

Relic of nature woodlands on the slopes of Gebel Elba (Mountain Elba) in the Elba Protected Area in the southern of the country, the largest protected area in Egypt (over 36,000 km²).



Sparse, scattered mangroves along the red sea coast.



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Forestry in Egypt (continued)

- A few indigenous species occur over the country. These include:
 - sycamore,
 - acacia,
 - tamarisk,
 - carob,
 - popular,
 - mulberry-trees and
 - above all date-palms as well as various fruit trees.
- Forestry in Egypt is mainly based on plantation forests with the most common species being:
 - Casuarina spp. and
 - Eucalyptus spp.



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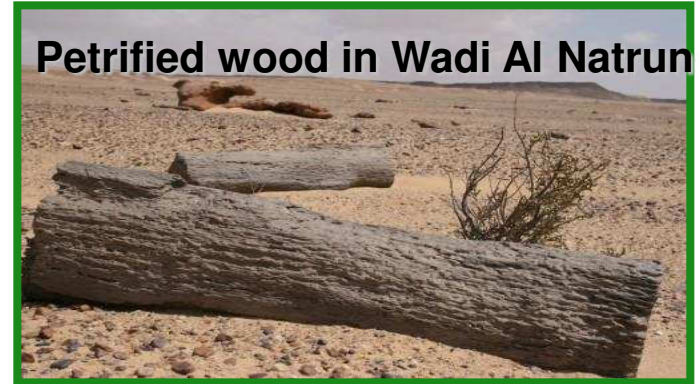


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Forestry in Egypt (continued)

- Many excavations in various parts of the country support the opinion that large parts of ancient Egypt at both Nile banks were forest zones. Also the Sinai Peninsula with its many valleys was rich in forest. The names of the valleys are still good indication.
- At the end of the first century, over a thousand years ago during the Fatimids era, Egypt was the first country in the world, which established a national forest organisation (Goldmann, 2001). Usage of wood was well managed. Wood was mainly used for the construction of cargo ships. Thousands of ships of a size of about 85m long and 35m abeam were built.
- Today, far less than 0.1% (around 720 km²) of the country's land area is covered with trees.



Petrified wood in Wadi Al Natrun



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Egyptian National Programme for Afforestation

Afforestation is the planting of trees on lands formerly used for purposes other than forestry. It is a cost-effective tool to reduce emission. Planting large areas of new forests is effective to slow the increase in atmospheric carbon dioxide.

- In the mid 90s, the “***National Programme for the Safe Use of Treated Sewage Water for Afforestation****” was launched to mainly improve the prevailing environmental situation by
 - making use of unutilised sewage water, which is a hazard for the environment and in addition a waste of water resource and nutrients, in
 - establishing forest plantations “green areas” to support the efforts exerted to stabilise the greenhouse gas concentrations in the atmosphere.
- Within the frame of this programme, a **pilot project** on over 6,000 hectares spread over the country was conducted to determine the success/failure of afforestation using basic-treated sewage water.



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National Programme for Afforestation (continued)



Planted species within the pilot project

- Acacia (*Acacia nilotica* and *Acacia saligna*)
- Casuarina (*Casuarina equisetifolia*)
- Cupressus (*Cupressus sempervirens*)
- Eucalyptus (*Eucalyptus camaldulensis*)
- African Mahogany (*Khaya senegalensis*)
- Neem (*Azadirachta indica*)
- Pinus (*Pinus pinea*)
- Popular (*Populus spp.*)
- Jatropha (*Jatropha curcas*) and Jojoba (*Simmondsia chinensis*) as biofuel crop
- Sisal (*agava sisalana*) and ornamental trees



National Programme for Afforestation (continued)



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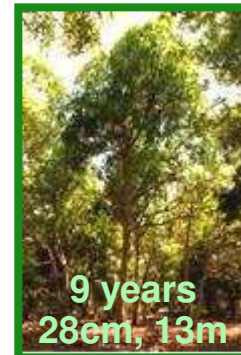
Potential of the afforestation in Egypt

Eucalyptus camaldulensis *Eucalyptus citriodora* *Khaya senegalensis*

Ismailia (civil wastewater)



Sadat City (civil and industrial wastewater)



Potential of the afforestation in Egypt (continued)

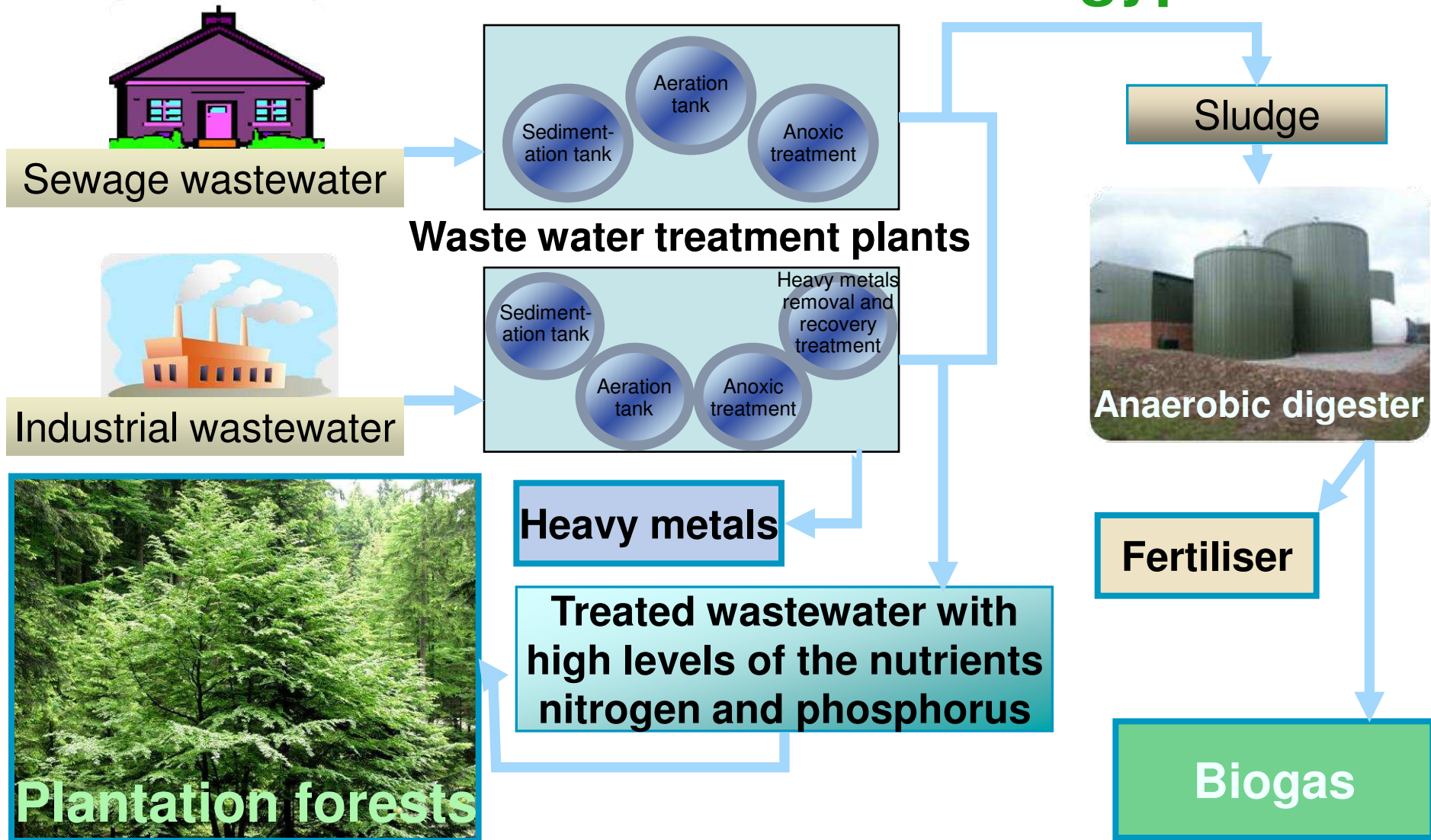
Estimated yield (El Kateb and Mosandl, 2012)

	<i>Eucalyptus citriodora</i>	<i>Eucalyptus camaldulensis</i>	<i>Khaya senegalensis</i>
Rotation period	11 years	12 years	15 years
Total volume*	348 m ³ /ha	346 m ³ /ha	333 m ³ /ha
Total biomass	306 t/ha	325 t/ha	241 t/ha
Annual CO ₂ sequestration	51 t/ha/year	50 t/ha/year	30 t/ha/year

*Compared to Germany, the leading country in Forestry in Europe, this volume in average for all tree species is achieved after 60 years. This means that the same yield in Egypt is attained 4.5 times earlier than in Germany.



Potential of wastewater in Egypt





Egyptian-German Collaboration



**Ministry of Agriculture and Land Reclamation
Ministry of State for Environmental Affairs**
**National Programme for the Safe Use of
Treated Sewage Water for Afforestation**
*administration, coordination, infrastructure,
sewage water analysis*

**Bavarian State Ministry of Agriculture and
Forestry**

knowledge transfer, exchange of experts

Forest Finance Group

*forest carbon development, sponsoring,
commercial application*

**Department of Agricultural Engineering,
Ain Shams University**
(water research, irrigation)

**Department of Forestry and Wood
Technology, University of Alexandria**
(silviculture research)

**Agriculture Research Centre, Ministry of
Agriculture and Land Reclamation**
(soil research, forest tree breeding)

**Institute of Silviculture, Technische
Universität München (TUM)**
(silviculture research, forest tree breeding)

**Institute of Hydraulic and Water Resources
Engineering, TUM**
(water research)

**Institute of Water Quality Control,
TUM**
(wastewater research)

German Academic Exchange Service (DAAD)
*supports enhancement of education and
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Multi-functionality of the afforestation in Egypt

- Decreasing pollution as growing trees absorb carbon dioxide from the atmosphere
- Protection against desertification and erosion
- Sand dune fixation and coastal protection
- Efficient use of water resources
- Wood production, and biofuel-crop production
- Human settlement protection from wind and sand
- Food security for an increasing population through the protection of adjacent arable and new reclaimed lands from wind and combating desertification
- Establishment of new industries related to wood and wood processing
- Creating new jobs and qualification opportunities among young people whose unemployment rate is high.

Beside the attraction of forests in arid regions to local inhabitants as well as tourists.



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Opportunity for large scale afforestation in Egypt

Resources

- sewage water (6.3 billion m³ annually, of which 2.6 billion m³ is only treated) and
- desert lands of over 950 thousand km².

Potential

Using 5.5 billion m³ sewage water for the afforestation and assuming an average annual water requirement of 8,500 m³/ha

- **650 thousand ha** in the desert lands can be afforested (approximately 20% of the total agriculture area) and
- **25 million tons of CO₂ annually** can be stored.

Large-scale afforestation may stimulate cloud formation and may result in rainfall (University of Hohenheim 2012) that the country urgently needs.

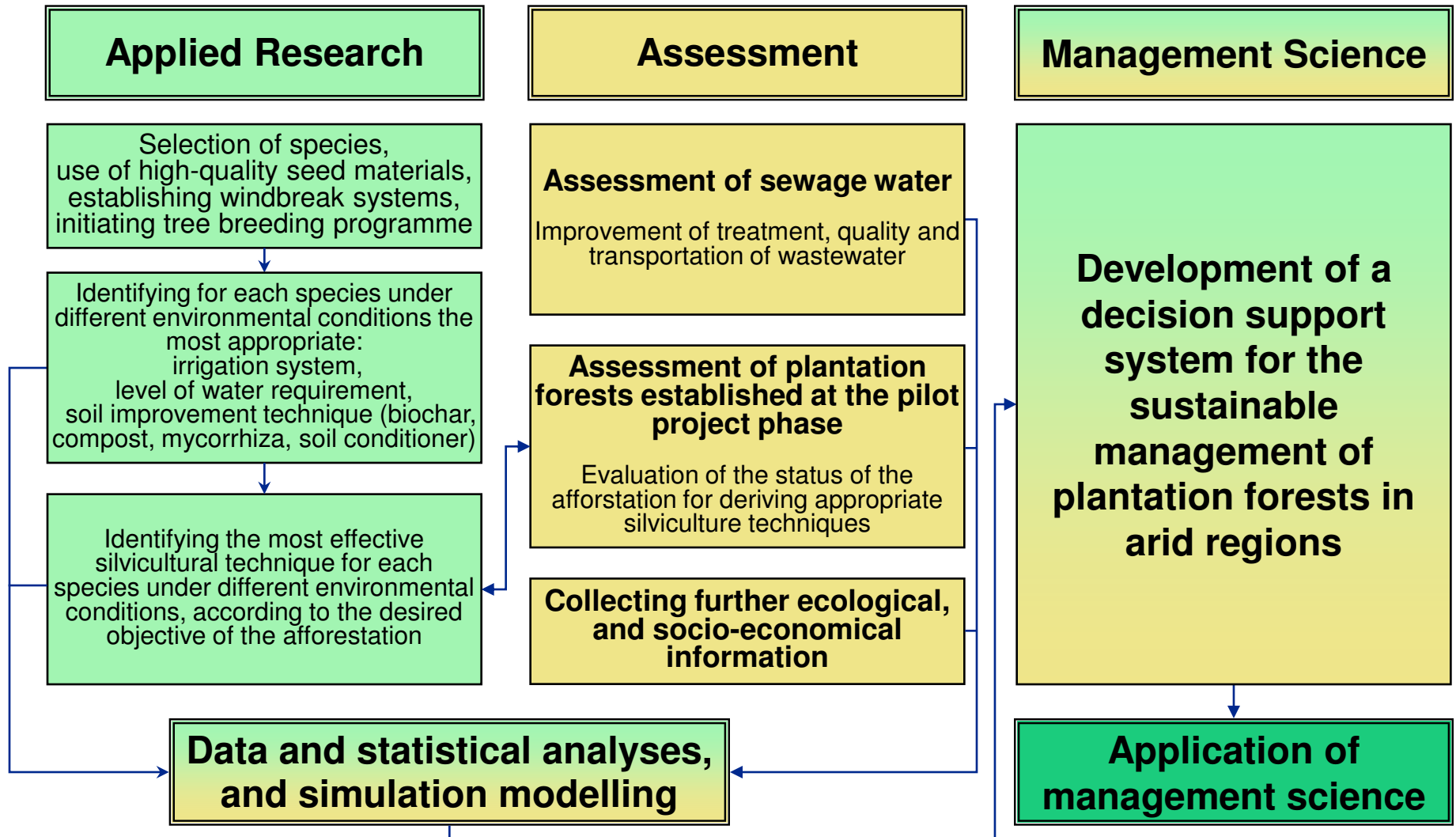


Approach to establishment of large-scale plantation forests in the desert lands of Egypt

- Making optimal use of the potential available in the wastewater and in plantation forests.
- Development of sustainable forestry in desert lands by improving productivity, quality, technology, cost-effectiveness, and economic returns of the plantation forests.
- Development of sustainable management for the wastewater resources.
- Building of forest administration liable to implement the forestry policy, to provide guidelines for forest management, to approve and to control the implementation of forest management plans.
- Capacity building of trainers and technical staff.
- Enhancing education and research related to wastewater and forest management.
- Conducting interdisciplinary researches to accompany the afforestation activities and develop decision support systems.



Accompanying Scientific Studies - Scientific Approach



Thank you for your kind attention

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