



**THE  
DARK  
SIDE OF**

# SOY

Is America's  
favorite health food  
making us sick?

by Mary Vance, from *Terrain*

**AS SOMEONE WHO IS CONSCIOUS** of her health, I spent 13 years cultivating a vegetarian diet. I took time to plan and balance meals that included products such as soy milk, soy yogurt, tofu, and Chick'n patties. I pored over labels looking for words I couldn't pronounce—occasionally one or two would pop up. Soy protein isolate? Great! They've isolated the protein from the soybean to make it more concentrated. Hydrolyzed soy protein? I never successfully rationalized that one, but I wasn't too worried. After all, in 1999 the Food and Drug Administration (FDA) approved labeling I found on nearly every soy product I purchased: "Diets low in saturated fat and cholesterol that include 25 grams of soy protein a day may reduce the risk of heart disease." Soy ingredients weren't only safe—they were beneficial.

After years of consuming various forms of soy nearly every day, I felt reasonably fit, but somewhere along the line I'd stopped menstruating. I couldn't figure out why my stomach became so upset after I ate edamame or why I was often moody and bloated. It didn't occur to me at the time to question soy, heart protector and miracle food.

When I began studying holistic health and nutrition, I kept running across risks associated with eating soy. Endocrine disruption? Check. Digestive problems? Check. I researched soy's deleterious effects on thyroid, fertility, hormones, sex drive, digestion, and even its potential to contribute to certain cancers. For every study that proved a connection between soy and reduced disease risk another cropped up to challenge the claims. What was going on?

"Studies showing the dark side of soy date back 100 years," says clinical nutritionist Kaayla Daniel, author of *The Whole Soy Story* (New Trends, 2005). "The 1999 FDA-approved health claim

pleased big business, despite massive evidence showing risks associated with soy, and against the protest of the FDA's own top scientists. Soy is a \$4 billion [U.S.] industry that's taken these health claims to the bank." Besides promoting heart health, the industry says, soy can alleviate symptoms associated with menopause, reduce the risk of certain cancers, and lower levels of LDL, the "bad" cholesterol.

Epidemiological studies have shown that Asians, particularly in Japan and China, have a lower incidence of breast and prostate cancer than people in the United States, and many of these studies credit a traditional diet that includes soy. But Asian diets include small amounts—about nine grams a day—of primarily fermented soy products, such as miso, natto, and tempeh, and some tofu. Fermenting soy creates health-promoting probiotics, the good bacteria our bodies need to maintain digestive and overall wellness. By contrast, in the United States, processed soy food snacks or shakes can contain over 20 grams of nonfermented soy protein in one serving.

"There is important information on the cancer-protective values of soy," says clinical nutritionist Ed Bauman, head of Bauman Clinic in Sebastopol, California, and director of Bauman College. Bauman cautions against painting the bean with a broad brush. "As with any food, it can have benefits in one system and detriments in another. [An individual who is sensitive to it] may have an adverse response to soy. And not all soy is alike," he adds, referring to processing methods and quality.

"Soy is not a food that is native to North America or Europe, and you have issues when you move food from one part of the world to another," Bauman says. "We fare better when we eat according to our ethnicity. Soy is a viable



food, but we need to look at how it's used."

Once considered a small-scale poverty food, soy exploded onto the American market. Studies—some funded by the industry—promoted soy's ability to lower disease risk while absolving guilt associated with eating meat.

"The soy industry has come a long way from when hippies were boiling up the beans," says Daniel.

These days the industry has discovered ways to use every part of the bean for profit. Soy oil has become the base for most vegetable oils; soy lecithin, the waste product left over after the soybean is processed, is used as an emulsifier; soy flour appears in baked and packaged goods; different forms of processed soy protein are added to everything from animal feed to muscle-building protein powders. "Soy protein isolate was invented for use in cardboard," Daniel says. "It hasn't actually been approved as a food ingredient."

Soy is everywhere in our food supply, as the star in cereals and health-promoting foods and hidden in processed foods. Even if you read every label and avoid cardboard boxes, you are likely to find soy in your supplements and vitamins (look out for vitamin E derived from soy oil), in foods such as canned tuna, soups, sauces, breads, meats (injected under poultry skin), and chocolate, and in pet food and body-care products. It hides in tofu dogs under aliases such as textured vegetable protein, hydrolyzed vegetable protein, and lecithin—which is troubling, since the processing required to hydrolyze soy protein into vegetable protein produces excitotoxins such as glutamate (think MSG) and aspartate (a component of aspartame), which cause brain-cell death.

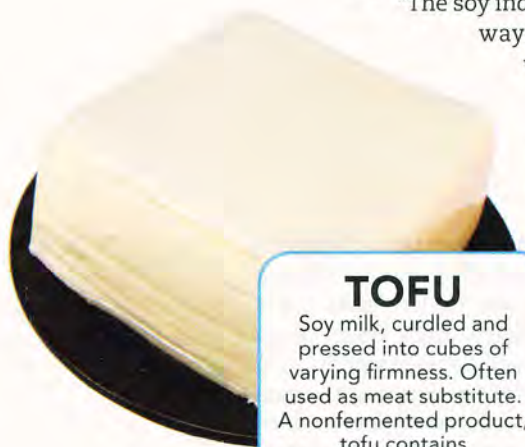
Soy also is one of the foods—in addition to wheat, corn, eggs, milk, nuts, and shellfish—most likely to cause allergic reactions. Most people equate food allergies with anaphylaxis, or a severe emergency immune response, but it is possible to have a subclinical sensitivity,

which can lead to health problems over time (and is exacerbated by the lack of variety common in today's American diet).

"People can do an empirical food sensitivity test by eliminating the food for a period of time and reintroducing it to see if there's an immune response, but most don't do this," says Bauman. "Genetically modified (GM) soy is the most problematic, and that's probably what most people are eating if they're not paying attention. People can develop sensitivity to a food that has antigens or bacteria not originally in the food chain, as is the case with GM foods."

Yet avoiding GM soy doesn't mean all is well, Daniel says: "One question I get all the time is, 'What if I only eat organic soy?' The assumption is that GM soy is problematic and organic is fine. Certainly, organic is better, but the bottom line is that soybeans naturally contain plant estrogens, toxins, and antinutrients, and you can't remove those."

The highest risk is for infants who are fed soy formula. "It's the only thing they're eating, they're very small, and they're at a key stage developmentally," says Daniel. "The estrogens in soy will affect the hormonal development of these children, and it will certainly affect their growing brains, reproductive systems, and thyroids." Soy formula also contains large amounts of manganese, which has been linked to attention deficit disorder and neurotoxicity in infants. The Israeli health ministry recently issued an advisory stating that infants should avoid soy formula altogether.



### TOFU

Soy milk, curdled and pressed into cubes of varying firmness. Often used as meat substitute. A nonfermented product, tofu contains antinutrients, which can block absorption of essential minerals.



### MISO

Fermented soybean paste, used in soups and sauces. Rich in probiotics, good bacteria that aid vitamin absorption. Miso is high in sodium but is considered one of the healthiest soy products.

TOFU © ISTOCKPHOTO.COM / RADU RAZVAN • MISO © ISTOCKPHOTO.COM / NICOLE WEISS



## SOYBEAN OIL

To extract oil, soybeans are superheated, ground, pressed, mixed with chemicals, and washed in a centrifuge. Soybean oil accounts for 80 percent of all liquid oils consumed annually in the United States.

Antinutrients in soy block enzymes needed for digestion, and naturally occurring phytates block absorption of essential minerals. This is most worrisome for vegans and vegetarians who eat soy as their main source of protein, and for women in menopause who up their soy intake through supplements.

Soy contains phytochemicals—plant nutrients with disease-fighting activity—called isoflavones. Studies claim isoflavones can mimic the body's own

estrogens, raising a woman's estrogen levels, which fall after menopause, causing hot flashes and other symptoms. On the other hand, isoflavones may also block the body's estrogens, which can help reduce high estrogen levels, therefore reducing risk for breast cancer or uterine cancer before menopause. (High estrogen levels have been linked to cancers of the reproductive system in women.)

Although soy's isoflavones may have an adaptogenic effect (contributing to an estrogen-boosting or -blocking effect where needed), they also have the potential to promote hormone-sensitive cancers in some people. Studies on the effects of isoflavones on human estrogen levels are conflicting, and it's possible that they affect people differently. In men, soy has been shown to lower testosterone levels and sex drive, according to Daniel.

Bauman believes processed soy foods are problematic but maintains that soy has beneficial hormone-mediating effects. "People are largely convenience-driven," he says. "We're looking at this whole processed-food convenience market and we're making generalizations about a plant. Is soy the problem, or is it the handling and packaging and processing of the plant that's the problem?"

"Primary sources of food are a good thing. Once there was a bean, but then it got cooked

and squeezed and the pulp was separated out, and it was heated and processed for better shelf life and mouth feel. Soy milk is second or third level in terms of processing."

Bauman's eating-for-health approach calls for a variety of natural and seasonal unprocessed whole foods, including soy in moderation, tailored to individual biochemistry and sensitivities. "Using soy as part of a diet can bring relief for perimenopause, for example," he says. "Throw out the soy and you throw out the isoflavones." (It is possible to obtain plant estrogens to a lesser extent from other foods, such as lima beans or flax.) "The literature is extensive on the benefits of soy, and that should always be stated, just as the hazards should be. That's science. These studies are not ridiculous or contrived, but take a look at them. Who's funding them?" asks Bauman.

"There are a lot of problems with these studies," Daniel says, adding that the 1999 heart health claim was an industry-funded initiative. "Even if there is positive information, and even if these studies are well designed, we need to weigh that against the fact that we've also got really good studies showing the dangers. Better safe than sorry is the precautionary principle. Possible benefits are far outweighed by proven risks."

Daniel and Bauman agree on the benefits of variety. "My experience as a clinical nutritionist is that people who have a varied diet tend not to get into trouble," says Daniel.

"We like to demonize certain foods in this society," says Bauman. "If you want to find a fault, you'll find it. The bottom line is: What is a healthy diet?"



## SOY MILK

A processed beverage made of ground soybeans mixed with water and boiled, which removes some toxins. Sugar is added to improve flavor. An eight-ounce serving contains up to 35 milligrams of isoflavones, which may change estrogen levels and hormonal function.

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# How Much Is TOO MUCH?

Clinical nutritionist Kaayla Daniel on the Dos and Don'ts of soy consumption

interview by Mary Vance, from *Terrain*

*Editor's Note: Kaayla Daniel is a certified clinical nutritionist with a Ph.D. in nutritional sciences and anti-aging therapies from the Union Institute and University of Cincinnati, Ohio. She is the author of The Whole Soy Story: The Dark Side of America's Favorite Health Food (New Trends, 2005).*

**What health problems do you see in your practice that can be traced back to overconsumption of soy?**

I work mostly with midlife women, and they're likely to eat a lot of soy and drink a lot of soy milk. They're taking soy isoflavone supplements because they've heard that it's going to help them through menopause. A lot of these women are very intelligent and educated, and, unfortunately, they get this idea that if a little of something might be good, then they should do a lot of it. They start gaining weight, feeling fatigued; they get lethargic and depressed, and when they go to a regular doctor, they're told "Well, what do you expect, you're getting old," and that this is typical of menopause. In fact, the symptoms are almost entirely coming

from that change in their diet, which had to do with soy.



## SNACK FOOD

Highly processed, a source of trans fat. Check your labels: Potato chips, tortilla crisps, and many other deep-fried things have been cooked in soy oil—straight up or partially hydrogenated.

**How much soy does the average person consume in a day?**

Someone on a junk-food diet is getting soy flour in the fast-food hamburger bun, soy protein in the burger itself, and soy oil in the fries; soy is in every one of these products because it's cheap and abundant. You'll find soy hidden in so many foods, and small quantities add up.

People often start by drinking a lot of soy milk. If they are taking supplements, they can be getting really high doses. Even scientists working for the soy industry will say they support soy food but do not support use of soy supplements. It is so dangerous at such a high level, and it's harming many people.

**How does marketing affect soy consumption?**

It's very much about marketing. If we look back, the soybean was used in this country for soy oil. They take apart the bean and take out the oil and turn it into margarines and shortenings and all those liquid vegetable oils. Once the oil is out, what they had left over was a whole lot of protein.

What's happened is that some of the things they tried to get rid of they're now marketing as things that can prevent cancer or prevent problems. They take something that's bad and turn it into something that's good. Every time they remove a component of soy, they have another thing they can sell.

In Kenya, the soy industry is talking to bakers, teaching them to use soy flour in baked goods, and down in Johannesburg they're working on using soy protein shake powders to help AIDS patients. When the tsunami hit [in 2004], the soy industry was right there giving people assistance and free soy products. Rather than helping people pick up the pieces and get their small farms back

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together, they're replacing local foods with something that's global.

#### Which soy product is the worst?

The biggest problem is soy milk. Those with lactose intolerance think that soy milk is a great alternative, and they're drinking a lot and getting a huge dose of isoflavones. If you're drinking soy milk, you're going to have a problem, or most people will sooner or later. We're all different—some people will start having problems in a day, and some people will think they're fine and a year later things will start to go downhill.

Drinking just one glass a day of soy milk will give someone the level of plant estrogens that has hurt the thyroids of healthy Japanese men and women. Most people are drinking several glasses, plus the soy protein energy bars and the bags of edamame.

If people are concerned about getting enough calcium, try a homemade coconut tonic made with coconut milk and dolomite powder. It will match the mineral content of milk and support the immune system and thyroid.

#### What provoked the Israeli health ministry warning on soy foods?

The Israeli health ministry issued an advisory saying that babies should not get soy formula and that children under 18 should eat soy no more than once a day, three times a week maximum. Adults should exercise caution due to the adverse effects on fertility and increased breast cancer risk.

It started a few years ago when several babies were hospitalized with severe beriberi and brain damage because of a soy infant formula that was deficient in vitamin B<sub>1</sub>. The manufacturer had gotten the idea that if soy is such a perfect food, already high in B vitamins, why should they add extra B vitamins? They didn't understand that babies need added B<sub>1</sub> and that processing affects vitamins. National alerts were issued, the product was recalled, and all the babies on soy formula immediately got injections of B<sub>1</sub>.

That incident caused the Israeli health ministry to start looking into soy formula. They formed a committee including toxicologists, oncologists, pediatricians, and other experts, they reviewed literature, and they decided there are some risks. The Israeli soy

industry has protested mightily and threatened to sue the government, but the health ministry maintained its position.

#### How much soy is OK?

I'll use the numbers the Israelis used. But, of course, some people are allergic to soy, some are sensitive to soy, some have thyroid problems already. Those people should probably avoid it. Then there's the issue of what types of soy we're talking about. I still enjoy miso soup.

#### Do you think we should have a warning label here in the United States?

That's the next step. I will be involved with three petitions to the Food and Drug Administration (FDA). The first will petition to remove from labels the current health claim that soy prevents heart disease. It's been on foods since November 1999, and soy food sales went from less than \$1 billion to \$4 billion [annually] between 1999 and 2004. [In 2006] the American Heart Association retracted its position on soy. They're now saying that soy does not prevent heart disease or lower cholesterol. Second, we're going to petition the FDA to remove the GRAS [generally recognized as safe] status for soy protein isolate. The third petition will have to do with putting warning labels on soy foods.

#### Do you think that labeling will ever be a reality?

We're hopeful that our petitions will work, but we're also bringing attention to the issues. What amazes me is that so many vegetarians and vegans will say that the FDA would never have approved a "soy prevents heart disease" claim unless there was good strong evidence. Hello! This is the same FDA that gave us Vioxx and aspartame. I'm sure in Berkeley in the '60s there were little companies that made tofu and soy milk, and people still believe that soy is that kind of food. What they're not getting is that we have Big Pharma, and now we have Big Soy.



### TEMPEH

Whole soybeans pressed into loaves, which are then fermented. Often used as a meat substitute. Tempeh is rich in B vitamins, minerals, and omega-3 fatty acids.

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# Whole NEW DIET

A health-savvy cookbook shows how to get away from processed foods

by Julie Hanus

Even though health-conscious consumers have learned to shop cautiously, a close inspection of America's cupboards reveals that even the savviest of shoppers aren't necessarily eating better. Highly processed foods

are still successfully marketed as healthy alternatives, and for every study showing the benefits of a particular piece of produce, there's an ambitious industrialist ready to extract, refine, and repackage the nutrient du jour (pomegranate smoothie, anyone?).

Our food culture can even take a well-known health food like soy and transform it into a danger.

The reality, hard to digest amid all the preservatives and additives, is that a truly healthy diet is not only balanced but also *whole*, right down to the basic ingredients in our pantries.

"I grew up and still live in the San Francisco Bay area. It's a place where farmers' markets have a real impact

on many chefs and home cooks," says Heidi Swanson, author of *Super Natural Cooking* (Ten Speed, 2007). "But I started seeing that many of my everyday 'foundation' ingredients, the ones used to support the good stuff from the farmers' market, were heavily processed: nutritionally

barren flours and grains, refined sugars, nut butters made from sprayed crops, and industrially produced cooking oils."

Swanson set out on a mission to revamp the building blocks of her diet and documented the transformation at her website, 101Cookbooks.com. "I started by gradually overhauling my pantry, and it immediately opened my eyes to a whole world of exciting—and completely underutilized—grains," she says. "I traded standard pasta for noodles made of buckwheat, spelt, and spinach. Getting rid of all-purpose flour paved the way for whole wheat pastry flour, and oat, mesquite, and wild rice flours.

"Many industrial food producers bank on the idea that you aren't going to ask questions, or look under the hood at all, and they take advantage of this," the author says, reminding us of the introduction to *Super Natural Cooking*, where she writes: "Before these products made their way into your house or apartment, many were showered with agricultural chemicals, treated with chemical solvents, and stripped of most of their vitamins, minerals, fiber, and flavor."

Perhaps most nefariously, industrialization means that even diets that seem balanced can contain too much of a seemingly good thing. Just as corn begat the now ubiquitous high-fructose sweetener, soy oil now accounts for 80 percent of all liquid fat consumed in the United States. Anything processed or prepared probably contains the stuff, which is extracted from soy beans with a solvent that contains commercial hexane—also used in gasoline, glue, and heavy-duty cleansers. Soy oil shows up in cereal, bread, snack items, frozen foods, and imitation dairy and meat products.

"When I get overwhelmed or just plain confused by a product I'm unfamiliar with, I ask



## FAST FOOD

A source of hidden soy. Processed soy proteins extend some burgers and chicken (nuggets, patties, even "grilled breasts"). Buns contain soy oil and to a lesser extent soy flour and lecithin. Soy oil also appears in dressings and dips, in American "cheese," and as the No. 2 ingredient in fries.

There's even soy in Big Mac's secret sauce: Soybean oil nets top billing.

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myself two questions," Swanson says. "If pressed, could I make this in my own kitchen? Can I explain how this is made to a young person?"

If you're interested in decreasing soy, forgo vegetable oils and margarines, many of which are made from soy, and consider using almond oil, cultured organic and clarified butter, or coconut, pistachio, and pumpkin seed oils.

While you're at it, Swanson also suggests pulling all the white stuff from your shelves—flour, sugar, rice, and bread. "This kicks off the creative process," she says. Then follow the five steps outlined in *Super Natural Cooking*.

### Build a Natural Foods Pantry

Swanson explains how to dump the white stuff, and introduce a variety of flours and whole grains. This chapter also navigates oils and fats, and decodes natural sweeteners, such as agave nectar, molasses, and brown rice syrup, that take the place of granulated sugar.

### Explore a Wide Range of Grains

Swanson advises, "Don't try to make the transition overnight," and previews grains such as barley, farro, millet, and quinoa, which due to its

high protein content is great for vegetarians decreasing their soy intake. Recipes include Wild Rice Flour Pancakes, Do-It-Yourself Power Bars, and Risotto-Style Barley.



Super Natural Cooking



### Cook by Color

Color-saturated vegetables are rich in healthy phytonutrients, such as lutein and beta-carotene. Eating a variety of them is not a revolutionary

idea, writes Swanson, but it is often overlooked. Rainbow-hued treats include Baked Purple Hedgehog Potatoes, Sweet Potato Spoon Bread, and Agua de Jamaica.

### Know Your Superfoods

Swanson profiles her nutritional all-stars: alliums (such as garlic), cruciferous veggies, dried beans (such as butterscotch calypso and black valentine), lentils, nuts and seeds, sea veggies, sprouts, tea, and yogurt. Recipes include Chocolate Turtle Bean Tostadas and Golden-Crusted Brussels Sprouts.



### EDAMAME

Whole soybeans, commonly boiled in the pod and eaten as a snack. Most commercial edamame has been preheated to make digestion easier, but it still contains antinutrients.

### Use Natural Sweeteners


Sweeteners lend moisture and volume to baked goods, act as binding agents, and provide texture, so forgoing granulated territory requires guidance. Swanson makes experimenting delicious with recipes for White Sangria with Drunken Peaches, Thin Mint Cookies, and Coconut Panna Cotta.

Other resources to help clean up your diet:

*Real Food Daily* (Ten Speed, 2005) by Ann Gentry. Another Californian, Gentry reflects the fare of her restaurants in this cookbook of the same name. Recipes are more complicated but no less delicious, and vegan to boot.

*The Organic Cook's Bible* (Wiley, 2006) by Jeff Cox. Less of a cookbook and more of a resource, look here when you're ready to break out the big rutabagas, or when you got too impulsive at the market and now you've got to cook that thing, whatever it is.

*Whole Grains: Every Day, Every Way* (Clarkson Potter, 2006) by Lorna Sass. Exclusively dedicated to great grains, half of Sass's mouth-watering recipes call for some sort of meat, because whole foods aren't just the domain of vegetarians and vegans.

*Whole Foods Allergy Cookbook* (Vital Health, 2006) by Cybele Pascal. A place to turn for whole-food cooking for common food sensitivities: dairy, eggs, wheat, soy, peanuts, tree nuts, fish and shellfish, and refined sugar. 





# Biofuel's BIG BEAN

How large-scale soy is threatening the environment and a South American way of life

by April Howard and Benjamin Dangl, from *In These Times*

Rural eastern Paraguay was once flush with jungles, small farms, schools, and wildlife. Now it is a sea of soybeans. The families, trees, and birds are gone. The schools are empty. The air is filled with the toxic stench of pesticides.

We drive through this sea of green on a red dirt road. Meriton Ramírez is taking us to the former community of Minga Porá, to the farm where his family used to live. Ramírez is a member of the Asociación de Agricultores de Alto Paraná (ASAGRAPA), a farmers union spearheading the fight against the expansion of the soy industry.

"I didn't want to leave. I built my farm and raised my children here. I planted fruit trees. For the first time in my life I had good land," Ramírez says, motioning to the vacant space that used to be his home. "Then the soy farmers arrived and we couldn't stand the fumigation. We had terrible headaches, nausea and skin rashes, problems seeing, respiratory infections. The chickens died. The cows aborted their calves and their milk dried up." In 2001, his crops destroyed,

the neighborhood reduced to a swath of soy fields, Ramírez and his family left the land. Now Minga Porá, once a community of several thousand farmers, is home to just 30 families.

Paraguay has the most unequal land distribution in Latin America, with 95 percent of the country privately owned by large estates. Incomplete and corrupt agrarian reforms have left most small farmers, called *campesinos*, without property, occupying unused land for small-scale subsistence farming. In the mid-'90s, if the pesticides didn't drive the *campesinos* away from this land, the soy industry tried to buy them off. ASAGRAPA members say that when farmers refused to convert or sell, thugs showed up to convince them to grow soy or leave. "If you tried to resist, they'd kill you," Angélica Ramírez, Meriton's daughter, says.

In recent years soy production has increased exponentially due to worldwide demand for animal feed and the rise of an insatiable biodiesel industry. Biodiesel made from soy oil is touted as good for the environment, even more effi-

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cient than ethanol. In 1999, 44 million acres of soy were grown in South America; by 2004 there were 94 million acres. In the past six years, annual expansion of land cultivated for soy in Argentina, Brazil, and Paraguay has exceeded 10 percent, mainly at the expense of rainforest and savanna. If current trends continue, by 2020 global demands will require 370 million acres of cultivated land worldwide, and in Latin America an additional 54 million acres of forests and savanna will be destroyed.

In June 2006, the chief executive of Cargill told the *New York Times* that the biofuel industry is a "gold rush." Transnational seed and agrochemical companies such as Monsanto, Pioneer, Syngenta, DuPont, Archer Daniels Midland, and Bunge manage the industry. International financial institutions and development banks promote and bankroll the export of monoculture crops. The World Trade Organization grants increased subsidies to these agribusinesses and tax credits to refiners involved in biofuel production.

The cheap, unregulated land and labor available in places like Paraguay, Brazil, and Argentina make the economic deal even sweeter. According to the *Ecologist* (March 2007), biotech businesses look to set up shop in countries where environmental regulations are slack.

Argentina has recently created corporate incentives to expand soy cultivation for biodiesel. And worldwide subsidies to the biofuel industry are now between \$5.5 billion and \$7.3 billion annually, according to a Global Subsidies Initiative (GSI) report published in October 2006. "Many of these subsidies are poorly coordinated and targeted," says GSI director Simon Upton. "The potential for waste on a grand scale and some spectacularly perverse environmental outcomes is large."

The last agricultural census in Paraguay was taken in 1991, making guesswork of how much deforested land is used to plant soy. Of the Interior Atlantic Forest, however, which once covered 300 million acres, including 85 percent of eastern Paraguay and parts of Argentina and Brazil, even the most liberal estimates state that no more than 13 percent remains. According to the Nature Conservancy, Paraguay has one of the "largest" remnants of original forest—a mere 3.2 million acres.

An acre of forested land absorbs almost twice as much CO<sub>2</sub> as land used to grow biofuel crops, thereby cancelling out any climate advantage advertised by biofuel production. Soy cultivation

dumps more than 24 million liters of agrochemicals in Paraguay every year. They include Paraquat, which has no antidote if ingested; Metamifos, which has reduced sperm count in exposed males; and Endosulfan, which causes birth defects in the infants of repeatedly exposed mothers. The Paraguayans we spoke with didn't use the terms *pesticide* or *herbicide*; they called the chemicals *venenos*, venoms or poisons.

As we drive through the soy fields, a terrible smell often forces us to cover our noses and eyes. "That's the venom," says Angélica Ramírez.

"How would you describe the smell?" we ask.

"Dead dog," she says.

"The soy workers also wash their machines in the river after spraying [pesticides]," says Angélica. "Combined with the agricultural run-off, this means that there are no fish left in our rivers, and the water is completely contaminated."

Leonida Laivas is the Ramírez family's old neighbor. Her land is a tiny island of trees in the expanse of soy. Her entire family suffers from stomach pains, headaches, and sight problems. "The poison never gives us a rest," she says. "Just yesterday the tractors came to spray the soy crops, and the wind blew it all over us." In the nearby town of San Isidro, cancer rates are high and several children have been born with malformed limbs.

Since the first soy boom, the industry has evicted almost 100,000 of Paraguay's small farmers from their homes and fields and forced the relocation of countless indigenous communities. More than 100 *campesino* leaders have been assassinated, and more than 2,000 others have faced trumped-up charges for their resistance. The Ramírez family now lives in El Triunfo, a community formed by farmers involved in the Asociación de Agricultores de Alto Paraná and designed to prove that small-scale, nonchemical agriculture is possible. The land is communally owned and farmers aren't allowed to sell it.

"There has to be a change," ASAGRAPA President Tomás Zayas says. "Because if not, we are facing the end of the Paraguayan *campesino*."

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