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Features

Skyfarming

A Columbia professor believes that converting skyscrapers into crop farms could help reduce global warming and make New York cleaner. It's a vision straight out of *Futurama*—but here's how it might work.

- By Lisa Chamberlain

Urban farming has always been a slightly quixotic endeavor. From the small animal farm that was perched on the roof of the Upper West Side's Ansonia apartment building in the early 1900s (fresh eggs delivered by bellhop!) to community gardens threatened by real-estate development, the dream of preserving a little of the country in the city is a utopian one. But nobody has ever dreamed as big as Dr. Dickson Despommier, a professor of environmental sciences and microbiology at Columbia University, who believes that "vertical farm" skyscrapers could help fight global warming.

Imagine a cluster of 30-story towers on Governors Island or in Hudson Yards producing fruit, vegetables, and grains while also generating clean energy and purifying wastewater. Roughly 150 such buildings, Despommier estimates, could feed the entire city of New York for a year. Using current green building systems, a vertical farm could be self-sustaining and even produce a net output of clean water and energy.

Despommier began developing the vertical-farming concept six years ago (his research can be found at verticalfarm .com), and he has been contacted by scientists and venture capitalists from the Netherlands to Dubai who are interested in establishing a Center for Urban Sustainable Agriculture, either independently or within Columbia. He estimates it could take a working group of agricultural economists, architects, engineers, agronomists, and urban planners five to ten years to figure out how to marry high-tech agricultural practices with the latest sustainable building technology.

What does this have to do with climate change? The professor believes that only by allowing significant portions of the Earth's farmland to return to forest do we have a real chance of stabilizing climate and weather patterns. Merely reducing energy consumption—the centerpiece of the proposal Al Gore recently presented to Congress—will at best slow global warming. Allowing forests to regrow where crops are now cultivated, he believes, would reduce carbon dioxide in the atmosphere as least as much as more-efficient energy consumption.

There is another reason to develop indoor farming: exploding population growth. By 2050, demographers estimate there will be an additional 3 billion people (a global total of 9.2 billion). If current farming practices are maintained, extra landmass as large as Brazil would have to be cultivated to feed them. Yet nearly all the land that can produce food is already being farmed—even without accounting for the possibility of losing more to rising sea levels and climate change (which could turn arable land into dust bowls).

Depending on the crops being grown, a single vertical farm could allow thousands of farmland acres to be permanently reforested. For the moment, these calculations remain highly speculative, but a real-life example offers a clue: After a strawberry farm in Florida was wiped out by Hurricane Andrew, the owners built a hydroponic farm. By growing strawberries indoors and stacking layers on top of each other, they now produce on one acre of land what used to require 30 acres.

Why build vertical farms in cities? Growing crops in a controlled environment has benefits: no animals to transfer disease through untreated waste; no massive crop failures as a result of weather-related disasters; less likelihood of genetically modified "rogue" strains entering the "natural" plant world. All food could be grown organically, without herbicides, pesticides, or fertilizers, eliminating agricultural runoff. And 80 percent of the world's population will be living in urban areas by 2050. Cities already have the density and infrastructure needed to support vertical farms, and super-green skyscrapers could supply not just food but energy, creating a truly self-sustaining environment.

Like the Biosphere 2 project in Arizona, a real vertical farm will probably require a utopian philanthropist with deep pockets. In the eighties, Edward Bass spent $200 million of his own money to construct the Biosphere. A smaller and less complex vertical farm would probably cost that much to build today and could be funded by someone from a country where arable land is already in short supply, such as Japan, Iceland, or more likely Dubai. Despommier is convinced the first vertical farm will exist within fifteen years—and the irony is, oil money could very well build it.

- Next: Inside a Vertical Farm

1. The Solar Panel
Most of the vertical farm's energy is supplied by the pellet power system (see over). This solar panel rotates to follow the sun and would drive the interior cooling system, which is used most when the sun's heat is greatest.

2. The Wind Spire

An alternative (or a complement) to solar power, conceived by an engineering professor at Cleveland State University. Conventional windmills are too large for cities; the wind spire uses small blades to turn air upward, like a screw.

3. The Glass Panels
A clear coating of titanium oxide collects pollutants and prevents rain from beading; the rain slides down the glass, maximizing light and cleaning the pollutants.

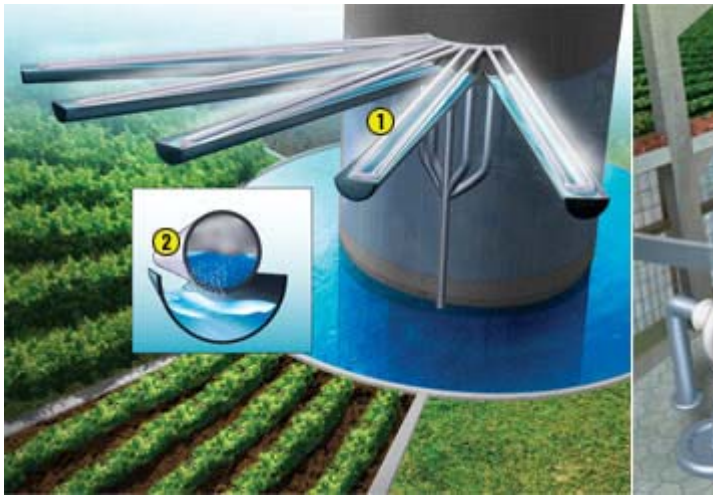
Troughs collect runoff for filtration.

4. The Control Room
The vertical-farm environment is regulated from here, al
round, 24-hour crop cultivation.

5. The Architecture
Inspired by the Capitol Records building in Hollywood.
uses space most efficiently and allows maximum light ir
stack like poker chips for flexibility.

6. The Crops
The vertical farm could grow fruits, vegetables, grains, a
Enough, Despommier estimates, to feed 50,000 people a

Next: How It Works



The vertical farm doesn't just grow crops indoors; it also generates its own power from waste and cleans

1. The Evapotranspiration Recovery System
Nestled inside the ceiling of each floor, its pipes collect moisture, which can be bottled and sold.

2. The Pipes
Work much like a cold bottle of Coke that "sweats" on a hot day: Super-cool fluid attracts plant water va
they drip off (similar systems are in use on a small scale). Despommier estimates that one vertical farm c
of water a year.

3. Black-Water Treatment System
Wastewater taken from the city's sewage system is treated through a series of filters, then sterilized, yielc
drinkable but can be used for irrigation. (Currently, the city throws 1.4 billion gallons of treated wastewa
Solaire building in Battery Park City already uses a system like this.

- Next: The Field

4. The Crop Picker
Monitors fruits and vegetables with an electronic eye. Current technology, called a Reflectometer, uses color detection to test ripeness.

5. The Field
Maximization of space is critical, so in this rendering there are two layers of crops (and some hanging tomatoes). If small crops are planted, there might be up to ten layers per floor.

6. The Pool
Runoff from irrigation is collected here and piped to a filtration system.

7. The Feeder
Like an ink-jet printer, this dual-purpose mechanism directs programmed amounts of water and light to individual crops.

- Next: The Pellet Power System

8. The Pellet Power System
Another source of power for the vertical farm, it turns nonedible plant matter (like corn husks, for example) into fuel. Could also process waste from New York's 18,000 restaurants.

9 to 11. The Pellets
Plant waste is processed into powder (9), then condensed into clean-burning fuel pellets (10), which become steam power (11). At least 60 pellet mills in North America already produce more than 600,000 tons of fuel annually, and a 3,400-square-foot house in Idaho uses pellets to generate its own electricity.

Concept design by Chris Jacobs for United Future.