

## *Sustainable Sustenance*

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We all may want our cars, our homes, our computers and our jobs, but there is one thing we can all agree we need: food. Unfortunately, in the world today, food is highly problematic — from a global perspective, it's expensive, it's unfairly distributed and its production is an environmental disaster. Statistics detailing the extent of food's many problems are easy to find, but so far, solutions to this global plight have proven elusive.

There does not yet exist a simple, out-of-the-box solution to the food crisis. For the future, however, both a class at Columbia University and a small non-profit in Kansas are working on two fundamentally divergent solutions that could change the face of cultivation forever: vertical farming and Natural Systems Agriculture.

By the end of this year, more than half of the world's population will live in cities. Advocates of vertical farming propose that food production should follow this demographic transition into the urban environment, with the food of the future grown not in fields, but in skyscrapers. While the idea might sound at first a tad ludicrous, Dr. Dickson Despommier and his students in Columbia's Medical Ecology class are convinced of its potential.

By growing diverse crops aeroponically — roots dangling in a fine mist of nutrient-rich water — inside a vertical greenhouse, Dr. Despommier contends that a twenty story building spanning a square city block could provide adequate nutrition for 50,000 people. If this figure could be practically realized, it would mean that an urban area the size of San Francisco could feed the entire United States.

Dr. Despommier also contends that his design would be energy positive, producing almost twice as much energy as it consumes. Unlike conventional farms, most of which require fossil fuel inputs and pollute the environment via synthetic chemical runoff, the only inputs in vertical farming would be solar energy, composted waste and water, and the only outputs food, water and energy. Waste generated inside the building would be biologically recycled and used to grow more crops, meaning no pollution.

Individual floors of the vertical farm could be conditioned to optimize growth for each crop, and the indoor nature of the system would eliminate risk of crop failure due to droughts, floods, and pests, and greatly reduce the danger of food-borne diseases. By

switching to vertical farming, current cropland could ideally be restored to its natural state, not only eliminating the environmental problems associated with agriculture, but also producing environmental benefits.

Wes Jackson and the researchers of The Land Institute, on the other hand, believe the answer is not a further departure from nature, but instead a return to it. By mimicking natural systems instead of fighting them, they say, human food production could exist in harmony with the earth.

The Land Institute's new agricultural paradigm, Natural Systems Agriculture, is based on the observation that a prairie provides food for all of its inhabitants without needing a single drop of fossil fuel or synthetic pesticide and fertilizer, while at the same time sequestering carbon dioxide and enriching the soil. What does nature know that we don't? Nature understands that without diversity, and without closed cycles, nothing can be sustainable.

Currently, most human agriculture is based on a system of annual monoculture, in which each field is designed to grow only one crop which is harvested, plowed over and replanted annually. The problem with this method is that it is equivalent to mining the soil for nutrients, a process made possible only by copious doses of synthetic fertilizer.

As opposed to our current agricultural methods, Natural Systems Agriculture would be based on a system of perennial polyculture, where multiple different crops would grow on the same field, retreat after they were harvested, and then return naturally when seasonal conditions again became favorable. Growing a diverse range of crops in the same system would protect against massive crop failure, deter pests organically and make each acre more productive. Returning organic wastes to the field in the form of compost and matching plants that generate essential nutrients for each other would eliminate the need for chemical fertilizers. While Natural Systems Agriculture would still require massive tracts of land for food production, these acres could be returned to a more natural, sustainable state.

In order to realize the concept of Natural Systems Agriculture on a wide scale, researchers at the Land Institute are working to develop perennial versions of important crops. Like vertical farming, Natural Systems Agriculture will require more development to get things off the ground. Though I remain cautiously hopeful about both methods, awaiting full proof that these concepts are viable in practice, these innovative ideas deserve further investigation, as each provides an unprecedented opportunity to provide cheap, abundant and sustainable sustenance for the future.

*For more information about vertical farming, see <http://www.verticalfarm.com>. For further studies in Natural Systems Agriculture, go to <http://www.landinstitute.org>. Nick has a craving for a sustainable strawberry, vertical or natural will do, as long as it's yummy. Email him at [nick@positivesustainability.org](mailto:nick@positivesustainability.org).*

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