OREGON STATE UNIVERSITY RESEARCHER STEVE STRAUSS IS ENGINEERING TREES THAT MIGHT HELP SAVE THE PLANET. SO WHY DO SO MANY GREENIES WANT TO STOP HIM?

BRANCH SCIENCE

BY DAVID WOLMAN
PHOTOGRAPHS BY LINCOLN BARBOUR

Steve Strauss stands in a grove of genetically modified poplar trees near Corvallis.

A SOFT AUTUMN RAIN HAS BEGUN TO FALL, droplets drumming on the silver Volvo V40's windshield as Oregon State University forest biotechnology professor Steve Strauss and I arrive at a farm just outside of Corvallis. The tires crunch against gravel as we slow to a stop beside a gate marking the entrance to the field road. A hawk circles overhead. "Over there," Strauss says, pointing across the field to where the flat land meets a stand of several hundred poplar trees. To the untrained eye, the trees look entirely unremarkable: tall, thin poplars with yellowing leaves. But to many self-appointed guardians of the world's native forests, they are freakish, alien, and dangerous.

These trees are—deep breath now—GMOs, genetically modified organisms. That three-letter acronym, *GMO*, is enough to ignite emotions on par with words like *Guantánamo*, *nuclear proliferation*, or *abortion*.

In the eyes of most agriculture, policy, and biotechnology watchers, the Pacific Northwest is far from the epicenter of the GMO debate. Most of the GM, or genetically modified, crops grown in the United States—primarily corn, soy, canola, and cotton—are farmed in the Midwest and the South. But Oregon may turn out to have a pivotal role in the longer history of this science, either as home base for a brilliant GMO innovator whose research helps to save the planet, or as the stage for a screwup that would foreshadow the downfall of this potentially valuable technology.

SCIENTISTS ACROSS the country describe Strauss as one of the preeminent tree geneticists on the planet—"a one-man institute," as one colleague put it. He is also, in many ways, a typical Oregon greenie. A bearded, fleece-wearing biologist, he hikes, runs, recycles, eats locally crafted cheeses, and votes liberal. The environmental threat that keeps him up at night stems from the same seemingly unresolvable tension that troubles many people, especially here in the Northwest. At one end of the rope: humanity's insatiable appetite for forest products—building materials, paper, firewood, biofuels. At the other end: relentless deforestation, which in turn leads to a cascade of ecological consequences such as soil erosion, loss of biodiversity, trashed salmon habitat, and, of course, the big kahuna: global warming.

But, unlike many of his peers, Strauss does more than just bike to work, frequent the farmers market, and eschew dryers for clotheslines. The 54-year-old scientist has spent more than 25 years striving to comprehend the inner workings of trees. A better understanding of their genetics enables timber companies to make smarter, more sustainable decisions, and allows tree farmers to improve their yield so that more wild forestland can be left alone. It is as straightforward an eco-premise as they come: be more efficient with the resources we use so as to reduce our overall take. "Steve's something of an enlightenment figure in forest biotech," says University of Washington biologist Toby Bradshaw. "He's trying to preserve the forests we have, but also provide the fiber that we need."

Trained at Cornell, Yale, and Berkeley, Strauss has authored or co-authored more than 100 peer-reviewed papers, won Oregon State's 2009 distinguished professor award, and brought to the university over $16 million in research funding. Some of the trees Strauss planted in the early 1990s are the oldest transgenic trees in North America, and this year he was named Forest Biotechnologist of the Year by the not-for-profit Institute for Forest Biotechnology. "Tree species have long been ignored in terms of molecular research, but Steve and his lab are blazing the trail in this area," says Richard Amasino, a professor of biochemistry at the University of Wisconsin.

Strauss's projects have included experiments like breeding trees that require less water, tolerate saltier soil, grow faster, or could more efficiently be used for green fuels of the future. (Biofuel made from fast-growing plantation trees like poplars could someday prove to be a viable substitute for corn-based products.) Strauss is also trying to make farmed trees sterile, and to engineer trees that are easier to turn into paper, thus requiring fewer nasty chemical inputs in the paper-manufacturing process.

The sterility research may be the most important: if any type of genetically engineered tree is ever going to be approved for commercial use, there must be airtight science to show that they won't spread into the wild, threaten native trees, or upset the ecological balance by passing along genes they weren't supposed to. Imagine, for example, if genes for faster growth made their way into an already invasive species like Himalayan blackberry or Scotch broom. "There's obviously a history of sterile trees, seedless grapes and whatnot in horticulture," says Brian Stanton, managing director of global tree improvement for Portland-based GreenWood Resources, a timber products company focused on sustainable tree farming. "Steve is making terrific progress in this area."

The rub is that experimenting in the greenhouse gets you only so far. Nature's vicissitudes can't be mimicked indoors, which means that at some point, the research has to move outside. It is here, where GMOs meet field trials, that this issue becomes explosive. Indeed, seven years ago, field trials gone awry put Oregon in the global spotlight of the battle over GMOs.

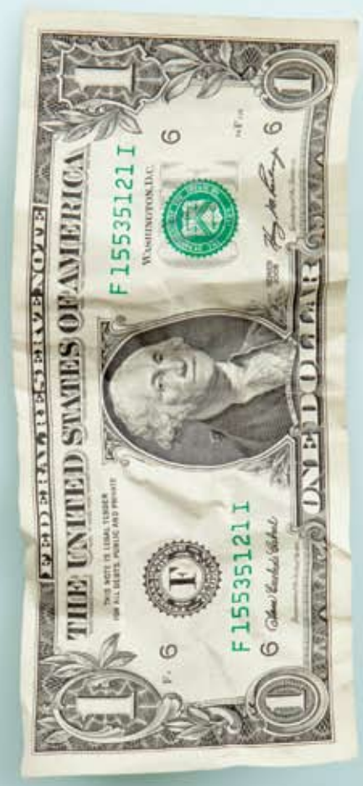
FOLLOW THE RISING grade from the town of Warm Springs toward the farmland of Madras, turn west off of Highway 26, and you'll soon arrive at a cluster of green buildings with a line of pickup trucks out front. Inside the cavernous processing facility at Central Oregon Seeds, founding partner Mike Weber checks weather reports and measures the moisture content of seed samples from a nearby field before sitting down to explain what happened back in 2003.

STRAUSS'S PROJECTS HAVE INCLUDED EXPERIMENTS LIKE BREEDING TREES THAT REQUIRE LESS WATER, TOLERATE SALTIER SOIL, GROW FASTER, OR COULD MORE EFFICIENTLY BE USED FOR GREEN FUELS OF THE FUTURE.

PORTRAITS FROM A GENETICALLY MODIFIED WORLD

CASH

MARKET: The economy produces approximately 26 million notes a day **GM INGREDIENT:** Cotton (75%) **SOURCE:** 79% of US-grown cotton is genetically modified **BENEFITS:** Lower cost, fewer pesticides needed



A windy summer afternoon was all it took. The Ohio-based grass-seed and garden-supply giant Scotts (now Scotts Miracle-Gro) had developed a transgenic variety of grass. Creeping bentgrass is the dense, verdant turf you see on golf course greens. Scotts' particular variety was engineered to resist the herbicide glyphosate, known to the rest of us as Roundup. If Roundup-resistant grass proved successful, groundskeepers at golf courses worldwide would be able to more easily kill unwanted weeds and grasses while sparing the coveted lush, green carpets.

Scotts contracted with Oregon growers to plant 400 acres of transgenic grass. Because the bentgrass was an experimental crop, agriculture officials and farmers wanted it sequestered so that it couldn't contaminate the Willamette Valley's grass-seed farms, which fuel a $500-million-per-year industry. Locating the transgenic grass on the east side of the Cascades meant the mountains would provide an effective ecological buffer. Still, 400 acres is a large test area. As Jim King, the company's vice president of corporate affairs, put it, Scotts was "proactively pursuing deregulation, so that the day they got approval, they'd have seed to sell."

But the push to combine experimentation with sales production backfired. Willamette Valley farms were well out of range of the test site, but that didn't mean the grass wouldn't spread. Trouble kicked up with what was euphemistically identified as a "wind event"—or, according to locals, a "dust devil"—a tornado-like whirlwind common during summer in the high desert. Scotts had instituted a number of controls to keep the transgenic grass from migrating, but to no avail. (In fact, an outside study conducted during the trials found that, even before the wind event occurred, pollen had already traveled 13 miles outside the control area.) Tiny seeds carried on the breeze landed outside the lines that had been neatly penciled onto county maps. Seeds that took flight and managed to take root will, assuming they survive hazards like trampling or drought, keep coming back year after year, just like other wild perennials, and in turn will send their seeds up into the wind. Not only that, but there is already evidence that the grass cross-pollinated with other species, passing on the trait of Roundup resistance to other area grasses.

The headlines about GM bentgrass establishing itself in the wild spread quickly: "Smoking Grass: A US Study of Frankenfood Crops Spells Trouble for Europe" (*Newsweek*), "Genes from Engineered Grass Spread for Miles" (*New York Times*), "GM Grass Takes a Walk on the Wild Side" (*Times* of London). From activists, warnings cropped up along the lines of "Monsanto's Frankengrass Sows Controversy" (*Organic Consumers Association*). (Monsanto had invested in the bentgrass project.) In a flash, Scotts was facing a public relations disaster, growers and agriculture officials were scrambling to protect the name of Oregon-grown goods, and ecologists were trying to comprehend the grass's environmental impact.

Despite the ominous headlines, the grass escape was worrisome not so much because it happened—regulators, scientists, and local growers had predicted that it would, but concluded that the risk to local farms and ecology was minimal. The episode was shocking because the seeds flew much farther than expected, then established themselves in the wild and spread their genes more quickly than anyone had anticipated.

On his company property just a few miles from one of the experimental grass plots, Weber of Central Oregon Seeds takes pains to distinguish what was—and was not—cause for alarm. "Let's be perfectly clear: there has been no problem with seed from the contamination event. Nothing got into our containers or shipments to any of our customers. That is just critical," he says. Critical because of what's at stake for a company that ships locally grown seeds for carrots, onions, and parsley to customers across the globe.

When word reached Weber that the transgenic grass had spread, he didn't fret, he says, because the harvest times for the grass and the crops his farmers grow are different, and the tiny size of the grass seed means that even if it had been brought into the sorting facility, it would be separated out from other seeds during the collection and packaging process. Still, in response to the wayward GM grass seed, Weber had a "rouging crew" of about a dozen workers walk through fields and collect bits of grass material that had blown onto carrot plants and other crops. "We certainly had to take our time with it," he says.

What truly caught Weber by surprise was how much of a shadow the rogue GM seed cast over his company's product, or more precisely, over any products coming from Jefferson County farms. Weber soberly recalls the words spoken by the president of Central Oregon Seeds' biggest customer, the Dutch vegetable-seed multinational Bejo: "If you ever send us GM anything in a vbag of carrot seed, it's on you."

"That put the fear of God in me," says Weber. "This was not something to trifle with."

INSULIN

MARKET: 6.5 million Americans with diabetes **GM INGREDIENT:** Recombinant (or laboratory-created) DNA **SOURCE:** Modified bacteria and plants **BENEFITS:** Saves 8,000 pounds of animal pancreas (from which insulin is otherwise made) per pound of insulin

CAT PHOTOGRAPH COURTESY ISTOCK

TO UNDERSTAND THE uproar over GMOs, one must first understand the science behind genetic engineering. Without that baseline, most conversations about GMOs quickly devolve into shouting fests between stereotyped extremes. For starters, genetic engineering is nothing new. Humans have been crossbreeding different plant varieties for millennia, a practice that, over generations of people and plants, has enabled farmers to successfully develop crops from corn to tomatoes that are bigger, tastier, and more resistant to disease. Such trait refinement, and the trial and error required to pull it off, are essential to agriculture, and this practice of modifying the genetic makeup of a crop plant is as organic as they come.

In conventional breeding, two types of a plant, let's say two types of corn, are crossed, with the hope that their offspring will be a new and improved variety. This breeding approach is a bit like playing the slots. But by the mid-20th century, we got better at breeding thanks to two developments: irradiation and, later, gene splicing. Irradiation—walloping the genome of an organism with radiation—speeds up the rate of random DNA mutation, in effect, pulling the handle of the slot machine more quickly. In a 2005 paper published in *Nature Biotechnology*, Strauss and his co-authors point out that more than 2,200 crop varieties are on the market "that had an irradiation-induced mutation step in their pedigrees." Yet none of these crop varieties—Rio Red seedless grapefruit, semi-dwarf rice, high-oleic sunflower seed—are considered GMOs by opposition groups, government regulators, or your local supermarket, even though these crops' genes have been dramatically modified by humans.

So what exactly is a GMO? It's the product of a specific technique. In the past few decades, scientists have learned how to cut and paste genes with remarkable precision. This ability is the essence of genetic engineering (aka gene splicing or recombinant DNA technology). What makes this breeding method powerful, and distinct from irradiation, is that it removes the guesswork. More critically, scientists can now transfer DNA not just between similar plants, but also between organisms that would otherwise never reproduce, which is to say mix their DNA, on their own.

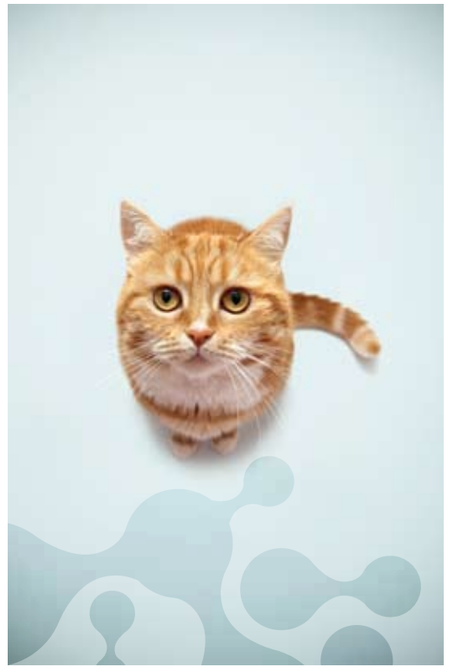
For example, in the case of one type of genetically modified corn, the plant is armed with a protein toxic to a certain crop pest. The chance that corn could ever acquire this defensive ability by way of random DNA mutation is minuscule, according to Mace Vaughan of the Portland-based Xerces Society, an invertebrate conservation organization that often deals with pest issues. "It's less likely, even, than a roomful of chimpanzees ever typing out a Shakespeare sonnet," he says.

But the way in which GM corn or any other transgenic plant is developed doesn't make an organism hazardous. Thus far, in fact, the evidence is to the contrary. We have been consuming GM foods for more than a decade, and a mountain of studies about possible health consequences have to date revealed no threat or harm to human health.

Today, more than 150 million acres of farmland in the United States are planted with GM corn, soy, cotton, squash, papaya, alfalfa, sugar beet, and canola, and an estimated 70 percent of all products on supermarket shelves nationwide contain at least some GM ingredients, such as corn syrup or canola oil. And although amber waves of GM grain may conflict with our Michael Pollan–inspired fantasy of little family farms everywhere, GMOs may be greener than you think. The journal *AgBioForum* has estimated that GM crops reduce pesticide use by nearly 250,000 tons, and can also help reduce greenhouse gas emissions, because farmland planted with them requires less tilling. Less tilling means more carbon dioxide remains locked in the ground, and diesel tractors spend less time spewing exhaust.

Nevertheless, anti-GMO activists have at the ready scattered studies that reinforce their belief that this technology is dangerous. (One favorite, conducted by health researchers in Austria, found reduced fertility rates in third- and fourth-generation mice that had eaten GM corn.) "We do not believe that GMOs have been demonstrated safe for human health and for the environment," explains Rick North, an educator who leads the Campaign for Safe Food at Oregon Physicians for Social Responsibility. Noting that he's not an anti-technology "luddite," North argues—as do many of his fellow anti-GMO activists—that the prospect of negative consequences from GM technology is reason enough not to invest in this area of agricultural science. It's really about what he calls "the evidence of what we don't know."

A small number of studies, however, taken together with the earnest but vague fears expressed by opposition groups, have not proven adequately compelling to policymakers or regulators. "We look at information from all sides," says Dan Hilburn, administrator of the Oregon Department of Agriculture's plant division. "We struggle with it, but we're going to go with the preponderance of the evidence." The following is only a partial list of those institutions and organizations that have concluded that the GMOs currently on the market are not harmful to the environment or world health: the National Academy of Sciences, Britain's CONTINUED ON PAGE 120



CATS & DOGS

MARKET: Allergy-prone animal lovers **GM INGREDIENTS:** Two felines or canines of the opposite sex **SOURCE:** The Allerca LifeStyle Pets company genetically selects dogs and cats that do not secrete certain allergy-causing proteins from their skin and salivary glands **BENEFITS:** Drastically reduces pet allergy symptoms in humans

AMBER WAVES OF GM GRAIN MAY CONFLICT WITH OUR MICHAEL POLLAN–INSPIRED FANTASY OF LITTLE FAMILY FARMS EVERYWHERE.

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Royal Society, Europe's Organization for Economic Cooperation and Development, the United Nations Food and Agriculture Organization, the International Council for Science, the French Academy of Sciences, the British Medical Association, and the German Academies of Science and Humanities. The World Health Organization's director-general said in 2002 that "WHO is not aware of any scientifically documented cases in which the consumption of these foods has negative human health effects."

On the environmental side, the United Nations and other organizations have arrived at similar conclusions. In *Starved for Science: How Biotechnology Is Being Kept Out of Africa*, author and Wellesley College professor of political science Robert Paarlberg gathers together some of the biggest studies of GMOs, including one from 2007 that surveyed 10 years' worth of research, articles, books, and national and international reports. His conclusion? "The data available so far provide no scientific evidence that the cultivation of the presently commercialized GM crops has caused environmental harm."

BUT COMPARING GM corn and GM trees is like comparing, well, apples and oranges. With crops like corn, the stalks are cut down at the end of the season and that's it. Dead. Next year's crop requires new seeds. But poplar trees, like bentgrass, are wind-pollinated perennials, so they could migrate—off of a tree farm, for instance—and spread their genes. "The underlying concern about Steve's work," explains Jud Isebrands, owner of Wisconsin-based Environmental Forestry Consultants, "is that if we deploy the transgenics at the commercial scale, they could jump over into the native forest." That situation would be terrible if, for example, genes for fast-growing poplars somehow spread into wild populations of another species that is already considered weedy. Such a jump may have the ring of a Michael Crichton plotline to it, but in the eyes of scientists, the potential hazards of these crops should be assessed just like any other agricultural innovation. In other words, the potential threat posed by a GM crop doesn't have anything to do with the fact that it was developed by way of gene splicing; it has to do with whether the traits conferred might cause problems, and whether those traits could move into species where we don't want them to be. "New technologies for farmers are sometimes good, sometimes bad," says Strauss. "Scientists will say, 'Keep options on the table.' Why isn't that a good thing?"

SOAP

MARKET: The dirty **GM INGREDIENT:** Fatty acids **SOURCE:** Vegetable oil (80% of which is derived from soybeans; 85% of the US soybean crop is genetically modified) **BENEFITS:** Less expensive than olive oil; doesn't use animal fat

The poplars growing in one of Strauss's test plots, for instance, are engineered to contain lesser amounts of a compound called lignin. An essential constituent of most woody plants, lignin is also a scourge of the paper industry, which uses harsh chemicals to separate it from the wood. (US wood-pulp production exceeds 80 million tons a year, but in the process, the industry has to extract 30 million tons of lignin from the wood.)

The sulfury smell we sometimes wake up to in Portland? That's from the sulfides used to remove lignin at the paper mill in Camas, Washington. A few years ago, Strauss set out to test whether trees could survive with less lignin, perhaps someday leading to a dramatic reduction in the amount of chemicals needed to manufacture paper.

Although the test trees are young, Strauss can easily see that some look weak and stunted compared with wild or conventionally bred trees. For a tree, having substantially reduced lignin is a serious handicap. His assessment in the field was validated by the data. "This experiment helped us get past the hype of the low-lignin miracle tree," Strauss says. It also exemplified the incremental reality of research: try something, learn a few facts, try something a little different, learn something more.

Yet, if Strauss's trees aren't freakish super-trees poised to take over the forest (they're actually the opposite, too wimpy to do much of anything), and if valuable information was gleaned from the results, why does he request that I not record our exact location?

Because his science is under attack, literally. In 2001, eco-insurgents vandalized trees in a similar test plot. Ironically, many of the damaged or destroyed trees were not genetically engineered varieties; the attackers couldn't tell the difference. The week of the incident, Strauss was a portrait of upbeat resilience. "The damage to our research program is actually fairly modest," he told OSU's news service. "Most of the older trees had already provided the data we needed and were ready to be removed. The research was coming along quite well, and the results are very promising."

Personally, though, Strauss was shaken. A few weeks after the vandalism, he was called to Tacoma for dinner with George Weyerhaeuser, then senior vice president of technology for pulp and paper giant Weyerhaeuser, and great-great grandson of one of the firm's founders. His company has lent support to Strauss's research, so Weyerhaeuser (now retired) wanted the scientist to know he was appreciated. During dinner at the swank Cliff House restaurant overlooking Puget Sound, Weyerhaeuser could tell that Strauss was downtrodden. And bitter. "I saw a human being who was really wondering about the world," he says. "I'm sure he thinks he's on the side that's driving safe science forward. Yet he seems to be cast in the same lot with the greedy capitalists like me, who presumably just don't care."

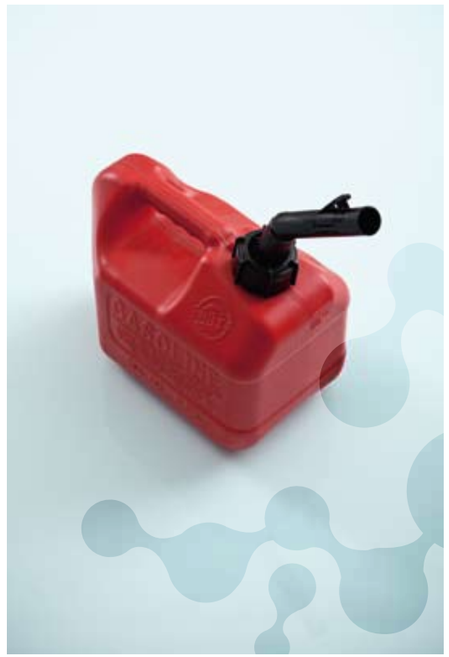
Weyerhaeuser recalls telling Strauss that someday people would value his work's social and environmental benefits, but he now concedes that he "may have been overly optimistic." Eight years later, the public perception of this research is largely unchanged. According to the co-director of the Global Justice Environmental Project, genetically modified trees "pose what many consider to be the most serious threat to the world's remaining native forests since the invention of the chain saw."

Despite such outlandish claims, Strauss says he doesn't mind being vilified by zealots—"whacktivists," he calls them. What makes him crestfallen is just how much the public has subscribed to the whacktivist ethos with no apparent interest in evidence-based analysis—and the ramifications that has had on his ability to conduct research.

A decade ago, some of Strauss's transgenic trees were grown on small test plots along the Columbia River Gorge. Until 2001, some of these plots were owned by the James River Corporation, but the research project was being conducted by the Tree Biosafety and Genomics Research Cooperative, of which Strauss is a leading member.

But GreenWood Resources, the global timber management company that owns roughly 27,000 acres of poplar plantations throughout the state and now owns these plots, was not willing to host Strauss's transgenic research. (The trees were in fact uprooted before GreenWood bought the land.) A valuable selling point for the company's products today is certification by the Forest Stewardship Council, or FSC. The FSC stamp is a sign to consumers of more sustainable practices, and enables businesses selling FSC-certified products to charge higher prices. But FSC prohibits its clients from growing GM trees. The size of the test plots, the containment measures applied, the traits of the trees being grown, and the distinction between commercial and research settings—none of that matters to the council once the label GMO is involved.

Strauss was sympathetic when GreenWood broke things off. After all, what company executive doesn't want the seal of approval that will help improve the bottom line? Nevertheless, the experience served only to add to Strauss's sense that transgenic tree science is being asphyxiated. A decade ago, he says, he had companies "falling over me" to join his industry consortium, the main source of funds for field trials, regulatory staff, and other costs. "At one point I had 14 members, but now it's a struggle to get more than a few."



GASOLINE

MARKET: Drivers **GM INGREDIENT:** Corn-sourced ethanol **SOURCE:** Modified corn (4 billion bushels of US-grown corn are made into ethanol each year) **BENEFITS:** Reduces pesticides, pollutants, and dependence on foreign oil

Strauss and I drive to a second site, the rain pattering more heavily now. Here, another stand of poplars grows next to a field that Strauss cleared years ago in preparation for more tree planting. But the land sits fallow. Strauss anticipates that he will have to abandon the project once destined for this plot and possibly plow under the nearby trees. Years of laboratory science and field work, scrapped because of the negative perception of GMOs.

At the final stop on our tour, he parks the car alongside a metal fence topped with barbed wire and stares out the window at the trees within the enclosure. Rain hammers the Volvo's roof. Strauss points to nearby irrigation equipment installed with university dollars, equipment that may go unused if his tree experiments are canceled. Gaining insight about the genetics of trees, he explains, takes years (as compared with, say, studying fruit flies, which mature and produce offspring in a matter of days), making the prospect of abandoning this and other experimental plots especially disheartening. More painful still is the feeling that although his work is valuable, for the environment and for humanity, it's being suppressed because of fear, not facts. "It makes me insane," he says.

WHILE STRAUSS'S work stalls, genetic engineering is thriving and widely accepted. Today, roughly 25 percent of all new drugs are produced using the tools of biotechnology, yet no one complains when this science is applied to medicine. Within the published literature about plant biology, explains the University of Washington's Toby Bradshaw, a substantial fraction of research involves transgenics. As a tool for conducting the biology and agriculture science of tomorrow, "these methods aren't just useful; they're essential."

But GM fuels or biofuels cooked in a giant vat are substantially different from GM plants growing outdoors, and few GMOs make people as nervous as transgenic trees. Trees, after all, conjure Wordsworthian notions of nature's purity. The more substantive concern is that they could spread genes that might harm wild trees—or spread a *trait* that makes it harder for humans to be good stewards of the land. After all, herbicides like Roundup are critical tools for wildlife managers. As one conservation scientist put it, the

SCIENTISTS CAN NOW TRANSFER DNA NOT JUST BETWEEN SIMILAR PLANTS, BUT BETWEEN ORGANISMS THAT WOULD OTHERWISE NEVER REPRODUCE.

worry about biotech crops is not so much that a nefarious corporation is trying to push harmful products onto farmlands or into Happy Meals, but that GMOs could spread pesticide- and herbicide-resistant genes to other plants, and eventually those very pesticides or herbicides will no longer work.

In the case of the Madras grass escape, scientists' conclusions about how much harm was really done have landed far from the sensational media reports. OSU professor of weed science Carol Mallory-Smith, OSU crop scientist Marvin Butler, recently retired USDA geneticist Reed Barker, and other experts all agree that the Roundup-resistant bentgrass blunder has had, and will likely have, negligible ecological effects.

That is not to say that they, or anyone close to this issue, is nonchalant about what happened, or about gene flow in general. But these wayward grass plants are not a threat to the high desert environment. Pull a grass clump out of the ground or nuke it with any other herbicide—let alone a dose of dog pee or organic manure—and it will die the same undramatic death as any other clump of grass. "If you're not trying to kill it with Roundup," says Mallory-Smith, "you won't be able to tell the difference."

All transgenes, from whatever crop, will spread to some extent, says Strauss. "This is well known and is also true of all conventional agriculture and forestry. The question is: When does it matter?"

Which brings us back to one of Strauss's core research missions: the catch-22 of sterility. "Unless Steve finds a way to sterilize these plants without limiting speed of growth, commercialization will be hard," says Jud Isebrands of Environmental Forestry Consultants. But how can Strauss find the key to tree sterility if no one will support, or even host, his field research?

The hurdles and costs of getting permission to run and manage extensive field trials of a GM crop are a huge disincentive for most companies or institutions. Oftentimes, the only firms that can overcome these barriers are multinational giants like Monsanto. It's an irony not lost on Strauss: opposition to GMOs has led to tighter restrictions and higher costs to enter the market. That means that anti-GMO greens are, at least indirectly, gift-wrapping a monopoly for the very Monsanto executives they loathe.

No level-headed researcher is pro-GMO across the board. Talking to scientists, you will hear over and over again that GM crops must be addressed on a case-by-case basis, because annuals are different from perennials, food crops differ from ornamentals, wind-pollinated plants differ from seed crops, and so on. The caricature that Strauss is trying to resist is that of the environmentally reckless mad scientist. "Breeding of any kind isn't innocuous," he says, noting that enhancing the reproductive powers of an already weedy plant, for instance, could be trouble, whether done by way of conventional breeding or gene splicing. But breeding is something humans do, and always have done, to domesticate and improve plants, and we should not reflexively reject the newest tools for doing it.

WHOLE WHEAT BREAD

MARKET: The hungry **GM INGREDIENT:** Whole wheat **SOURCE:** A transgenic hybrid of two related grasses first crossbred in ancient Mesopotamia **BENEFITS:** Easier to harvest than either original strain of wheat

In some ways, Strauss's worldview and career illuminate the false dichotomy between the green movement and biotechnology. "Steve is one of the most vocal advocates for the sound application of science for evaluating the potential of this technology," says Barry Goldfarb, a professor of forestry and environmental resources at North Carolina State University. Bradshaw, at the University of Washington, is even more emphatic: "The idea that scientists like Steve are trying to undermine public concerns or safety review processes for money, to exert domination over nature, or because they don't think about ecological impact—that's absurd. No one is as aware as scientists are of this impact [of transgenics] on the environment." Strauss, his colleagues argue, is a newer breed of scientist, a green biotechnologist, whose realism is reminiscent of those environmentalists who favor nuclear power, or who at least accept that it may have to be part of our energy future if we are serious about quitting carbon.

But so many years spent trying to convince people to rethink GMOs have taken a toll on Oregon State's tree wizard. "Maybe I should walk away and do something else," Strauss says. He continues to hope that a company like GreenWood Resources might give transgenic poplars a chance, but he doesn't see it happening for another decade, maybe longer.

On the drive back to campus, the rain slows to a drizzle, and Strauss confesses that sometimes he wonders whether he would have been happier working for a biotech firm. But he loves teaching and still believes in his research. As he pulls up to a traffic light, he sighs and then leans forward to inspect the bumper sticker on the Honda just ahead of us. The image is of a colorful double helix, the telltale intertwining structure of DNA. The accompanying slogan reads: "Support Our Scientists." Strauss chuckles. "Let's pull that person over and give 'em a kiss."

ANTI-GMO GREENS ARE, AT LEAST INDIRECTLY, GIFT-WRAPPING A MONOPOLY FOR THE VERY MONSANTO EXECUTIVES THEY LOATHE.