




## The Farming Technique That Could Revolutionize the Way We Eat

Aquaponics uses fish to create soil-less farms that can fit into cities much easier.

ROMAN GAUS | Mar 6, 2013 |  46 Comments



Urban Farmers Ltd.

On an early June morning in 2010, I stood outside the Aquaponics research facility at the University of Applied Sciences, perched on a green hilltop in Wädenswil, Switzerland, 20 minutes outside Zurich. The lab director, Andreas Graber, had finally given in to my persistent calls requesting a visit. Graber, Switzerland's most prolific aquaponics researcher, had been publishing on the subject for eight years — a long time in this young field.

Graber greeted me, and we stepped inside. The lab, bright and humid under its

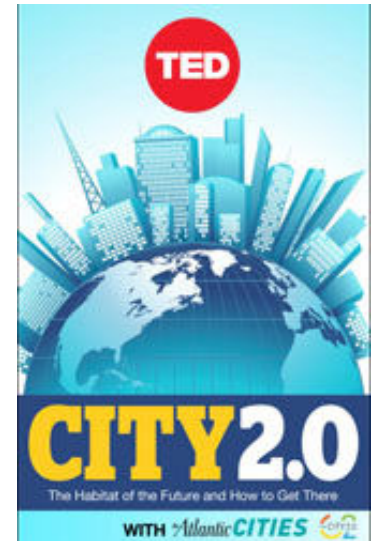
greenhouse roof, contained a few round fish basins, each about 6 feet wide. Fierce-looking fish, red and shiny, swam around inside. A host of instruments and sensors, connected to a small screen, dashed out data on oxygen and carbon dioxide levels in the water. Large PVC pipes led from the fish basins to a "water garden," an area the size of a small bedroom, canopied by huge banana leaves. Growing beneath them were about 10 different plants, including coffee and lemongrass.

I would later describe this sight to friends and family as my come-to-Jesus moment.

Aquaponics is a method of combined fish and vegetable farming that requires no soil. The farmer cultivates freshwater fish (aquaculture) and plants (hydroponics) in a recirculating water system that exchanges nutrients between the two. Wastewater from the fish serves as organic fertilizer for the plants, while the plants clean the water of fish feces and urine. The net result: a 90 percent reduction in freshwater use compared with conventional fish farming, and a significant reduction in added nutrients such as fossil fertilizers. The system can be run without pesticides and, because the fish environment is spacious and clean, without antibiotics.

I had first heard about aquaponics from a friend in Nashville, Tenn., where I ran the North American branch of Franke, a Swiss espresso equipment supplier. I was intrigued by the method's natural resource efficiency and its potential for large-scale urban cultivation. But it took me until this moment in Graber's lab to recognize how dramatically aquaponics would change my life and that it could radically change how we feed the booming cities around the world.

In the lab, the pumps made gushy sounds at regular intervals. The water dripped. As the plants' leaves evaporated moisture, I could hear the place breathe. I picked a ripe, red tomato from a vine. This lab, I sensed, could morph into an urban oasis: a lush, breathing organism inside the city. Unlike static green spaces like parks, this would be an actual farm as well as a place of



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tranquility in the city — not to mention a space that could generate the food to feed that city, with minimal harm to the environment or human health, just steps from residents' tables.

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Urban farming today is no longer a hobby practiced by a few dedicated enthusiasts growing food for themselves. It has become a truly innovative field in which pioneering ventures are creating real, robust, and scalable solutions for growing food for large numbers of people directly at the point of consumption. This is great news not only for urban designers, architects, and building engineers, but also for residents and communities that want to increase food security and become more resilient to climate change.



Thus aquaponics, which was reportedly used by ancient civilizations such as the Aztecs, is seeing the sprouts of resurgence in modern cities. The fact that the method requires no soil makes it particularly suitable for urban environments. Large amounts of fresh and healthy food — including fish — can now be grown sustainably on urban rooftops, parking lots, or any vacant plot in the city. Think of fresh fish harvested just minutes before it is delivered to your doorstep!

After seeing Graber's farm, I grew determined to get this vision out of the

laboratory and into real cities, starting with mine.

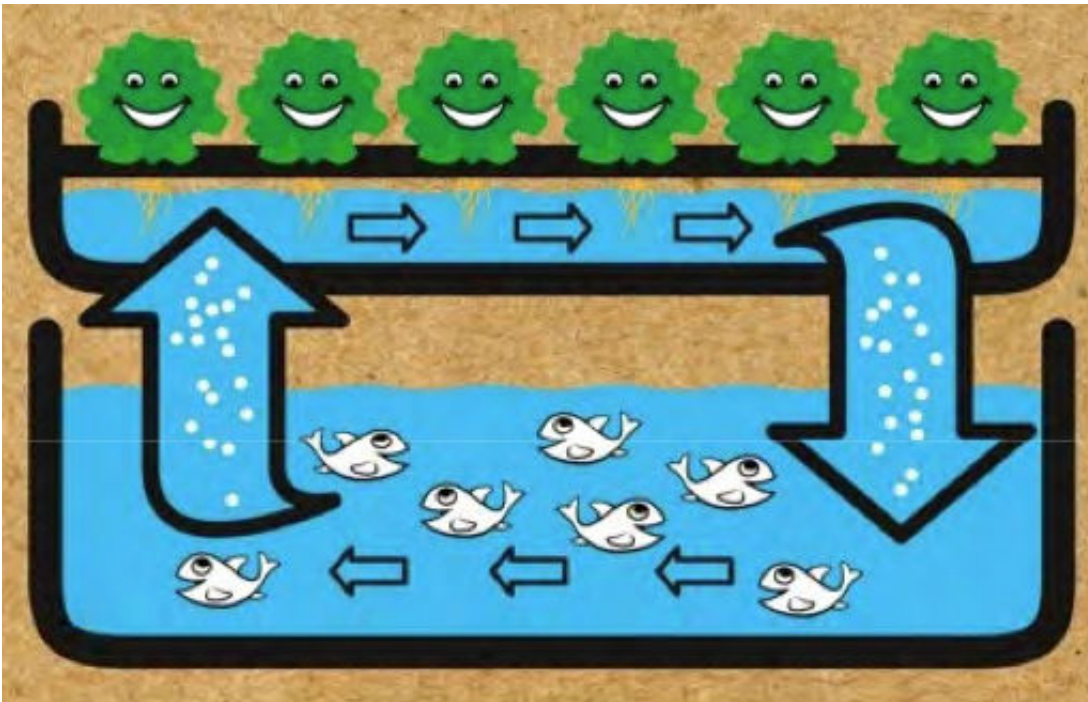
Graber and I teamed up to launch the company [UrbanFarmers](#) in 2011, with the goal of developing large-scale, productive, commercial rooftop farms. Until then, urban aquaponics had been tried in small ventures, with mixed success. We believed it was time for the technique to grow up. This would require technological improvements to make aquaponics more robust and reliable, as well as a new business model for urban food systems selling directly to the consumer. Never mind that I was an MBA who had never grown anything bigger than some basil on my balcony for spaghetti sauce.

To test and prove my idea, I investigated urban-farm options and came across a French design for a 20-foot cargo ship container with a greenhouse module built on top. It looked like it could house an aquaponics system. The container was relatively small and portable — the size of two parking spaces — and could be easily toured in public places: in front of schools, supermarkets, or parking lots. All it required were electrical and water hookups. I liked the ruggedness of the cargo container combined with the leafy beauty of cultivation. The UrbanFarmers Box was born. Two containers arrived from Hamburg — old, rusty versions that had spent the last 11 years at sea, now ready to embark on a new life.

The Box was a hit at the International Federation of Landscape Architects convention in Zurich and outside an old factory building in Berlin. We had built the box so that visitors could walk inside. They loved it. The German weekly *Der Spiegel* wrote it up. It was time for urban aquaponics to scale up.



The need for large-scale urban food solutions is profound. The way we currently grow food in Switzerland accounts for nearly one-third of the country's total environmental footprint in CO<sub>2</sub> emissions and the use of water and other natural resources, the Swiss government has determined. Other Western nations' consumption is likely similar. This means producing the food on our plates makes more than twice the impact on the environment as fueling our cars or heating our homes.



Aquaponics, simplified. Courtesy of Urban Farmers Ltd.

Health concerns with food also abound. Recurring food safety scandals have reminded us how dependent we are on farms that operate far away, out of sight. What's more, the extensive use of chemical additives, fertilizers, pesticides, and antibiotics has become an indispensable part of conventional agriculture today. This practice grants us higher productivity but at the expense of animal and human health. Urban farming tends to use truly organic practices and thus is less prone to such hazards.

The basic business concept for an urban farmer is simple: Grow local food in the city, avoid middlemen and transportation distances, and exploit higher margins by selling directly to customers. The farmer avoids the hugely complex, costly, and polluting distribution and refrigeration system through which city food otherwise travels. Therefore, the farmer also enjoys a competitive advantage in delivering truly fresh, tasty, and nutrient-rich food to customers' doorsteps. Urban farming also helps cut way back on food waste — which currently represents about one-third of all food produced worldwide, reports the United Nations' Think.Eat.Save program — through smaller and more direct delivery from harvest to plate.

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The solitary Boxes we first showcased on city sidewalks are now multiplying

and morphing. We are building a 2,700-square-foot greenhouse farm on a rooftop in Basel, Switzerland. We started selling fresh produce to five local restaurants in January 2013, just six months after construction started. This roof-garden-on-steroids should yield more than five tons of fresh vegetables and nearly a ton of fish per year, feeding a local community of 100 people year-round.

Rooftops present a great opportunity for farming; they are large, unexploited spaces within the city. Most commercial rooftops are also perfectly fit for the technical challenges, in terms of building physics, zoning laws, and system integration with the host building. A standard commercial rooftop in a Western city is about four times the size of our test farm, which means it could produce up to 20 tons of vegetables and four tons of fish — an annual harvest to feed 400. A significant part, if not the entire annual consumption, of fresh fish and vegetables for a building's tenants could be served through its roof.



UrbanFarmers' first commercial-scale farm takes shape on a Basel rooftop.

Courtesy of Urban Farmers Ltd.

Urban aquaponics ventures have sprung up elsewhere since we started. In the

U.S., they're playing a role in the promising urban agriculture hubs emerging from Milwaukee (see Sweet Water farm) and Chicago (like at 312 Aquaponics), providing green jobs in otherwise depleted industrial areas. Large investors and Silicon Valley tech firms are taking notice and helping to fertilize the growth of so-called Agriculture 2.0. Aquaponics is also used in Cuba and North Korea.

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Amid the excitement, however, we must remember that commercial-scale aquaponics is a delicate technology requiring a sensitive balance between the cultivation of fish and vegetables. You cannot maximize yields for either part without creating problems. Maintaining food safety and quality in these systems is critical. Going forward, it will take time, ingenuity, and significant investment to perfect our methods, become profitable, and make an impact.

We are only beginning to understand the vast potential of aquaponics rooftop farming in the city. I am convinced that it will prove a working, robust, and scalable solution to feed growing urban centers in the 21st century. It won't replace our conventional food system but could achieve a sizeable urban market share. With populations already large and still exploding, growing food in the city for the city makes sense not only environmentally but also commercially. The future could see us integrate solar panels on a greenhouse roof with waste heat streams from server farms within a building, possibly even creating zero-emission urban farms. Additional integration synergies are yet to be explored.



The UrbanFarmers Box demonstrates that food can grow in the seemingly unlikeliest of places, such as on the Viadukt in Zurich. Courtesy of Urban Farmers Ltd.

The urban sanctuary I envisioned in Graber's lab is coming to life. Our farm and others like it can transform urban communities from food deserts into living oases where fresh food is grown, delivered, and directly consumed. Now it's time for pioneers and entrepreneurs around the world to expand this reality and bring a fresh revolution into our cities, one fish and one tomato at a time.

This essay appears in the ebook ["City 2.0: The Habitat of the Future and How to Get There,"](#) co-produced in partnership by [The Atlantic Cities](#) and [TED Books](#).

## About the Author

Roman Gaus is the founder and CEO of UrbanFarmers, a pioneering clean-tech company that develops sustainable agriculture systems for urban applications. In his previous life, he was a corporate maverick in the food and health space in Europe and North America.

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