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### **Why We'll Succeed in Saving the Planet from Climate Change** by Emma Marris

MY MOTHER'S BROWN HAIR is long and parted in the center. She is sewing a eucalyptus seed-pod to a dress made of pale green drapery fabric, laughing with her friends. She is 19 years old.

It is February 1970, a few months before the first Earth Day, and students at San Jose State College in California are throwing a "Survival Faire," during which they plan to bury a brand-new yellow Ford Maverick. The Maverick and all combustion engines are to be declared dead because they belch pollutants that have helped create vile, ground-hugging smog in San Jose and cities around the world. The Maverick, San Francisco Chronicle reporter Paul Avery wrote, "was pushed through downtown San Jose in a parade led by three ministers, the college band and a group of comely coeds wearing green shroudlike gowns."

My mother remembers those gowns well, 50 years later. The students that day were worried about dirty water and overpopulation as well as dirty air, but my mother was optimistic. "I assumed that human beings would step up when we had to," she says. And to an extent we did: Cars in the United States are 99 percent cleaner than they were back then, thanks to pollution laws.

I didn't inherit my mother's brown hair or her sewing ability. At 41, I still take my clothes to her for repair. But I got her optimism—and these days we have new things to step up about. After 15 years of reporting on the environment for scientific and popular publications and for a book on the future of conservation, I am still frequently overwhelmed by the web of problems that face us: climate change, dwindling populations of wild plants and animals, widespread environmental injustice. They're all harder to fix than smog. But in the midst of a swirling sea of sorrow, anxiety, fury, and love for the beautiful weirdness of life on Earth, I find an iron determination to never, ever, give up.

What gives me hope? We already have the knowledge and technology we need to feed a larger population, provide energy for all, begin to reverse climate change, and prevent most extinctions. The public desire for action is bursting forth on the streets. Last September some six million people worldwide went on "climate strike." Just as in 1970, the electric crackle of cultural change is once again in the air. I believe we will build a good 2070.

It will not look like 2020 or 1970. We cannot undo what we've done; we cannot go back in time. Change—ecological, economic, social—is inevitable. Some of it will be tragic. We will lose things we love—species, places, relationships with the nonhuman world that have endured for millennia. Some change will be hard to predict. Ecosystems will reshuffle, species will evolve.

We will change too. Many of us will learn to see ourselves differently, as one species among many—a part of nature, not in opposition to it. I predict that we will look back at the late 20th and early 21st centuries as a painful, turbulent transition, during which humanity learned to thrive in positive ecological relationships with one another and with the species around us.

OUR BIGGEST SHARED CHALLENGE is climate change. If it seems overwhelming, it's in part because we, as individuals, can't stop it. Even if we're perfect green consumers—refusing to fly, reusing shopping bags, going vegan—we're trapped in a system that makes it impossible to stop adding to the problem. Living requires eating, getting to work, and staying warm enough

in winter and cool enough in summer to work and sleep. For now, it's impossible to do these things in most places without emitting carbon.

But change can happen faster than many people appreciate. Cars replaced horses within 15 years in many places. For thousands of years we got along without plastic, and then in a few decades it was everywhere. Throughout history, we've been both ingenious inventors and quick to adopt new technologies. With popular will and the right policies, we'll have no problem creating new energy and transportation infrastructures, goods made without toxins or carbon emissions, biodegradable plastic substitutes.

As individuals it's much more effective to spend our energy demanding those policies, which will make going green the cheaper, easier path, than it is to buy the expensive, niche-market green options available today. Increasingly I am seeing people realize this, and that too gives me hope. We cannot solve the climate crisis by being "good" consumers. But we absolutely can make things much better by being good citizens.

A quarter of emissions come from electricity and heat generation. Happily, with the political will, these are also the easiest emissions to eliminate. "We could easily cut it in half in 10 years," says Jonathan Foley, the executive director of Project Drawdown, which does cost-benefit analyses of climate change solutions. Wind and solar power are mature enough to deploy on a massive scale, and batteries to store the power—both centrally and house-to-house—are getting better and cheaper. Meanwhile, coal companies are going bankrupt.

Agriculture, forestry, and land use are trickier. They produce another quarter of our emissions—mostly nitrous oxide rising from manure or synthetic fertilizer, methane belched by livestock, and CO<sub>2</sub> from burning fuel and fields. By 2070 there may be more than 10 billion of us to feed. How do we shrink the land and climate footprints of farming and still produce enough calories to go around?

One solution is to stop subsidizing meat production and to encourage society-wide shifts to more plant foods. Beef in particular takes the most land and water; to grow a pound of it, you have to feed the animal about six pounds of plants. Luckily there's hope, in the form of tasty new meat alternatives such as the Impossible Burger or Beyond Meat. I don't imagine everyone will be vegan in 2070. But most people will simply eat far less meat than they do today—and probably won't miss it.

What about farms themselves? Environmentalists tend to fall into two camps. One camp says farming must intensify, using robots and GMOs and big data, so as to produce an astronomical amount of food on a tiny footprint. The other camp says farms must become more "natural," mixing crops and reducing toxic chemicals while leaving the borders of fields as wildlife habitat. After years of reporting on this, I wonder: Why can't we do both? We can have some urban "vertical farms" in skyscrapers running on renewable energy. We can also have large outdoor farms that are high yield and high-tech, friendly to wildlife and actively storing carbon in their soils.

The rest of our carbon emissions come from industry, transportation, and buildings. These are the ones that keep Foley up at night. How will we retrofit billions of buildings, replacing gas and oil furnaces? How will we wrestle some 1.5 billion gas-guzzlers off the roads? We can't count on hippie undergraduates to bury them all.

The only real option is for governments to drive the change with tax incentives and regulations. In Norway half of new cars registered are now electric, in large part because the government exempts them from sales tax, making them as cheap as gas-powered cars—the sale of which will be banned by 2025. In New York City the city council last spring adopted a law that will require large- and medium-size buildings to cut their carbon emissions by more than a quarter by 2030. Converting an entire country like the U.S. to efficient buildings, easy mass transit, and electric cars won't be cheap—but let's keep the expense in perspective. “The money we are talking about is not more than what we bailed out the banks with,” Foley says, referring to the federal response to the 2008 financial crisis.

We know how to do this: That's the basic message of Project Drawdown. One of the most cost-effective solutions to climate change, Foley and his team say, is ensuring that girls and women have access to education and birth control. Women in Kenya, for example, went from having 8.1 children on average in the 1970s to just 3.7 children in 2015. When that decline was briefly interrupted in the 2000s, it was linked to an interruption of girls' access to education. Empowering women will help stabilize the global population—and limit demand for food and energy.

To tackle climate change, even as we turn global emissions down to near zero, we still will need to invest in methods to remove some greenhouse gases already in the atmosphere. Technologies to do this are promising but mostly in their infancy—except for trees, which in the short term at least are good at soaking up carbon. Trees have another advantage: They create forests, where lichen hangs and lizards doze, and monkeys holler back and forth while they gorge on wild figs. I've spent time in forests like that, and the dry word “biodiversity” can never convey their worth.

YOU MAY HAVE HEARD that we are in the sixth mass extinction. This assertion is based on the elevated rate of extinction, not the total losses so far. Fewer than 900 documented extinctions have happened since the 1500s, which is absolutely too many, and likely a substantial undercount. But given that scientists have assessed more than 100,000 species so far, it is hardly yet a “mass” extinction, which paleontologists define as a period in which at least three-quarters of all species go extinct. If we keep these rates up for a few million years—or massively increase them by crossing some threshold of climate or habitat destruction—then we could find ourselves in a mass extinction. But we are not there yet, and if we don't paralyze ourselves with despair, we can still change course.

New research suggests most species can be saved and wildlife restored to higher abundances with a combination of more parks and protected areas, restoration of some ecosystems, and a reduction in farmland. Agriculture currently uses a third of the Earth's land. But if we cut meat eating and food waste in half, increase crop yields, and trade food more efficiently, the researchers estimate, we could grow all the food we need on less land. That would create more space for other species.

Naturalist E.O. Wilson and others have called for a “half Earth” approach, in which half the planet is reserved as wilderness where human activity is carefully limited. Big parks are wonderful, and necessary for some species, but the effort risks displacing a lot of people. “For sure, they are necessary, and we probably need 20 percent or more,” says Georgina Mace, a biodiversity expert at University College London (UCL). “We also have to have people living with and alongside and amongst wildlife.” In her vision of the future, people and other species share space nearly everywhere. “I'm a whole-Earth person, not a half-Earth person,” Mace says.

I believe such hybrid thinking will be the norm in 2070. Borders will be softer, backyards messier. Wilderness corridors will thread through farmlands and cities; floodplains will store carbon, produce food, and control floods. Kids will climb trees in schoolyard orchards to pick fruit.

Wild places will still exist, and people will still fall in love with them. But they might look very different than they do today. As species move in response to climate change, trying to prevent ecosystems from changing will become impossible and, in some places, counterproductive. Instead we'll focus on making sure the planet retains most species with robust populations. The purist idea that all species can be sorted into "native" or "invasive" will be retired. It never made much sense anyway. Ecosystems are always in flux, and most have been influenced by humans for thousands of years.

Management won't be hands-off everywhere. In New Zealand and on other islands where non-native species are the main threat to beloved natives, we may use humane traps or genetic engineering to remove the newcomers. In other places, threatened species will need help adapting, maybe even a ride to new habitats that aren't too hot. Intensive management will be required for many species in the short term.

By 2070 huge swaths of the Earth will be managed by indigenous nations, as their sovereignty is finally taken seriously. That will benefit wildlife, since indigenous-run lands turn out to have more species on average than national parks. In some cases traditional methods honed over millennia may be revived—the ones that created the beautiful, thriving landscapes that colonizers encountered when they first invaded, and mistook for "wild" nature.

FOR ANY YEARS I focused on the science of extinctions and climate change, and I looked for technological and policy solutions like solar panels or more parks. Meanwhile, in my private life, I fought for justice for the poor and the oppressed. It took me way too long to connect those battles—to realize that forces such as colonialism and racism are part of the climate crisis and need to be addressed as part of the solution.

Those who benefit the most from fossil fuels aren't usually the people who suffer the most from their use. Power plants and their toxic fumes, for example, are disproportionately found in poor, nonwhite neighborhoods. The disconnect crosses borders: One analysis has suggested that the gap in per capita GDP between the poorest and richest countries is already 25 percent wider than it would be without climate change, largely because temperature increases in tropical countries reduce agricultural productivity. Larger storms, droughts, and floods are already hurting the world's poorest.

The 2015 Paris Agreement included a mechanism for richer countries to help poorer ones, to begin to make things right. The funding so far is inadequate, but it can be expected to grow, especially once the U.S. government accepts the global scientific consensus and rejoins the agreement. Some funds could be used to build climate research centers in hard-hit regions—"a kind of epistemic reparations," according to Olúfémi Táíwò, a philosopher at Georgetown University in Washington, D.C. He points out that centuries of colonization concentrated not only wealth but also the best universities in rich nations, creating a brain drain out of poorer ones.

Real climate justice would make Earth more resilient even as it helped humanity heal from historic trauma and pain. In a sense, climate change is an opportunity for us to step up—to grow up—as a species.

THERE IS A NEW NEEDLEWOAN in my family. My daughter, now 10, loves to sew. I like to imagine the life she'll lead when she is 60.

The first thing she notices as she wakes up in her city apartment in 2070 is the birdsong: a raucous dawn chorus, a multispecies symphonic alarm clock. It's easy to hear because there's no traffic noise. She flips on her light, powered by solar shingles that cover nearly every roof in the city. Her building is itself built of "drawdown blocks" made from carbon captured from the atmosphere. She gets up, has some coffee. She doesn't have to hunt for "fair trade" or "bird friendly" coffee because everything on the grocery shelf qualifies. She hops on a zero-emissions train that automatically pauses for two minutes because cameras down the line detect a family of foxes approaching the tracks. The sky is bright blue, undimmed by smog, albeit a little hotter than in 1970. In the distance she can see elegant windmills spinning.

When she reaches her stop, she steps out into a huge cloud of migrating monarch butterflies, en route to milkweed patches growing in a nearby park. People on the platform pause and let the butterflies wash over them.

She gets a message: She's invited to a party to celebrate the 100th Earth Day—a party, not a protest. There are no reluctant politicians left to convince. There are no gasoline cars left to bury. There will be a band and dancing, six kinds of meatless tacos and 'ehpaa—prickly pear cactus—imported from the Kumeyaay Nation, near San Diego.

As she walks down the street, she stops and picks a half dozen eucalyptus seedpods off the ground, remembering vaguely that there was some talk in the early 21st century about cutting them all down because they weren't native to the Americas. Holding them in her hand, she decides to sew them around the collar of her green dress to wear at the party.

She gets another message: It's me! I am 91 years old. I want to come to the party too.

*Emma Marris is the author of Rambunctious Garden: Saving Nature in a Post-Wild World. She is working on a book about wild animals and how we relate to them. For the magazine she has written features on urban rats and on Manú National Park in Peru.*