Cities, Climate Change and Urban Agriculture

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The current challenge posed by climate change and its interaction with urban poverty and food security is recognised globally. As highlighted in the international conference organised by UN-Habitat (2009) "Cities are a major part of the cause and are suffering the most impacts and therefore play a primary role in finding the appropriate solution." This article will discuss the potential contributions of urban and periurban agriculture and forestry to climate change adaptation and mitigation, and the role and approach of RUAF.

Cities and climate change

Cities produce about 70 percent of greenhouse gas emissions worldwide. It is expected that the urban population will double by 2030, and that 90 percent of the urban growth will take place in developing countries. Accordingly about 90 percent of the expected increase in greenhouse gas emissions will be from the rapidly growing cities in developing countries (World Bank, 2010).

The World Bank argues in its 2010 report that cities not only are main contributors to climate change and suffer most of its impacts (see below) but also hold important competencies to act on climate change (e.g. authority over land-use zoning, regulation of energy supply and industrial emissions, waste management and water services). Moreover, the co-benefits of climate change adaptation measures are largest in cities: in cities climate change adaptation actions can more easily be linked with local development aims and have more positive effects on, for example, poverty reduction, improved sanitation and basic health, enhanced food security and nutrition. The report identifies cities as major players in the effort to establish "low carbon" growth as well as to help their populations prepare for climate uncertainty and natural disasters. The report also makes a plea for innovative "outside-the-box" solutions to climate change adaptation and points out that environmentally sustainable solutions for food, water, energy and transport as integrated components of a city climate change adaptation and disaster risk management plan are needed (World Bank, 2010).

Urban agriculture is one of these "outside-the-box" solutions currently being considered, as urban agriculture can play a strong role in enhancing food security for the urban poor, greening the city and improving the urban climate, while stimulating the productive reuse of urban organic wastes and reducing the urban energy footprint.

UPA can reduce the impacts of higher rainfall (Photo Marielle Dubbeling)

While attention to adaptation in urban areas has been grossly inadequate to date, urgent action is required since (it has been suggested that) the earlier risk reduction and adaptation efforts are incorporated into city investment and development plans, the lower the unit costs will be (Reid and Sattertwhaite, 2007).

Effects of climate change on cities

Increased risk of floods and landslides

Areas where climate change will lead to higher rainfall or a rise in sea level face an increased risk of floods and landslides, leading to infrastructure damage, economic losses and to more poverty and epidemics. Many cities in low-lying areas in coastal areas and along rivers are at risk of flooding and extreme precipitation and storm events. UN HABITAT identified 3,351 cities in 2009 that are situated in low-elevation coastal zones worldwide. Together these cities hold 10 percent of the world's total population, and 64 percent of them are located in developing regions (UN-HABITAT, 2009).

Increased urban heat

A significant factor linking food security and climate change is the urban heat island effect. The buildings and surfaces of concrete or asphalt store enormous amounts of heat. In conjunction with the heat produced by transport, cooling systems and industrial activities, this causes cities to have temperatures that are several degrees higher than the surrounding countryside (American Meteorological Society, 2000). In areas where climate change increases the mean and peak temperatures, the urban heat island effect is enhanced, causing discomfort and greater levels of energy

consumption (for cooling and refrigeration purposes), with a side effect of additional air pollution and smog and related health problems.

Food supply problems

Climate change may lower agricultural production in the hinterland due to changes in average temperature or precipitation, especially in African countries. Without the adoption of crop rotation and improved water conservation techniques, agricultural production could decline 10 -25 percent by 2020 (Herren, 2009). Moreover, transport of food to urban areas may be disrupted more frequently by storms or floods, leading to higher food prices and food shortages in the urban areas.

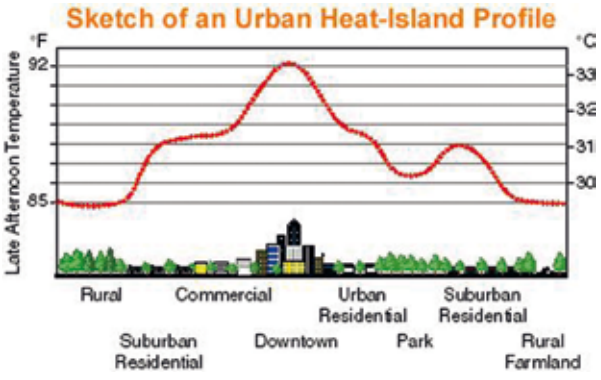
Maxwell *et al.* (2009) points out that the decline in agricultural productivity will not mainly affect the rural population: "urban and periurban areas are similarly impacted as natural causes can lead to increased (temporarily or sustained) higher food prices, food shortages, epidemics, and sudden settlement of those displaced by the shock. To make matters worse, natural causes of food crises are often cyclical, repeatedly affecting the same regions or agro-climatic zones."

Water scarcity

Climate change in certain regions could also contribute to reduction of stream flows leading to problems for the hydropower production and more difficult and costly management of sanitation, waste disposal, water supply and public health in urban areas.

Urban poor are at greatest risk

The impacts of climate hazards disproportionately affect people "who live in slum and squatter settlements on steep hillsides, in poorly drained areas, or in low-lying coastal zones." Often 50-60 percent of an urban population lives in slums, which often are located in such areas, lack storm drains, and have weak housing structures (United Nations Population Fund, 2007). Climate change adds to the existing problems in these slum areas, either directly (through the effects of more frequent and heavier floods and landslides) or indirectly (through higher food and water prices, inflow of migrants, more diseases). Moreover, the urban poor have a low capacity to cope with the effects of climate change. For example, the urban poor often spend 60 percent or more (up to 100 percent for the poorest!) of their cash income on food.



Sketch of an Urban Heat-Island Profile

UPA produces food close to the city, hence less energy use (Photo Hubert de Bon)

If food prices increase due to damaged infrastructure or a decline in agricultural productivity, this directly effects the urban poor who can save only on the number of meals and food quality (since rent, electricity and water have to be paid anyway), leading to a decline in nutrition and health status (Prain, 2010).

The importance of urban agriculture and forestry

As indicated above, urban and periurban agriculture and forestry (UPA&F) is increasingly recognized as an important strategy for climate change adaptation and mitigation. For example, at the International Tripartite Conference on Urban Challenges and Poverty Reduction in African, Caribbean and Pacific countries, UPA&F was recognized as having high potential for improving the urban environment and urban adaptation to climate change (UN-HABITAT, 2009).

A review of the literature indicates that UPA&F helps cities to become more resilient in the following ways:

a. Reduced vulnerability of the urban poor and enhanced coping capacity

- UPA&F reduces the incidence and impacts of floods and landslides on the urban poor (see b.).
- UPA&F enhances access to nutritious food and diversifies food sources, thereby reducing the impacts of disturbances in food supply from rural areas or imports and increases in food prices.
- Income opportunities are diversified through the the creation of "green jobs", thereby providing a safety net in times of economic crisis.
- UPA&F enhances community building and acts as a source of innovation and learning.

b. Reduced impacts of higher rainfall (average/extremes)

- UPA&F can keep low-lying zones free from construction so that floods have less impact, storm water runoff is reduced, and excess water is stored and infiltrates in the green open spaces.
- Forestry or agro-forestry on steep slopes prevents construction on risk-prone slopes and reduces the likelihood and impacts of landslides.
- UPA&F reduces the heat island effect by providing shade and enhancing evapo-transpiration; CO_2 and dust are also captured.

c. Reduced urban energy use and greenhouse gas emissions

- UPA&F produces fresh food close to the city (hence less energy is used for transport, cooling, storage, packaging).
- UPA&F enables productive reuse of organic wastes, which reduces methane emissions from landfills and energy use in the production of fertilizers.
- Reuse of urban wastewater in UPA&F frees fresh water for higher-value uses and reduces emissions from wastewater treatment.

The way forward

Urban and periurban agriculture and forestry can play an important role in responding to a range of challenges faced by developing countries by building more resilient and food-secure cities. The size and urgency of these challenges require innovative solutions. As pointed out by the World Bank (2010), there is a need for innovative solutions that combine climate change adaptation and mitigation with attention to local development needs in order to produce meaningful co-benefits. The promotion of safe, sustainable and multi-functional UPA&F is one of the innovative strategies that meets this requirement.

Metropolitan, municipal and other local government institutions directly concerned with urban development can play a proactive and coordinating role here, and may take measures such as the following:

- Protecting and stimulating sustainable UPA&F in flood zones and wetlands and on steep slopes in order to prevent construction in such areas and to reduce run-off.
- Promoting forestry and agro-forestry in order to reduce the urban heat island effect, to reduce landslides and to enhance biodiversity and landscape management.
- Facilitating (safe) reuse of urban wastewater and organic wastes in order to reduce waste disposal into landfills and open water systems and promote recycling of nutrients. *Urban wastewater can be recycled and safely applied in a number of uses including floriculture and fruit crop irrigation, irrigation of forest plantations, combating desertification, providing fuel wood*[1]*, and turning steep slopes and low-lying lands into urban "green lungs" that can be used as recreational areas while creating flood buffers for neighbouring housing areas.*
- Integrating UPA in social housing and slum upgrading programmes by including space for home gardens or community gardens, street trees for shade and fruits, "productive parks" combining productive with recreational and educational functions.
- Making municipal land available to groups of urban poor households through medium-term lease arrangements or providing occupancy licenses to the urban poor producing informally on municipal land under the condition that they adopt safe and sustainable production practices. The land that is provided might be land that is earmarked for other uses but not yet in use as such, or land that is not fit for construction (e.g. zones prone to earthquakes, landslides, land under power lines, ecologically valuable areas, etc.).
- Involving groups of urban poor in the maintenance of open green spaces such as greenbelts, green fingers, parks and other open spaces and the collection and recycling of urban wastes (green jobs).
- Providing training and technical assistance to urban producer groups and supporting them to strengthen their organisations and improve their production, processing and marketing activities and related food safety measures.
- Facilitating preferential municipal food procurement from family- and community-based farms located within the city and its environs for government canteens, school feeding programmes, etc., and facilitating direct marketing of fresh and ecologically produced food from local producers to urban consumers (establishing farmers' markets, special labels, support for infrastructure development, etc.)

UPA enhances community building (here in Chicago) (Photo René van Veenhuizen)

UPA enhances access to nutritious food (Photo IPES)

But on the other hand, it is also required that research is done and innovative and suitable systems of UPA are developed that are resilient to climate change. Increased rainfall, floods and changes in temperature will affect crop and livestock production, so these innovative systems may include adjustment of cropping patterns, selection of adapted crop varieties, diversification of cropping and/or farming systems, improved water management etcetera.

Various cities are already including UPA&F in their climate change adaptation programmes. Three examples:

Toronto Live Green

Toronto's climate change plan:

- includes financial support to community-based UPA&F projects, e.g. community orchards and gardens, home gardens;

Community gardens in Lima (Photo René van Veenhuizen)

- promotes composting of organic wastes and rainwater harvesting;
- seeks to double the existing tree canopy by 2020;
- seeks to reduce the city's "food print" by
  - requiring that the shipping distance is mentioned on all food labels
  - promoting regional products
  - supporting farmers' markets
  - facilitating preferential procurement of food.

Amman Clean Development Plan

Urban agriculture and forestry is one of the five components of the Amman Clean Development Strategy (supported by the World Bank: CDM City Wide Approach), which:

- identifies vacant open spaces suitable for urban agriculture and creates a land bank to facilitate owner-user contacts and contracts;
- encourages organic food production and value adding (e.g. washing/ packaging/labeling);
- promotes water harvesting and more efficient water use in agriculture;
- facilitates urban and periurban forestation (productive street/park trees; use of treated wastewater);
- promotes (productive) green roofs.

Freetown Climate Smart land use zoning

The Sierra Leone Ministry of Land Country Planning and Environment, Ministry of Agriculture, Forestry and Food Security, Freetown City Council and Western Area Rural District Council signed an agreement to map and protect valley bottoms and wetlands and allocate low-lying lands for UPA&F in order to prevent construction in the flood plains, enhance storm water infiltration, enhance urban food security and create alternative income opportunities.

RUAF's approach

The RUAF Foundation has defined the following strategy in the field of climate change:

- liaise with major climate change programmes (UN-HABITAT, World Bank, Rockefeller Foundation, bilateral donors, national programmes);
- select cities that are developing a city climate change strategy and are interested in including an urban agriculture and forestry component;
- make available planning guidelines and "best practice" manuals for different types of UPA&F (e.g. community gardens, productive parks, green roofs, UPA&F in slum upgrading programmes, agro-forestry in floodplains);
- train staff of local organisations involved in the integration of UPA&F in the city climate change strategy and land use planning;
- support the design and implementation of demonstration projects by local actors; facilitate "learning in/from practice";
- develop indicators and tools to monitor the adaptation and mitigation impacts and co-benefits of UPA&F activities.

More information is available at www.ruaf.org. We welcome contact with international and national programmes, municipalities and other organisations that are to incorporate a UPA&F component (some prefer the term "green infrastructure") into their programmes.

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Notes

1) In many cities attempts to decrease pressure on wood energy (fuel wood and charcoal) by subsidizing gas or electric technologies have not succeeded. The prognostic for many regions, such as in Africa, is that wood energy will continue to be the main source of energy for cooking and heating for the majority of their populations.

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