

Urban Agriculture: Farming of the Future

Sonia Singhal

Urban agriculture sounds like an oxymoron: agriculture is normally associated with large fields in rural areas, not the hustle and bustle of a city. Interestingly, many cities around the world have citizens who practise farming. For very poor families, keeping a small garden can be one of the main ways to bring food to the table. However, the practice is expanding to include a wide range of citizens, not just impoverished ones. Urban farming allows city-dwellers to receive fresh produce, cuts down on transportation of food to the city, and even heightens city aesthetics. Ultimately, urban agriculture increases the sustainability of food consumed in cities.

Growing food is the “ultimate green energy” [1]. Plants are able to store energy they receive from sunlight by converting it into sugar. Later on, the plants (or the animals that eat them) break the sugar back down into its components to use the stored energy for mechanical work. This system does not require fossil fuels in order to run. For centuries, the energy used to produce food came from solar or other renewable energy resources [2].

In the mid-1900s, the Green Revolution changed the food production system to facilitate large scale growth and transportation of food. To feed the maximum number of people, quantity and speed were emphasized over quality [3]. Our current food production system relies heavily on coal, oil, and natural gas. Fertilizers and pesticides are made out of petrochemicals (petroleum or natural gas); fossil fuels are also required to run the machines that harvest, process, and transport crops. A single calorie of food requires 10 to 15 times as much fossil fuel energy for its production and

distribution [3]. The food sector uses 17% of our national supply of fuel—more than any other sector [1, 3, 4]. With oil supplies diminishing, it is doubtful whether the current system of food production can be sustained for future generations [3, 5].

One way to make food production sustainable is to grow it organically. Organic farming cuts down on the use of petrochemicals in the growing process by eliminating

“ During World War II, Victory Gardens provided 40% of US food supply. ”

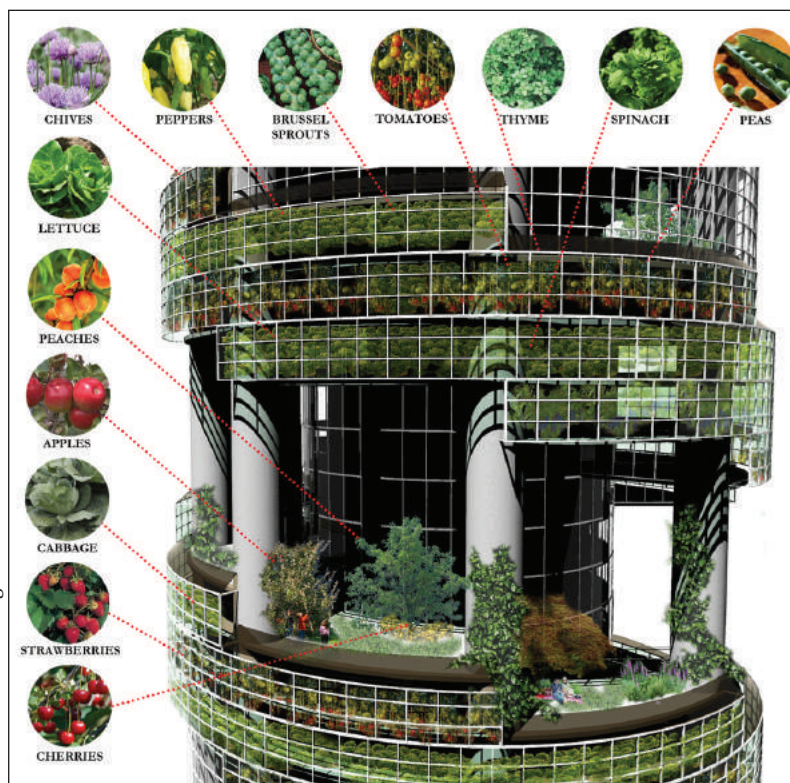
fertilizers and pesticides. Instead, organic farmers use natural cycles to keep their crops healthy. For example, solar farms in Argentina rotate beef and grain in an 8-year cycle, growing beef on grass for 5 years and then using the land to grow grain for 3 years. Waste products from the cattle create large deposits of nitrogen, an essential nutrient for plants. After five years of such nitrogen buildup, wheat thrives, but weeds do not. Similarly, by rotating wheat and potato crops, farmers can lower the number of potato pests [1].

For all its benefits, though, traditional organic farming continues to use fossil fuels for transportation. Organic food sold in stores is often shipped thousands of miles from a distant farm, perhaps even from another country [6]. Local production of food needs to be an integral part of sustainable agriculture.

At first glance, the city may not seem like the ideal place for food production—just finding space to grow food seems to be a daunting task. Urban agriculture has much to offer cities. It allows food to be produced locally, reducing the carbon footprint of transportation. It means that city-dwellers, too, can receive fresh fruits and vegetables. Finally, the green spaces created by urban farms can enhance a city’s aesthetic appeal.

Particularly in times of economic stress, urban agriculture can help offset the severity of food and money shortages. For example, during World War II, 20 million Americans planted Victory Gardens to help with the war effort and provided 40% of the nation’s supply of produce [7, 8]. Urban farmers in third-world countries like Ghana, Tanzania, and Guinea Bissau are able to provide substantial percentages of their city’s fresh produce, meat, and dairy, from 10% up to 90% or even 100%. Moreover, around the globe, impoverished families that practice urban agriculture have greater food security than families that do not [9].

The increasing popularity of urban agriculture can be seen in the successes of sustainable and





© www.verticalfarming.com

organic community gardens across the United States. The New Haven Land Trust in New Haven, Connecticut, which initially established three community gardens in 1991, now helps neighborhoods manage more than 40 [10]. On a broader scale, the Urban Farming non-profit organization manages 600 different community gardens in 15 cities and 5 countries [8], including Newark, Los Angeles, Detroit, and Montego Bay, Jamaica [11]. The gardens are usually planted in vacant lots in impoverished inner city regions; otherwise, Urban Farming will use any and all available space to create a garden, including rooftops, mall planters, and even walls [11]. Proponents of community gardens are setting their sights even higher: In an open letter to the President, Michael Pollan proposes that five of the White House lawn's 18 acres be used to create an organic garden [7].

Community gardens bring many advantages to a neighborhood in addition to food. Planting gardens in run-down areas brightens them up with greenery and encourages its citizens to fix up their own homes and yards [8]. Urban Farming encourages businesses to incorporate edible landscaping into architectural designs [11]. Most importantly, the gardens act as community centers to bring together and educate the people of the neighborhood. Citizens learn about farming, science, and health by helping to plant food. They can also develop business techniques and entrepreneurship by selling the produce they grow and by managing the gardens.

However, community gardens take time, effort, and money to implement and sustain. Ideally, the community would eventually learn to keep and manage the garden on its own, without outside help. The reality of it, though, is often quite different. The New Haven Land Trust, for example, must buy compost for the gardens from another municipality [10]. In impoverished neighborhoods in Detroit, it can be hard

to keep people involved in the gardens. Although they are interested by the idea and willingly pick the food for their tables, numerous other stresses often leave them with no motivation or energy to do much more [8]. In addition, communities are allowed to plant in their garden whatever they would like. While this helps to raise people's investment in the garden, a truly self-sufficient urban farm would need to take into account the plants that best grow in the region and establish a rotation system to prevent depletion of nutrients in the soil.

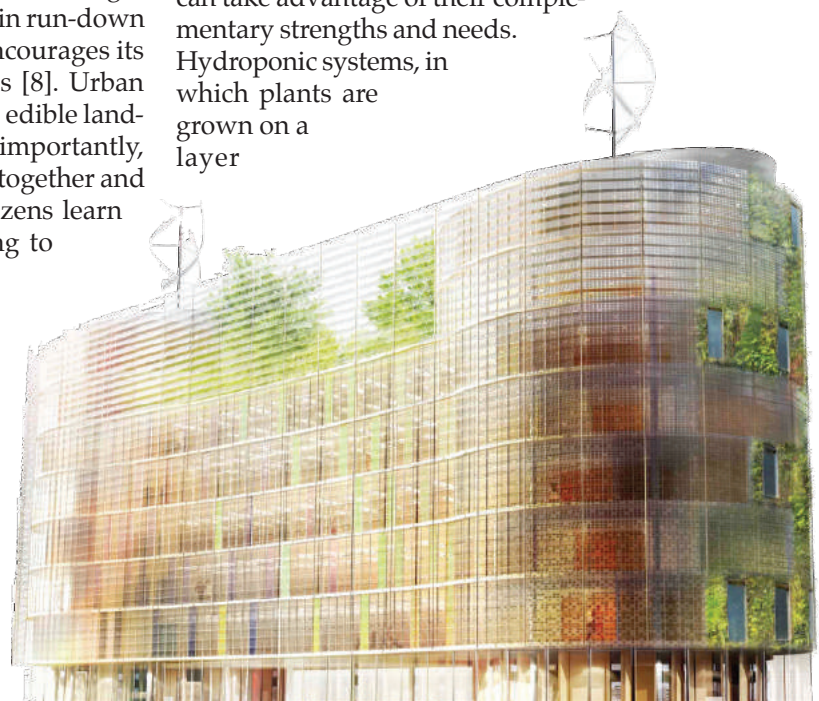
A revolutionary attempt to commercialize urban farming was first put forth in 1999 by Dickson Despommier, a professor of microbiology at Columbia University. Over the past five years, Despommier and his students at Columbia have been developing the concept of a vertical farm—growing crops and small livestock on every floor of a 30-story, city block-wide skyscraper. Growing food indoors is not a new concept. Greenhouses are already widely used to grow plants that might not survive the region's climate or that have particular

“ Crop yield is independent of climate change, disease and natural disaster ”

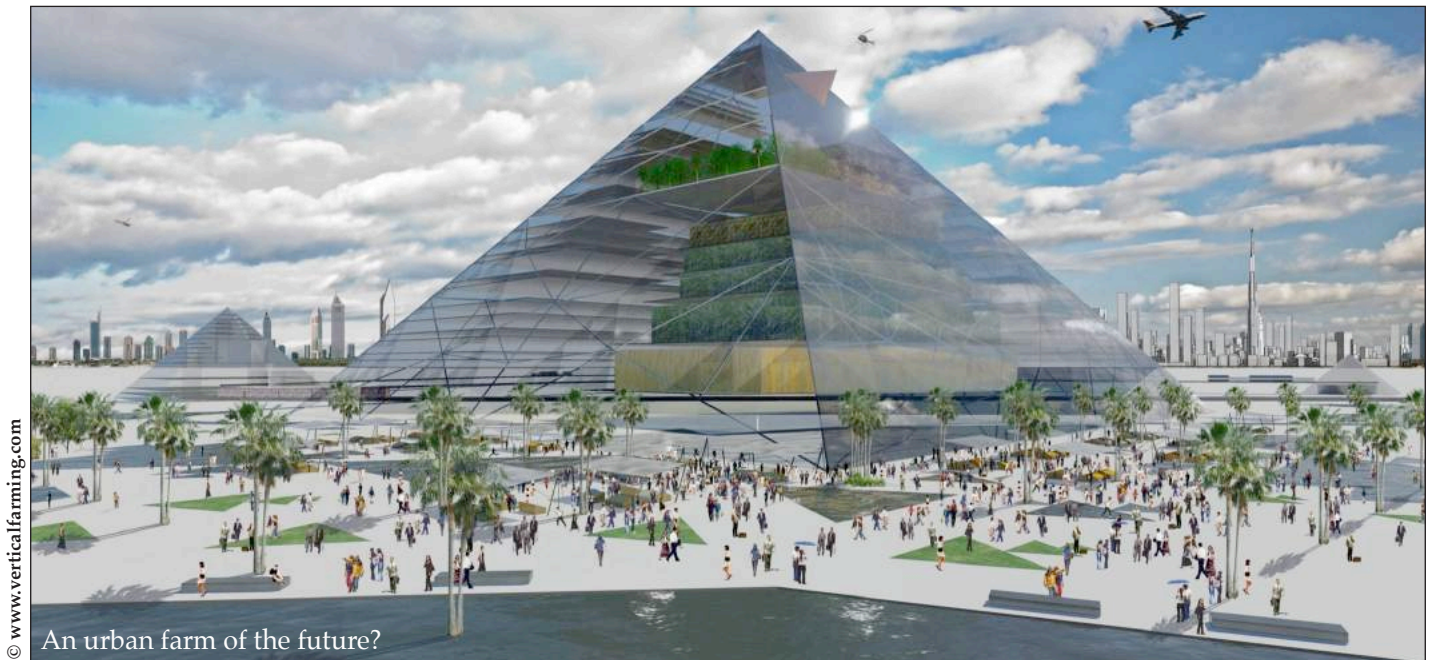
care requirements. What makes Despommier's proposal unique is its scale. Not only would the farm take up an entire building, but it would also use automated, state-of-the-art technology to closely monitor plant growth [12].

According to Despommier, the design is not only sustainable but would also have a significantly reduced carbon footprint [13]. This would be accomplished by recycling wastes and resources. Waste water, for example, would be filtered through plants, gravel, and mussels, then re-circulated back through the building. Similarly, by having a number of different plants and animals in the same location, one can take advantage of their complementary strengths and needs.

Hydroponic systems, in which plants are grown on a layer



© www.verticalfarming.com



© www.verticalfarming.com

An urban farm of the future?

of water rather than in soil, require that nutrients be consistently replenished, while fish tanks need a constant supply of clean water. Combining the two might alleviate both problems: Fish wastes would provide nitrogen-rich nutrients for the plants, while the plants would filter the water [12].

One of the most attractive aspects of the vertical farm is that it gives cities high food security. Each crop is given the precise light, nutrient, and water requirements that it demands, ensuring stable growth. Because production is indoors, crop yield is independent of climate change, natural disaster, and disease. Furthermore, food can be produced year-round, giving cities access to a variety of exotic and out-of-season produce [13].

Although fully-automated, vertical farms can also act as important education centers, allowing students and citizens alike to gain sophisticated training in plant growth and technology [8]. Without education, sustainable agriculture cannot be maintained in any location. Farmers of the next generation will require interdisciplinary knowledge for sustainable agriculture [1,8]. Whether students, citizens, or workers, farmers must understand how various factors such as climate, compost, and surrounding plants influence crop growth. Organizations such as the New Haven Land Trust and Urban Farming already include this educational component in their construction of community gardens.

College campuses can also train farmers of the future.

Yale University was planning to use the flat rooftops of Morse and Stiles Colleges to grow native grasses and flowers. The plants would not only serve as habitats for birds and insects, but also reduce energy needs by cooling the buildings and filter rain runoff for reuse in toilets and showers. Such a design could also incorporate urban agriculture. A sustainable garden on a university campus would be a liv-

“ Urban agriculture may sound like an oxymoron today ”

ing laboratory, where students could learn hands-on about agriculture and the biology of food. To involve students from all disciplines, the gardens could be used to field-test growing techniques for community gardens or new technology for vertical farms.

“Urban agriculture” may sound like an oxymoron today. But an increasing population and changing climate may make farming in the city an important contributor to the food supply in the future. ■

Sonia Singhal is an undergraduate at Yale University.

References:

- [1] Gross T, Miller D. Food as a National Security Issue. Fresh Air from WHYY [radio program]. National Public Radio; 2008 Oct 20.
- [2] Gianpietro M, Pimentel D. The tightening conflict: Population, energy use, and the ecology of agriculture. 1994 [cited 2008 Dec 1]. Available from <http://www.dieoff.com/page69.htm>.
- [3] Tomczak J. Implications of fossil fuel dependence for the food system. Tompkins County Relocalization Project. 11 December 2005 [cited 2008 Dec 1]. Available from Energy Bulletin. <http://www.energybulletin.net/node/17036>.
- [4] Pimentel D, Gianpietro M. Food, land, population, and the U.S. economy. 1994 [cited 2008 Dec 1]. Available from <http://dieoff.org/page40.htm>.
- [5] Church N. Why our food is so dependent on oil. Powerswitch 2005 Apr 1. Available from Energy Bulletin. <http://www.energybulletin.net/node/5045>.
- [6] Pollan M. The food issue: An open letter to the next farmer in chief. N.Y. Times [newspaper online]. 2008 Oct 9 [cited 2008 Dec 1]. Available from The New York

Times Magazine. <http://www.nytimes.com>.

- [7] Sevelle T. Presented at the Urban Farming Panel sponsored by Yale Sustainable Food, New Haven, CT. 2008 Nov 6.
- [8] Mougeot LJA (Ed.). Agropolis: The Social, Political, and Environmental Dimensions of Urban Agriculture. London: Earthscan; 2005.
- [9] Randall C. Presented at the Urban Farming Panel sponsored by Yale Sustainable Food, New Haven, CT. 2008 Nov 6.
- [10] Urban Farming [homepage on Internet]. [cited 2008 Dec 1]. Available at: www.urbanfarming.org.
- [11] Ehrenberg R. Let's get vertical. Science News 2008 Oct 11;174:16-20.
- [12] Despommier D. The Vertical Farm Project [homepage on Internet]. 2008 [cited 2008 Dec 1]. <http://verticalfarm.com>.
- [13] Kuang C. Farming in the sky. Popular Science 2008 September 4 [cited 2008 Dec 1]. Available from Popular Science. <http://www.popsoci.com>.
- [13] Despommier D. The Vertical Farm Project [homepage on Internet]. 2008 [cited 2008 Dec 1]. <http://verticalfarm.com>.