Urban Intersections

FOOD SECURITY • WATER • CLIMATE CHANGE

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Introduction

With the majority of the world's population living in urban areas, cities must learn to govern in a way that mitigates the causes of, and vulnerabilities to, climate change and adapts to changes that have already occurred. To achieve lasting results, cities must have consistent access to leading practices and tools, and the capacity to implement them.

ICMA builds the capacity of local governments and their partners to find innovative ways to promote and finance appropriate solutions to climate change and other urban challenges, identify vulnerabilities, and design and implement preparedness, adaptation, and mitigation plans that improve the lives of community members. Together with our partners, ICMA facilitates dialogue among different actors and levels of government, builds networks, and strengthens associations to address national and sub-national level climate change challenges.

Employing a combination of approaches, including city-to-city partnerships, direct technical assistance, knowledge management, and capacity building, ICMA provides tools that enable cities to access knowledge and prevailing practices, build trust, and create collaboration and opportunities for meaningful participation with citizens and businesses.

ICMA's flagship international program, CityLinks™, funded by the U.S. Agency for International Development, enables municipal officials in developing countries and countries on the path to decentralization to draw on the resources of their U.S. counterparts. The current five-year CityLinks program supports the emergence of resilient cities that have the capacity to address the three challenges of climate change, food security, and access to water and sanitation.

In year four of the program, CityLinks partnered with the RUAF Foundation-International Network on Urban Agriculture and Food Security to present a two-part webinar series illustrating local government responses to the interlinked sectors of climate change, food security, and water. The series explored examples from Nashik, India; Rosario, Argentina; New York City, New York; and Toronto, Canada preceded by an overview from UN Habitat and GIZ-German Development Corporation. This paper comes as a companion to this series by summarizing the presentations and discussions generated by the webinar. It concludes with some concrete recommendations to bilateral donors, sub-national governments, and support organizations to integrate the pioneering experiences of these cities in their own programs and policies.

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Urbanization, climate change, water, and food security are intrinsically linked. Urban growth (concentrated in Africa and Asia) is, in many cases, concentrated in small and medium-sized cities and towns, drastically affecting their rural and peri-urban areas. This rapid geographic expansion, with loss of density and urban expansion into agricultural land, will threaten rural livelihoods[1], food production and supplies; and increase challenges of scarcity of water and tension over use of natural resources[2] (UN Habitat, 2015).

A recent study based on global data on croplands and urban extents using spatial overlay analysis indicated that 60 and 35 percent of all irrigated and rain-fed croplands, respectively, fall within a distance of 20 km's of a city (Thebo et al., 2015). According to Tuts (2015), in the USA, two-thirds of the total value of agricultural production takes place in, or adjacent to, metropolitan counties. These data indicate the need to seriously consider the impacts of urban expansion and shifting land use patterns on food production.

At the same time, climate change will increase pressures on food production and security. The fifth Intergovernmental Panel on Climate Change (IPCC) report projects that in many regions there is likely to be a loss of food production and productive arable lands. Cities with a heavy reliance on food imports would be more significantly affected with regards to their urban food security (University of Cambridge and ICLEI, 2014). The urban poor will be most affected by disruptions in food supply and increasing food prices.

Similarly, with climate change, water conservation and management in cities becomes even more of a crucial issue (UNEP, 2008). In areas where climate change leads to extreme weather events and heavy rainfall, the increased flood-risk levels adds to already serious deficiencies in provision for storm drainage in many cities in developing countries as well as the reduction of open spaces where excess storm water can be stored and infiltrate (University of Cambridge and ICLEI, 2014).

Urban demand for fresh water is rising rapidly due to population growth as well as increasing supply, coverage, and overall urban economic growth. Availability of fresh water is becoming a serious problem in already water-scarce countries (especially in the Near East and North Africa, South Africa, Pakistan, and large parts of India and China) and in densely populated areas. A growing competition between industrial, energy, agricultural, and domestic uses of water can be observed. At the same time, water demand for food production is increasing due to rising populations and changes in urban food consumption patterns as urban dwellers move towards richer and more varied diets (from tubers to rice; from cereals to meat, fish and high-value crops) that require more water to be produced (UN Water, 2007).

In order to ensure more sustainable urban development, cities and metropolitan regions need to respond to the *triple* challenge of ensuring adequate access to sufficient water, energy, and food for their population; sustaining local economic development and

[1] Smallholder farmers produce 80% of the food consumed in developing countries (UN Habitat, 2015).

[2] 40% of all violent conflicts in the last 60 years have been linked to natural resources (Tuts, 2015)

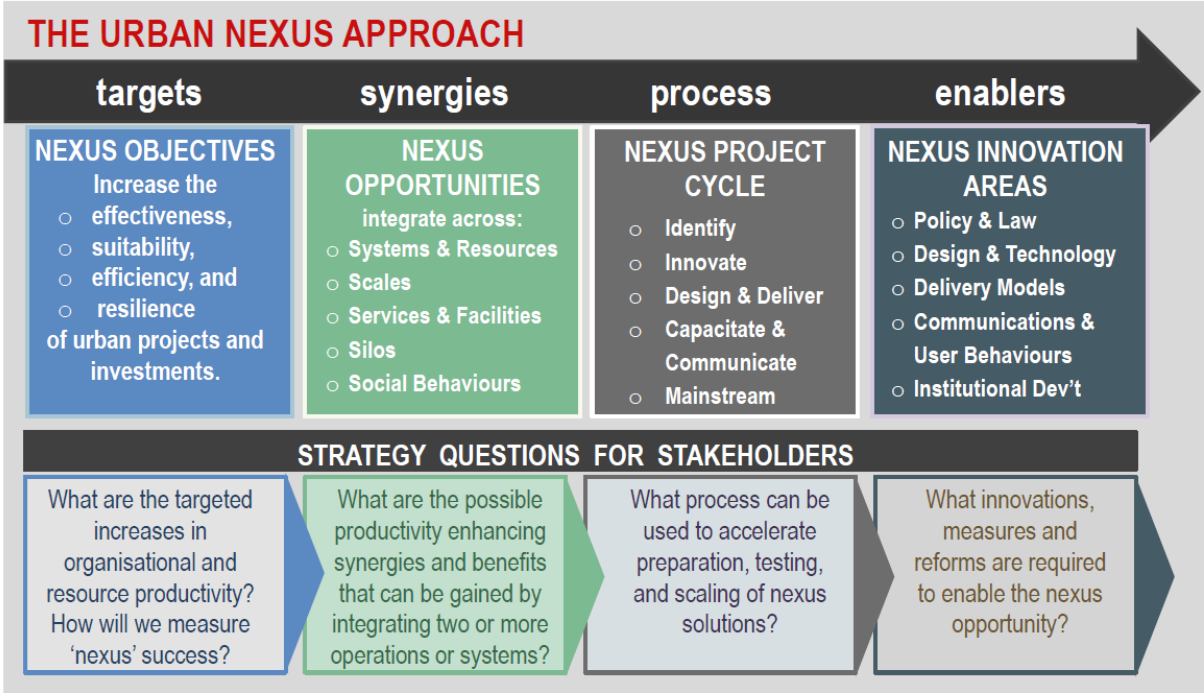
sustainably managing their resources, while at the same time addressing the challenges of climate change mitigation and adaptation. This requires an integrated development and planning approach that connects urban food security, water and sanitation, and climate change strategies with programs and stakeholders across urban and rural areas, and enhances more efficient and coordinated strategies needed to contend with increasing public sector fiscal constraint. Operationalizing such integrated and coordinated approaches calls for institutional and behavioral changes, new incentives, sustainable territorial planning at city region level, working at different scales and stronger attention for urban food systems.

The Urban Nexus Approach

In 2014, GIZ and ICLEI coined the term *Urban Nexus* to describe a more responsive, coordinated, and efficient approach towards the cooperation among and integration of different sectoral policy, practice, and planning strategies, such as those around water, food security, and climate change.

An Urban Nexus approach should help change the mind-set of institutions to favor cooperative and inter-sectoral planning approaches instead of traditionally siloed sectoral practices. This requires changes in institutional set up and attitudes, such as reconsiderations and reform of institutional responsibilities and mandates; enhancement of horizontal (between sectors and stakeholders) and vertical linkages (different levels of government); and incentives and budget allocation for coordination, cooperation, and fostering of community awareness and participation (Vogt, 2015).

Examples of an Urban Nexus approach include linking of water, energy, and agriculture (food) sectors as done in Nashik or the integration of urban agriculture as a climate change mitigation and adaptation strategy in Rosario.



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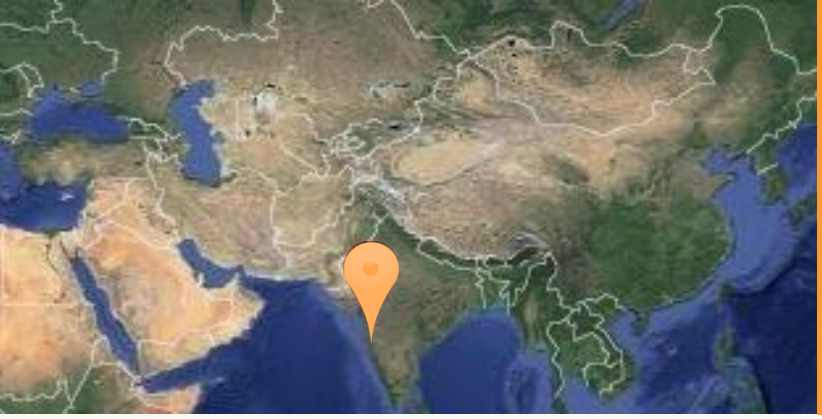

Case Study

Nashik, India

Nashik Municipal Corporation Piloting the Urban Nexus to Support Peri-Urban Agriculture Development

In December 2013, the Nashik Municipal Corporation, supported by ICLEI-South Asia and the German Development Cooperation, adopted an Urban Nexus approach to improve water, energy, and food security at the local level.

Nashik is one of the most important agricultural hubs in the Maharashtra State. Its agricultural production is very much dependent on groundwater supply. However this supply has been depleted in the past years due to over-exploitation and compounded by climate change (decreasing and more erratic rainfall), threatening agricultural livelihoods and food security. State energy policies promoted highly subsidised energy use for pumping of irrigation water, further negatively affecting over- and unsustainable use of groundwater. Coupled with increasing urbanization and sale of agricultural land for housing, the Municipality is confronted with the dual challenge of maintaining agricultural production while sustainably managing its water and energy resources for both agricultural and urban consumption.

All three components of the Urban Nexus in Nashik – water, energy, and agriculture (food) – fall under the jurisdiction of state governments in India. However, the land use plan is developed by Nashik's town planning department while decisions regarding water supply for drinking and irrigation rest with the City Corporation and irrigation department. Traditionally, the three departments and different levels of government work in isolation and do not interact with each other before making decisions regarding resource uses. This fragmented approach has led to major resource use inefficiencies and a disconnect between food, energy, and water sectors, despite their complex and interlinked relationship.

An Urban Nexus pilot project was designed and implemented to demonstrate how water, energy, and land resource use could be optimized in peri-urban agricultural practices in Nashik. This included support to improving the functioning and maintenance of energy-efficient agricultural pumps (reducing energy use and related greenhouse gas emissions); the creation of a groundwater recharging system and promotion of rainwater harvesting; promoting the use of alternatives to fossil fuels such as biogas; and education on resource efficiency to a wider population. This also with a larger goal of protecting agricultural lands in peri-urban areas.

Ground water over exploitation for agricultural use in Nashik, India. *@ Thakur and Kumani, 2015*

Results: The project implementation of the Urban NEXUS approach resulted in the adoption of basic measures in an integrated manner with the aim to address multiple issues in one go. Energy and resource efficiency were improved, conservation of natural resources (water) enhanced, climate mitigation and adaptation measures addressed.

Impact on Governance: Multi-level governance was achieved through the involvement of stakeholders from the district and state level. The stakeholders realized that resource and ecosystem boundaries transcend administrative boundaries, hence requiring intensive coordination across actors and institutions.

Lessons Learned: Considerable time and effort is needed to bring multiple levels of government and stakeholders together, and create awareness and incentives for more coordinated approaches. Institutional siloes need to be broken down, trust created, and information, expected gains, and outcomes shared in a permanent and transparent way. Political will and commitment, and continuous awareness raising are essential factors of success (Thakur and Kumani, 2014 and 2015).

Thakur, Ritu and Emani Kumar, 2014. **Demonstrating the Urban NEXUS approach to optimize water, energy and land resources in peri-urban agriculture**. Urban Nexus case study 02. In: GIZ and ICLEI, 2014. Operationalizing the Urban Nexus- Towards resource-efficient and integrated cities and metropolitan regions. Bundes Ministerium fur wirtschaftliche Zusammenarbeit unt Entwickling, Germany. http://www2.giz.de/wbf/4tDx9kw63gma/02_UrbanNEXUS_CaseStudy_Nashik.pdf

Thakur, Ritu and Emani Kumar, 2015. **Operationalization of Urban nexus approaches in the city of Nashik, India.** Presentation to the ICMA-RUAF webinar on Urban intersections-food security, water and climate change (May 2015). http://www.ruaf.org/publications/webinar-1-urban-intersections-food-security-water-and-climate-change-2015; http://learning.icma.org/store/streaming/seminar-launch.php?key=xPOcG7qeLRBn%2FuQ6tr4%2F0XdKb6%2Ft1am5O5CQr3NXOVE%3D

Case Study

Rosario, Argentina

Urban Agriculture and Forestry as a Climate Change Strategy

In the past years, Rosario has been increasingly impacted by rising temperatures (resulting in increased demands for cooling and related energy use) and incidences of heavy rainfall and flooding. The growing city is furthermore increasingly dependent on food imports and (cooled) transports from distant rural areas, making up a relatively large part of its greenhouse gas emissions.

Since 2001, the city's Social Development Secretariat has managed an urban agriculture program designed to increase food security and income generation for its vulnerable population. The program was, however, never considered for its potential climate contributions or possible climate financing. On the other hand, the city's climate plan, led by its Secretariat for Environment, never considered food security or the role of urban agriculture and green areas as potential climate change strategies.

Research on the potential impacts of urban agriculture and forestry (UPAF) on climate change adaptation and mitigation was carried out from 2012 to 2014 and involved researchers and municipal staff from various departments and programs including the Urban Agriculture Program, Environment, Social Development, Production, Hydrology and Planning.

The results showed that presence of UPAF statically lowered the urban heat island effect in the city during the summer. Temperature differences between non-UPAF and UPAF areas reached maximum values of 8° to 10°C in spring and winter respectively. Findings also illustrate that temperature effects of a small urban agricultural garden (1620 m2) where similar to that of larger garden and public park of two and three hectares, respectively. This implies that including small UPAF areas in new or upgraded housing and neighborhood settlements would bring desired effects on human comfort levels.

In another study, urban food scenarios were designed focusing on local production and consumption of the six vegetables (potato, tomato, lettuce, carrot, onion, pumpkin) that are most highly demanded by urban consumers and can –and have traditionally been– produced locally. When comparing the current food import system to local production of the six vegetables, emission reductions in the case of local production would add up to 95%. Further research demonstrates that only 6151 ha of land will be needed to produce the total required volume of the six vegetables to satisfy local consumer demand in the greater Rosario region. Land use analysis illustrates that this entire 6151 ha of land can indeed be found in the urban and peri-urban zone of Rosario (Piacentini and Vega, 2014).

A third study applied runoff modelling. Comparing future land use that has the maximum amount of green areas, UPAF, green streets, sidewalks, and roofs to current land use would reduce run-off by 4%. This corresponds to reduce flood risk by 0.72 times. For this future scenario, the urban drainage system would be able to cope with a rainfall intensity of 146 mm, implying that no further expansion of drainage infrastructure would be needed in the foreseen future (Zimmermann and Bracalenti, 2014).

In Rosario, 250 families produce 98,000 kg of vegetables and 5,000 kg of various aromatic plants annually, 10,000 kg of which are transformed into preserves, sweets, creams, and gels.*@ Marcelo Tenaglia, 2015*

Results: The city's climate change plan is now looking at how to better integrate urban agriculture, food security, and greening into its temperature mitigation and storm water management strategies, in order to promote more cost-effective solutions and alternatives to higher-cost building insulation and drainage infrastructure improvements (Piacentini and Tenaglia, 2015).

Impact on Governance: Following the studies, Rosario placed new emphasis on protection and promotion of peri-urban agriculture for localized food production. In 2014, Rosario doubled the peri-urban production area (from 400-800 ha) in its urban development plan. The involvement of the subnational (Santa Fé provincial) governments was key to addressing agriculture and land-use planning at larger scale (outside municipal boundaries), facilitating access to financing and developing provincial policies that must accompany city-level strategies. The Province and Municipality now jointly finance a program for training and support to peri-urban producers and for direct marketing to restaurants and institutions.

Lessons Learned: Urban and peri-urban agriculture and forestry thus showed to be a potential Nexus strategy to simultaneously address climate change adaptation (flood risk reduction, temperature mitigation, enhancing resilience by diversifying food sources), climate change mitigation (reduction of food transport related emissions), food security, and income generation for urban producers and city inhabitants.
Understanding these multiple benefits and inter-linkages gave new impetus to the city's urban agriculture program, with decision makers being able to call for further expansion of the area of garden-parks in the city to address multiple policy objectives.

Piacentini R., and M. Vega, 2014. **Consumo de combustible y emisión de CO2 comparando la producción y transporte de vegetales hacia la ciudad de Rosario, Argentina con una producción local**. RUAF Foundation, CONICET, National University of Rosario and Municipality of Rosario

Piacentini, Ruben and Marcelo Tenaglia, 2015. ***I*ntegrating urban and peri-urban agriculture and forestry (UPAF) in city climate change strategies.** Presentation to the ICMA-RUAF webinar on Urban intersections-climate change and food security (June 2015). http://www.ruaf.org/publications/webinar-2-urban-intersections-climate-change-and-food-security-2015; http://learning.icma.org/store/streaming/seminar-launch.php?key=ieyq1wRb8jiuq94Ht0caQzwdzPbBYO06iLb8zlGvQB4%3D

Zimmermann E. and L. Bracalenti, 2014. **Reducción de riesgos de inundación urbana mediante incremento de áreas para la agricultura y forestería urbana y periurbana**. RUAF Foundation and National University of Rosario

Case Study

New York City

Linking Food-Water and Climate Management

New York City, like many large cities, has a food system that depends on concentrated distribution channels and legacy infrastructures that are all prone to climate-related disruption. Nearly 95% of the 5.7 million tons of food that enters the city is transported by truck, mostly over one bridge, the George Washington Bridge. At the same time, about 60% of the city's produce and half of its meat and fish pass through North America's largest wholesale food market, Hunts Point Food Distribution Center located in the South Bronx. If a storm hits and the bridge needs to be closed or the market (located in a flood plain, as is much of New York's food retail) is flooded, the entire food distribution system is disrupted. Climate-induced power failures will also impact food storage and marketplaces. These vulnerability challenges also extend to the city's surrounding areas, particularly its agricultural area and watershed.

Like all major cities, New York City only has about a 3 day supply of fresh food for its eight million residents. Diversifying the food distribution system can make the city less vulnerable to disruption while also reducing adverse impacts (like highly concentrated truck traffic) in neighborhoods like Hunts Point. Diversification should include new transportation infrastructure including rail and water transport, and an emphasis on various sources of food production and forms of food retail (including farmers markets and cooperatives) that build community-based social networks, competencies, and infrastructures. For this, support and planning at both the local and regional level is required. Both New York City and the state of New York support a variety of programs to achieve this goal. New York, through the Watershed Agricultural Council, supports peri-urban and rural dairy farmers in adapting to climate change. This prevents the loss of farming in the watershed and the resulting adverse water quality effects and the need for costly and carbon emissions-intensive mechanical filtration. New York City's water is kept safe and clean by an innovative cooperative agreement with farmers that benefits both the city and rural communities. The water-food nexus program demonstrates that water utilities can go beyond applying traditional engineering solutions and pioneer innovative governance, management, and financial arrangements with upstream farming communities.

After 5 years, the program achieved the following results:

- -75 to 80% reduction in farm to water pollution loading.
- -The pristine quality of the city's drinking water was restored without spending billions on advanced water treatment.
- -The clean water was generated at an affordable price. The program more than paid for itself through cost savings and helped stabilise water and sewer rates, which, benefited low-income households.
- -The fact that watershed conservation could be folded into consumers' bills created a sustainable pool of conservation financing, far more stable than many of today's popular NGO-led watershed funds.

The program helped increase urbanites' support for additional watershed protection strategies, such as restoration of stream corridors and purchase and stewardship of city and state owned lands (Moss, 2015).

New York City also promotes regional and local food procurement. The city funded the Pure Catskills marketplace program to get consumers to buy food produced in the Catskills. In the fiscal year 2014, the city itself bought $25.5 million worth of local produce, milk, and yogurt, for its school food program. One result has been a growing demand for local yogurt, which has enabled two major yogurt companies, Chobani and Fage, to open new processing facilities in New York State. This led to a significant boost in demand for the dairy farmers in the city's watershed.

Landscape protection and resource management is extended to built-up areas. New York City's Department of Environmental Protection (DEP) committed to investing $192 million USD in green infrastructure by 2015 (DEP, 2012), including "blue roofs" that hold rain-water and release it to the sewage system slowly, extra-large street tree planters, landscaped storm water "green streets", parking lots paved with porous concrete, and vacant paved lots and asphalt rooftops turned into gardens. New York's experience, like Rosario's, suggests that if productive landscapes are integrated into storm water management planning, cities may be able to reduce storm water flow and at the same time support the creation of farms and edible gardens, with their respective social and other benefits, at a lower cost than traditional storm water adaptation measures would require . Over twenty years, the green scenario would cost $5.3 billion, including the $2.4 billion for this green infrastructure. In contrast, an estimated $6.8 billion would be required for a scenario based solely on grey infrastructure. The green infrastructure scenario thus saves the city and the property owners who pay water and sewer fees $1.5 billion in costs over a 20-year period. Beyond initial savings, there are also the lower maintenance fees, which would be considerably higher for grey infrastructure over the years.

One such green infrastructure model is Arbor House, a low-income apartment building in the South Bronx built by New York City's social housing authority. The hydroponic farm atop the building hires residents to grow food, and sells what they produce within the community, a neighborhood with few retailers selling fresh vegetables. Rain on the roof is channeled to cisterns in the basement, and is used for maintenance and for the hydroponics system. The City's social housing agency also created a half-hectare farm at one of the largest public housing projects in the city as a part of a program to train youth in various job skills. The agency is in the process of creating four more large farms at other public housing projects.
Urban-rural linkages are also strengthened by a citywide organic composting program that returns processed compost to regional farms. This would reduce methane generation at landfills and help to build soil fertility, benefitting farmers and the environment, while reducing greenhouse gas emissions (Cohen, 2015). This activity expands the nexus to waste-water-food-climate change intersections in the city.

Programs like New York's can stabilize rural land use and stewardship by strengthening urban support for farmers producing environmentally-friendly food and fiber. In addition, the New York City example offers lessons about resiliency in the age of climate change.

New York's food infrastructure vulnerability to climate change.

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Cohen, Nevin, 2015. **Urban intersections- food security, water and climate change: Lessons from New York City.** Presentation to the ICMA-RUAF webinar on Urban intersections-food security, water and climate change (May 2015). http://www.ruaf.org/publications/webinar-1-urban-intersections-food-security-water-and-climate-change-2015; http://learning.icma.org/store/streaming/seminar-launch.php?key=xPOcG7qeLRBn%2FuQ6tr4%2F0XdKb6%2Ft1am5O5CQr3NXOVE%3D

Operationalizing the Urban Nexus Approach

As illustrated by these three case studies, operationalization of a Nexus approach requires (1) shifting from a silo to a coordinated and cross-sectoral approach of working; (2) collaboration across government jurisdictions and amongst multiple stakeholders; and (3) awareness raising/evidence demonstration, incentives and financial and staff resources for such collaboration and coordination.

Fourthly, the case studies illustrate the need for planning and working at the city-region level. A city region is conceptualized as one or more urban centers and its surrounding peri-urban and rural areas. It is, after all, at this level that urban expansion, agricultural land use, management of water and catchment areas, and climate change play out and can most effectively be managed. Urban and rural areas are, however, still often treated as separate sectors at the national and local level, and within different agencies. This distinction does not reflect realities on the ground. Nor will this false dichotomy enable the needs of sustainable urbanization and rural transformation to be met. Applying a city-region perspective can also help create participatory governance structures that include stakeholders from multiple sectors

Like New York City, the City of Toronto also has a wide variety of policies and programs, trying to link its food, energy and climate pans and optimize these different scales of planning. Examples include its 2013 GrowTO urban agriculture program to promote local food production and increase rooftop and community gardens (household, neighborhood level), its 2013-2017 Parks Plan to enhance the quantity of quality of green areas in the city (neighborhood and city level); its Live Green Toronto program to engage Toronto residents, community groups and businesses in taking action to reduce their energy use and emissions (city level), its 2012 Greater Golden Horseshoe Action Plan which promotes the preservation of farmland in Ontario as well as the expansion of urban opportunities to grow food (regional level) as well. All these plans are linked through Toronto's environmental Program and Food Policy Council.

Up-scaling and replication of pilot initiatives at the city level is facilitated by supporting projects and programs with policy development. Local food growing is, for example, supported by the City Council's local food procurement policy passed in 2011, which set targets of 25% local food purchasing. Complementary strategies to increase local food purchasing include: menu planning support and training; community food procurement portal; local food promotion. Review of zoning bylaws is another strategy used to address barriers to the expansion of agriculture in Toronto. Elaboration of a soil assessment guide aims similarly to support promotion of agricultural activities.

The City's Life Green Toronto Program provides grants, incentives and support for home-based improvements (energy loans, eco-roofs), school programs and city wide public programs for more sustainable public infrastructure and transportation (cycling, carpooling). Live Green Awards and community facilitators play an important role in sustaining and up-scaling specific interventions (Baker, 2015).

Baker Lauren, 2015. **Toronto's food and environmental policy.** Presentation to the ICMA-RUAF webinar on Urban intersections-climate change and food security (June 2015). http://www.ruaf.org/publications/webinar-2-urban-intersections-climate-change-and-food-security-2015; http://learning.icma.org/store/streaming/seminar-launch.php?key=ieyq1wRb8jiuq94Ht0caQzwdzPbBYO06iLb8zIGvQB4%3D

from both urban and rural areas (Forster, Hussein and Mattheisen, 2015).

Fifthly, the New York case study illustrates the importance of planning at different levels: including household and institutional level (composting program, rooftop farms), farm level (farm support programs), street and neighborhood level (green infrastructure, food retail and marketing), city level (green infrastructure, food distribution, composting) and regional level (rural farming areas and water shed).

Finally, while food security is recognized as an important global issue with significant resources devoted to it, until recently too little attention has been focused on the issue of urban food security. Food should be an integral part of and provides concrete opportunities for operationalizing the Urban Nexus. An alarming increase in diet-related health problems (like obesity and diseases related to food quality) in many cities around the world have made it very evident that cities need to think about how to ensure access to sufficient, affordable, healthy, and safe food for their populations (3Keel, 2014).

For many years, urban sustainability debates have centered on issues of transport, energy, waste and water management, housing and land planning, and climate change. Only more recently, and triggered by the 2007-2008 food price crisis, the economic crisis affecting many countries, and climate-induced disruptions to food supply, resilient urban food systems are considered a key component of sustainable cities and integral to urban-water-energy-climate intersections. The three case studies from Nashik, Rosario, and New York, and the example from Toronto illustrate the role that food and agriculture can play in linking different urban sectors, as well as in linking urban to rural areas. Cities, as hubs of consumption, increasingly recognize their responsibility in building more sustainable food systems that provide decent livelihood opportunities for those producing, processing, and selling food in rural, peri-urban, and urban areas.

In addition, food in itself is increasingly seen as a driver for other sustainable urbanization policies. Food is not only directly related to other urban domains, such as water management and climate change, but also to transport (a large part of city transport is related to food supply and consumption), health (malnutrition, obesity, school feeding), land use planning of agricultural and multi-functional areas, community development and revitalization, employment generation (in food production, processing, retail) and waste management (productive use of waste (water) and management of food waste.

Summary of Key Recommendations for Governments and Support Agencies

1. **Avoid silos and promote cooperation**
   Linking water, food, and climate change through different technologies and at different scales, offers many opportunities and benefits in and around urban areas. Applying an Urban Nexus approach guides stakeholders toward identifying and pursuing possible synergies between sectors, jurisdictions, and technical domains so as to increase institutional performance, optimize resource management, and service quality. It counters traditional sectoral thinking, trade-offs, and divided responsibilities that often result in poorly coordinated investments, increased costs, and underutilized infrastructures and facilities. Enhanced inter-sectoral coordination and cooperation, however, requires sufficient human and financial resources and time for the approach to work (GIZ and ICLEI, 2014).

2. **Strengthen horizontal and vertical governance/ work across city regions**
   Cities do not operate in a vacuum. As they seek to create urban nexus strategies they will undoubtedly cross their own geographical and jurisdictional boundaries and find the need to collaborate with state/regional and federal organizations. In order to achieve the greatest success and efficiency, a coordinated effort must occur across all levels of governance. This can, however, be a difficult challenge. One challenge still present is to involve central, provincial and local governments (vertical governance), without losing sight of the need to build strong and permanent relations between local government departments as well as and between local governments and local actors from civil society (horizontal governance). In better linking these various levels, attention should also be paid in developing functional and political links from the bottom up, preserving the capacity of producers, community members and citizens to be part of the decision making processes at all levels.

3. **Recognize food as a critical component of an urban nexus**
   The urgency of urban food security should be recognized as well as the potential of food and agriculture to address the urban nexus. Food can be the entry point or common denominator that brings down broader issues such as water management, climate change, and resilience to a digestible form and provide cities and metropolitan regions practical strategies to address broader issues (UN FAO and RUAF, 2015; UN Habitat, 2015).

   Sufficient resources should be dedicated to food and agriculture as part of urban development, water management, and climate change programs. There is growing recognition of urban and peri-urban agriculture and forestry as an important strategy for climate-change adaptation and disaster-risk reduction, while also bringing mitigation and important developmental benefits. The case studies show examples of promoting urban agriculture in flood-risk prone areas, developing rooftop gardens and other green infrastructure in dense urban settlements as part of storm water management or temperature mitigation strategies, including urban agriculture and forestry in new housing schemes and preserving peri-urban greenbelts for local food

production, while at the same time promoting water and climate friendly production technologies.

Crucial to all these strategies are control measures to safeguard agricultural land from urban sprawl while encouraging sustainable urban agriculture where appropriate, securing producers' access to and tenure of land, credit and capital and providing technical training and support (de Zeeuw et al., 2011; World Bank, 2012, Dubbeling, 2013, UN Habitat, 2015).

4. **Develop nexus strategies at different levels and scales of planning**
   Development of concrete nexus strategies can take place at different levels and scales: in a neighborhood or small community, at the city level, and city region level. A multiplicity of interventions at different levels should be promoted for entire city regions to benefit from scale effects. The key challenge remains to upscale to whole cities and regions interactions between different intervention strategies which often tend to start with (and may remain limited to) robust initiatives at smaller scales.

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