

LAURA SAYRE

*In the Water*

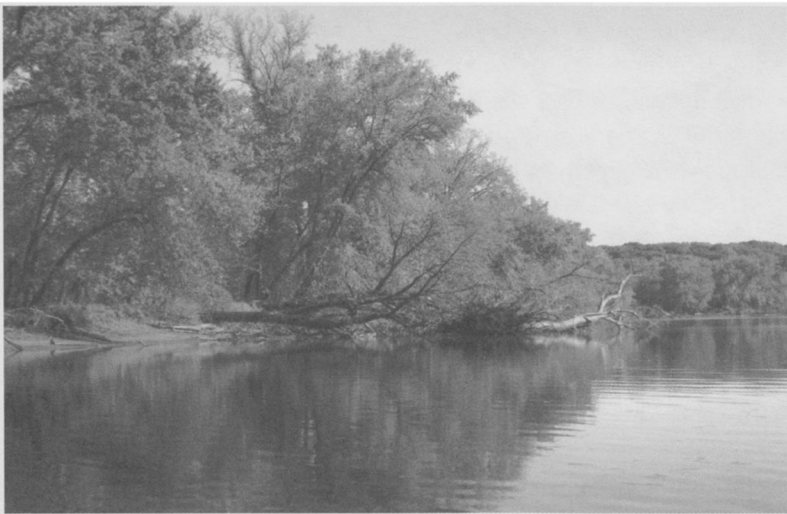
Last summer I rode RAGBRAI, the *Des Moines Register's* Annual Great Bike Ride Across Iowa. It was my second RAGBRAI (my first was in 2006), and far from my first bike tour through the Iowa landscape—growing up in Iowa City I used to ride out to Sugar Bottom and West Branch a dozen times a summer—but in the aftermath of the 2008 floods it felt distinctly different. On RAGBRAI you always feel exposed to the elements—there's always at least one night when you get roused from your tent by the tornado sirens, and in 2008 there was a day when we rode along a path taken by a tornado the previous night, with trees downed and grain bins crumpled like pop cans by the side of the road. But the floods were something else. The paw prints of raccoons in the silty mud left along the swollen creeks looked so vulnerable. Riding through areas that had been heavily impacted, I realized I had been engaged in a kind of magical thinking whereby the landscapes of my childhood had remained protected from further environmental degradation—had probably even improved, thanks to better land management and strengthened regulations—even though another part of my brain knew very well that intensification of agriculture in Iowa had in no way slackened its pace since I left home.

Four or five years ago, as my friends' babies started growing into toddlers, it came to my attention that children drink water. I never drank water as a kid. We mostly drank milk—raw milk from Moss's Dairy on the edge of town—or we drank orange juice, the frozen concentrate kind, or herbal sun tea steeped on the back step. Occasionally we could persuade our mom or dad to buy RC or Dr. Pepper in those heavy old eight-packs of sixteen-ounce bottles. At friends' houses we sometimes got Kool-Aid, but our mom dismissed Kool-Aid as “lollipop juice.”

Anything, in other words, but straight water. Nobody seemed to have thought of such a thing as bottled water in Iowa in the 1970s and '80s, but it was understood that you needed something to disguise the taste of what came out of the tap. When I was grow-

ing up, the taste of the water in Iowa City was a source of comedy. Everyone knew it was terrible, and worse than terrible in the spring, but that was the beginning and the end of it. When Berke Breathed, author of *Bloom County*, said goodbye to the town in 1985, he drew a special cartoon that appeared on the front page of the *Iowa City Press-Citizen*. It depicted Opus and Milo hanging out in the fountain on the pedestrian mall, talking about everything they would miss, from the sandwiches at Bushnell's Turtle to the Hare Krishnas on the Pentacrest. "Except the water," Milo adds. "The water tastes like Spic 'n' Span."

I grew up in the Iowa City neighborhood called Woodlawn, eleven blocks east of the Old Capitol, a green patch of land set aside for the never-to-be-built governor's mansion. We were very fortunate and we knew it because we had this wonderful park-like landscape to play in, a dead-end gravel drive with very few cars and a strong pack of neighborhood kids. There were about twelve of us, and we spent most of our time outside, building tree houses and riding bikes and foraging for mulberries across our little oak-hickory-and-back-garden savanna. We liked to pluck the Virginia bluebell blossoms out of the shade and squeeze their miniscule drops of nectar against our tongues.



*Iowa River between Coralville Dam and the Dubuque Street bridge, north of Iowa City, October 2008. (Photograph by the author)*

But our number-one source of entertainment was Ralston Creek, which bounds Woodlawn on two sides and which we considered very much part of our territory. We collected interesting bits of garbage, looked for crawdads under rocks (although these were scarce), and even built a small dam behind which we floated a barge we had built out of scraps of wood scavenged from our parents' garages and basements. One summer—I must have been nine or ten—a thunderstorm turned our creek into a surging, muddy river, and we put on swimsuits and life preservers and old tennis shoes and spent the day surfing the flood from one end of the neighborhood to the other, hauling ourselves out of its muddy roar by a rope we strung across the creek just before it boiled under the Evans Street bridge.

In later years we graduated from the creek to the Iowa River, floating downstream on inner tubes around the great oxbow that borders City Park and then jumping off the Hancher footbridge. There was a rumor about a submerged shopping cart it was inadvisable to land on, so we figured it was safer to jump when the river was high. Eventually the university posted a sign on the bridge recording the date of the last death of a bridge jumper, and that served as an effective deterrent. But we never once gave a thought to the water quality, even though we did have a story about a favorite cat, Brave Daniel, who had died, it was said, after drinking out of another creek draining into the Iowa. Dirty Face Creek, we called that one.

I was reminded of these memories last summer. When the floods came, all of us expatriate Iowans suddenly became famous: Is your family OK? people would ask. How bad is it, really? Do you know anyone who's been affected by the floods? Yes, I would answer. And yes. It's very bad. Worse than I could imagine, I found, staring at the aerial photos on the *Press-Citizen* website, my mind filling in features beneath the wide muddy ribbon stretching across our familiar little municipal valley. One friend said, Well, I guess with all that flooding it must mean that Iowa isn't flat, which gives you an image of a tabletop country, level as an ocean horizon, thirty-six million acres with an ankle's depth of water. If Iowa were truly flat, we'd have no problem with water: it would settle into our loamy soils like a blanket smoothed across a bed. No, I said, Iowa is not flat.

A year or so ago I was looking through a 1989 report from the National Research Council titled *Alternative Agriculture*—a landmark

publication in its time, one of the first quasi-official endorsements of organic farming—and I happened across some data I had somehow managed not to see before:

Pesticide Concentrations From Finished (Treated) Public Drinking Water Supplies Derived from Surface Waters in Iowa City, Iowa, on May 18 and 19, 1986:

Alachlor, 8.8 parts per billion. EPA Health Advisory Level, 1.5.

Atrazine, 15 ppb. EPA Health Advisory Level, 3.

Metolachlor, 10 ppb. EPA Health Advisory Level, 10 ppb.

Cyanazine, 7.2 ppb. EPA Health Advisory Level, 9 ppb.

Low levels of 2,4-D, metribuzin and the insecticide carbofuran also present.<sup>1</sup>

Exposure to alachlor has been linked to anemia, cancer, and ailments of the eyes, liver, kidneys, and spleen. Atrazine is associated with cardiovascular and reproductive problems. Carbofuran can lead to problems with the blood, and nervous and reproductive systems.

Iowa's Groundwater Protection Act of 1987 provided the first authorization for hydrologists to measure pesticide levels statewide and to link these to agricultural use. Researchers had their work cut out for them because prior to the Act, state officials had only piecemeal information about pesticide application rates or contamination levels. According to Mary Skopec, who has run the water-monitoring program for the Iowa Geological Survey since the early 1990s, they began with national agricultural statistics on the dollar value of pesticides sold, traced those back to the individual dealers, and then extrapolated pounds applied using conversion factors provided by Iowa State University. By the year 2000, they had a comprehensive monitoring program in place, with eighty sampling sites on rivers across the state. In 2007 they were forced to suspend the program because of budget cuts, although the United States Geological Survey (USGS) continues to monitor twelve sites where Iowa's major rivers drain into the Mississippi and the Missouri. So

---

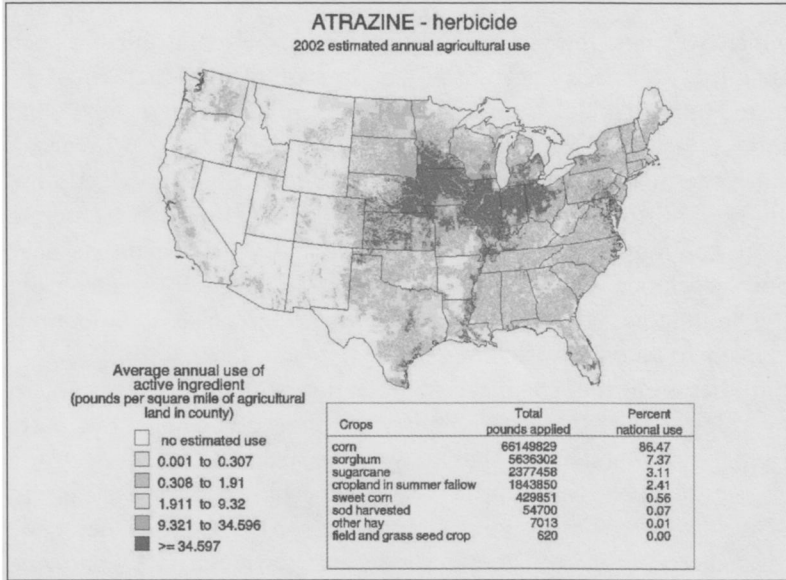
1. Committee on the Role of Alternative Farming Methods in Modern Production Agriculture, National Research Council, *Alternative Agriculture* (Washington, D.C.: Academy Press, 1989), pp. 103, 107–8.

they have about eight years of fairly comprehensive data, supplemented by some project-based studies in specific parts of the state.

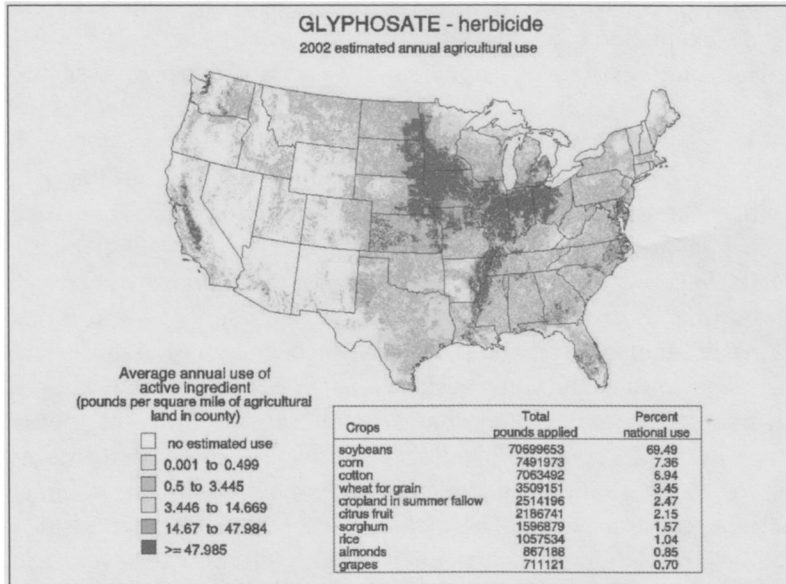
It turns out that these hydrologists and geochemists know more about my childhood than I do. For those who can read it, Iowa's surface and ground waters offer a kind of ethnography of the soil, a liquid record of human activity. Two-thirds of the surface area of Iowa is treated with agricultural chemicals each year, including synthetic fertilizers, pre- and post-emergent herbicides, insecticides, and fungicides. Herbicide usage—the largest class of pesticides by far—is determined in part by geology: on less freely draining soils, for instance, farmers have to be more careful about applying atrazine because it won't leach quickly enough and can end up damaging the next crop. Market forces also play a role. Farmers in the southern tier of counties tend to be less affluent and to rely more heavily on the less expensive herbicides. Over time, alachlor has been replaced by acetachlor, cyanazine by atrazine. Finally, there are individual factors: "If you've got a dealer who's really excited about a particular chemical," Skopec says, "you can see a hot spot."

Based on data from these and other sources, the USGS has created a series of digital maps showing average annual herbicide applications by county, nationwide, in terms of pounds of active ingredient applied. In effect, the herbicide maps double as crop species distribution maps, with the dominant herbicides for each of our primary crops, corn and soybeans in the Midwest, lighting up the states and regions where they are most widely grown. Virtually all of Iowa and Illinois, and parts of Minnesota and Indiana and Ohio glow orange and red with atrazine, glyphosate, and metolachlor—the great wealth of the Mississippi and Missouri River valleys draining south toward the Louisiana delta.

But although the use of glyphosate, better known as Roundup, has spread with the popularity of Roundup Ready soybeans, in other ways these maps are growing dated. In recent years, the hydrologists and the chemical salesmen have been engaged in a game of cat and mouse. Responding to pressure from the Environmental Protection Agency, pesticide manufacturers have begun developing compounds that are more water-soluble and thus break down more quickly. When levels of detected parent compounds started to fall as a result of this shift, survey scientists became curious about the first- and second-level pesticide breakdown products, many of



[http://water.usgs.gov/nawqa/pnsp/usage/maps/show\\_map.php?year=02&map=m1980](http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m1980)



[http://water.usgs.gov/nawqa/pnsp/usage/maps/show\\_map.php?year=02&map=m1099](http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m1099)

*Pesticide use maps created by the Pesticide National Synthesis Project, National Water-Quality Assessment Program, U.S. Geological Survey, Department of the Interior.*

which still have herbicidal and other environmental effects. Each chemical and each “degradate,” or breakdown product, must be tested for individually, and the survey scientists have to guess what to test for based on their knowledge of the chemistry involved, since the manufacturers don’t volunteer that information. A 2004 study confirmed that herbicide degradation products are found more commonly than parent chemicals, and USGS scientists have now developed an “additive toxicity model” to help predict what the cumulative effects of these mixtures of associated compounds is likely to be on aquatic life.

In between the chemical manufacturers and the government hydrologists sit the weed scientists and weed ecologists, who are feeling rather embattled these days. One major fear centers on the impact of global warming, which is expected to favor the growth of weeds over the growth of crops. A second issue is herbicide resistance. Dozens of common weeds worldwide are now showing resistance to commonly used herbicides; at least thirteen resistant weed species have been reported in Iowa, including lamb’s-quarter, giant foxtail, and giant ragweed.

Herbicide resistance is understood to be a product of over-reliance on single, dominant herbicides like atrazine and glyphosate. Weed scientists have responded by advocating a rotational approach to herbicide use, a system in which chemical diversity attempts to compensate for the loss of biological diversity. Instead of rotating crops, in other words, we’re now supposed to rotate chemicals. Herbicides are divided into groups based on “modes of action”: those that affect plants’ ability to make use of sunlight, those that affect cell metabolism, and those that affect cell division, for example. The Iowa State University Extension Service is now obliged to publish pamphlets and charts explaining the different modes of action of different herbicides, the active ingredient percentages of the various commercial blends, and their effectiveness under various conditions. The herbicide marketed as “Expert 4.9SC,” for instance, contains 1.74 pounds of S-metolachlor for every 2.14 pounds of atrazine and 0.74 pounds of glyphosate. “Yukon” is 12.5 percent halosulfuron and 55 percent dicamba. Extension agents also have to combat disinformation on the part of the herbicide companies, some of which downplay the issue of herbicide resistance. Despite the best efforts of the weed scientists, however, the world

of herbicides remains in large part *terra incognita*, since the commercial chemists' ability to imagine and market new forms of chemical weed control far outstrips the scientists' ability to describe how they function. A final group within the taxonomy of herbicides is officially designated by the letter Z, for chemicals whose mode of action is "unknown."

And the situation is only getting worse in terms of the continuing intensification of conventional agriculture and what's going into the river, both upstream and downstream. We don't like to blame farmers, but in our effort not to blame them we end up putting the problem out of our minds altogether. I've spent a fair amount of time talking and visiting with organic farmers, both in Iowa and elsewhere, and this is what I've learned from them.

First, there's a real question out there about the ability of organic and non-organic farming to coexist in this landscape. This is a difficult thing to say publically in Iowa, but privately it is what you hear. For a while the flashpoint centered on genetically modified corn and soybeans and their contamination of organic crops. This issue has been partially addressed through strategies like choosing varieties that tassel out and pollinate at different times, so the risk of cross-pollination is reduced, but to some extent it's just been swept under the rug. The European Union organic standard now includes a "tolerance level" for accidental contamination of organic crops by genetically modified varieties of 0.9 percent, but so far this step has been resisted in the U.S. on the grounds that it would represent a capitulation to agribusiness interests and a betrayal of consumers of organic foods, not to mention of organic farmers.

But there are other kinds of contamination as well. An organic farmer in northeast Iowa once showed me his buffer zone for soil runoff from his neighbor's conventional field. Organic farmers are required to maintain buffer zones or buffer strips between their organic fields and neighboring non-organic fields that might act as sources of contamination. Usually, the concern is with spray drift, in which case the best kind of buffer is a dense tree-row or hedgerow. But in this case the neighbor's conventional field lay slightly higher than this farmer's organic field, and there was so much soil coming off the eroding conventional land that the organic farmer had to fence off a fan-shaped area of his pasture to keep his cattle from



grazing in the part of the field that was receiving all this chemically treated soil. It was an improvised solution, the first I'd seen like it, and only minimally satisfactory, but how much land should organic farmers be expected to sacrifice to the practices of their neighbors?

An even bigger problem faces organic pig farmers, of which there are only a handful in Iowa because organic pork production is so challenging—it's much more difficult than raising organic beef or chicken. Part of the reason is that, as one farmer put it to me, "Iowa is a sink for pig diseases." Organic pigs will have stronger immune systems, but you have to be really careful about isolation and quarantine so as not to bring diseases in from outside. There are so many pigs in Iowa, kept in such concentrated, unhealthy conditions, that pig diseases are everywhere; they will blow in on the prevailing winds.

In 1970, when I was born, there were about fifteen million pigs and hogs spread across 91,000 farms in Iowa; today, according to the National Agricultural Statistics Service, there are nearly twenty million, confined to just 8,500 operations, and virtually all of them are hidden behind closed doors. Today we have 600 hog operations housing more than 5,000 animals each, and another 1,700, each with more than 2,000 animals. And yet you can drive or ride your bike across Iowa and stand a fair chance of not seeing a single hog or pig. The only pigs I saw on RAGBRAI last summer were on an organic farm managed by an acquaintance of mine, where I stopped in to say hello. Confined animal feeding operations are now the primary source of persistent nitrate contamination in Iowa, which has also been rising over the past twenty years. Confinement systems also shed other contaminants of serious concern, like antibiotics and antibiotic-resistant bacteria, not to mention adversely affecting the quality of life in their neighborhoods.

But the second open secret of rural Iowa is the good news, and it's just as important: organic farming works, and not just for small-scale organic vegetable production or big California companies, but for traditional, diversified, Midwestern-style family farming of corn, soybeans, small grains, livestock, and hay. Don't let anyone tell you otherwise. So buy local and buy organic, support the work of groups like Practical Farmers of Iowa, and fight for limitations on agricultural subsidies. Don't settle for the notion that herbicide use on this massive scale is inevitable. Farmers use herbicides because

they're fast and easy, not because they're reliably safe or even particularly effective. They make it possible to farm more ground, to produce large quantities of low-value farm products. The organic way produces a crop higher in value and in volumes that can equal the yields of conventional farming, though that degree of success, it is true, requires more labor.

Today we may have better science and better right-to-know laws, better treatment plants, and greater awareness; but the fact of the matter is, we have more environmental impacts and contaminants. On the up side, we have some really powerful tools at our disposal now with which to tell these stories. The digital revolution is putting data and interpretative graphics in the hands of anyone who has the determination to surf for them.

However, neither last year on RAGBRAI, nor in 2006, did I have the impression that riders sensed the meaning of the landscape they were cycling through. The Natural Resources Conservation Service puts up a tent each day of the ride—actually it's one of the best tents from a rider's perspective; they give away free bananas and free postcards, which they stamp and mail for you—and they have a little display about soil erosion, but it's pretty low-key. Practical Farmers of Iowa sponsored a stop in 2008 for the first time, but only because the route happened to go right by the farm of Dick and Sharon Thompson, near Boone, who were among the driving forces behind the founding of that organization. To my surprise, however, they didn't (at least when I stopped) have any kind of educational display set up, just free water and T-shirts for sale.

There's something of a puzzle in the fact that organic farmers today regularly cite weed management as their number-one challenge, whereas the accounts of pre-herbicide-era farmers tend to downplay the challenges of weeds as opposed to those of insect pests. This is one reason why the insecticide treadmill was set in motion some two or three decades earlier than the herbicide treadmill. As late as 1954, *The Midwestern Farm Handbook* advised that "Most chemical weed controls are quite expensive and are limited to use on rather small areas. Chemicals should always be used as an adjunct or supplement to good cultural practices of weed control, never as a substitute for them." Nor is it clear that herbicides are the contaminant of greatest concern. But herbicides and pesticides together construct the science of making things not grow. For most

of human history, the major problem facing agriculturists has been soil depletion. Today, we suffer from an excess of nutrients, excess fertility laid down “just in case” and rushing through the soil faster than crop plants can make use of it. Farmers are enjoined to maintain a delicate balance between fertility and weed control, a kind of arms race of vigor and weakness. In fact one could almost suggest a rule by which the less acutely toxic herbicides become, the more we use of them. And the less effective they are. As Dennis Keeney writes in his book *Bugs in the System*, pesticides are characterized by a well-known *revenge effect*.

When you grow up in Iowa you think cornfields are natural. From the backseat of the car you watch the optical play of sightlines skipping across the long rows like a horizontal kaleidoscope, hiccupping over the crossroads once a mile. Later, when you learn about the native tall grass prairie, the landscape turns itself inside out, the scope of the wild retreating to a clutch of wooded ravines and forgotten railroad embankments. My introduction to the prairie came during two college summers at Lakeside Labs, the field biology station in northwest Iowa run jointly by the three state universities. At Lakeside, you could walk along the road at night and on one side look out over the dark hush of a cornfield exhaling that sweet smell of tassel and husk. When you turned to look the other way, twenty acres of restored prairie lay stretching beneath a suspended, shimmering cloud of fireflies, as abundant as the stars.