Harmful Farming

The Effects of Industrial Agriculture

In the process of swallowing up small, family farms, industrial agriculture is gobbling up fossil fuels, water, and topsoil; belching out pollutants; and disrupting local economies, asserts Leo Horrigan, urban agriculture coordinator, and his colleagues at The Johns Hopkins Bloomberg School of Hygiene and Public Health in Baltimore, Maryland, in this issue [***EHP*** **110: 445–456**].

The team's summary of farming's environmental and human-health effects reveals the magnitude of the problem—and the importance of addressing it. "When you consider how much agriculture impacts our health, it's amazing there's not more focus on it in public health fields," Horrigan notes.

Agriculture's environmental impact has grown since farmers became dependent on chemical pesticides and fertilizers. Since the 1950s, fertilizer and pesticide use has increased substantially worldwide. Crops absorb only one-third to one-half of fertilizer applications, and less than 1% of applied pesticide reaches the target pests. The chemicals seep into local soils and waterways. Indeed, farms produce 70% of the river and stream pollution in the United States.

Many insects—about 500 species as of 1990—have become resistant to pesticides. Pesticides are linked to honeybee die-offs, developmental abnormalities in amphibians, and poor immune function in dolphins, seals, and whales. Pesticides increase the risk of cancer in humans, particularly among farm workers, and may cause endocrine and reproduction dysfunction.

Concentrated animal feeding operations are particularly hard on the environment, as they create huge waste management problems. U.S. livestock produced 1.4 billion tons of manure in 1997. Livestock are inefficient sources of protein when you consider the natural resources they consume. For example, compared with grains, cattle require about 100 times more water to produce the same amount of protein.

Animal agribusiness directly impairs human health. The overuse of antibiotics in livestock is contributing to the worldwide problem of antibiotic resistance. Seventy percent of antibiotics produced in the United States are fed to healthy animals as growth promoters. Also, the most common food-borne illnesses, such as salmonella, come primarily from meat produced in large farms and high-speed processing facilities. Cardiovascular disease, cancer, and Type II diabetes are becoming more common as meat consumption increases among the world's affluent.

Agricultural angst. Industrial farming, with its consumption of resources and creation of waste, is giving new meaning to the phrase "living off the land."

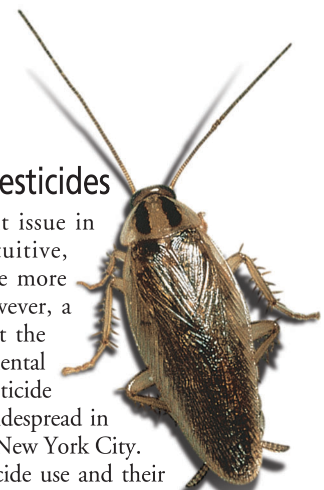
Farms are using large amounts of the world's nonrenewable fossil fuels and scarce water supplies. About two-thirds of all water used worldwide goes to farming. The average U.S. farm uses 3 kcal of fossil energy to produce 1 kcal of food energy. For beef production, the ratio is 35:1. Processing foods requires lots of energy: 1,800 kcal/kg for frozen fruits and vegetables, 16,000 kcal/kg for breakfast cereals, and a whopping 18,600 kcal/kg for chocolate.

Agriculture's bounty is not reaching those most in need. Although meat consumption has doubled since 1950 among the world's richest, the poorest have seen no significant increase. Large farms drive out small ones and undermine rural communities. Despite this, government subsidies go disproportionately to large farms.

"It doesn't need to be this way," Horrigan contends. "We can develop relatively small, profitable farms that use fewer inputs (such as less fossil fuel and pesticide use), have greater plant diversity, and use renewable forms of energy and sustainable farming practices, among other innovations." For example, Gallo, a large wine producer, switched from chemical to organic practices on 6,000 acres. The result? Equivalent yields, lower costs.**–Tina Adler**

The Hazards of Cleaning House

Urban Women's Exposure to Pesticides



That pesticide residues are an important issue in urban communities may be counterintuitive, because concerns about pesticides may be more obviously expected in farming areas. However, a report by Robin Whyatt and colleagues at the Columbia Center for Children's Environmental Health [***EHP*** **110:507–514**] shows that pesticide use and the residues it leaves behind are widespread in highly urbanized minority communities of New York City.

The Columbia group found that pesticide use and their airborne residues are highly prevalent in the homes of pregnant women living in minority communities in New York City. They report findings for 316 African-American and Dominican pregnant women living in Harlem, Washington Heights, and the South Bronx. The women were questioned about the levels of housing disrepair, sighting of pests, and the pest control measures used in the household during the time of pregnancy. Seventy-two women wore personal ambient air monitors during two consecutive days in the third trimester of their pregnancy to detect the presence of 21 different pesticides or their degradation products.

The results show that pesticide use and exposure are widespread among this cohort. Of the 314 pregnant women who completed questionnaires, 85% reported that pest control methods were used in their homes during the pregnancy. Over a third of these women reported that pesticide application was conducted by an exterminator. Other common methods of pest control were sticky traps, gels, and bait traps. Use of can sprays and bombs was reported in 31% of the pest control users. Nine percent of users reported use of illegal pesticides such as Tempo (a pyrethroid) and Tres Pasitos (aldicarb). These pesticides are sold illegally on the streets of many communities where there is demand for pest control alternatives. Much of the pest infestation in these communities may be due to housing disrepair. The use of pest control measures increased with the level of housing disrepair reported by the women in this study, and it is a prevalent problem in the communities studied in this report.

Pesticides were found in the air samples of all of the 72 women who were tested. Four pesticides were detected in all these samples: the

Top to bottom: USDA Agricultural Research Service; PhotoDisc organophosphates chlorpyrifos and diazinon, the carbamate propoxur, and the fungicide o-phenylphenol. Other four pesticides were detected in lower concentrations: the pyrethroid trans-permethrin, piperonyl butoxide (an indicator of exposure to pyrethrins), and the organochlorines DDT (dichlorodiphenyltrichloroethane) and chlordane.

The proportion of pesticides inhaled adds to the total pesticide exposures that come from other environments, including exposures through skin contact and from the diet. This study also shows that a mixture of pesticides can be detected in the air breathed by urban minority women. This is important because little is known about the toxicity of pesticide mixtures.

The women who participated in this study are being recruited as part of a larger research project that will follow their children as they grow to assess the effect of pesticide exposure on a child's ability to learn. Data from many studies in laboratory animals show that pesticides can have significant effects on brain function and structure. By recruiting women during pregnancy, assessing their exposure to pesticides, and following their offspring over time, this study will provide important insight into the possible effects of pesticides in children.**– Luz Claudio**

Farm Kids and Chlorpyrifos

An Accurate Assessment of Exposure

Estimating children's total exposure to organophosphate pesticides is a formidable challenge. In this issue, Richard Fenske and colleagues at Seattle's University of Washington School of Public Health and Community Medicine report on using two different methods to investigate pesticide exposure in preschool children in the apple-growing region of Washington State. [*EHP* **110: 549–553**] The researchers measured pesticide concentrations in house dust and also used pesticide metabolites in urine as a biomarker. They found that house dust concentrations of parathion fell dramatically after the pesticide was restricted, but concentrations of chlorpyrifos in house dust were five times higher in farmworkers' homes than in nonfarmworkers' homes. These differences in the content of pesticides in house dust were not reflected in the biomonitoring. Children from either type of family had similar concentrations of pesticide metabolites in their urine.

Organophosphate pesticides, which are metabolized relatively quickly and excreted in the urine, are prime candidates for biological monitoring. Fenske's team is working to use biomonitoring to estimate total exposure and environmental sampling to determine the main sources of sources of pesticide exposure.

The researchers obtained two urine samples from 109 children (up to six years old) from 75 homes in the central part of Washington State where tree fruit production is the major industry. The samples were taken from May to July in 1995 when apple orchards are sprayed with organophosphate. They also collected a hand wipe sample from each child, a household dust sample from a carpeted area, and wipe samples from a noncarpeted area, the steering wheel of the family vehicle, and the farmworker's boots.

The study included 91 children from farmworker households and, as controls, 18 children from nonfarmworker families who live at a distance from the orchards. The researchers then selected one child from each household (61 cases, 14 controls) to include in the statistical analysis.

The researchers measured chlorpyrifos and parathion in house dust and wipe samples using gas chromatography. They also measured pesticide metabolite concentrations in urine and found that most children did not have measurable levels of chlorpyrifos or parathion metabolites in their urine. This finding could be due in part to the relatively high limits of quantitation (LOQs) for the metabolites, the authors write. LOQs were higher than normal for this method because urine sample volumes were too low, the authors state.

These measurements showed that levels of chlorpyrifos in house dust in farmworkers' homes were five times higher than levels in nonfarmworkers' homes, demonstrating that farmworkers bring pesticides home with them. But because the researchers found no significant difference between urine metabolites from farmworkers' children and control children, the farmworkers' children did not appear to have increased exposures. In a separately published paper, the same research group reported a positive correlation between use of organophosphate pesticides in home gardens in the Seattle, Washington area and elevated levels of organophosphate metabolites in urine.

There are many reasons why metabolite levels in urine do not correlate with house dust levels, or any other environmental measurements in this study, according to team member Chensheng Lu. The main reason, he says, is that urine metabolites provide a snapshot of the total amount of pesticides absorbed through all the possible routes of exposure, whereas environmental samples can only provide indications of potential exposures and help determine which pathway contributes the most to the total exposure.

The good news from this study is that once a pesticide is removed from general agricultural use, as parathion was in 1991, residue levels in agricultural community homes appear to decrease rapidly. Parathion house dust levels dropped dramatically—by more than 10-fold—between 1992 and 1995.**–Rebecca Renner**

Comparing apples and oranges? A new study compares methods for estimating children's exposures to agricultural chemicals and finds farmworkers' children do not necessarily have increased exposures.