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A Special Report Produced by The Washington Times Special Sections Department and Skyscraper Farm LLC.

Agricultural Mixed-Use Revolutionizing Farming

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Washington
Times**

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PHOTO COURTESY OF CITY MANAGER'S OFFICE/CITY OF HENDERSON

A teacher with students at C. T. Sewell Elementary School in Henderson, Nevada, examine plants in a community garden bed donated to the school.

Cities can and must work to end food deserts within their communities



By Mayor Debra March

Limited access to healthy food continues to affect urban communities across the U.S., including the City of Henderson, Nevada, where I am privileged to serve as mayor.

Nearly all of the food consumed by the 2.1 million residents and 42 million annual visitors to the Las Vegas Valley, where Henderson is located, comes from somewhere else. This is a necessity given the environment of our drought-burdened Mojave Desert home, which makes growing fruits and vegetables for residents and visitors challenging.

In addition, many economically challenged areas across the nation, including our own, lack access to supermarkets with affordable fresh vegetables, fruits and other nourishing foods, so residents rely on neighborhood corner stores and fast-food chains that offer

few fresh food options. As a result, despite being a vibrant community with a robust economy, safe neighborhoods and high student achievement, Henderson is not immune to the development of food deserts or food insecurity.

But hope is on the horizon. Among the strategies we are implementing to increase access to healthy food in economically challenged neighborhoods is the incorporation of urban vertical farming. This is an innovative process that sustainably produces exponentially greater numbers of crops while using significantly fewer land and water resources, making it a viable option for our desert home.

Even under normal conditions, our hot and arid climate — which averages less than 4 inches of rain a year — make it very challenging to grow produce. But through hydroponic watering and microclimate controls for crop cultivation, vertical farming can use up to 90 percent less water than traditional farming methods. This is a critically important benefit for a region that finds itself in the 18th year of a serious drought, with no relief in sight.

Vertical farming is an emerging industry, and the private sector is eager to encourage its development as evidenced by an increasing number of vertical farms being built across the country. And just recently, Oasis Biotech opened its doors in Las Vegas, joining Urban Seed Inc., which opened in 2016.

Oasis Biotech, located near Henderson, is producing 9,500 servings of green salads per day from its 200,000

square-foot facility that houses the equivalent of a 34-acre traditional farm. The healthy food produced there supports local resorts, casinos and a national supermarket chain. Before this development, all local produce was usually supplied by distant farms in California and Arizona. In addition to added cost, produce shipped to Southern Nevada often loses vital nutrients and freshness during transport.

Being able to access locally produced and vertically farmed leafy greens and fruits for their restaurant salads allow these resorts to decrease reliance on produce shipped by truck or train. This change helps reduce air pollution and cuts carbon emissions while also promoting increased water conservation and sustainable farming techniques.

In addition, vertical farms like Oasis Biotech and Urban Seed Inc., will be able to tailor their produce to the specific need of its resort and supermarket partners and go from farm to table in 24 hours, which will create more nutritious, better tasting and diverse options for their clientele.

Henderson is taking a multifaceted approach to resolving issues that contribute to the lack of fresh produce experienced by our residents — an issue that can often lead to major health concerns including diabetes, hypertension and low student performance.

We recognized the importance of working with community stakeholders to effectively meet the challenge of providing all residents with access to healthy food. We incorporated this goal into the City's "Henderson Strong"

comprehensive plan and made this healthy food strategy a key component of the revitalization plan for Pittman, one of the City's oldest underserved neighborhoods.

Part of this approach also includes working to attract new supermarkets and expanding existing stores. We're also supporting school and community gardens and mobile farmers markets. The City Council also will consider an urban agriculture ordinance to support and facilitate larger scale and more sustainable food production — like vertical farming — in our city.

We have an exciting opportunity that will allow us to address the challenge of food deserts and food insecurity in our urban centers with vertical farming that takes place 365 days a year and produces food closer to where it's consumed. But we must keep in mind that continued growth of this industry will not be possible without the assistance of public and private funding to support the infrastructure needed to develop it.

While there is no quick and easy panacea for the lack of healthy food options that residents across the nation face on a daily basis, forward-thinking municipalities like Henderson are actively implementing community-supported programs and exploring new technologies like vertical farming that will provide our most vulnerable families with healthier options.

Henderson Mayor Debra March, a former councilwoman, was elected to Nevada's second largest city in 2017. Please follow @debra_march and @cityofhenderson.

‘The next evolution of farming has already begun’



By Austin Stankus

The world population continues to grow with ever-increasing urbanization predicted to reach 80 percent by 2050. The U.N. predicts that human population will reach nearly 10 billion by 2050. This increasing population is also growing richer — and hungrier.

To feed this population using traditional farming practices, much more land would need to be brought under cultivation. But, already much farmland around the world has been degraded from poor management practices, and lands remaining available for food production are decreasing from the effects of erosion, salt buildup and pollution.

As you read this today, tens of millions of children are going to bed hungry, with the Food and Agriculture Organization of the United Nations estimating the number of hungry in 2018 at 812 million or approximately one out of 9 people.

Something needs to change. Food production needs to get more efficient, more equitable and more environmentally minded. Moreover, food production should follow the population to the cities, or as Dickson Despommier, a forerunner of this movement, simply states: “Put the food where the people live.”

Indoor farming through controlled-environment agriculture (CEA) will be an important component towards establishing local food systems that can address this pending crisis in global food insecurity. CEA, simply put, is using smart, sustainable farming practices inside of high-tech greenhouses. This is nothing new, and these modern greenhouses are an established technology and can be found around the world. In fact, much of the lettuce, tomatoes, peppers and cucumbers in the EU come from CEA in the Netherlands and Spain.

These greenhouses have incredible



benefits compared to traditional farming: They use less water because they are protected from the sun and wind, they use fewer pesticides because insects and disease can be kept outside, and there is less waste because production can be matched exactly to consumer demands.

If hydroponics or other soil-less practices are used, the farmer does not need to use tractors for tilling, plowing and reaping, so the oil bills and energy consumption are lower. In addition, the fertilizer usage is reduced, and all the fertilizer the farmer uses is consumed by the plants, thereby reducing nutrient-rich runoff that can pollute watersheds. Known as eutrophication, this nutrient pollution is a huge problem for coastal communities in the Chesapeake Bay and Gulf of Mexico and has impacted fisheries, recreational activities and livelihoods around the world.

However, CEA greenhouses can occupy a lot of space. So, the next logical evolution is stacking these modern greenhouses, one atop the other.

Vertical farming, as greenhouses stacking is called, has additional benefits. Reducing the footprint means that more food can be grown in a smaller area and therefore can be brought closer to the people eating that food. As populations move toward the cities, it makes sense for the food to follow.

Part of the vision of vertical farms is the reconnection of the producer and the consumer plus the restructuring of food value chains to become more

transparent and responsive to the needs and wants of the people.

An added benefit of farming inside of skyscrapers is the option of having mixed-use buildings. When combined with a wholesale market, the skyscraper can not only produce the food but get it to the consumer faster. Less time in storage, less transportation and less handling means fresher produce and reduced need for postharvest treatments like irradiation and chemical fumigation.

There are still some daunting challenges as well as some encouraging recent developments.

Unleashing the innovative power of American small businesses has jump-started the transition to modern farming, and the public desire for local, healthy food is an economic engine driving the industry toward change. In fact, there are currently so many vertical farm startups that a shortage of qualified workers is now the main hurdle to accelerating the establishment of new indoor farms. On one hand this is a challenge to the industry, but on the other it presents an enormous opportunity for job creation in urban areas if an inclusive, enabling environment is codeveloped with the vertical farms to provide vocational training and career advancement prospects.

On a technical level, there is a significant energy demand needed for pumping water, maintaining good environmental conditions like temperature and humidity, and powering the grow

lights to keep producing year-round. However, with smart buildings wired on intelligent platforms, the energy consumption can be monitored and controlled to maximize efficiency — and by tying into other green enterprises like photovoltaic and biogas generation, this energy demand is decreasing day by day. In fact, with the new innovations in LED lighting technology, the power demand has been reduced tenfold in the last few years.

The next evolution of farming has already begun, and big players are already involved. In fact, the National Grange wrote a letter to Congress with their support to public-private funding mechanisms to accelerate the modernization of agriculture, specifically highlighting the potential of vertical farming. With this type of buy-in from large agribusinesses, national and international agricultural organizations, funded with innovative financial mechanisms, and driven by the innovative spirit and technological power only found in the U.S., vertical farming will feed tomorrow’s children with healthy, safe food; protect the environment while being resistant to environmental shocks; and spur economic growth in the process.

For a detailed look at one such startup, see the centerfold story on Skyscraper Farm.

Austin Stankus, an integrated farming specialist, is chief science officer at Skyscraper Farm LLC.

2018 World Food Prize laureates: Ending malnutrition for mothers and young children

By THE WASHINGTON TIMES
SPECIAL SECTIONS DEPARTMENT

Alarmed by the vast numbers of malnourished children in the world, two British men have spent their lives working to ensure that mothers and their young children can obtain high-quality foods and vitamins.

This month, the men — economist Dr. Lawrence Haddad and physician Dr. David Nabarro — will be honored with the prestigious 2018 World Food Prize.

The men will split a \$250,000 prize as part of an award envisioned decades ago as the “Nobel Prize of Food and Agriculture” by its late founder, legendary agricultural scientist Dr. Norman E. Borlaug.

In a June 25 announcement about the laureates, Ambassador Kenneth M. Quinn, president of the World Food Prize, praised Dr. Haddad and Dr. Nabarro for having brought “extraordinary results at national and international levels.”

“Through their leadership, our laureates have inspired efforts that between 2012 and 2017 reduced the number of stunted children in the world by 10 million,” Ambassador Quinn said at the ceremony at the U.S. Department of Agriculture in Washington, D.C.

Their work also cemented the idea that highly nutritious, healthy foods — not just basic staples — are essential for mothers and their children during the children’s first 1,000 days of life.

“Undernutrition — whether growth failure or micronutrient malnutrition — is falling too slowly,” said Dr. Haddad, a pioneer in food policy research who is now executive director of the Global Alliance for Improved Nutrition (GAIN).

Poor diets are associated with diabetes, hypertension and obesity, and one in three people are malnourished — “with no country exempt,” Dr. Haddad said in June. GAIN’s mission, he added, is to make nutritious, safe food more available, affordable and desirable for all, and especially for babies, toddlers, young children and other vulnerable people.

Dr. Nabarro’s career highlights include his leadership of the U.N. High Level Task Force on Global Food Security from 2008 to 2014. During those years, he successfully brought 54 countries and one Indian state into a new, anti-malnutrition U.N. project called the Scaling Up Nutrition (SUN) Movement. Today, the SUN program involves 60 countries and is working toward ending malnutrition in all its forms by 2030.

There are “thousands of courageous women and men” working in well-functioning, local food systems, said Dr. Nabarro, who is now strategic director

of Skills Systems & Synergies for Sustainable Development (4SD). These local leaders “have the wisdom needed to reduce levels of malnutrition or diet-related illness ... They are the transformation leaders of the future,” he said.

The Oct. 18 World Food Prize award ceremony is a highlight of this year’s gathering, which is held in Des Moines, Iowa, Oct. 15-19 and features events such as the Iowa Hunger Summit, the Borlaug Dialogue International Symposium and Global Youth Institute.

The theme of this year’s symposium is “Rise to the Challenge” — a reference to “the single greatest challenge in human history,” which is “whether we can sustainably feed the 9 billion people who

will be on our planet in the year 2050,” Ambassador Quinn said.

The World Food Prize, which recognizes pivotal achievements in improving the quality, quantity and availability of food, was established in 1986 by Dr. Borlaug, an Iowa-born agricultural scientist who participated in the events until his death in 2009 at age 95.

During the 1940s and 1950s, Dr. Borlaug developed many strains of high-yielding, disease-resistant “miracle wheat” in Mexico. He then got these seeds into countries with severe food shortages — like India and Pakistan in the 1960s — and sparked the “Green Revolution” in food production.

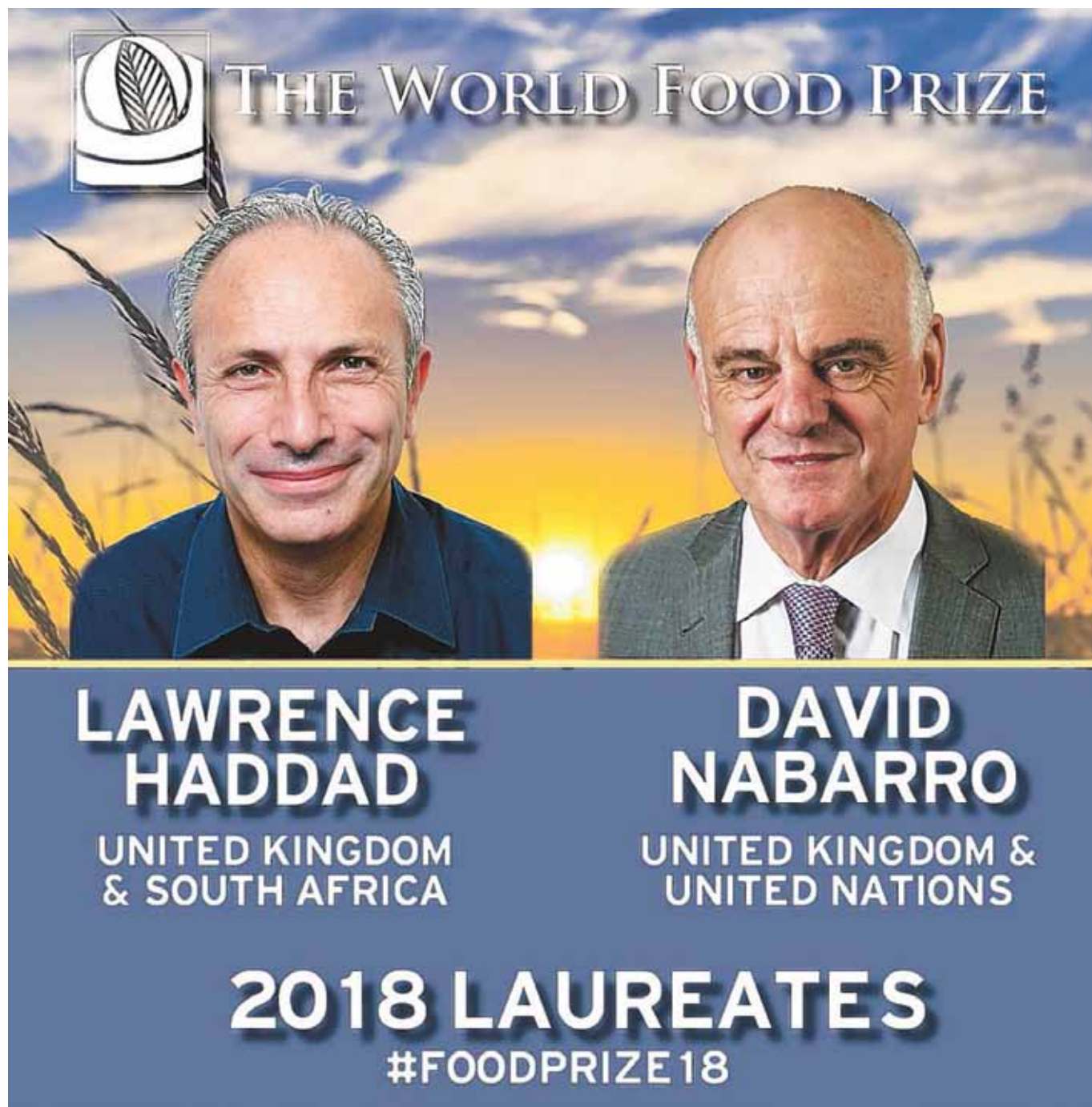
In 1970, Dr. Borlaug became the first

person from the world of agriculture to be awarded the Nobel Peace Prize.

The World Food Prize and its \$250,000 award are presented by the World Food Prize Foundation with support from dozens of companies, foundations and individuals, including the family of the late Des Moines businessman and philanthropist John Ruan Sr.

To date, the 48 laureates have come from Bangladesh, Belgium, Brazil, Cape Verde, China, Cuba, Denmark, Ethiopia, Ghana, India, Israel, Mexico, Sierra Leone, Switzerland, Uganda, United Kingdom, United States and United Nations.

Please follow @WorldFoodPrize.



Abundant, nutritious food, available close by and year-round

A Q&A with Skyscraper Farm founder Nick Starling



By Nick Starling

U.S. Army Ranger, economist and real estate developer Nick Starling is founder and chairman of Skyscraper Farm LLC. Below is a conversation he had with Washington Times Special Sections Manager Cheryl Wetzstein about his company and his vision for worldwide vertical farming that is conducted in very tall buildings — with residential and commercial space as well as dozens of floors for aeroponic and hydroponic crops — and relies primarily on sunlight for the crops. The conversation has been edited for length and clarity.

Q: What attracted you, an economist, to the concept of vertical farming?

I first came up with the idea of Skyscraper Farm during my freshman year taking “Intro to Human Geography” at Hawaii Pacific University. A professor put up a map of America, pointed to the coasts and said, “This is where everybody lives,” and then pointed to the center and said, “And this is where we grow our food.” That’s when I had my light bulb moment, and I made this really crude drawing trying

to figure out how to get sunlight into the center of the building.

Q: What kind of innovations distinguish Skyscraper Farm from other types of vertical farming?

You can’t feed 9.6 billion people with field farms. And we, at Skyscraper Farm, are betting that sunlight is better than LED lights. Sunlight is like dinner to the plants, and LED lights are like protein bars.

Also, Skyscraper Farm is the only vertical farming solution that can maintain its “alpha,” which means it will keep a return on investment above the industry standard. The reason why we’re able to do that is due to low cost of goods sold — 90 percent of costs in other vertical farms are their electric bills because they’re running LED lights 24 hours a day. We cut that out completely; we use sunlight. Judging by its track record, we’re pretty confident in betting that sunlight can grow plants.

Q: You have an overarching concept you call HIDDEN WAFER about your project. Can you explain this?

The acronym stands for health, infrastructure, diplomacy, development, energy, national security and water, agriculture, finance, environment and real estate.

With health, the shorter time to table has massive implications for health and nutrition. When you can get a vegetable right from a bush, it’s so much more nutritious and it just tastes better. If you can get food from farm to table in less than an hour — or within an hour to everyone within a 15-mile radius, which is a goal of Skyscraper Farm — then that’s great. And for those who buy our condos, it’s farm to table in less than five minutes.

On infrastructure: There’s a 55,000-trucker shortage so that means it

costs even more to get fruits and veggies across the country to your table. With a vertical farm right in the center of the city, you can reduce the number of what’s called “food miles” — and reduce wear and tear on the nation’s highways and byways. There’s also a reduction in the need for water infrastructure or to get water to remote fields where those farmers are farming.

Development refers to the elevation of economic conditions. The global average farm yields are 50 percent; with vertical farming, there’s greater yield of 92 percent or better at a cheaper cost. Engel’s law says that the less money you make, the greater proportion of your income you spend on food, which is why people in Haiti are spending 60 cents on the dollar for food while Americans spend 6.7 cents on the dollar for food. Furthermore, if people can spend less money on high-quality, high-nutrition foods — like kale and other vegetables — it will help fight malnutrition.

Diplomacy means vertical farms will permit diplomats to pull certain levels in their diplomatic relations with countries; no more food or water riots.

Energy: Around 20 percent of U.S. oil demand is for agriculture, and a full 60 percent of that is for production. People may see 16-wheelers hauling produce, but they don’t see the combines and tractors running in the field. Vertical farming can make countries more energy independent.

And national security is critical: Armies march on their stomachs. So having a Skyscraper Farm in the world’s largest Navy base means fresh produce can be delivered from farm to ship almost immediately before departure as well as provide a stable source of fresh crops. Moreover,

field farms are absolutely indefensible and subject to constant threat of bio and chemical attacks; a Skyscraper Farm is the only defensible option.

And W-A-F-E-R?

Then with water: We don’t have a water crisis, we have a water allocation crisis. Seventy percent of the world’s fresh water is used on agriculture. With the current 50-percent yield globally, there’s a lot of water wasted on food that doesn’t even make it to harvest. Vertical farming recycles 95 percent of the water it uses. Furthermore, the quality of water is greatly affected: With regular farming, you have agricultural runoff [with pesticides and herbicides] that get into the watersheds and ultimately into the oceans, creating nitrogen hypoxia, algae blooms, ocean acidification and other deleterious effects.

Regarding agriculture, we are able to do 17 to 20 harvests a year with speed breeding or selectively breeding a crop such as wheat that grows shorter and faster, with more wheat and less chaff. You can imagine that one of the things we’re going to be working on with Skyscraper Farm is developing fast-growing lettuces, arugulas and spinaches — with the proteins of lentils and quinoa bred into them and as many vitamins as we can pack in there. Our produce will maintain the highest nutrient content out there. People on diets could eat just one bowl of Skyscraper Farm salad and have everything they need for the day, which is also huge for the developing world where people might only be able to afford one bowl a day. No messing with genetics. Non-GMO. No pesticides. No herbicides. No fungicides. Just fresh, clean food for

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SKYSCRAPER FARM

11 benefits with Skyscraper Farm model of vertical farming

An acronym — HIDDEN WAFER — quickly captures the multiple dimensions of how the Skyscraper Farm version of vertical farming can improve and benefit people’s lives and communities, says company founder Nick Starling.

H	I	D	D	E	N
Health	Infrastructure	Development	Diplomacy	Energy	National security
W	A	F	E	R	
Water	Agriculture	Finance	Environment	Real Estate	

Urban farming projects attracting greater interest, investments

By THE WASHINGTON TIMES
SPECIAL SECTIONS DEPARTMENT

International interest in sustainable urban ecosystems — especially vertical farming — is exploding, according to numerous market forecasts.

Valued around \$2 billion in 2015, the global vertical farming market is projected to reach anywhere from \$6 billion in 2022 to \$10 billion by 2025, according to forecasting firms such as Research and Markets and Grand View Research.

The impetus to scale up vertical farming worldwide stems from two U.N. projections on population and urbanization: The world's population is expected to grow to 9.6 billion people by 2050, and most of these people — 68 percent, according to the U.N.'s revised 2018 urbanization report — will live in cities.

Governments, urban planners and architects, researchers, investors and the entire world of agriculture are now exploring ways to make sure there will be abundant, high-quality, nutritious foods to feed such a growing population — while also conserving energy and water and reducing environmental damage.

To many observers, the future is bright, thanks to advances in greenhouse technologies such as hydroponics, aeroponics and aquaponics.

"These high-tech systems represent a paradigm shift in farming and food products and offer suitable and efficient methods for city farming," Dr. Kheir Al-Kodmany, an urban planning scholar, wrote in the *Buildings* journal in February 2018.

Dr. Al-Kodmany and his colleagues at the University of Illinois at Chicago reviewed more than 100 sources about vertical farming research since 2010 and

examined 15 vertical farming projects worldwide — including two rooftop farms in New York; four "low rise" farms in Michigan, Illinois and Tennessee; and six proposed "high rise" farms in Sweden, France, Canada and the Philippines.

"[H]ypothetically, if vertical farms were integrated in the city, they will be able to supply food for the entire population," Dr. Al-Kodmany concluded. However, there are many challenges to address, including finding funding to build and sustain such projects; finding less costly ways to power facilities; and quickly assembling interdisciplinary research and collaborations on urban agriculture, he wrote in the *Buildings* article.

In the U.S., the U.S. Department of

Agriculture is already supporting research funding on vertical farming through its National Institute for Food and Agriculture.

Also, on June 27-28, the USDA and the Department of Energy co-hosted a stakeholder workshop on vertical agriculture and sustainable urban ecosystems. A report on the two-day event, which was open to the public, will be issued later this year, a USDA spokesman said.

In its workshop, several USDA officials spoke, including Dr. Dionne Toombs, director of the USDA Office of the Chief Scientist; Dr. Chavonda Jacobs-Young, acting USDA chief scientist and acting deputy under secretary for research, education and economics; Dr. David Babson, senior advisor in the USDA Office of the Chief

Scientist; Dr. John Hartung, research plant pathologist at the USDA's Agricultural Research Center in Beltsville, Maryland; and Dr. Sarah Federman, AAAS Science and Technology Policy Fellow in the USDA Office of the Chief Scientist.

Additional featured speakers at the workshop included:

-- Dr. Sabine O'Hara, dean of the College of Agriculture, Urban Sustainability and Environmental Sciences at the University of the District of Columbia, on envisioning ways to incentivize sustainable urban ecosystems.

-- Dr. Dickson Despommier, microbiology and public health professor emeritus at Columbia University and author of the 2010 book, "The Vertical Farm: Feeding the World in the 21st Century," on envisioning vertical agriculture.

-- Dr. Nate Storey, co-founder and chief science officer at Plenty, Inc., a San Francisco-based indoor farming startup, on vertical agriculture in practice.

-- Dr. Raymond Wheeler, NASA plant physiologist, on expanding applications for controlled agriculture.

-- Nick Starling, U.S. Army Ranger and founder of Skyscraper Farm, LLC, on the economics and scalability of vertical farms.

-- Dr. Weslynn Ashton, associated professor of environmental management and sustainability at Stuart School of Business at Illinois Institute of Technology, on industrial ecology for sustainable urban ecosystems.

The two-day workshop featured breakout sessions on pest and pathogen management, plant selection and breeding, systems engineering, community services, ecosystems services and economics.



STARLING

From page C6

your family.

For finance, we will be able to finance buildings off of clean, nutritious and safe commodities. For example, there was news in April of soil-based spinach crops being attacked by algae. If this were to try to happen in a Skyscraper Farm, we would clean out the buildings and have new harvests in 18 to 22 days. Also, in times of scarcity of a crop, with enough scale and quantity, we can push the price back down. That way poor people who could barely afford to buy spinach would be able to buy it again.

Another financial impact occurs through the leasing options that can be instituted with American farmers. Hydroponic and

aeroponic growing systems will make such large quantities of food that field farmers will not be able to compete. So, if our farmers don't move inside and start using vertical farming technologies, within 10 years almost all of our produce is going to come from China because they will be able to outpace us. China is watching and learning everything that Singapore, the world capital of vertical farming, is doing and will likely be close behind in vertical farming technology.

Environmental impact: Once Skyscraper Farm is to scale, there will be an elimination of agricultural runoff. There's a dead zone in the Gulf of Mexico from Houston to Pensacola because of runoff from the Mississippi River. In the Chesapeake Bay, 45 percent of the nitrates, 44 percent of the phosphates and 55 percent of the sediment come from agriculture. That's

why we want to put Skyscraper Farms all around the Bay — to prove the point about agricultural-runoff elimination.

Going into real estate, we need to feed 9.6 billion people in several decades — which could mean needing an extra 8.5 million square kilometers of farmland! That's the size of Brazil. So, we need to be able to grow up instead of growing out.

Q: What is your vision for Skyscraper Farm in terms of number, timeline, etc., in the next decade?

I would like to see at least 75 52-story Skyscraper Farms built in the United States in 10 years. To maintain energy neutrality, we must have at least 200 sunlight days a year; if there are more sunlight days, we can actually add energy back to the community.

Q: Are there likely to be differences by country? Or is a Skyscraper Farm in Dubai likely to function the same as

one in Manila?

No, it's all the same building. Any differences would relate to height variances that are allowed.

Q: What kinds of jobs — and how many jobs — do you anticipate being associated with a Skyscraper Farm?

Tons of jobs: engineer, mechanical engineers, electrical engineers, software developers, all kinds of jobs. And, of course, training farmers on indoor harvests year-round.

U.S. Army Ranger Nick Starling is a Harvard-educated economist and Virginia-based real estate developer who has been researching vertical farming since 2011. For more information, please follow @SkyscraperFarm, visit skyscraper.farm or email info@skyscraper.farm.



Skyscraper Farm: Army Ranger takes aim at global hunger

By Skyscraper Farm

Everyone knows what's coming: The agricultural sector will face enormous challenges to feed the 9.6 billion people projected to inhabit the planet by 2050. In order to do so, food production must increase by 70 percent in spite of the limited availability of arable lands. Another 8.5 million square kilometers, or land the size of Brazil, are needed.

Not only is land needed but there are also increasing needs for fresh water — more than 70 percent of the world's fresh water already goes to agriculture. As Skyscraper Farm CEO Nick Starling puts it: "We don't have a water crisis. We have a water allocation crisis."

Society has responded to these challenges with three innovative shifts: new farming techniques, younger farmers to pioneer them and utilizing technology to make fulfillment easier. Vertical farming refers to the practice of growing crops indoors in vertically stacked layers or on vertically inclined surfaces inside structures like warehouses, shipping containers or even skyscrapers. These indoor farming systems are designed to maximize crop yields while minimizing environmental impacts. Moreover, by bringing farms closer to where people live, this farming method is expected to be both efficient and cost-effective by reducing transportation expenses and environmental damage. Indoor farming has its challenges: Most methods consume a surplus of energy, calling into question the impact on sustainability, or are located too far from urban centers where populations need it most. Thankfully, one firm is ready to bridge the gaps.

Skyscraper Farm, LLC, is a Virginia-based business venture dedicated to vertical farming. Founded by Nick Starling, an Iraq invasion war veteran, its vision is to bring sustainable, cost-effective agricultural products to city centers and remote sites in the U.S. and abroad by combining cutting-edge vertical farming with high-end, attractive, mixed-use real estate.

Skyscraper Farm specializes in the construction of urban, mixed-use buildings that feature an indoor, vertical farm that uses primarily sunlight to grow plants and has the capacity to have 20 harvests a year. The Company has designed three types of buildings: a four-story facility that is solely outfitted



for growing space, a mid-rise built on top of grocery stores, and a 52-story skyscraper that includes residential condos, commercial office space and restaurants.

Skyscraper Farm plans to strategically roll out its first two buildings in Northern Virginia. The Company is in partnership talks with nearby institutions — such as the Department of Energy and the National Science Foundation — to offer state-of-the-art laboratory space in each Skyscraper Farm building for development programs at the Advanced Evolution Lab (AEL). The AEL will focus on speed breeding to selectively breed for nutritious and delicious food varieties as there will be no need for these crops to have pest resistance or thick skins to survive stressful shipping conditions. This will facilitate input and output improvements to the world's leading growing systems, and by partnering with leading agribusinesses (such as Archer Daniels Midland or John Deere) to develop robotic and/or mechanical

vertical farming harvesting equipment, Skyscraper Farm intends AEL to serve as an incubator.

The global hydroponics market is projected to be worth \$461 million by the end of 2023, according to several marketing forecast organizations. While the concept promises to be lucrative, the Company is concerned with solving the impending fresh food crisis with large-scale indoor farms. Skyscraper Farm has the ultimate vision of liberating both developed and developing nations from the ravages of food insecurity and environmental damage by securing sustainable food sources.

The benefits to each community are numerous — eliminating the need to truck and haul food from far away reduces fossil fuel consumption and greenhouse gas emissions. This is an important advantage since 20 percent of U.S. oil demand is used for agriculture alone.

Another benefit of Skyscraper Farm is in energy usage. Traditional vertical farms use four times the energy of field farms due to their large lighting needs. In contrast, Skyscraper Farm's specialized building design uses utility-patented technology to capture sunlight year-round; this will result in energy-neutral crop production.

Skyscraper Farm is also able to produce exponentially more output than horizontal farmers per acre while dramatically reducing environmental impact.

The standard mid-size Skyscraper Farm is 20 floors, equivalent to approximately 6.4 acres of farmland. However, the Company's pace of production is exponentially higher than that of field agriculture, ranging between 2.2 million and 4.5 million pounds of food each year depending on the types of crops grown. The lowest vertical production output applied to corn results is 2,250,000 pounds of corn per year compared with 11,980 pounds of corn produced through field agriculture. The 52-story Skyscraper Farm will be able to produce 4 million pounds per month!

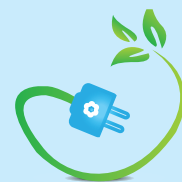
Traditional impact on Environment to be eliminated by Skyscraper Farms:

Land conversion & habitat loss
Wasteful water consumption
Soil erosion and degradation
Pollution
Poor adaptability to changing climate
Genetic erosion
Loss of biodiversity

USING SKYSCRAPER FARM HELPS THE ENVIRONMENT

ADVANCED EVOLUTION LABORATORY

The first floor of office space in each building will be dedicated to lab facilities for flagship institutional partners such as the National Science Foundation, the Advanced Research Projects Agency-Energy (ARPA-E) and Virginia Tech. These spaces will be advanced laboratories where researchers can selectively breed plants for enhanced flavor and increased nutrition profiles in a much shorter period of time and with drastically less resources.



ENERGY

The state-of-the-art integrated photovoltaic, geothermal and water turbine systems achieve energy independence and potentially generate excess energy while mitigating the environmental impact of fossil fuels associated with power production.

URBAN JOBS

Moving agriculture closer to population centers creates local job opportunities. Each Skyscraper Farm will create jobs from support and logistics and packaging and production line associates to supervisors and technicians. With an on-site training center, each Skyscraper Farm will act as a catalyzing center for community development by not only providing food but also supporting local economic growth.



WATER

Agriculture consumes 80 percent of the U.S. fresh water supply. Skyscraper Farm's water usage rate is 99 percent less than horizontal farming, making the Company's vertical farm highly drought-resilient and ideal for water-constrained environments.

FRESHER, TASTIER VEGETABLES

The average vegetable travels nearly 1,000 miles before it reaches the consumer, and some crops sit in storage for months. This process adds environmental and financial costs as well as reduces the quality, nutritional composition and taste of the vegetables by the time they reach the customers. By bringing production into urban and suburban areas, vegetables can arrive to the customer faster, fresher and at the peak of flavor.

LIGHT

To avoid reliance on artificial lighting, Skyscraper Farm uses a patented, overhanging design, combined with new glass technologies and controlled panel positioning to maximize sunlight capture. Incoming sunlight is not blocked by upper floors, and the sunlight penetrates the inner areas and lights up all of the plants. In areas with at least 200 days of sunlight a year, a Skyscraper Farm will maintain energy neutrality.

NO POISONOUS CHEMICALS

Skyscraper Farm's vertical farming system uses zero pesticides, herbicides and fungicides and completely eliminates destructive agricultural runoff that causes acidification, dead zones and algae blooms in rivers and oceans.



GRAYING OF AGRICULTURE

The average age of the American farmer is 55 or older, and the age of farmers is rising across the globe. Few young people are interested in becoming farmers, choosing instead to move to the city searching for alternate livelihoods. Vertical farming offers exciting new farming practices, and the high-technology requirements mean that Skyscraper Farms will create jobs for software designers, robotics engineers and greenhouse operators as well as laborers and farmhands.

Vertical farming as a local food market innovation

By Dr. Dawn Thilmany and Elizabeth Thilmany

Vertical farming is an emerging niche in the food supply chain, defined as the practice of growing food indoors by controlling all elements of its development.

As vertical farms are stacked, multi-story and typically aligned with large skyscrapers in densely populated urban areas, they can prompt mixed feelings about their aesthetics: Some observers believe they make urban areas feel green while others believe the structures will compete with their access to sunlight.

There are additional unique issues related to their role in food markets, the food environment and broader community impacts.

The nature of production

One potential benefit of vertical farming is its role in encouraging cities to become more self-reliant by producing at least some share of their food supplies. This may lead to more resiliency if there are natural or political events that disrupt our food distribution system. Plus, in an era of renewed interest in food-based economic development, a new generation of farmers may be attracted to vertical farming since their operations can be year-round and integrate high-tech solutions.

Still others see vertical farming as a potential innovation in real estate development — operations may be designed to be aesthetically pleasing, or, if rooftop development is used, permit buildings to conserve air-conditioning costs, and more broadly, help mitigate urban heat islands.

However, many potential benefits (eliminating food miles, reducing spoilage and food waste, better management of environmental implications from agricultural inputs) have yet to be evaluated.

Only a few successful vertical farms have been built, and both building and maintenance costs for a vertical farm are expensive, according to a 2014 article in the *Journal of Agricultural Studies*. In 2011, vertical farming pioneer Dickson Despommier estimated an upfront cost of \$80 million to build a commercially viable vertical farm and over \$6 million in annual energy expenditures (with other operating and labor costs above that).

One can quickly estimate that such investments are only possible if one is creative about the potential benefits that may accompany a vertical farming development, such as:

- A strong consumer base to create demand to provide a viable market for the local produce offerings as local produce is seen as a premium offering in mainstream food retailers and supply chains.

- The positive “spillovers” of such a real estate amenity, e.g., aesthetic, lifestyle or environmental benefits to the business, government or residential partners who



may help offset the original investment of operating costs. For example, a residential building may see vertical farming as an amenity akin to a golf course or fitness center for its tenants.

- The multiple ways vertical farms can benefit communities economically



retailers and chefs as well.

Through farmers markets, community-supported agriculture and farm-stands, direct-to-farmer consumer (DTC) engagement is found to be a value to a growing set of consumers — e.g., those who want to re-engage with their food



— acting as a food provider to education venue to source of starter plants that expedite production on surrounding farms.

Consumers as a catalyst for change

We can address some of the research that has been done as a starting point to consider these economic tradeoffs.

Consumer research on food buyers is newly focused on where, how and even why people make their food purchase decisions and confirms that local food is a key driver for several food industry changes. For decades, there has been increasing evidence farmers markets were growing as consumers sought to reconnect with their food sources, but increasingly, local foods have been identified as a key market trend by food manufacturers,

producer, perceive direct purchases as higher quality or believe they can verify that the farms and ranches they purchase from are better environmental stewards or an important part of their local economy.

Direct markets are not always practical for producers (who have too much volume to sell or they live far from consumer markets) or consumers (who perceive barriers to the locations or prices of direct markets). Thus, the majority of consumers experience local food only in the context of intermediated channels, the term used for food hubs or distributors that broker local foods to mainline retailers, restaurants and other large buyers. Within the U.S. food system, major food retailers see the integration of local foods

into their product offerings as one means to compete, but local sourcing by retailers can be challenging as consumers rely on in-store signage, product labelling and/or recognized farm brands to identify local items.

Since retailers entering the local foods space will need to pay particular attention to clearly and credibly communicating their retailer-farmer partnerships, perhaps they will seek nearby sources, such as vertical farms that are visible to urban dwellers. Yet, it may require vertical farms to engage their communities, be transparent with their production processes, and align with other values that local food consumers seek (e.g., environmental benefits, returns to the farmer, healthful offerings and fair treatment of workers). Since few locally oriented producers have the requisite scale and/or consistent quality to work with medium/large distribution or food retailer networks, vertical farms may be well-suited for intermediated local food sales. If consumers encourage their primary grocer to carry more local food offerings, vertical farms can seize the opportunity to be a key food source for their nearby retailers.

Vertical farming in communities

Urban agriculture, widely upheld as a solution to the food crises facing increasingly metropolitan populations, has seen a resurgence in recent years.

There are, however, potential disadvantages to this increasing drive for urban agriculture including associated urban health risks and threats to already limited water supplies. In response, cities such as Denver, New York City and Baltimore are bringing more permeable land to rooftops to capture and filter water in hopes of lessening the burden to overwhelmed sewage plants.

Clearly, the potential that controlled atmosphere systems, such as vertical agriculture, may have for addressing food security and economic development justifies a closer look, and public institutions are stepping up to that challenge. Expect to see more pilot programs of vertical agriculture aligned with real estate development such as Denver's Green Roofs initiative (<https://www.denver-greenroof.org/the-basics/>), or technical assistance from land grants such as University of Maryland's programs in Baltimore (<http://extension.umd.edu/baltimore-city/urban-agriculture>).

Still, it is important to realize these new innovations come with questions about best practices for production, and there is a need to develop a policy and regulatory environment that allows for this sector to operate effectively. As a response to new interest in urban farming as a potential food system investment in

» see **THILMANY** | C11

By Dr. Michael Evans

The production of food crops such as fresh greens (like lettuce and arugula) and herbs (such as basil) in vertical production facilities is part of a larger field of agriculture

often referred to as controlled environment agriculture (CEA). In addition to production of these types of crops in vertical facilities, production also occurs in such facilities as greenhouses and plant factories inside of converted warehouses and shipping containers. The types of crops most commonly grown in CEA production include tomatoes, peppers, cucumbers, strawberries and fresh greens and herbs.

Depending on the crops being grown, different types of production systems might be used in CEA, but the most common systems are nutrient film technique, floating beads, Dutch bucket systems and various types of gutter systems. These systems might be true hydroponic systems — in which the plant roots are suspended in a static or recirculating fertilizer solution — or a system that uses an artificial soil or substrate in which the plant roots grow.

Across all of the types of controlled environment structures, systems and crops, the production of food crops in CEA has been experiencing rapid growth in the U.S. In fact, Rabobank, a Dutch multinational banking and financial services company, reported that the value of U.S. greenhouse-grown food crops exceeded \$3 billion in 2013 and is expected to exceed \$4 billion by 2020.

The U.S. Department of Agriculture's statistics also support the conclusion that greenhouse-grown produce production has been rapidly increasing. Many factors have been reported to be responsible for the growth in greenhouse food crop production including reducing water and fertilizer inputs needed to grow crops, an ability to better program and have predictability of crops in CEA versus open fields, the ability to grow crops year-round and thus better serve the local markets, the ability to

Vertical farming: Bursting with promise — but unknown costs



potentially better use biorational disease and pest control, the ability to grow food crops on nonarable land, the ability to produce higher volumes of produce on limited land (especially with vertical farms), and the potential for reducing food safety issues as compared to open field production.

In addition to these factors, the growth of CEA was reported as being fueled by market and human factors. Karen Halliburton Barber of Rabobank noted in a report that, "There is a growing preference among U.S. retail and food service buyers for greenhouse produce." She also noted that, "The buyers are seeking the quality and reliability of supply that greenhouse products provide."

As a type of CEA, vertical farming

affords the opportunity to produce larger volumes of these crops per area than traditional field production. This is achieved by both the potential for year-round production and the multiple levels of production systems employed. Vertical systems also allow for the production of produce crops in areas where land is very limited or very expensive as is often the case with highly urbanized areas. However, compared to both field production and even traditional greenhouse (single level production) hydroponic production, the fixed costs and variable costs of production will be different for vertical farming. Some costs are likely to be significantly higher while others might be lower. Costs are likely to be spread over higher levels of crop production.

It is important to understand these costs. It is important also to understand the market. What is the target market? What crops does the market want? How large is that market and what are the prices for a given product that the market will tolerate are all important questions before deciding to move forward with any type of CEA operation — including vertical farms. Having a strong understanding of the crops to be grown, the level of production achievable, the costs of production and the market will increase the chances for a successful CEA business venture.

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Michael Evans, Ph.D., is director of the School for Plant and Environmental Sciences in the College of Agriculture and Life Sciences at Virginia Tech (@VTCals).

THILMANY

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communities, the U.S. Department of Agriculture has developed toolkits that offer up resources for both urban agriculture producers (<http://www.usda.gov/sites/default/files/documents/urban-agriculture-toolkit.pdf>) and the communities that want to assess their potential community and economic impacts (<https://localfoodeconomics.com/toolkit/>).

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Dawn Thilmany McFadden, Ph.D., is a professor at Colorado State University

and specializes in economic development related to food supply chains, focusing on market responses to consumer behavior. She has over 90 peer-reviewed publications and has presented to over 400 academic, industry, community and policy audiences. She is co-director for CSU's Regional Economic Development Institute and worked with the USDA on many projects, most recently a Toolkit on the Economics of Local Foods (localfoodeconomics.com). She has provided leadership to the Colorado Food Systems Advisory Council, Agricultural and Applied Economics Association, the Western Agricultural Economics Association, and the Food Distribution Research Society.

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Elizabeth Thilmany is an undergraduate student at University of Maryland-College Park studying Agriculture and Natural Resource Economics and has conducted research with Colorado State University on adding value along the wheat supply chain for a Foundation for Food and Agriculture Research project. On campus, she is involved with the Food Recovery Network and the Sustainability Department.

For more information on local food consumers and vertical farming, please read:

Banerjee, C. and L. Adenaeuer. 2014. Up, Up and Away! The Economics of Vertical Farming. *Journal of*

Agricultural Studies. 2, 1-21.

Bauman, A., D. Thilmany and B.B.R. Jablonski. 2018. The financial performance implications of differential marketing strategies: Exploring farms that pursue local markets as a core competitive advantage. *Agricultural and Resources Economic Review*. 1-28.

Bond, C., D. Thilmany, and J. Bond. 2008. "Understanding consumer interest in product and process-based attributes for fresh produce." *Agribusiness* 24(2):231-252.

Despommier, D. 2011. *The Vertical Farm: Feeding the World in the 21st Century*, second ed. St. Martin's Press, New York.



Locally grown foods: Fresh, delicious and nutritious



By Courtney Millen

In 2007, the New Oxford American Dictionary dubbed “locavore” the “2007 Word of the Year,” adding the term to its pages and solidifying the local food movement as a piece of American culture. From a grass-roots beginning to dictionary recognition to being spoofed on sketch comedies like “Portlandia” (“Ah [the chicken’s] name was Colin. Here are his papers.”), eating local is a trend that’s here to stay.

More than 10 years after the concept’s introduction, the emphasis on locally grown foods remains prominent. According to the National Restaurant Association’s 2018 Culinary Forecast, a focus on local foods occupies two of the top 10 concept trends, with “hyperlocal” claiming the highest spot (think chefs using restaurant gardens) and locally sourced produce coming in at No. 8.

So what nutritional benefits does local food offer and how does Skyscraper Farm distinctively provide those benefits?

First, let’s look at the national and global landscape of healthy eating

behaviors. According to the U.S. Department of Agriculture’s 2015-2020 Dietary Guidelines for Americans, fewer than 20 percent of Americans consume the daily recommended amount of vegetables (2.5 cup-equivalents for a 2000-calorie diet) and fewer than 30 percent of Americans consume the daily recommended amount of fruits (2 cup-equivalents for a 2000-calorie diet). Yet research consistently shows that increased fruit and vegetable consumption is part of a healthy eating plan, influential in weight loss and in lowering the risk of a variety of chronic diseases (cardiovascular disease, type 2 diabetes, some cancers).

Global intake of fruits and vegetables also falls short of recommendations, and in 2016, 3.88 million deaths were attributed to a diet low in fruits and vegetables according to an analysis of the Global Burden of Disease Study 2016. Additionally, even if the global population adhered completely to the Dietary Guidelines, growth to support such demand would require an additional 3.86 million square miles (roughly the size of Canada) of fertile land using current agricultural methods.

Enter Skyscraper Farm. With vertical farming practices utilizing sunlight instead of artificial light, Skyscraper Farm is uniquely positioned to sustainably combat the land-deficit problem while providing local, nutrient-rich produce.

With current consumption habits in mind, Skyscraper Farm provides two important shifts offering health benefits. The first relates to access. Skyscraper Farm increases access to healthy food, allowing consumers to make healthier choices. As explained in the 2015-2020 Dietary Guidelines for Americans, environment strongly impacts people’s eating

behaviors. These behavior changes may require additional resources such as nutrition education, but increased access through sunlight-driven vertical farming provides the option to select healthier items, which is a necessity when implementing a healthy eating plan.

The second shift that Skyscraper Farm provides relates to diet quality. When a fruit or vegetable is harvested at peak ripeness, the nutrient content is at its highest. When grown and sold locally, farmers can pick fruits and vegetables at peak ripeness and quickly bring them to market. Conversely, when fruits and vegetables are shipped a longer distance, harvesting occurs earlier than peak ripeness to reduce chances of bruising or overripening during storage and transportation. Those fruits and vegetables never reach their full potential for nutrient content. Additionally, fruits and vegetables are subject to nutrient degradation once harvested related to the effects of temperature, light, oxygen and water within storage and transport environments. The longer the timespan from harvest to table, the greater the vitamin, mineral and water content decreases.

As Skyscraper Farm increases accessibility to healthy food while improving the nutrient content of those foods, people within the community will be better equipped to increase fruit and vegetable intake, reaping the benefits of vitamins and minerals that aid in reducing the risk of chronic diseases. As access to fruits and vegetables becomes as common and convenient as access to less healthy foods, the potential for positive nutrition behavior change increases. Local, sun-ripened fruits and vegetables picked at their peak, offering the highest quality in nutrition and taste, will land on

plates shortly after harvest, providing the nutrient-dense options that fall within a healthy eating pattern. Locavores, rejoice.

Courtney Millen, MNSP, RD, is chief operating officer at Skyscraper Farm LLC. She is founder and lead dietitian of Palate Theory (palatetheory.com) and has worked professionally in food-service management, provided evidence-based nutrition counseling and conducted nutrition workshops in academic and military settings. Follow her on Twitter @palatetheory.

“Farm.” Portlandia, season 1, episode 1, IFC, 2011. Netflix, <https://www.netflix.com/watch/70222162>.

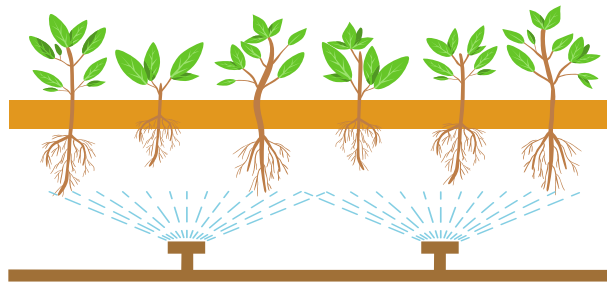
National Restaurant Association. (2018). What’s Hot - 2018 Culinary Forecast, 1-14. Retrieved from [http://www.restaurant.org/Restaurant/media/Restaurant/SiteImages/News and Research/Whats Hot/Whats_Hot_Culinary_Forecast_2018.pdf](http://www.restaurant.org/Restaurant/media/Restaurant/SiteImages/News%20and%20Research/Whats%20Hot/Whats_Hot_Culinary_Forecast_2018.pdf).

Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990 – 2016: a systematic analysis for the Global Burden of Disease Study 2016. (2017). Lancet, 390, 1345–1422. [https://doi.org/10.1016/S0140-6736\(17\)32366-8](https://doi.org/10.1016/S0140-6736(17)32366-8).

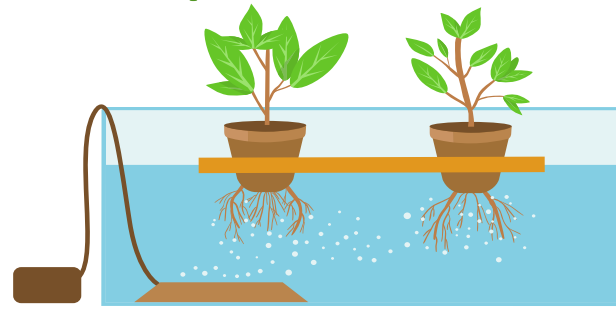
Rizvi, S., Pagnutti, C., Fraser, E., Bauch, C. T., & Anand, M. (2018). Global land use implications of dietary trends. PLoS ONE, 13(8), 1–12. <https://doi.org/10.1371/journal.pone.0200781>.

Rickman, J. C., Barrett, D. M., Bruhn, & M. C. (4179). Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 1. Vitamins C and B and phenolic compounds. Journal of the Science of Food and Agriculture, 87, 930–944. <https://doi.org/10.1>

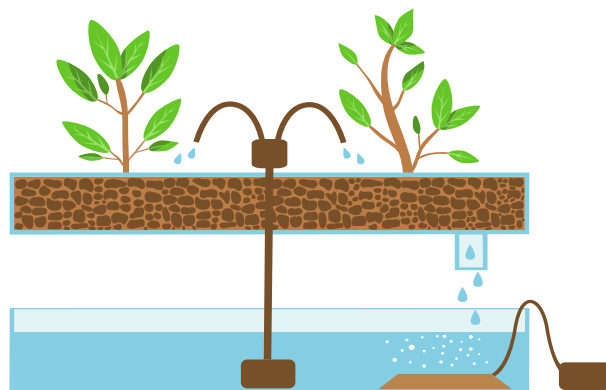
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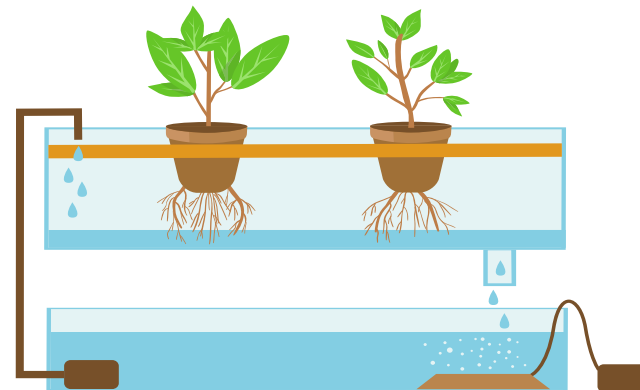
Deep Water Culture



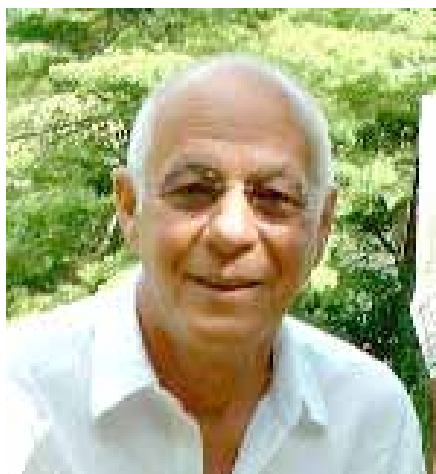
Drip System



Nutrient Film Technique



iGrow News: Informing the world on vertical and urban farming ecosystem



By Herbert H. Kliegerman

Grow News, launched in 2015, is the first and longest-running “exclusive” international online news publication for the indoor farming industry. One can rely on iGrow News for timely, accurate, unbiased news and insights.

The iGrow.News portal — as a one-stop site for all things in vertical and urban farming — covers industry-relevant topics including Indoor Vertical, Hydroponic, Aeroponic, Aquaponic,

Greenhouse, Rooftop, Container Farming, Residential Systems, Indoor and Urban Farming, New Ag Tech, Education, Finance, Innovation, Sustainability, and Technology.

iGrow’s ecosystem hosts an interactive community for freelancers, businesses and consumers and offers information on industry-related topics such as hydroponic equipment, seeds, sensors, beginning residential appliances for growing, LED lamps, CO2 systems and nutrients.

iGrow’s mission is to normalize the integration of vertical farming into the global economy, and as an emerging publication, iGrow offers free publishing to all companies in this nascent industry.

The initial unfolding of iGrow actually developed decades ago.

My professional career began in the late 1960s with the founding of the first publicly held real estate brokerage company, First Met Realty Corp., with offices in New York City, and a subsidiary urban redevelopment company, Development Corporation of American (DCA), in Washington, D.C. In 1973, First Met Realty was sold, and I founded several other real estate brokerage companies in the metropolitan



New York area.

For years, I used my brokering and financing skills in the real estate realm, but with life changes, my wife and I made a decision to rear our children in a culture with more connections to nature and healthy living.

Now I spend my time bringing people together in an industry that promotes health, wellness and sustainability. From providing the latest in urban development for commerce and housing to focusing on innovative ways to provide nourishment and improve our environment, I have worked to be a progressive thought leader and innovator.

Over the decades, I have seen:
— a cultural shift from the

consumption of fresh food to the consumption of processed foods.

— a marked upsurge in the use of and exposure to pesticides, herbicides, etc.

— a marked upsurge in decreased health caused by the consumption of unhealthy food.

— a disconnect with the earth and food as a source of direct nourishment.

It is the goal of iGrow to remedy these current realities by promoting controlled environment agriculture (CEA) as part of a healthy global economy.

iGrow continues to grow from a seed of thought to a relevant and disruptive tool that is necessary in the world today. Food is not just for our good health, it is also our most primary connection with the earth. As food researcher and author Frances Moore Lappe has said, “The act of putting into your mouth what the earth has grown is perhaps the most direct interaction with the earth.”

Herbert H. Kliegerman is the founder of iGrow.News and serves as its media curator, information editor and publisher. For more information, please write to Herb@iGrow.News. Follow on Twitter @iGrow.News.

Vertical farming and ‘soft power’



By Edward Timperlake

Whatever one’s religious belief, all can acknowledge that World War II was the closest humanity has come to unleashing what is symbolically known as The Four Horsemen of the Apocalypse: war, famine, pestilence and death.

However, that Hobbesian view of humanity can be offset by walking along a unique “trail” in D.C., called “The Peace Trail,” on our National Mall. <https://www.usip.org/peace-trail-national-mall>

One of the central points of note on the Peace Trail are four bronze statues. Two are known as “The Arts of War” and flank the entrance leading from the

Lincoln Memorial to Memorial Bridge, crossing over the Potomac River to Arlington Cemetery. The second two statues, “The Arts of Peace,” flank the road that runs parallel to the Potomac River.

The Arts of War have one word on each statue: “Valor” on one, “Sacrifice” on the other — appropriately so, given that the Memorial Bridge leads to Arlington Cemetery.

The Arts of Peace have carved in their stone bases “Aspiration and Literature” on one and “Music and Harvest” on the other.

No better connection of words embodies the power of human nature’s resiliency with pure joy as when these words, “Music and Harvest,” are joined together.

Those words take on additional importance when one reads that the stone castings were done in Naples, Italy, and they are a gift from the Italian people to the American people in 1950, just four years after the horrors of World War II.

From Roman engineers building roads and aqueducts to help harvests to the great “Green Revolution” beginning in the 1950s and continuing to this day, some of the best minds in the world have sought to meet the challenge of feeding humanity.

One key leader was Norman Borlaug, an American agronomist who is often called the father of the Green Revolution and who received the Nobel

Peace Prize in 1970 for increasing food production. His efforts to develop — and deliver — high-yielding varieties of cereal grains to India and Pakistan are credited with saving as many as a billion people from starvation. Additional elements of the revolution were helping farmers improve their irrigation techniques and get access to man-made fertilizers and pesticides.

Imagine, one brilliant man saving a billion lives! Thus, all people can appreciate that the advances in agriculture are a genuine “soft power” contribution to world peace: Impoverished nations will not have to fight for basic survival if they can simply feed their citizens.

From the great land-grant institutions to scientific research labs and schools such as Cornell’s College of Agriculture and Life Science, research pioneers have played an important dynamic role in advancing knowledge in growing nutritious food.

Now, agriculture in the 21st century is entering the practical and achievable dimension of vertical farming. This phrase — describing growing plants in multistory buildings rather than on a horizontal farm — was actually coined in 1915. But thanks to renewed efforts in development, it is now possible to move from the scientific linear approach of advancing yields from a horizontal farmer’s field to going vertical. This is a true step-function

into creating a “fourth Agriculture Revolution.”

There is tremendous promise when the best innovations of the Green Revolution are integrated into vertical farming, especially in urban and suburban settings.

Food insecurity is a concern for anyone living in a city. Poor quality, limited options and a fragile supply line are only some of the challenges in feeding people.

Looking at agriculture more broadly, many practices that have been used for decades — and even thousands of years — are breaking down and are ultimately unsustainable. Fertilizers produce chemical runoff that is polluting the water supply. This, in turn, has led to a number of aquatic “dead zones.” Huge amounts of water and land are needed to keep pace with the population.

Vertical farming can address these concerns in ways that greenhouses and regular urban farming can’t.

Picture several high-tech greenhouses stacked on top of each other. Now add in hydroponics, a fairly familiar growing technique that uses a third the amount of water required by regular agriculture.

Now think about a vertical farm using aeroponics, a technique that needs only a third the water of hydroponics and recycles the water so it can be used over and over.

Moreover, unlike some vertical farms, a new approach is to design the building to fully maximize sunlight to grow plants, with OLEDs (organic light-emitting diodes) as a supplement. OLED is like a protein bar for plants whereas sunlight is like dinner with all the fixings.

With greater use of vertical farming, some of the farmlands that are currently used in agriculture could be returned to a more natural state of better soil through carbon sequestration.

This, plus reduced water needs; multiple annual harvests; recycled waste; crops protected from disease and the elements; and real 21st century jobs, are just some of the benefits that can be brought by vertical farming.

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U.S. Marine Fighter Pilot Edward Timperlake, who owns a farm in Rappahannock County, Virginia, served in the Ronald Reagan and George H.W. Bush administrations and is a former assistant secretary with the Department of Veterans Affairs and former director of technology assessment in the Department of Defense. He has co-authored four books, including “Rebuilding American Military Power in the Pacific: A 21st-Century Showdown” (Praeger, 2013), and currently writes for Defense.info.



A national security perspective on vertical farming



By Dr. Robbin Laird

Since the very earliest wars, battlefield commanders have known that a successful strategy is to use food as a weapon. Vertical farming is a bold approach that will become a critical national asset — and will require protection.

Vertical farming — growing multiple crops in specially designed tall buildings in urban and suburban areas — is taking international farming into the 21st century. As urbanization accelerates in the 21st century and as many of the world's urban areas are by seas, ensuring the security of these areas — inclusive of provision of basic quality of life, such as food — is a key requirement and challenge.

When nations go to war, history has shown that control of sea lines of communication is an essential element of strategic war planning. Consequently, the most visible aspects of a nation flexing its muscle are airplanes and ships rather than other dimensions of national security such as the industrial heartland and the great agricultural farms.

However, history shows that the free movement of all logistics, including agriculture products, during times of crisis and actual war can be the key to eventual victory.

With vertical farming, the output of food is significantly larger than horizontal farm land. So fully understanding the need to militarily protect vertical farms as a critical national asset, greater output means much greater sustained deterrence.

An additional aspect of modern continental war is that flat or slightly rolling farmland is often a perfect battlefield for mechanized war. Tank engagements with infantry and combined arms artillery fires are very destructive

of harvests. That is the tragedy of Poland's and Ukraine's topography.

This is where 21st century vertical farming can make a major difference.

Vertical farming's infrastructure directly supports defense and security by reducing stress on transportation and delivery systems.

And one of the most important aspects of this infrastructure is the ability to provide for self-sufficiency without the need to rely on global supply chains and long-distance shipping. By removing choke-points for provision of basic sustenance of a nation, national security is enhanced and defense demands are reduced.

And for a country like the United States, which is a large federal system with several key urban areas defining its global reach, enhanced autonomy within those urban areas is paramount. Vertical farming provides both a self-sustaining flexible farming infrastructure for urban populations and increased redundancy to support operations from a variety of points of operation for U.S. forces. Global military installations with self-sustaining vertical farms might be a way for future mitigation of the need for global transportation of agriculture products.

Put in other words, the success of the vision of vertical farming is part of a 21st century renaissance in reshaping the infrastructure for the security of the nation. And when that vision is implemented in the urban areas of our partners and allies, an overall enhancement in infrastructure security is

clearly on the way.

Moreover, by introducing vertical farming in dense and packed urban areas in Third World nations, poverty

security system — these are part of the benefits that can be delivered by vertical farming.



could be reduced as well the demand side on countries like the United States that are often required to provide global assistance.

In short, agility in a much more efficient supply coupled with a commiserate reduced demand on the transportation system are major enhancements to the theory and practice of combat logistical planning to the national

Robbin F. Laird, Ph.D., is a senior military and security analyst and author of 16 books. He is a member of the Breaking Defense Board of Contributors (<https://breakingdefense.com>) and Editor of *Defense.info*, which looks at the changing global strategic environment.



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