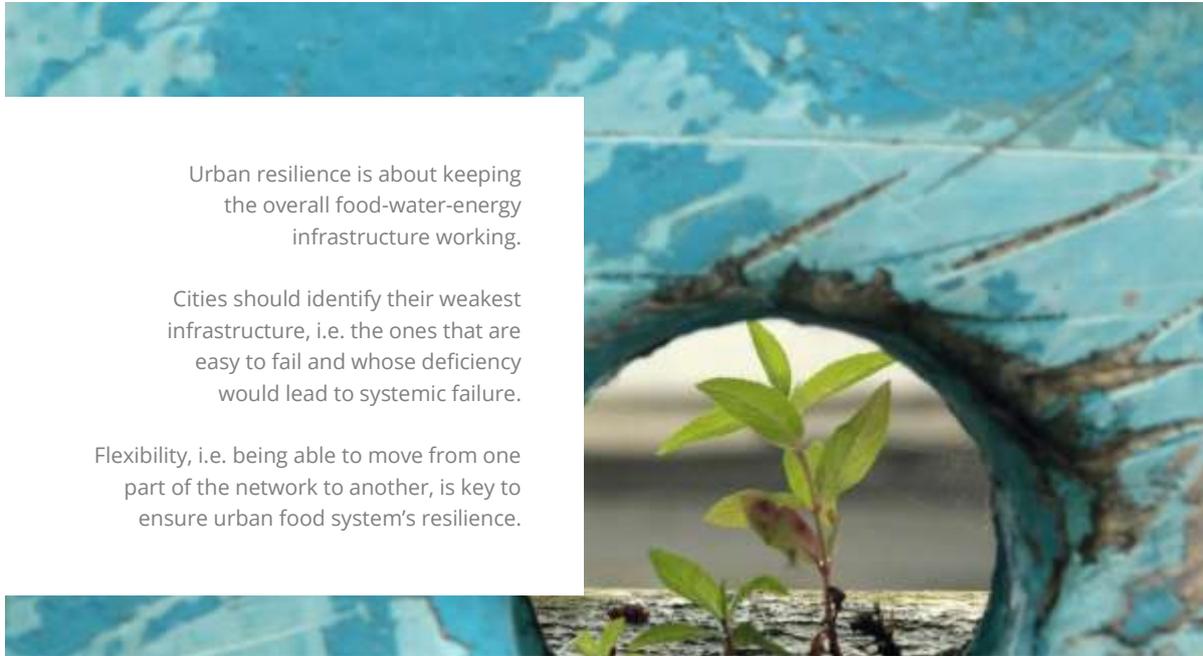


The three pillars of urban food resilience

Urban resilience is about keeping the overall food-water-energy infrastructure working.

Cities should identify their weakest infrastructure, i.e. the ones that are easy to fail and whose deficiency would lead to systemic failure.

Flexibility, i.e. being able to move from one part of the network to another, is key to ensure urban food system's resilience.



Food, energy and water resources are closely interwoven. But what does it concretely mean for a city's food system? And how does understanding these relationships help plan a more resilient food system? Researchers from New York University have developed a framework that helps cities map, and act upon, the links between food, energy, and water.

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Urban Food Futures would like to thank [Rae Zimmerman](#) and [Quanyan Zhu](#) for their inputs and comments.

Source : [R. Zimmerman, Q. Zhu, and C. Dimitri](#), "A Network Framework for Dynamic Models of Urban Food, Energy and Water Systems (FEWS)," *Journal of Environmental Progress & Sustainable Energy*, Vol. 37, Issue 1, January 2018, pp. 122-131. DOI: 10.1002/ep.12699

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Visualising interdependency and interconnections

The researchers have created an **energy-food-water map** of city food systems. How does this work?

- **First, they sketched a food map.** They documented each step of the food chain, from when food enters the urban area to when it is discarded. The more stages, the more links on the map. For instance, the preparation of food can lead to storage, to canning or directly to distribution, etc.
- **Then, they added layers to capture the water and energy systems the food chain relies on.** Indeed, each stage in the food system requires energy and water. The volume of demand will depend on the kind of food (processed / or not), the need for transportation, refrigeration, storage... Intensity of use of energy and water varies across the food chains, and across food items.



The map also shows interdependency between water and energy resources. For instance, energy is needed along the water chain (e.g. water pumps), and energy generation might need water.

Cities can therefore generate a three-layer map, each layer accounting for one type of resource (food, water, energy). It helps visualising interdependency and interconnections that are often difficult to grasp. It makes the underlying infrastructure of our cities tangible.

Identifying key vulnerabilities

Such a map can contribute to resilience planning against natural (floods, storms...) or man-made disasters (e.g. cyber attacks).

It makes it possible to identify **the weakest links, i.e. the ones that are easy to fail and whose deficiency would lead to systemic failure.** To prevent this, cities may want to think about infrastructure redundancy (e.g. backup power generation that will take over if the main source goes off) or about diversifying sources of energy (e.g. investing in on-site renewables). This could prevent, for instance, that an electric or water supply breakdown prevents food cleaning or processing. **It could well be that the most strategic infrastructure for the city's food system is a power generation unit located well outside of the city.**

It can also help cities define operational procedures for recovery processes. For instance, they can develop scenarios in which one-step is removed from the chain to reduce overall vulnerability of the system. How will food flows re-adjust? Will they be able to? As Rae Zimmerman, who co-authored the article, recalls, **flexibility, i.e. being able to move from one part of the network to another, is key to ensure a system's resilience.** Indeed, as the paper puts it, *"a system is resilient when the impact of the loss can be reduced or mitigated"*.

Time for coordinated effort

According to Quanyan Zhu, another co-author of the paper, it is important to understand that **resilience is about keeping the overall food-water-energy infrastructure working.** Focusing on just one infrastructure is not enough.

This will require coordination:

- **Between actors**, as strategic infrastructures are generally owned and operated by a great number of different actors. These are not used to working together, caring about infrastructure outside of their remit, let alone sharing data. Mapping relationships between infrastructures can actually be a great way to gather stakeholders and start making them understand that their resilience relies on other infrastructure that the one they work on.
- **Across scales**, as many infrastructures are not managed at the city level. Therefore, **cities may find that the resilience of their food system relies on decisions taken by regional or national governments.**

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