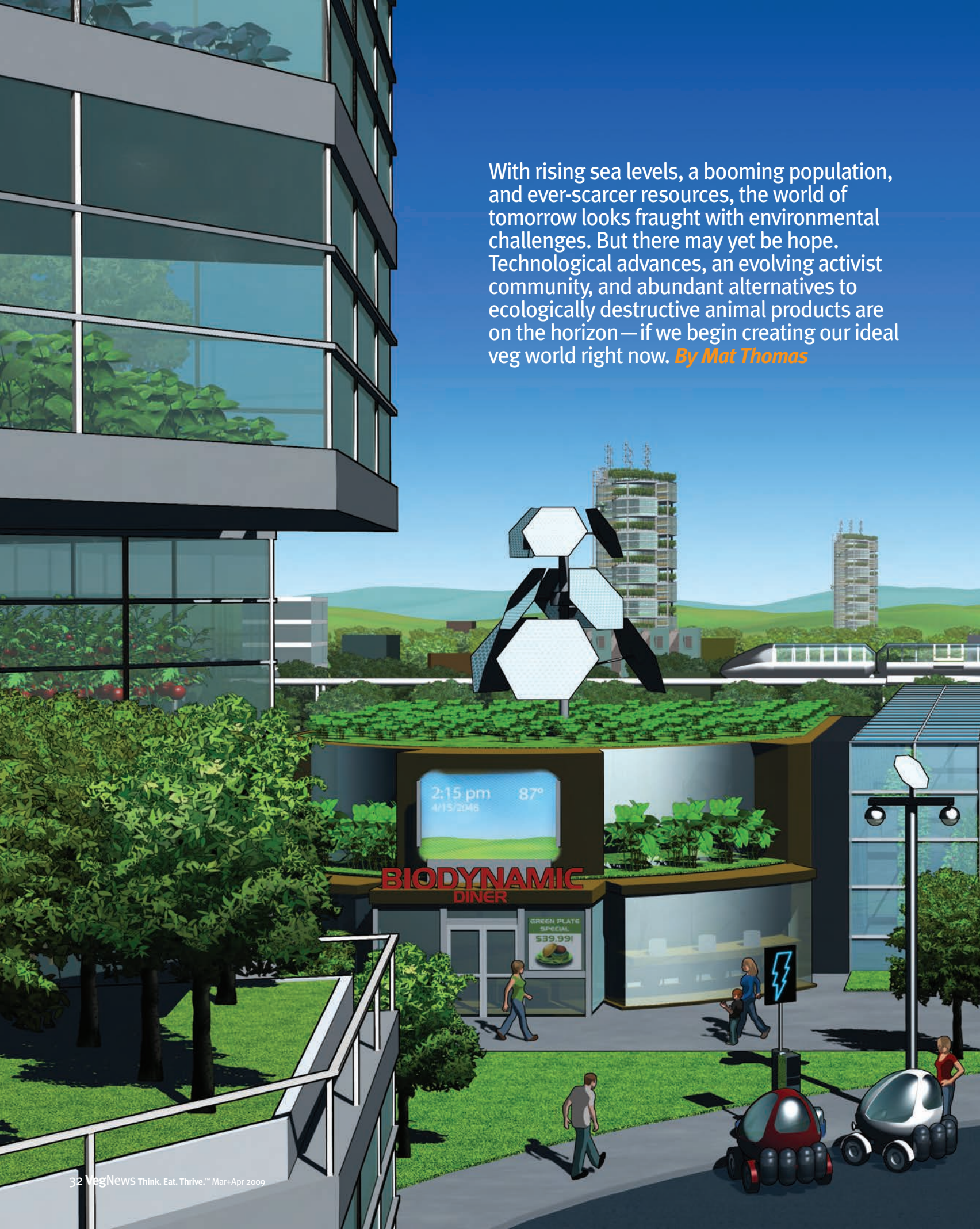
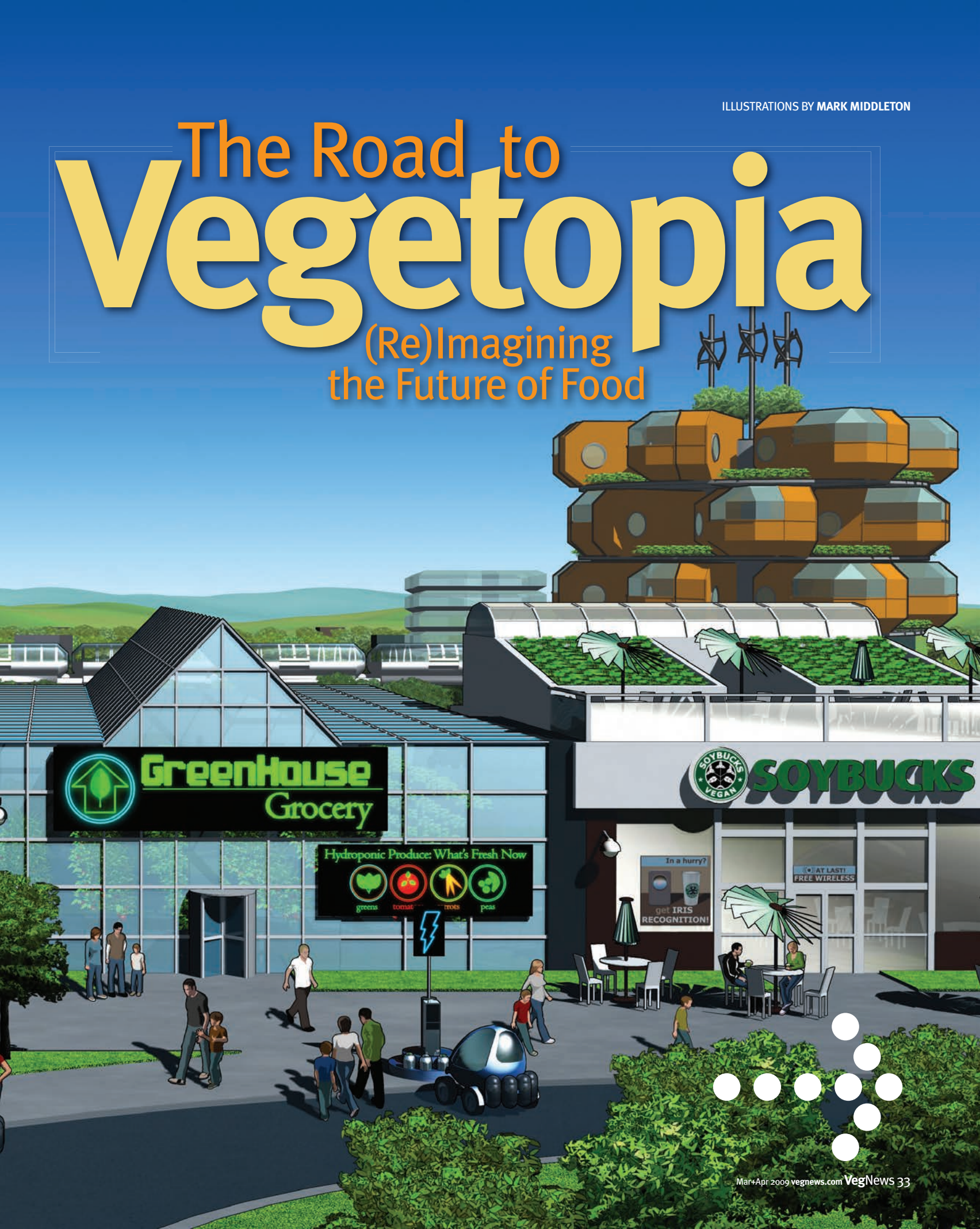
With rising sea levels, a booming population, and ever-scarcer resources, the world of tomorrow looks fraught with environmental challenges. But there may yet be hope. Technological advances, an evolving activist community, and abundant alternatives to ecologically destructive animal products are on the horizon—if we begin creating our ideal veg world right now. ***By Mat Thomas***



ILLUSTRATIONS BY **MARK MIDDLETON**

The Road to Vegetopia

(Re)Imagining the Future of Food



THE MORE OPTIMISTIC PREDICTIONS OF half a century ago had us all flying around in rocket cars, vacationing on Mars, and subsisting on astronaut food by 2009, but apparently the future didn't go quite as planned. Perhaps it did in some parallel universe, but here in *our* reality, we're immersed in a world of iPods, Obama, and nascent global warming—which, from the 1950s perspective of record players, legalized segregation, and 30-cents-a-gallon gasoline, is really just as improbably far-fetched as the one envisioned for us. But, you may wonder, what bearing does this have on vegetarians?

Quite a lot, actually, but the truly salient question is, *what does vegetarianism have to offer the future*—the next 10, 50, 100 years? The answer concerns not only those who adhere to a humane way of life, but all of humanity, as well as most other Earthlings. Given the current state of our planet and where we may be headed, it is certainly one of the most crucial issues we face.

The future is the ultimate frontier: it is by definition unknown, and will always be there waiting for us as long as we are around to live through it. Let us "boldly go where no one has gone before" by taking a wide-ranging (and admittedly speculative) look at what we may have to look forward to … and how we can help shape tomorrow starting today.

First, brace yourself for the bad news …

Climate Change, Overpopulation, and Food Scarcity

Given rising temperatures and birth rates, the world of the future will be both hotter and more crowded. By 2050, Earth's human population is expected to exceed nine billion—up from more than six billion today—while global temperatures increase by three degrees Fahrenheit or more, with potentially catastrophic effects on agricultural output.

Climatologists warn that the frequency and intensity of hurricanes and other "superstorms" will only increase as global temperature rises, and that many parts of the planet will also be blasted by heat waves and droughts that could make some regions all but uninhabitable. Meanwhile, the world's coastal cities and island nations may be completely submerged when Arctic glaciers melt and sea levels rise around the globe. The Intergovernmental Panel on Climate Change estimates that, by 2100, global sea levels will rise between seven and 23 inches. An increase of several inches would flood much of Florida's coastline, and leave New Orleans (which is two feet below sea level) underwater. However, this is a conservative conjecture that does not account for the fact that the Greenland and West Antarctic Ice Sheets collectively contain enough ice to raise global sea levels by *more than 40 feet* if they melt.

Agriculturally, those hardest-hit by rising sea levels would be low-lying nations including Indonesia, Thailand, Egypt, and Bangladesh. In other regions, the biggest impact of flooded coastal cities would be the mass-migration of populations to inland and higher-elevation areas—where they may not be welcomed with open arms if food, water, and other basic necessities are already in short supply.

Humans would not be the only ones forced to abandon their habitat: wild-animal populations would also be displaced, and some are already migrating further north as global temperatures increase. A 2004 study published in the journal *Nature* concluded that between 15 and 37 percent of all species studied are "committed to extinction" by 2050 based on mid-range climate-warming scenarios. What's worse is that as agriculture outputs decrease, hunting and poaching are likely to increase, further endangering animals already threatened with eradication.

Animal agribusiness accounts for 18 percent of all greenhouse gasses—a full five percent *more* than all of the world's cars, trucks, trains, and planes combined.

One of the main culprits in the climate crisis is modern industrialized animal agriculture. In 2006, a study by the United Nations Food and Agriculture Organization warned that animal agribusiness accounts for 18 percent of all greenhouse gasses—a full five percent *more* than all of the world's cars, trucks, trains, and planes combined. Some of these noxious emissions result from cow belching and flatulence, but much worse is that nearly one-third of all landmass on Earth is used for grazing livestock, and that much of this "pasture" was created by cutting and burning down forests which would otherwise absorb carbon dioxide. Plus, farm animals generate approximately 130 times the amount of feces produced by the entire human population, and this typically untreated waste spews nitrous oxide (a greenhouse gas that is nearly 300 times more potent than CO_2)

FutureFood Production

Agricultural innovations are—and will continue to be—determined by a complex interrelation of social, economic, and environmental factors that make prognostication tricky, to say the least. Nevertheless, here are some of the food-production techniques likely to expand and develop over the next few decades that could help promote the shift to a plant-based diet.

Veganic farming— Farmers produce *truly* vegan fruits, vegetables, and grains by only using fertilizer made from vegetable compost, rather than types containing animal products or by-products, such as feces or bone meal. The veganic label may not be a selling point for mainstream consumers, but it will capture a core demographic of ethically motivated vegan consumers wanting to eliminate *all* financial support for the exploitive animal agriculture industry from their diets. Demand will gradually rise as more vegans redefine the meaning of "vegan" food and refine their diets toward this evolving ideal.

directly into the atmosphere.

Bringing us to the *really* bad news, which is that global meat consumption is expected to *double* by mid-century, propelled by rising populations and incomes in China, India, and other developing countries. The animal-agriculture industry already consumes vast amounts of resources, including more than half the water and one-third of the petroleum used in the US, as well as 90 percent of the grain we grow. It therefore seems insane to amplify the very behavior that is already responsible for so much suffering and death, and imperils our species' very survival.

Meanwhile, the solution to this self-made existential crisis is staring humanity right in the face, but most people still refuse to acknowledge the obvious: that if we do not drastically decrease our reliance on animal flesh as a dietary staple, we will literally eat ourselves to death (along with thousands of other species).

Future Factory Farms

If meat consumption rises from 280 million to 560 million tons a year four decades hence, we can only assume that the current system of intensively raising livestock on factory farms is going to continue unabated, and even accelerate. Is it possible to produce such large quantities of flesh-based food sustainably and humanely? The short answer: no.

Jim Mason, who co-authored *Animal Factories*—one of the first books to examine and define factory farming—with Peter Singer in the 1980s, said trying to make industrialized animal agriculture eco-friendly is like "increasing the fuel efficiency of a Hummer by streamlining the side-view mirrors." Sure, Concentrated Animal Feeding Operations (CAFOs) can take measures such as capturing and burying methane to offset some of their environmental impact, "but these are a drop in the bucket against the inherent inefficiency of using animals as converters of plant protein and energy. Even pumped full of steroids, a steer will still only return about five percent of the protein he eats in the steak made from his body."

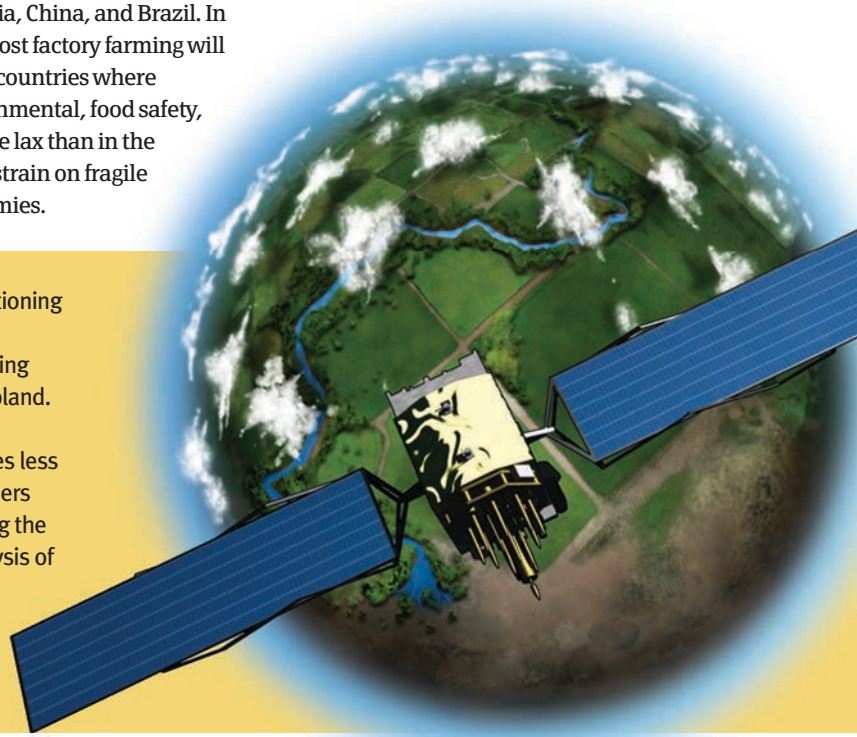
As Mason points out, when small farmers invented battery cages, gestation crates, and the other core mechanisms and methods of factory farming back in the 1940s, it was to maximize productivity and profit, *not* promote environmental sustainability or animal welfare. And the equation remains the same today—except that per capita US meat consumption has more than quadrupled since then, escalating ecological havoc and animal cruelty to new heights. Mason asserts that "it simply isn't possible to produce the massive quantities of meat on the market today without fundamentally defiling the environment and abusing animals."

In the future, increased production of meat, dairy, and eggs will be accomplished by spreading the factory-farming system pioneered in the US to countries where consumption is rapidly rising. Tyson Foods, the world's largest meat producer with about $27 billion a year in sales, already has a plan in the works to export its vertical-integration business model on a global scale by investing heavily in CAFOs in India, China, and Brazil. In the coming decades, most factory farming will probably take place in countries where animal welfare, environmental, food safety, and labor laws are more lax than in the US, placing additional strain on fragile ecosystems and economies.

On the US animal-welfare front, there are signs that modest reforms are on the way. In November 2008, California voters approved a ballot measure to ban battery cages for egg-laying hens, gestation crates for pregnant sows, and veal crates for male calves by 2015, making the progressive Golden State the first to pass a law regulating the treatment of chickens, who account for about 90 percent of farm animals. It is likely that other states, one by one, will eventually follow suit.

But that doesn't mean that animals will have it any better than they do today, if factory farms continue cramming them into ever-shrinking spaces. One way corporate entities may deal with the concerns of consumers who care about animal suffering is to turn factory farms into "spas" where animals are "pampered" with techno-luxuries before entering the slaughterhouse. And there are already indications that they are headed down this path.

For instance, a model dairy farm in New Zealand boasts the latest in cutting-edge gadgetry aimed at limiting worker contact with animals and making them more comfortable. Robotic milkers automatically clean the cows' udders and use computerized sensors to siphon mammary secretions into cups, while vibrating massagers soothe bovines waiting in line to be tapped. Another wheeled robot can be programmed to bring feed to animals any time of day or night.



Precision farming— Using cutting-edge technologies like Global Positioning Systems (GPS), computer grids, and aerial satellite imaging to monitor and address soil conditions, groundwater levels, and myriad other factors affecting plant health, precision farms focus on the biodiversity and variability of cropland. This approach improves efficiency and productivity, increases cost savings through conservation of land and resources, reduces crop loss, and produces less environmental runoff than conventional agriculture. Some Midwestern farmers are already practicing precision agriculture with promising results, indicating the potential for more sophisticated topographical mapping and chemical analysis of future farms down to the square inch.

Taken to its logical extreme, *The Meatrix* mode of factory farming could theoretically quell consumers' ethical concerns while continuing to produce huge quantities of animal products by creating an automated environment aimed at maintaining exploited animals in a perpetual state of oblivious contentment. Using treadmills, sensory-stimulators, and some form of virtual reality, producers could keep animals closely confined in high-tech contraptions that enable high population densities inside climate-controlled sheds. When this system is "perfected," advertising executives will market the concept that "Today's farm animals have it better than most people!"

Another move meat producers are likely to make is tinkering with farm animals' DNA to manufacture "designer" progeny whose bodies are built specifically for the artificial factory-farm environment. Such *transgenic* creatures could include pigs with human-like toes in place of hooves that enable them to withstand hard concrete flooring, or chickens with lips instead of beaks (see p. 39). Other animals will be tailored to consumers' taste for recombinant novelty by merging different species into new ones, like the hybrid sheep-goat (or "geep") first created in 1984.

Between the threat of global warming and the monstrous abominations of future factory farms, it may seem like we're headed for a house of horrors straight out of our worst nightmares, but don't despair: there's plenty to look forward to. Vegetarians are a hardy breed with a proud lineage, and the world of tomorrow will bear their stamp in some very significant ways.

Supermarket Shopping Spree, 2034

In the supermarket of the future, the produce section is more garden than grocery, with organic hydroponic fruits and vegetables growing in floor-to-ceiling rows. Enter through the glass doors of the walk-in greenhouse to browse the selection, and feel free to pull items fresh from the vine, but be careful—you pick it, you buy it (sorry, store policy, posted clearly on interactive telescreens throughout the section). Looking for something a little less pricey? Check out the pre-picked produce, and scan the barcode stickers with any of the infrared-sensor guns holstered on the bins for information about each plant's origin, ripeness, nutritional content, and whether it is genetically modified or cloned.

In the mood for burgers tonight? A wide selection of lab-grown meats—including ground beef and turkey, chicken nuggets, fish sticks, and panda patties (see p. 38)—takes up two long aisles of self-dispensing solar-powered refrigerators: just touch the image of the item you want and it slides right out. Changed your mind? Hold the package up to the slot and a pneumatic vacuum will gently retrieve it from your hand and place it back on the shelf.

Tucked away in the back corner behind a retracting curtain (like the "adult" section of an old-school video store) is the "specialty foods" section, where you can purchase eggs, milk, cheese, and cuts of meat trucked in from slaughterhouses. That is, *if* you can afford the exorbitant prices: without agricultural subsidies for cheap grain, a "real" chicken breast costs about 25 times as much as lab-grown chicken meat. And, of course, you have to listen to the butcher's legal disclaimer about cardiovascular disease, salmonella poisoning, and avian flu, and give your verbal consent verifying that you were informed of and accept the health risks involved in consuming actual animal flesh. But then, you're already vegetarian, so there's no need to reiterate this, right?

A Market for Change

According to a report by the Humane Research Council (HRC), a nonprofit consulting group focusing on animal advocacy, there are between 2.8 and 3.6 million adult vegetarians in the US as of 2008, and about twice as many self-defined vegetarians. Of these, somewhere between 425,000 and 766,000 are vegan. "At one to three percent of the entire population, vegans and vegetarians are a blip on the demographic radar," notes HRC's executive director Che Green. "Statistically speaking, we're below the margin of error for most surveys."

Still, the number of vegetarians and vegans is likely to rise in coming years, especially considering that the number of 8-to-17-year-old vegans is somewhat higher than the adult population. Plus, the proportion of semi-vegetarians is even more striking, with a

Robotic farming— The precision farms of tomorrow will likely be teeming with highly advanced "agrobots" performing a variety of specialized duties, from pulling weeds and applying pesticides to diagnosing and treating diseased plants. Field robots would be compact enough to patrol 30-inch-wide crop rows, and use lasers or web cams to distinguish between weeds and edibles. While robots would be autonomous, they would also be wirelessly linked to the internet, and have the ability to communicate with one another and work together as a team. A tractor controlled by a GPS satellite signal is currently on the market, and University of Illinois engineers have developed experimental prototype agrobots.

2005 HRC survey indicating that 13 percent of respondents eat meat at fewer than half their meals, and that one-quarter had reduced their meat consumption in the past year, which may mean there are a whole lot of vegetarians-in-the-making out there right now.

Green's most optimistic speculation for the future is that 10 to 12 percent of the US population will be vegan or vegetarian by mid-century, and that the number will only grow exponentially from there as this group has a "multiplier effect" on others, pushing society towards a tipping point that establishes veganism firmly in the mainstream. The twin keys to achieving this goal, Green believes, are "effective animal advocacy that emphasizes providing consumers with non-animal alternatives, and economies of scale for meat substitutes and lab-grown meat that make them cheaper. These two tendencies will work in tandem to make humane lifestyles both more attractive and convenient."

As a managing partner at Humane Capital, LLC, a financial firm specializing in socially responsible investing, William Christopher Kerr makes it his business to track the marketing trends that will most affect veganism's prospects for the future. According to Kerr, "Consumerism is the most powerful form of advocacy, and vegans are in a unique position to use that to our advantage. We're 'early adopters' of emerging animal-free products and services, which makes us good at identifying 'latent demand' or 'potential industry earnings'—essentially, the ability to see market opportunity for something before it hits the mass market. When all factors (meaning price, availability, health, taste, performance, and safety) are basically equal, consumers tend to choose more humane products. So, by purchasing, providing, investing in, and promoting high-quality animal-free products, the animal-protection movement can attain behavioral change in the marketplace by making it progressively more vegan-oriented."

Massive financial incentives and subsidies are proffered to producers of cash crops and intensively farmed animal products.

At present, however, the system is stacked against the emergence of a vegan economy, and healthy eating in general, by government policies prioritizing caloric quantity over nutritional quality. The problem is that massive financial incentives and subsidies are proffered to producers of cash crops and intensively farmed animal products. In fact, the two are closely linked: for decades now, federal Farm Bills have handed out payments to farmers for growing huge harvests of corn, soy, and other crops that are also fed to livestock, thereby artificially lowering the sticker price for meat, dairy, and eggs. Meanwhile, so-called "specialty crops," such as fruits and vegetables that are eaten directly by people are ineligible for most government assistance programs, making it harder for farmers who grow them to compete with animal products.

Vertical farming— Forty percent of Earth's land surface is already devoted to agriculture, so how do we feed an exploding human population as arable landmass shrinks due to the effects of global warming and other factors? One answer is to erect "skyfarms" in the midst of major urban centers. Columbia University's Dickson Despommier, PhD, proposes constructing self-sustaining 30-story "vertical farms" that could each free up thousands of acres for reforestation, provide 50,000 people with hydroponic food and purified water (through evapotranspiration), and enhance any city's skyline. Though building a prototype would probably cost $20 to $30 million, Despommier estimates that we'll see one within 10 years.

To fix the system, national food policies of the future must reflect our society's core values by supporting human health, rural communities, and animal welfare. This can be done by redirecting government subsidies *away* from the largest corporations profiting the most from unfair advantages, and *toward* those using sustainable production methods such as organic farming to grow food for *people* that is actually *good* for us. Future farm bills must also force CAFOs to clean up the mess they make of the environment, stop passing this hidden cost off to taxpayers, and include provisions for ensuring basic animal-welfare standards.

The increased availability and variety of vegetarian foods—from faux meats and cheeses to fresh fruits and veggies—provides perhaps the most convincing incentive for people to go veg, or at least reduce their consumption of animals. The possibilities for growing the market for these products in the coming decades is essentially limitless, but until we integrate commerce with sensible government reform that puts the interests of animals, people, and the planet above corporate profits, progress will be severely hampered.

The Evolution of Animal Advocacy

Society is going to change drastically in the 21st century, and animal advocacy will have to change along with it to do the greatest possible good. But how much can animal advocates expect society to change in their favor within this timeframe, even under the most ideal circumstances? Matt Ball, co-founder and executive director of Vegan Outreach (VO), provides an answer grounded in more than two decades of animal activism.

"Some vegans like to think that we will bring about a major change in society, altering people and institutions at a fundamental level that will leave our country unrecognizable from what it is today," he notes. "But looking at history and the nature of eating animals, I don't think there will be huge impacts along these lines. Society, as a whole, won't be composed of animal advocates. In the future, everyone won't think like many vegans do today. It will simply be that eating veg meats and *in vitro* meats will be the norm, because it is cheaper and in no way a sacrifice."

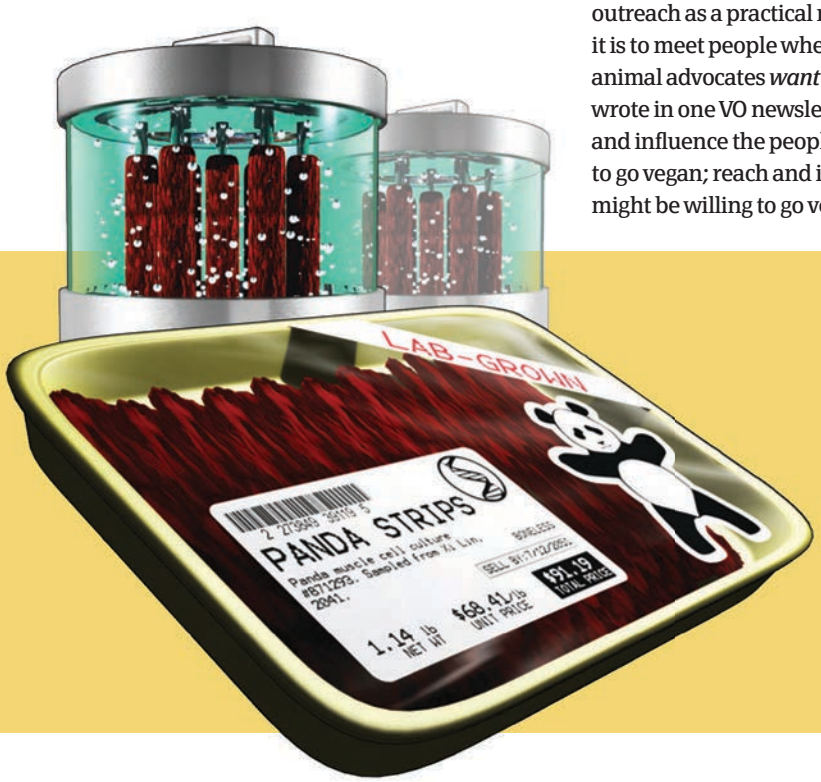
VO's approach, simultaneously pragmatic and forward-thinking, focuses on engaging those who are deemed most open to lifestyle changes: namely, the young, and, in particular, college students. Perhaps more importantly, its philosophy extends well beyond mere "vegan" outreach as a practical recognition of how vital it is to meet people where they *are*, not where animal advocates *want* them to be. As Ball wrote in one VO newsletter: "We must reach and influence the people who might be willing to go vegan; reach and influence people who might be willing to go vegetarian; reach and influence the people who won't (now) go veg, but who might stop buying meat from factory farms—and help support all of these people as they continue to evolve as consumers. Outreach efforts to all of these people are necessary if we are to help a large and diverse society evolve to a new ethical norm."

If there's one thing the sprawling future surely will be, it's diverse. Consider, for example, the US Census Bureau projection that more than half of all children will be "minorities" by 2023, and that by 2042, minorities will comprise the majority of the US population. Animal advocates will have to take shifting demographics into account to persuade society at large to embrace their ideals.

> Every day brings us closer to tomorrow: the mysterious world that will resemble our present reality, yet differ in unpredictable ways.

As a Latina, Food Empowerment Project (FEP) founder and executive director Lauren Ornelas understands that people of color have different life experiences than many animal-rights activists, and fashioned her organization's mission around that principle. The causes FEP primarily focuses on are farm-animal abuse, factory farming's environmental impacts, working conditions for farm laborers, and the lack of healthy food choices in low-income areas. Ornelas asserts that each one of these issues is just as important as the other, and that they are all closely interconnected.

"One thing that animal advocates need to appreciate is that environmental injustice is deeply embedded in the structure of our



Lab-grown meat—Take a few cells from a living animal, nurture them in a vat of chemicals, and *voila*: edible meat without the suffering and death! That's the basic idea behind lab-grown meat, which researchers hope will arrive at a supermarket near you by 2020. If commercially successful, lab-grown meat could spell the end of factory farming, and the environmental damage and animal suffering it causes. The most recent developmental breakthrough, says biologist Jason Matheny, is "Dr. Klaas Hellingwerf's success in using recombinant bacteria to produce growth factors, which is much less expensive than other mediums being used, and will help make it possible to manufacture meat on a mass scale using industrial bioreactors."

society," she declares. "It's something that people of color in low-income communities have to deal with all the time because polluters like to set up shop there, betting that the people don't have the resources to defend themselves. To reach these people, animal advocates need to understand and respect that they may be facing more urgent problems, like feeding their children or keeping toxic waste out of their backyard. But we can still promote veganism as long as we tailor our message to address their concerns, which means explaining how their dietary choices directly impact their lives, from their families to the environment."

To truly invite people of color to be an integral part of animal advocacy, the movement will also have to become more conscious of and sensitive to institutionalized white privilege, entitlement, and racism, while at the same time moving beyond the single-issue approach to animal protection. Historically (with notable exceptions), people of color have been either invisible to animal protectionists, or used to illustrate the oppression of other species by comparing the suffering of animals to the struggles of minority groups—unfortunately, without consulting people first to determine whether good intentions are getting across to the target audience. Both ignoring and offending people of color alienates them from speaking up for non-humans, drastically reducing the number of prospective animal allies and doing a disservice to our cause.

The animal-advocacy movement is generally stereotyped as white and economically advantaged, but this oversimplification marginalizes the many vegetarians of color whose concerns are often pushed aside in the single-minded pursuit of protecting animals from torture and death at the hands of humanity. At this historic moment, with the first African American president recently installed in the Oval Office, animal advocates are called to reflect on how they can make the humane movement as inclusive and powerful as possible for the betterment of all.

The Future is Ours to Make

Just as the present is a product of the past, so will our actions today ultimately determine our future. We are living through an era that will be gone before we know it, so let's make the most of the time we have. Every day brings us closer to *tomorrow*: the mysterious world that will resemble our present reality, yet differ in unpredictable ways—a prospect that can be very scary, but also exhilarating.

It takes courage to face the unknown, and even more to confront it head-on, especially when the road ahead appears treacherous. But what choice do we have? We either stick our heads in the sand, fearing our fate, or march onward toward our clearest vision of the promised land.

And just what does *that* mean? Well, whatever you want it to. It's the vision in your head, in your heart, of who you want to be, and what you want for others—those living now and yet to be born. Everyone has a stake and a say in the future, and there's no better time to start creating a veg-friendly world than now. VN

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Human-Made ChickenEvolution

Gallus gallus
(Red Jungle Fowl, circa 1900)

Gallus gallus domesticus
(Domestic Leghorn, circa 2009 physically debeaked)

Gallus gallus nuChix™
(nuChix™: New! From Transimal Labs circa 2050, genetically debeaked and defeathered)

Replication — Unbelievable as it may sound, some scientists predict that by mid-century, nanotechnology (the manipulation of matter on the atomic and molecular level) will have advanced to where we will be able to create food in home replicators. Nanoparticles are already present in hundreds of consumer products, from water-repellent fabrics to computer components, but if smart swarms of self-replicating microscopic nanobot "assemblers" can be designed, they can be programmed to arrange atoms to recreate just about anything—including food. While such a nanotechnological leap forward would radically transform humans and the rest of the world in ways beyond imagination, it could also turn the entire planet into "grey goo," should someone invent an assembler that can function outside of the replicators.