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The Egyptian Science, Research and Technology Landscape



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Dear Readers,

Especially since the German-Egyptian Year of Science in 2007, cooperation projects between Egyptian and German universities and research institutes are on a continuous rise. In both countries, international research cooperation is understood as one of the driving forces for scientific development and as the necessary tool to meet social, economic and ecological challenges. The opening of the German Science Centre in Cairo in 2012, as a one stop shop for Egyptian and German students and scientists, is another milestone of this enhanced cooperation.

Despite this high interest in scientific cooperation, the number of scholars and decision-makers in Germany, who are familiar with the Egyptian research landscape, is still relatively small. The knowledge about science policies and research production in different disciplines in Egyptian universities and research institutes is often limited to a small number of experts and those already involved in joint cooperation projects. The same holds true for many Egyptian researchers who did not yet have the opportunity to get in contact with German researchers and research institutions.

The aim of this publication is to gain a better knowledge of research trends in Egypt and Germany. This first edition of the Egyptian-German Science Monitor starts with the summary of a so-far unpublished evaluation of the Egyptian Science, Research and Technology Landscape. The findings are based on an extensive assessment of university-industry cooperation, jointly conducted by the Egyptian Ministry of Higher Education and Scientific Research and Fraunhofer Gesellschaft. The study not only reveals the strengths and the weaknesses of the Egyptian Innovation System, it also provides clear evidence for the design of future policies. Hence, the study will not only be of benefit for decision-makers, but also for those cooperating with universities and the industry in Egypt.

In addition to this flagship article, this edition contains numerous contributions of various partners of the German Science Centre. It is addressing diverse subjects as the sustainable development of forestry in desert lands and teacher-training in German schools in Egypt, both representing best practice examples of Egyptian-German cooperation. The Science Monitor also presents findings from ongoing investigations, such as research on desalination through solar energy. Two articles focus on current trends in Middle Eastern Studies. Another set of contributions deals with issues related to research dissemination and higher education management.

The Science Monitor is a rich panorama of Egyptian-German cooperation and encourages future initiatives.

Mona El Tobgui, Florian Kohstall, Philip Hanna and Roman Luckscheiter

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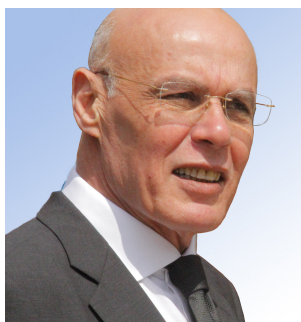
المركز العلمي الألماني
بالقاهرة



ألمانيا بلد الأفكار

Development of Sustainable Forestry in Desert Lands Using Sewage Water

by Hany El Kateb



Hany El Kateb is a Member of the Presidential Advisory Council of Scientists and Experts, Egypt, and a Senior Scientist at Technische Universität München (TUM). He has conducted research activities in forestry and resource management and has long international experiences in resource management, forestry, agri-business, and implementation of interdisciplinary projects.



INTRODUCTION

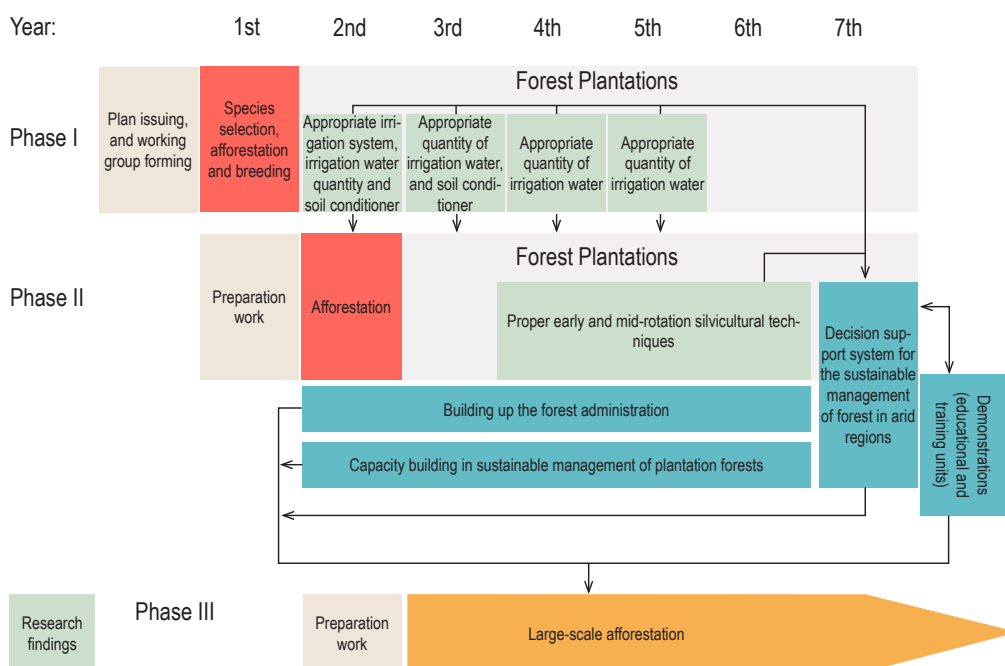
In the mid 1990s Egypt established the "National Programme for the Safe Use of Treated Sewage Water for Afforestation". Within the framework of this programme, a pilot project was conducted on over 4,000 hectares spread over the country to determine the success/failure of afforestation using basic-treated sewage water.

Based on the results of the pilot project and upon a Memorandum of Understanding between the Egyptian Ministry of State for Environmental Affairs and the Institute of Silviculture at Technische Universität München (TUM) in 2007, the Institute of Silviculture has proposed a concept for the "Establishment of Plantation Forests and Development of Sustainable Forestry in Desert Lands of Egypt Using Sewage Water" (Figure 1). The concept lays emphasis on the improvement of productivity, quality, technology, cost-effectiveness, and economic returns of the plantation forests. Therefore, an accompanying applied research was proposed with the main objective to develop a decision support system for the sustainable management of planta-

tion forests in arid regions including wastewater management. The supporting scientific work is carried out by highly qualified German and Egyptian scientists including: The Institute of Silviculture, Technische Universität München (TUM); Department of Agricultural Engineering, Ain Shams University; Department of Forestry and Wood Technology, University of Alexandria; Institute of Hydraulic and Water Resources Engineering, TUM; Institute of Water Quality Control, TUM; Agriculture Research Centre, Ministry of Agriculture and Land Reclamation.

The Bavarian State Government in Germany has expressed support to the afforestation attempts in Egypt by providing technical assistance in the form of technology transfer and support in capacity building. In 2012, the German Academic Exchange Service (DAAD) provided funds to support the implementation of a part of the research activities, the assembling of forest-management knowledge at the Egyptian Universities and the optimisation of the afforestation programme. In addition, the project aims to strengthen

research cooperation in forest and water resource management and scientific exchange through further partnerships between Germany and Egypt. The media, whether Egyptian or German, has in many contributions reported on TV and newspapers positively about the afforestation project.



PROJECT DURATION: 2012–2014

FUNDING ORGANISATION: DAAD

PROJECT MANAGEMENT:

Institute of Silviculture, Technische Universität München and Department of Agricultural Engineering, Ain Shams University

PARTICIPANTS AND PARTNERS

Technische Universität München, Ain Shams University, Alexandria University, Ministry of Agriculture and Land Reclamation, Ministry of State for Environmental Affairs

Figure 1: Concept scheme for the Establishment of Plantation Forests in Egypt

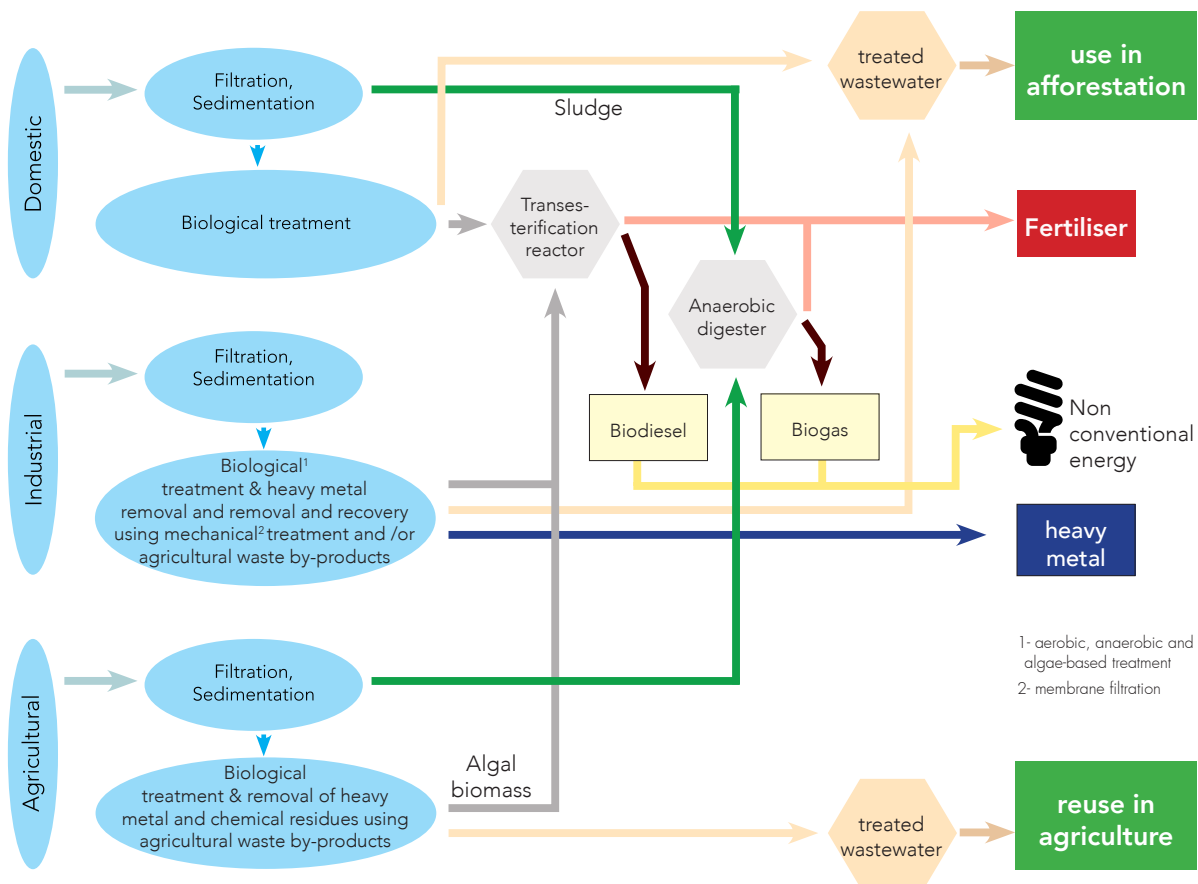


Figure 3: Treatment and use of potential of wastewater.

ACHIEVEMENTS

The scientific team in collaboration with the Under-secretariat for Afforestation and Environment of the Ministry of Agriculture and Land Reclamation could gain important scientific information and attain achievements towards the successful realisation of the afforestation in Egypt.

Hörl (2012) showed that the potential of forest trees growing in Egypt is high: 134 Forestry-relevant tree-species that are growing in only two parks in Cairo were found. El Kateb and Mosandl (2012)



Figure 2: 10-weeks old forest plantations (left: different species, right: Teak) in Sarabium forest near Ismailia.

determined the yield of some tree species of the plantation forests in Egypt and found out that it was relatively high. They estimate that each yield could be attained approximately 4.5 times earlier than in Germany, the leading country in forestry in Europe. Khalifa, El Kateb & El-Gindy (2013) investigated the feasibility of the afforestation in Egypt using water and concluded its environmental, social and economical impact. El Kateb, Eger & Waltersbacher (2013) estimated an internal rate of return exceeding 12% by afforesting 1,000 ha of desert lands using 14 tree species that were selected on scientific bases by the German and Egyptian scientific team. The species are:

- Precious hardwood species: Gmelina or White Teak (*Gmelina arborea*), African Mahogany (*Khaya senegalensis*), Outeniqua yellowwood (*Podocarpus falcatus*), Teak (*Tectona grandis*, Figure 2)
- Hardwood species: Mangium or Black Wattle (*Acacia mangium*), Neem or Indian Lilac (*Azadirachta indica*), Lemon-scented gum (*Corymbia citriodora*), River Red Gum (*Eucalyptus camaldulensis*)
- Softwood species: Caribbean Pine (*Pinus caribbea* var. *hondurensis*), Canary Island pine (*Pinus canariensis* C. Smith)
- Biofuel crops: *Jatropha* (*Jatropha curcas*), Jojoba (*Simmondsia chinensis*)
- Windbreak species: Orange Wattle (*Acacia saligna*), and Casuarina (*Casuarina equisetifolia*).

Within the framework of the Egyptian-German collaboration, many workshops were conducted to deal with the proper treatment of wastewater. Emphasis was also laid on the allocation of the available wastewater, the proper use of the potential of the wastewater and on improving its treatment (Figure 3) to ensure the safety and quality of the treated wastewater before reuse.

The Agriculture Faculties at the Egyptian Universities will integrate in their study curricula new study modules for higher agriculture educa- ➤

tion in plantation forest management and water resource management. The TUM is providing support by conducting study courses, practical training and workshops in Egypt and Germany.

The achievements have awakened the interest of national and international organisations. As an example, Forest Finance Group, a leading organisation in Germany in forest investments and in the development and operation of sustainable forest products, is supporting the development of the afforestation in Egypt in commercial applications and forest carbon trading.

LARGE-SCALE AFFORESTATION IN EGYPT

Large-scale afforestation in arid regions provides innovative solutions to national and global challenges, such as climate change, renewable energy, food security and management of resources. Afforestation is one of the most effective tools to carbon dioxide fixation. Forest products as wood and biomass are significant sources for renewable energy.

Egypt currently allocates 6.7 billion m³ of sewage water annually. 5.5 billion m³ of this sewage water is sufficient to afforest over 650,000 hectares of desert lands and store over 25 million tons of CO₂ annually in the new plantation forests (El Kateb and Mosandl, 2012). Large-scale afforestation may stimulate cloud formation and may result in rainfall that the country urgently needs to expand its agricultural production areas (El Kateb and Mosandl, 2012). Their conclusion is supported by a press release of the University of Hohenheim (2012) and a recent study from Becker et al. (2013). Becker et al. (2013) suggest large-scale plantations of *Jatropha curcas*

in hot, dry coastal areas to capture carbon dioxide from the atmosphere. The authors had conducted high-resolution simulations using an advanced land-surface atmosphere model and concluded that large-scale plantations of *Jatropha curcas* (10,000 km²) could lead to a reduction in mean surface temperature and an onset or increase in rain and dew fall at a regional level.

To ensure sustainability, ecological and economical success of large-scale afforestation, emphasis should be on the Political-Scientific-Economic Collaboration. This is achieved by a viable framework and optimal planning through the political, economical, and scientific environment, respectively, and by gathering the competences, experiences, possibilities and prospects of all the three spheres.

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Since late 2011, the Cairo Climate Talks (CCT) has been bringing together experts from Egypt, Germany and abroad to discuss current issues related to the environment, energy and climate change.

Every month, leading experts in the fields of agriculture, climate negotiations, food, energy, tourism, water, biodiversity, urban planning, transportation or waste convene for a day-long capacity-building workshop rich in presentations and discussions.

A public panel with a selection of experts is also organised, to bring awareness to a wider public of academics, students, and professionals.

The CCT has been initiated by the German Embassy, in cooperation with the Egyptian Ministry of Environmental Affairs (EEAA), the German Science Centre (DWZ), the German Academic Exchange Service (DAAD), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Egyptian German High Level Joint Committee for Renewable Energy, Energy Efficiency and Environmental Protection (JCEE). For the past three years, a total of 27 high-end CCT discussions have been held, and the popularity of this platform keeps growing.

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