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In cooperation with:

Participatory Development Programme in Urban Areas

Ministry of Urban Renewal and Informal Settlements

Urban Agriculture in the Greater Cairo Region

An Example of Rooftop Farming

Summary

Climate Change will impact **urban areas** in the Arab world by heat waves and an increased "heat island effect", by worsening living conditions (such as a decreasing water quality, lowering air quality, etc.) and affecting human health e.g. by ground ozone formation.

Rooftop farming has shown in a number of locations in the Arab World to improve living conditions and to generate income, proofing that it is a sound measure for climate change adaptation.

In informal settlements of Greater Cairo a pilot rooftop farming project was started in spring 2014, supported by GIZ. The results were promising, but many technical and managerial problems still have to be solved. This project belongs to the group of 'Innovations on Trial'; i.e. it should spark new ideas based on the preliminary findings.

Challenge

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2014) presents amongst its key findings that many emerging climate change risks are concentrated in urban areas and that climate change impacts on cities are increasing. Amongst others, key issues include rising temperatures, heat and air pollution stress, health problems, flooding and urban food insecurity.

The Arab region is one of the most urbanized regions in the world: Between 1970 and 2010 the region experienced 400% urban growth; during the next 40 years a growth of 200% is expected: Whereas in 2010 about 56% of the total population lived in cities, in 2050 the percentage will have risen to 68%. Cairo will remain the largest city of the Arab region, growing to 16 million inhabitants in 2050 (Fig. 1).

The mean annual air temperature in the **Greater Cairo Region** has been steadily rising and will rise further. Electricity-based cooling solutions (using air conditioners) are counterproductive in regard of mitigating climate change and over-stress the electricity grid each summer.

The fast-growing population and the failing government approaches to housing and spatial planning policies contributed to the growth of informal settlements within and around the center. For example, 8 million Egyptian live in informal settlements in Cairo with problems of unemployment, pollution, transportation, inadequate drainage and sewerage, and lack of usable urban open spaces. In Cairo, the amount of green space per inhabitant is roughly equivalent to 0.33 square meters per person (3.5 square feet), one of the lowest proportions in the world (Attia 2014).

Rooftop farming as a measure for climate change adaptation has shown in a number of locations in the Arab World to improve living conditions and to generate income. The prevailing flat rooftops provide a good condition for such a use.

Fig. 1: Cairo suburb

Fig. 2 (l): Vist to one of the rooftop farms

Fig. 3 (r): Harvesting gargeer, cultivated in a hydroponic system

Setup

GIZ, commissioned by the Federal Ministry for Economic Cooperation and Development (BMZ), cooperated with two NGOs and one private company when implementing the project "Urban Agriculture in the Greater Cairo Region – The Example of Rooftop Farming in Informal Settlements":

1. The 'Participatory Development Programme in Urban Areas' (PDP), which aims at enhancing community-based adaptation and resilience to climate change in Greater Cairo,
2. The Research Center on Urban Agriculture and Food Security (RUAF), which is a not-for-profit organisation registered in the Netherlands and
3. the Schaduf Company, the main partner for implementation. Schaduf was established in 2010 as an Egyptian rooftop farming enterprise designed to empower and sustain Cairo's low-income communities.

Opportunities

Urban agriculture is increasingly recognized for its potential to provide a better food supply, an additional source of income, social and environmental benefits and also possibilities for a better adaptation to climate change, with special regard to the urban microclimate. Rooftop farming as one element of urban agriculture is the more needed, the higher the housing density is.

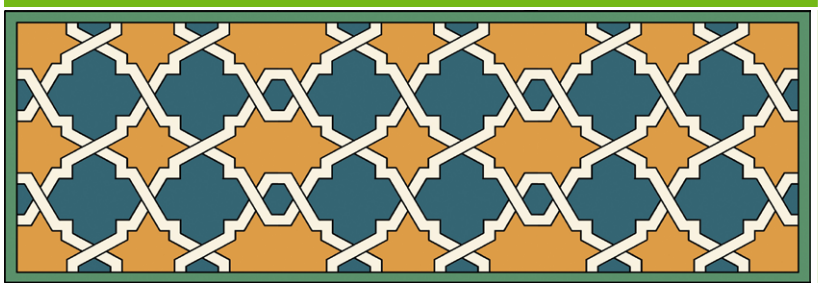
For that reason, a **pilot project** on urban rooftop farming was implemented in the Informal Settlement Ezbet el-Nasr, Greater Cairo region, in 2014. The implementation started with the selection of participants, followed by training and the technical setup. In order to be able to cover the costs for the technical installations, the low-income families received repayable loans (by Schaduf Company), which were repaid by monthly crop sales. Farmers were typically able to repay the loans within one year. Families kept roughly 10 percent of the crops grown for personal consumption; Schaduf Company purchased the remaining produce, reselling it to local markets with profit for the farmers.

A **hydroponic system** of waterbeds was proposed and installed by Schaduf Company directly on the rooftops (Fig. 2). The model consisted of 3–4 water beds (of 3.75 m^2 each) on each rooftop. The complete model costs around 1,575 EGP (175 €) for 3 beds. The costs include fertilizers, seeds and technical support for six months. The forecasted income was about 300 EGP (33 €) per month per 15 m^2, yet in reality turned out to be less. The hydroponic waterbeds were made of wooden frames, plastic sheets, foam panels and cups filled with peat moss and pyralite substrate. The 15 cm deep water is supplied by a water pipe through an electricity connection from downstairs and maintained by a water pump and water filter.

The **crops grown** were gargeer (*Eruca sativa, 'Rucola'*, Fig. 3), mint (Mentha spicata), molokheya (Corchorus sp.), onion, cherry tomatoes, strawberries and flowers. During the cultivation period the project was technically supported and monitored, but not intensively enough.

Fig. 4 (l): Soil based cropping on a rooftop

Fig. 5 (r): Rooftop farming in Cairo, applying different cultivation techniques



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A preliminary evaluation produced the following results:

1. A broader and more deep-going **capacity building** and **training** appears to be crucial relating to specific knowledge about rooftop farming. Capacity building should target the participants themselves as well as possible partners (NGOs) and have the form of so-called urban producer field schools (capacity building workshops on-site).
2. More **information** (e.g. about financial costs of the installation and operational aspects) would enable residents to participate better in the whole project and finally lead to their full empowerment as responsible actors within the project.
3. **Monitoring** should start from selecting the residents and evaluating the training sessions until the end of the production circle (costs, consumption, harvest, etc.).
4. On the technical side there are several **options to cultivate the crops.** Aside of the hydroponic system mentioned (waterbeds on the floor), a hydroponic system on tables and a soil-based system on tables (Fig. 4) were tested. But many more options have been tried in other locations (Fig. 5) and all of them have their pro and cons and more tests are needed to find the most suitable one.
5. The biggest challenges for the rooftop farmers were **irregular water supply** and **electricity cuts** and the increasing heat stress in the city.
6. The main driver of motivation is **income generation.** Micro-credits and micro-insurances could ease the implementation of rooftop farming.
7. In general, the pilot project for rooftop farming in informal settlements does offer some very valid lessons for a future development and upgrading of rooftop farming in Arab cities.

Outlook

Lessons Learned: Rooftop farming (as well as other types of urban agriculture) has a positive impact on microclimate and environment, food security and income, economic development as well as community participation. It bears great potential for the integration of marginalized groups, e.g. women and youth and can be regarded as **an option for adaptation to climate change** in urban environments. The remaining technical bottlenecks have to be tackled by on-site experimentation. Cooperation with other rooftop farming projects e.g. in Tunisia or the West Bank is recommended.

Transferability: Precondition for any transfer is the availability of an agency, a NGO or a socially oriented enterprise (or a combination of all) with a good background in rooftop farming, which creates the framework conditions, including micro-finance, micro-insurance, input-supply, marketing and monitoring. In regard to marketing, the production for niche markets should be considered, offering special rooftop farming products "pesticide-free", which will fetch higher prices.

Recommendations for decision makers: Community and institutional stakeholders have to be identified, training needs and participatory capacity building have to be assessed and (micro-) financing and micro-insurance models should be investigated. Funds have to be secured in case the agencies involved will not cover the costs. Women and youth should be specifically targeted. Marketing strategies based on a prior market and value chain analysis have to be developed.

Literature: Attia, Sh. (2014). Green Roof Potential in Arab Cities. ecoMENA. http://www.ecomena.org/green-roof-arab/

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