



High-tech high-rises could house the farms of the future.

The Farmer in the High-Rise

Growing food in skyscrapers? Some scientists say it's possible. BY ALISA OPAR

IN THE NEXT 50 YEARS, the U.N. estimates the world's population will reach roughly nine billion people, and the vast majority will live in cities. Feeding those hungry mouths, experts say, will require clearing an additional ten billion hectares for farming—that's an area roughly the size of Brazil. But Dickson Despommier, a microbiologist at Columbia University, doesn't believe that chopping down the world's forests to make new farmland is the answer to easing potential food shortages. Instead, he wants to bring farming to the places where most consumers and supermarkets are—namely, cities. Forget community gardens and the occasional greenhouse; Despommier and a team of his students propose farming in skyscrapers, or "vertical farms." They envision 30-story buildings that each take up a city block and grow enough food for 50,000 people per year.

"It's not just a way of generating food," says Despommier. "It's a way of dealing with municipal waste, recycling water, and using methane digestion to help a city be sustainable." According to his scheme, both animal and plant life could thrive indoors. Fish such as tilapia, trout, and striped bass would live in the pond on the ground floor, while fruits and vegetables would be grown hydroponically, without the use of soil, on upper floors. Wastewater from the fish tanks would be transported to the basement where, along with drain water from showers and sinks, it would be treated and then used to fill the fishponds and hydroponic tanks. Water containing human wastes and other organic material would pass through a methane reactor to create energy to power the building. With no need for pesticides or food transportation, and the ability to produce multiple crops in a season (six corn harvests, for example, instead of one), the vertical farm sounds like an eco-cornucopia.

Although this smacks of science fiction, industries operating on a similar principle are

already up and running. In 2001, the Dutch agriculture minister supported building a vertical farm in Rotterdam called Deltapark, in response to flooding farmland, livestock diseases such as swine fever, and growing agricultural pollution. Though the park hasn't been built, the idea of linking several industries together to reduce the environmental burden of agriculture has become increasingly popular, says Jan Broeze, the Wageningen University scientist who dreamed up Deltapark. "If you cluster various activities, like greenhouses, fish farming, and manure processing, then you create a sufficient scale for more sustainable food production," says Broeze, who is working with a group of farmers in Holland to link a chicken farm, a manure processing system, and greenhouses. "The idea is to use wastes from one industry to sustain another."

In the U.S., however, the idea has generated interest but not capital. "The problem is that nobody wants to be first," says Despommier. "I think this will arise when someone realizes that they can make a lot of money." He compares the vertical farm to the hybrid car, which "now everybody is producing. They aren't doing it for the sake of the environment; they're doing it to make money."

Vertical farms will likely become more economically viable in the coming years, according to John Ikerd, an agricultural economist at the University of Missouri-Columbia. "There will be even greater economic opportunities in the future, as the prices of industrial foods rise, markets for local and sustainably produced foods grow, and production systems for vertical farms become more efficient through research and practical experience," he says.

Meanwhile, Despommier and his students are refining their design by incorporating new technology. For example, aeroponic technology—plants grown in an enclosed, sterile chamber that retains mist and heat—grows plants faster than either hydroponic technology or plain old soil. And using windows coated with titanium oxide, which breaks down dirt and causes water to form sheets (instead of droplets) would clean the panes as they flowed down the surface.

Despite the environmental benefits, Angela Caudle, executive director of the International Federation of Organic Agriculture Movement, is not convinced that vertical farming is the way to achieve sustainability. "The technological solution distracts from our human connection to agriculture and food production," she says. "I can appreciate an attempt to find sustainable ways to deal with producing more food for more people, but for me this is kind of like laboratory food."

Others, however, would be keen on buying the food. "We're trying to buy as local as possible, and you can't get much more local than that," says Allen Zimmerman, produce buyer for the Brooklyn-based Park Slope Food

Co-op, which has more than 12,000 members.

For now, the vertical farm is "a think piece," says Despommier. There are still enormous obstacles to overcome, including cost and what he terms "political lull." The answer, he suggests, is to get the G-8 nations to pool their resources, or a foundation to provide the initial funding for a vertical farm in a country where it's desperately needed. After that,

Despommier believes the idea will take off. "The pieces all exist out there, they just need to be put together," he says. "Then, the waste streams could turn into profit streams." ■

A vertical farm could feed 50,000 people per year. Here's a look at some of the crops that could be produced (in tons).

Wheat	456
Cucumber	911
Lettuce	1,003
Peppers	1,368
Eggplant	1,495
Strawberries	1,514
Carrots	2,336
Soybeans	3,285
Spinach	3,285
Potatoes	3,833