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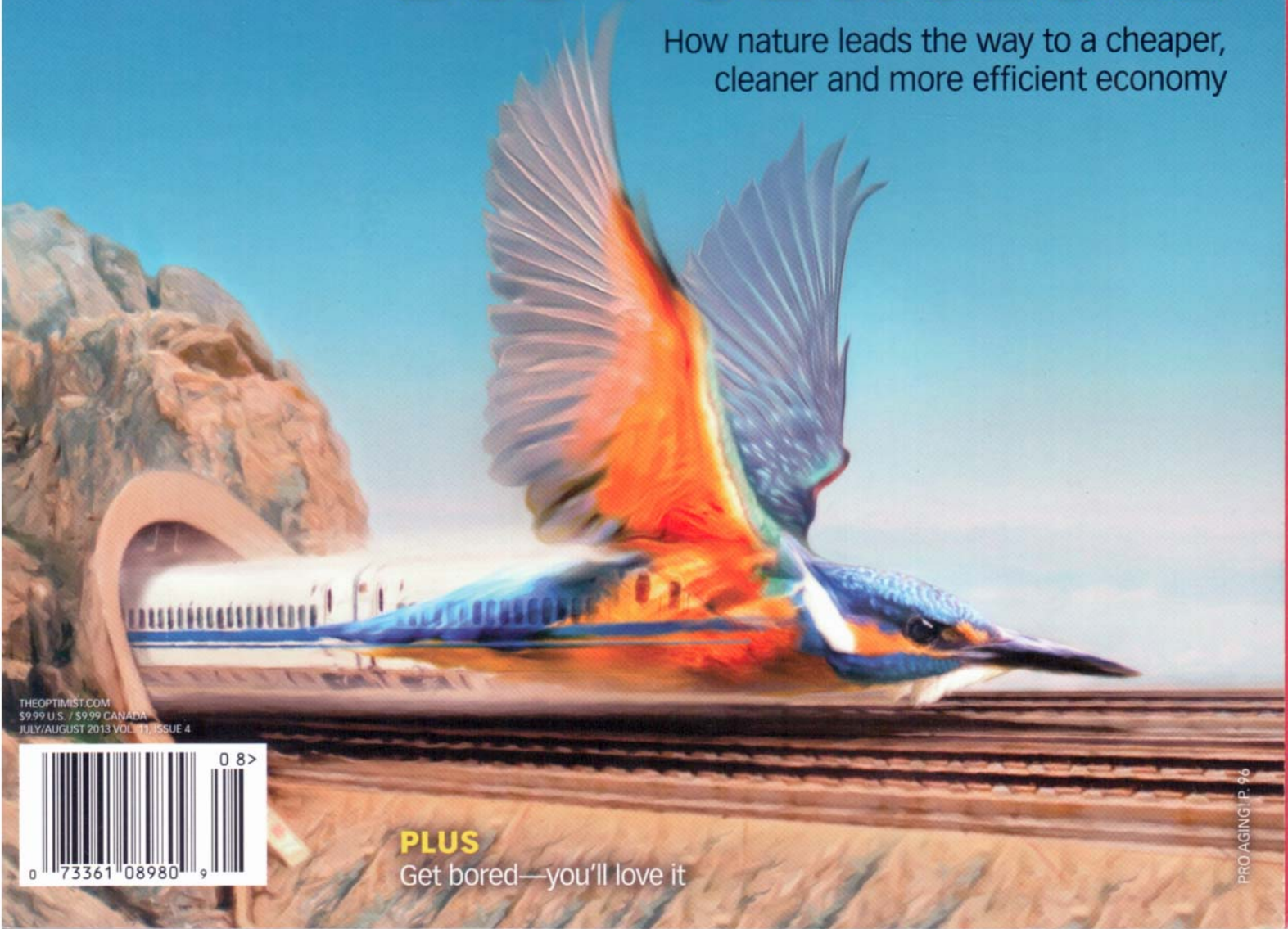
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"The waterboxx, an incubator for trees and larger plants that captures rainwater and condensation from the air, is one of many initiatives designed to combat a growing food crisis."



**Hydroponics:
Agriculture without soil**

The items on display in today's city supermarket are no longer what the consumer wants, according to BrightFarm Systems, which delivers produce without pesticides or greenhouse gas emissions. The solution was obvious, says the New York company: Grow food exclusively near the consumer.

BrightFarm Systems, which grew out of the New York Sun Works company, built its first greenhouse in May of 2007 on a boat on the Hudson River north of Manhattan. The greenhouse on the Science Barge gets its energy from a combination of solar and wind power and biodiesel, and it has been growing fruits and vegetables for nearly six years. In late 2010, they built a second "urban farm"—as the company calls its greenhouse projects—on the roof of the Manhattan School for Children. Director Benjamin Linsley says, "The greenhouse serves as a classroom, and the children learn everything there is to learn about the environment; the harvest from the greenhouse is served in the school cafeteria."

A third major project is a large greenhouse on the roof of the Whole Foods Market in Millburn, New Jersey. The supermarket manages the farm and sells the harvest in the store as soon as the first crops are ready. BrightFarm Systems built and maintains the greenhouse.

BrightFarm Systems' projects are possible thanks to hydroponics, a method of cultivating plants without soil. The technique has been around for 50 years and was invented by the Englishman Allan Cooper, who discovered that plants can thrive in water alone, as long as it contains sufficient nutrients. He called it the nutrient film technique (NFT), in reference to the thin film of water that flows past the plants to nourish them. Many horticulturists now make use of hydroponics.

Hydroponics is particularly well suited to a place like New York, where land is scarce, Linsley explains. "Hydroponics requires not only less water but less space. We can guide viny plants upward, leaving more room on the floor." According to Linsley, that's the reason why the Science



PIETER HOFF DISPLAYS HIS WATERBOXX, WHICH ALLOWS PLANTS TO THRIVE UNDER THE MOST ARID CONDITIONS.

Barge is able to grow 20 times as many plants as a field of the same size.

Farm upward not outward; that's also the idea behind The Vertical Farm, created by Dickson Despommier, an environmental scientist at Columbia University. He developed an urban farm too, but his was 30 stories high and had its own irrigation system. He made use of hydroponics, which Despommier considers ideal for cities.

The collaboration with the supermarket in New Jersey might be a breakthrough for local food production. A successful result will pave the way for consumers, entrepreneurs and anyone who stops to think about what's on a plate and wants to do something about the enormous number of miles a meal traveled to get there. And it's not such a crazy idea, given that the U.N. calculated that 70 percent of the world's population will live in cities by 2050.

Critics claim Despommier's "plant skyscrapers" can never succeed because they cannot capture enough sunlight in the city. Not even BrightFarm Systems' rooftop greenhouses can fill the bill. Insufficient

sunlight has been calculated into the business model, says Linsley. "We accept a lower yield."

The waterboxx: Agriculture amid water scarcity

Armed with a spade, Pieter Hoff, the inventor of the waterboxx, and Will Bucklin put the piece of equipment to the test. Out in Bucklin's Old Hill Ranch vineyard in the Sonoma Valley, just above San Francisco, Hoff carefully removes a green-and-white box from a young grapevine and begins to dig up an entire plant.

Old Hill Ranch is a small vineyard; it covers about 25 acres and produces roughly 2,000 bottles of wine a year. Bucklin believes in organic production, and his wine is organic. He also participates in dry farming, a cultivation method that eschews irrigation in favor of deep-root water mining. Says Bucklin: "We believe that watering the vines dilutes the fruit intensity."

To get enough water from the ground, it's important that plants have long, strong roots. That's the reason why Bucklin uses Saint George rootstock: "It's a strong plant that's very long-lived and resistant to most of the important pests." In its first four months, a grapevine is very vulnerable, and it's important during that period to give it sufficient water so it can develop strong roots. The vintner must also expend extra effort and energy to help the plant survive those first months.

That's precisely why Bucklin is happy with the waterboxx: It's hard to grow a vineyard using dry farming. "It requires a tremendous amount of work," he says. "If it works, it will save labor and increase the success rate of planting." According to Hoff, the plant is so strong after those four months that its roots grow to a depth of 30 feet in the subsequent year. The waterboxx's work is done. "Thanks to the waterboxx, this plant will never need irrigation," he says.

Hoff calls his invention a "tree nipple." The waterboxx gives the tree a helping hand at the start. As soon as the roots can find water on their own, the waterboxx's task is complete. The invention grew out of Hoff's concerns about the food crisis

he believes we will experience in the near future. Biomimicry—a method of solving human problems by taking inspiration from nature—showed him a way out.

Hoff zoomed in on the plant's germination and growth process and discovered that things went wrong in that early stage. Something else Hoff discovered: Trees grow well in arid places; they just can't germinate there. The waterboxx, a kind of bucket with a hole in the middle in which a tree can grow, helps the plant do so.

At night, the lid captures condensation and allows the water to trickle into the bucket. The rare spate of rain is also captured and stored, then fed to the plant in small doses along capillary cords. The waterboxx prevents the water in the uppermost layer of soil from evaporating; it also provides instant protection from wind, sun, weeds and rodents. Once its work is done and the plant can continue growing on its own, the waterboxx can be reused another five to 10 times for other trees.

The waterboxx has been on the market since March of 2010, and it's seeing a steady increase in users. Customers live everywhere, from the dry regions of the Middle East, Africa and India to wine country in California and mining areas in Spain. Hoff has already sold 250,000 units worldwide. The next step is even more promising. Hoff has two huge research projects, one in Holland and one in Ecuador, where he does experiments with vegetables using 90 percent less water than with the present production methods. And because fertilizers require that a lot of water be transported into the plant, he replaces them with *mycorrhizae* (fungi). The results are promising and might revolutionize vegetable production in eroded and dry areas.

The use of the Groasis Technology in dry areas is a form of progress that will be of incalculable value to a large group of farmers and growers in developed and less developed regions. It will produce not only more food but more tillable and fertile land that will also provide greater shade and sufficient food for animals. ■

MARIANNE LAMERS loves to eat vegetables, no matter how they're grown.