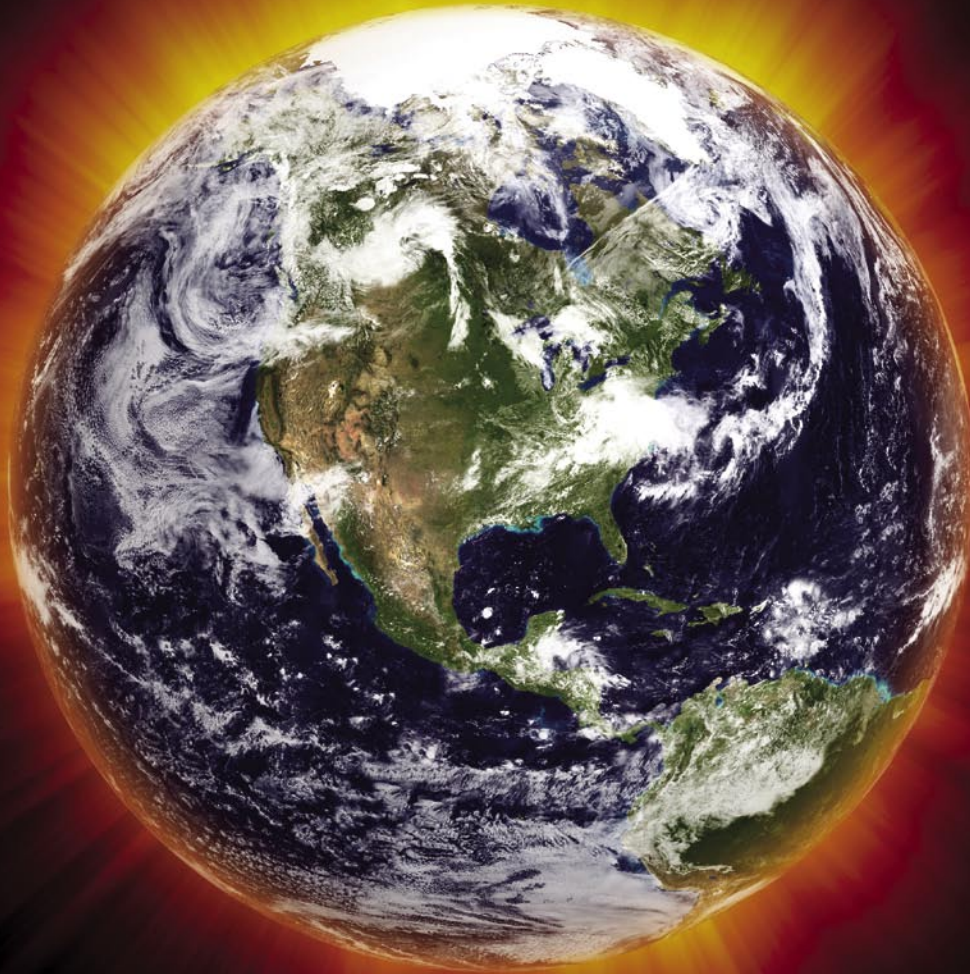


# Pesticides and You

News from Beyond Pesticides: Protecting Health and the Environment with Science, Policy and Action

Volume 27, Number 1

Spring 2007



## **Climate Change Consequences and the Organic Response**

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**Climate Change, Plant Biology and Public Health ■  
The Organic Farming Response to Climate Change ■ Fighting Fumigation ■  
Nanotechnology's Invisible Threat: Small science, big consequences ■  
The Omnivore's Dilemma**

## Defending Nature, Protecting Life Recognizing Rachel Carson and elevating her message

Rachel Carson would have been 100 this May. Her life was cut short by cancer at the age of 56 in 1964, just a year and a half after the publication of *Silent Spring* (September 1962), which launched the modern environmental movement. Ms. Carson's poignant words: "Can anyone believe it is possible to lay down such a barrage of poisons on the surface of the earth without making it unfit for all life? They should not be called 'insecticides' but 'biocides'."

We celebrate Rachel Carson, her legacy, and the continuing commitment to understanding and respecting our relationship to nature.

On the 1963 CBS program, "The Silent Spring of Rachel Carson," Ms. Carson said:

"It is the public that is being asked to assume the risks that the insect controllers calculate. The public must decide whether it wishes to continue on the present road, and it can do so only when in full possession of the facts."

"We still talk in terms of conquest. We still haven't become mature enough to think of ourselves as only a tiny part of a vast and incredible universe. Man's attitude toward nature is today critically important simply because we have now acquired a fateful power to alter and destroy nature."

"But man is a part of nature, and his war against nature is inevitably a war against himself. The rains have become an instrument to bring down from the atmosphere the deadly products of atomic explosions. Water, which is probably our most important natural resource, is now used and re-used with incredible recklessness."

"Now, I truly believe, that we in this generation, must come to terms with nature, and I think we're challenged as mankind has never been challenged before to prove our maturity and our mastery, not of nature, but of ourselves."

### The resurgence of DDT

The chemical industry tried unsuccessfully to discredit Ms. Carson after the publication of *Silent Spring* and has been working at discrediting those carrying her mantle ever since. It is somewhat ironic that as we celebrate Ms. Carson on her birthday, we are continuing to fight the use of DDT, now being promoted by the World Health Organization as the central tool in the fight against malaria in Africa and worldwide. This, despite agreement in the world community, with a 144 countries having ratified or adopted the Stockholm Convention on Persistent Organic Pollutants, which embraces the "goal of reducing and ultimately eliminating the use of DDT." A public health protection strategy dependent on DDT, a known carcinogen and endocrine disruptor, raises questions about human sustainability and short-term thinking. While it may be relatively easy to spray down the walls of a family's home with an inexpensive, persistent, synthetic, petroleum-based

chemical, it certainly ignores the long-term health of the occupants, especially the children, and does not recognize, nor attack, poverty and the conditions that give rise to insect-borne diseases such as malaria. The world community would rather ignore the development issues that contribute to mosquito breeding.

### Climate change: The organic solution

As this debate rages worldwide, people have been speaking with their dollars in the organic marketplace since the publication of *Silent Spring*, especially in the last 25 years as the organic food industry has grown to a nearly \$20 billion industry. We now see Walmart advertisements that tell us to buy organic clothing so that we can reduce pesticide use. Beyond Pesticides is increasingly working with the pest control industry and institutions like schools and hospitals on changing the pest management orientation from spray and pray to preventive techniques that eliminate the need for toxic chemicals. We have the experience to manage playing fields or turf organically. Clearly, our challenge is to ensure a commitment and a recommitment to the values of Rachel Carson as industrial organic advances. Some of this debate, which must be a national debate, is discussed in the review of Michael Pollan's book, *The Omnivore's Dilemma*, reviewed in this issue of *PAY*.

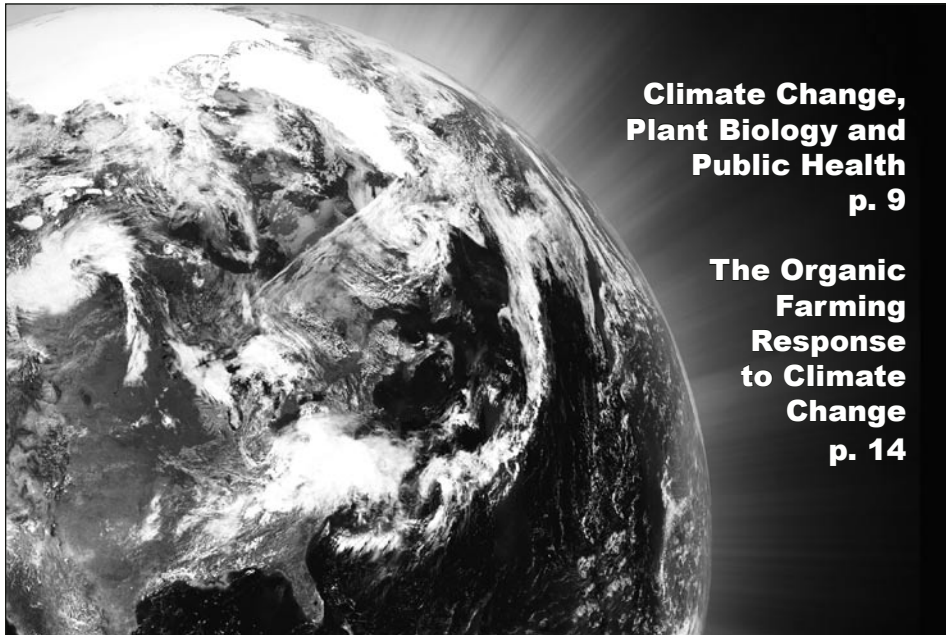
Now, climate change or global warming. With the new attention to climate change and the reduction in carbon loading in the environment, we now must begin—we must begin with an urgency—the expedited national and worldwide conversion to organic agriculture. The data from The Rodale Institute's Farming Systems Trial, perhaps the longest running agronomic experiment (began in 1981), shows that organic farming is one of the most powerful tools in the fight against global warming. The data is presented in this issue of *PAY* by the research and training manager for the Institute, Paul Hepperly, Ph.D. Carbon sequestration in organic no tillage (no till) farming systems are two to four times greater than in chemical-intensive no till systems. At the same time, the Rodale data shows reduced energy needs on the organic farm (37 percent less than conventional) with high consistent yields. In addition, the organic systems reduce nitrate and other nutrient runoff into waterways. While significant numbers of consumers in the marketplace have shown their commitment to organic, we now need government attention to helping with the national conversion to organic systems.



The organic solution is real. Now we must elevate this niche market, moving it from the exception to the rule with national and international goals for total conversion --understanding organics' importance to our future. Our commitment to make this happen is our birthday present to Ms. Carson.

- Jay Feldman is executive director of Beyond Pesticides

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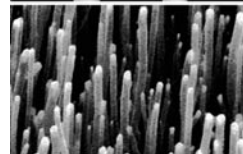
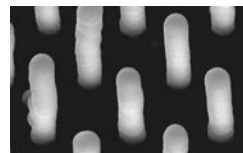
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## Unwanted Pesticide Application

Hi,  
I'm writing because Scotts recently treated my lawn with Prodiamine. I did not order it, and as I have a young daughter, I am concerned about letting her play outside. What should I do, both in terms of cleaning my lawn and making sure Scotts is held responsible?

Thanks,  
Tami  
Maryland

Dear Tami,

*I'm sorry to hear about your run-in with lawn pesticides. Unfortunately, this is a more frequent occurrence than it should be (see "Scotts Poisons the Wrong Family" in the Summer 2006 issue of Pesticides and You, Vol. 26, #2), and we don't hear about many incidents until it's too late for intermediary organizations to help.*

*First, contact Scotts directly and explain the situation. Hold them responsible for their error and request that they provide remediation, like removal of the top layer of soil and replacement with organic soil. If they are unwilling to cooperate, you have a number of options:*

*Write a thorough report of what happened. Then contact your state's Department of Agriculture and file a report with its pesticide division. (For contacts, see [www.beyondpesticides.org/states](http://www.beyondpesticides.org/states).) They can send an investigator to sample your yard and verify that it has been treated. They can then pursue penalties for violating regulations. This may not guarantee you an individual settlement, however.*

*Your next option is contacting your area's Better Business Bureau (BBB). They provide mediation and arbitration for disputes like yours, and can help you reach a resolution if Scotts is uncooperative.*

*The BBB can be helpful because any unresponsiveness from Scotts will appear on their record, and will be reported to potential customers.*



*If these measures do not succeed, compiling a complete record and going to small claims court or contacting an attorney to take your case to civil court should result in a resolution. Contacting local press, too,*

*press attention was very effective, visit our website's Daily News Archives from September 20, 2006, entitled, "Leading Anti-Pesticide Activist's Lawn Doused With Toxic Chemicals." Good luck!*

*will put pressure on Scotts to appear to "do the right thing," and also raise awareness of how common such incidents are. For an example of a similar instance when*

## Beyond Pesticides Daily News Blog

*On January 16, 2007, Beyond Pesticides converted its Daily News feature into a Blog, enabling readers to post additional relevant information that will further inform or give perspective to the daily issues of concern. Daily News is a service of Beyond Pesticides that is intended to keep activists, researchers, policy makers, the health care community, and pest managers informed on key issues and actions that are ongoing and important to the protection of public health and the environment. Daily News is intended to provide a tool for action as we seek to effect a shift in policies, practices and products to safeguard the health of people and the environment.*

*Excerpt from Beyond Pesticides original blog post (3/5/07):*

### **NRDC Sues EPA for Failing To Ban Two Highly Toxic Pesticides**

The Environmental Protection Agency (EPA) has failed to protect the public from exposure to dichlorvos (DDVP) and carbaryl, two commonly used pesticides that are known to cause severe neurological and developmental harm, according to a lawsuit filed February 28, 2007 by the Natural Resources Defense Council (NRDC). The lawsuit, *NRDC v. Johnson, U.S. EPA*, charges that EPA has missed its congressionally mandated deadline...

### **Fritzi Says:**

Hey this is great. We have been fighting the spraying of carbaryl in Willapa Bay, Washington by the commercial oysterman for over ten years. They've been spraying since 1965 to get rid of two types of little shrimp, ghost and mud, that aerate (they say muck up) the mudflats. They describe carbaryl as benign and unfortunately the elected officials in Washington State have looked the other way and encouraged putting more chemicals into Willapa Bay. Carbaryl also is known to be totally toxic to honey bees. Great going!

## So Many Products, So Little Time

Hello,

In one of your previous emails you advised that there are organic alternatives to pesticide applications and that the cost would probably be the same as what our Board of Trustees is spending on the current application. Would you be kind enough to provide me with the information on organic pesticide application and, if available, the approximate cost? Our community has plentiful lawn areas, and we are directly in the footprint of Cheesequake State Park (a large and beautiful forest). We have a new Board of Trustees and the members are willing to consider organic methods, so any information you can provide would be extremely helpful.

Sincerely,  
Dawn  
New Jersey

Hi Dawn,

I'm so glad you are able to work with your Trustees to begin an organic program for your lawn! As you know, there are quite a few things you can do to begin making your lawn safer and healthier. The basis of a good organic program is in balancing the mechanical care of the lawn with the products used on it – a well-maintained lawn with a healthy soil precludes most problems.

Two of Beyond Pesticides' fact sheets that you should read first are "Read Your Weeds: A Simple Guide to Creating a Healthy Lawn" and "8 Steps to a Toxic-Free Lawn." Both can be found on the Beyond Pesticides "Lawns and Landscapes" webpage, <http://www.beyondpesticides.org/lawn>, under the "Issues" tab. Both cover important components of a lawn care program like mowing, watering, and aerating your soil.

Finding specific products can be a challenge, especially if you are new to organic lawn care. One site that is an excellent reference is the Organic Materials Review Institute (OMRI). They have compiled a product list for fertilizers and pesticides that are either acceptable for organics or restricted. Their "crop" product list may be found at: [http://www.omri.org/crops\\_generic.pdf](http://www.omri.org/crops_generic.pdf), so you can check and

see if a given product is listed or not (although it's unlikely they have reviewed every product on the market). It's also a good reference list of the types of acceptable products out there (like corn gluten or compost). Many products have an OMRI certification on their packaging, ensuring you've found the real thing. Do be careful when reading organic claims on labels – they can be misleading as to the percentage of organic content in a product. Our tips for selecting a product can be found on the website's "Lawns" page, titled "Beware of Organic Claims."

Finally, our "Least-Toxic Control of Weeds" fact sheet has a list of some online and catalog retailers where you can



Many parks are routinely treated with toxic herbicides that can adversely impact the environment and the health of visitors.

find organic products, which you can find by clicking "Alternatives" under the "Info Services" tab on our website. Additionally, a simple Google search will bring up a number of other sites, like this one: <http://cleanairgardening.com/index.html>, which sells organic fertilizers and pesticides, and might give you some ideas (in addition to other eco-gardening ideas).

While we don't usually recommend specific brands, these links should give you a good idea of where to start. For ideas specific to your region, however, you can't beat visiting your local garden center. They are increasingly carrying organic alternatives. Good luck!

## Speak Your Mind!

Whether you love us, disagree with us or just want to speak your mind, we want to hear from you. All mail must have a daytime phone and verifiable address. Space is limited so some mail may not be printed. Mail that is printed will be edited for length and clarity. Please address your mail to:

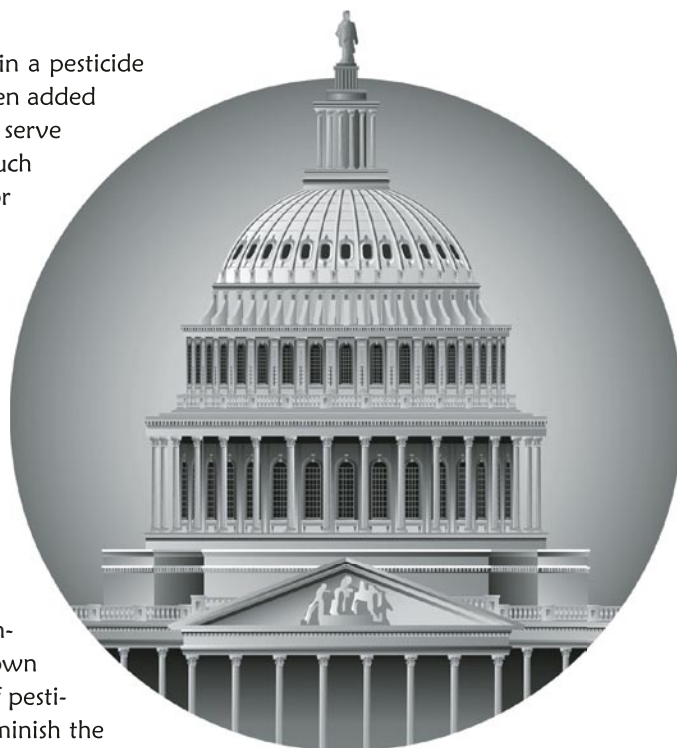
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fax: 202-543-4791, [info@beyondpesticides.org](mailto:info@beyondpesticides.org)  
[www.beyondpesticides.org](http://www.beyondpesticides.org)

## Scientists Call for “Inert” Ingredient Disclosure

Every time a pesticide product is used, people face the unknown risks of secret “inert” ingredients, which pesticide companies like to claim are trade secrets. Citing an extensive body of literature illustrating the concern over related human and environmental health effects, commentary in the December 2006 issue of *Environmental Health Perspectives* (Vol. 114, No. 12) continues the call for improvements in pesticide regulation and inert ingredient disclosure. The authors, Caroline Cox, research director at the Center for Environmental Health and Beyond Pesticides board member, and Michael Sorgan, Ph.D., chief scientist in the Office of the Attorney General of New York State, highlight the regulatory weaknesses that allow inert ingredients in pesticide formulations to go largely untested. In response, they are calling for a pesticide registration process that requires full assessment of formulations and full disclosure on product labels. “In-

ert” refers to ingredients in a pesticide formulation that have been added to the active ingredient to serve a variety of functions, such as solvents, surfactants, or preservatives. However, the common misconception is that “inert” ingredients are physically, chemically, or biologically inactive substances. Unfortunately, the majority of tests required by EPA are done solely on the “active” ingredient, ignoring the potential hazards of inerts. Additionally, some inerts are known to enhance the toxicity of pesticide formulations and diminish the protective effectiveness of both clothing and skin, reduce the efficacy of washing, and increase persistence and off-target movement of pesticides.

**Take Action:** Tell EPA Administrator Stephen Johnson (email: [johnson.stephen@epa.gov](mailto:johnson.stephen@epa.gov), phone: 202-564-4700, fax: 202-501-1450) that you



*have a right to know what ingredients are used in pesticide products and that EPA has a duty to fully test pesticide formulations. The full *Environmental Health Perspectives* article is available free at [www.ehponline.org/members/2006/9374/9374.html](http://www.ehponline.org/members/2006/9374/9374.html).*

## In \$1 Million Deal, EPA Allows Red Cross on Pesticide Products, Beyond Pesticides Asks States To Deny Label Change

Pesticide companies have tried unsuccessfully for years to put safety claims on pesticide labels. Now the Clorox Company convinced EPA to allow it to put the Red Cross logo, an international symbol of health and safety, on some of its products. In a cause-related marketing deal, Clorox will pay the Red Cross three cents for every labeled product it sells. March 12, 2007, all state agencies regulating pesticide use were asked by Beyond Pesticides to prohibit the marketing of such pesticide product labels because it violates federal pesticide law. Clorox says on some of its soon-to-be released pesticide labels that it will donate up to \$1 million to the Red Cross when people purchase the products. Last month, a dozen groups led by Beyond Pesticides, petitioned EPA to stop the release of the new labels, which they say will mislead consumers and violates labeling guidelines. According to the letter sent by Beyond Pesticides, “The use of the Red Cross symbol implies an endorsement of the product and may imply an endorsement of its safety to many, which may mislead users and contribute to product misuse.” While Clorox products are mistakenly viewed as safe chemical products without potential hazards, they do contain toxic materials that must be handled very carefully. Some of the products require that they be diluted with water and warn that they can cause irritation of the eyes, skin, respiratory and gastrointestinal tract. The label on some Clorox products warns, “Although not expected, heart conditions or chronic respiratory problems, such as asthma, chronic bronchitis or obstructive lung disease, may be aggravated by exposure to high concentrations of vapor or mist.” Some of the products are suspected neurotoxicants.

**Take Action:** Some states have the authority to deny pesticide label changes. Contact your state pesticide agency (see [www.beyondpesticides.org/states](http://www.beyondpesticides.org/states)) and tell them that you do not want misleading pesticide labels. For background information, including Beyond Pesticides’ letter to the Red Cross and petition to EPA, visit [www.beyondpesticides.org/redcross](http://www.beyondpesticides.org/redcross).

## Environmental Justice Act of 2007 Introduced

On February 16, 2007, U.S. Representatives Solis (D-CA), Hastings (D-FL) and Udall (D-CO), and Senators Durbin (D-IL) and Kerry (D-MA) introduced the *Environmental Justice Act of 2007* to protect communities of color and low-income communities from the ongoing disproportionate adverse human health and environmental impacts of pollution. The act was introduced as a way to fully implement the 1994 Executive Order 12898, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, which was issued by President Bill Clinton. The bill will require the Environmental Protection Agency (EPA) to fully implement recommendations included in three recent reports by EPA's Inspector General and the Government Accountability Office (GAO) highlighting EPA's failure to ensure that its policies protect environmental justice communities. It also creates reporting requirements, including an update on the inclusion of environmental justice in EPA's emergency command response structure. "For far too long federal agencies have disregarded the health of minority and low-income communities, choosing instead to reinterpret the Executive Order so that it fits the policies they want to promote," said Rep. Solis. The *Environmental Justice Act* is endorsed by more than 15 organizations, including Beyond Pesticides. For more information, contact Sonia Melendez in Rep. Solis's office at (202) 225-5464.

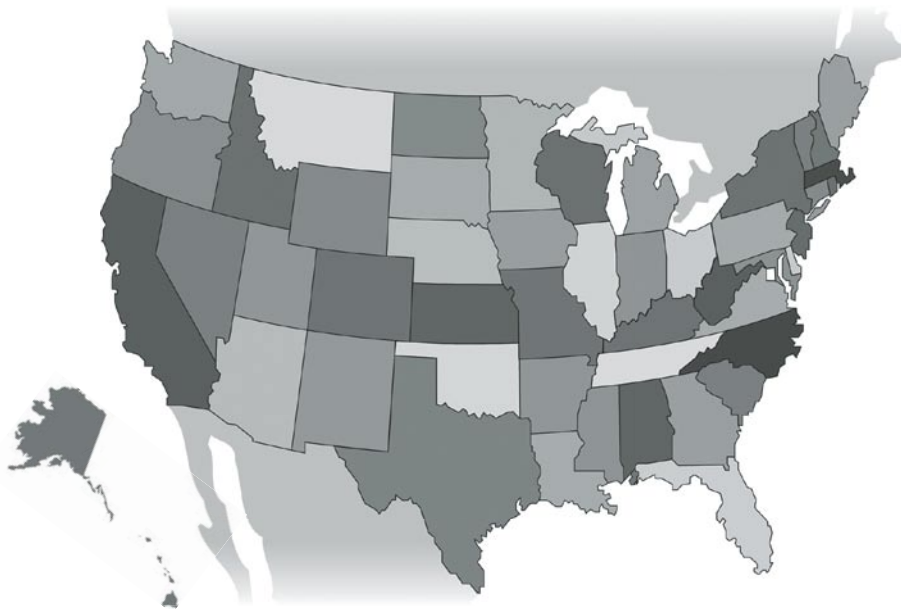
## Groups Call for Organic Budget Priorities

Farm and environmental groups are calling on Congress to incorporate organic and family farming priorities in the 2007 Farm Bill. The Farm Bill provides hundreds of billions of dollars to the agricultural sector, but groups believe the subsidies, which primarily support large, chemical-intensive agribusiness, are distributed poorly and are wasting taxpayer dollars. Groups say that research priorities and other incentives must support the shift to organic and assist with compliance under the *Organic Foods Production Act (OFPA)*. The National Organic Coalition (NOC), including the Rural Advancement Fund International, Center for Food Safety, Beyond Pesticides and others, is promoting an agenda that seeks equity for organic production under USDA programs. Priorities for NOC include: Organic certification cost-share reauthorization; Conservation security program, Organic conversion assistance; Seeds and breeds for the 21st Century; Competitive markets in organic; Organic research; genetically modified organism (GMO) liability; and, Crop insurance equity (details at [www.beyondpesticides.org/organicfood](http://www.beyondpesticides.org/organicfood)). Organizations, including California Coalition for Food and Farming (CCFF), Pesticide Action Network North America and others, are also promoting a Farm Bill policy platform that embraces a vision for a more just and sustainable agriculture and food system. For more information, visit *Beyond Pesticides Organic program page* at [www.beyondpesticides.org/organicfood](http://www.beyondpesticides.org/organicfood).

## Dean Foods, OTA Reject Milk from Cloned Cows

With the simple message that Americans do not want cloned animals in the food system, Dean Foods, the largest dairy processor in the U.S., adopted a policy statement rejecting milk from cloned cows, adding its name to a group of organic dairies already opposing the controversial technology. The food giant's policy comes in the midst of the Food and Drug Administration's (FDA) open comment period on its evaluation of the safety of animal cloning. While FDA is expected to determine that animal products from clones are as safe as those from naturally produced animals, Dean Foods' stance is a clear message that the market is not interested in purchasing them. The statement reads: "Based on the desire of our customers and consumers, Dean Foods will not accept milk from cows that have been cloned. If the FDA does approve the sale of milk from cloned cows, we will work with our dairy farmers to implement protocols to ensure that the milk they supply to Dean Foods does not come from cloned cows...We see no consumer benefit from this technology." Milk from cloned animals (as well as other animal products) has already been rejected by numerous members of the organic community. Caren Wilcox, head of the Organic Trade Association, said, "The Organic Trade Association (OTA) only supports the use of natural processes for breeding and raising animals in the organic system." She continued, "Organic animal products will not come from cloned animals." Organic Valley's CEO, George Siemon, added, "This is absolutely prohibited in our world. It goes against everything we believe. Organic is based on having plenty with what nature's given us."





## Inventor of Toxic Herbicide To Be Honored, Environmentalists Balk

On February 8, 2007, the National Inventors Hall of Fame announced that John E. Franz, Ph.D., inventor of the toxic herbicide Roundup, which contains the active ingredient glyphosate, as well as a hazardous surfactant, is to be a 2007 inductee, along with inventors of the MRI, the automotive airbag, vaccines, and various medicines. The induction ceremony, May 5, in Akron, OH, awards Dr. Franz the honor with the claim that glyphosate is nontoxic, something that is widely disputed in the scientific literature. A statement released by the National Inventors Hall of Fame states, “In

1970, while working at Monsanto, Franz discovered the glyphosate class of herbicides, later marketed under the brand name Roundup. Glyphosate herbicides eliminate more than 125 kinds of weeds and are nontoxic to animals.” Despite these claims, Roundup has been found to be harmful to animals and likely poses a threat to humans as well. Glyphosate, the most commonly

used pesticide in U.S. agriculture and the second most commonly used in non-agricultural settings in the U.S., is linked to cancer, reproductive effects, neurotoxicity, kidney and liver damage, and asthma. A 1999 study published in *Cancer* (Vol. 85, No. 6) finds that people exposed to glyphosate are 2.7 times more likely to develop non-Hodgkins lymphoma than the general population.

**Take Action:** Send a letter to the National Inventors Hall of Fame, 221 South Broadway, Akron, OH 44308 or [museum@invent.org](mailto:museum@invent.org), telling them that it is inappropriate to honor the inventor of a toxic chemical among the ranks of great inventors.



## Chicago Chef To Serve Organic School Lunches

Out with the mystery meat and greasy French fries and in with healthy organic school lunches! Joshua Grabowsky, a chef and CEO of Busypeople Inc., an organic catering firm in the Chicago area, is branching out to provide organic school lunches with its new subsidiary, Max's Organic Planet. The new business will provide healthy, organic lunches to public and private schools in Chicago and the surrounding suburbs. Mr. Grabowsky is gearing up for the 2007–08 school year, gauging interest and offering pilot programs and weeklong taste tests, so that school administrators, parents and students will sign on for organic lunches in September. The company's goal is to contract with schools for hot lunches every day, but the company is offering alternatives for communities that need more flexible plans, such as “TGIOF” (Thank God It's Organic Friday). Cost varies based on the schools' needs and larger schools will be able to negotiate volume discounts, but lunches will average between \$3 and \$6 per student per day. Down the road, Mr. Grabowsky hopes kids will grow most of the vegetables used in the lunches through school gardening classes.

*Chef Grabowski and Busypeople Inc. will be providing 100% certified organic meals at the 25th National Pesticide Forum, Changing Course in a Changing Climate: Solutions for health and the environment, convened by Beyond Pesticides, June 1-3, 2007 in Chicago, IL. For more information, see [www.beyondpesticides.org/forum](http://www.beyondpesticides.org/forum).*



## More Evidence Links Endocrine Disruptors to Frog Sex Changes

When Tyrone Hayes, Ph.D. presented data showing that endocrine-disrupting pesticides hermaphrodize frogs, his research stunned the participants of Beyond Pesticides 22nd National Pesticide Forum in 2004. Now new research out of Sweden, to be published in the journal *Environmental Toxicology and Chemistry* (ET&C) in May 2007, shows that frogs are even more sensitive to hormone-disturbing environmental pollutants than was previously thought. The study exposed two species of frogs to oestrogens, chemicals mimicking the effect of estrogen and similar to those detected in natural bodies of water in Europe and North America. The results are startling: whereas the percentage of females in two control groups is under 50 percent - not unusual among frogs - the sex ratio in the groups of tadpoles that matured in water dosed with different levels of oestrogen are significantly skewed. Even tadpoles exposed to the weakest concentration of the hormone are twice as likely to become females in one of the frog species. The groups of tadpoles receiving the heaviest dose of oestrogen are close to 100 percent female

in both species. "The results are quite alarming," said co-author Cecilia Berg, Ph.D., a researcher in environmental toxicology. "Pesticides and other industrial chemicals have the ability to act like oestrogen in the body. That is what inspired us to do the experiment."

Amphibians are declining at alarming rates across the globe, and many scientists believe that industrial chemicals and pesticides may be partially to blame. The environmental impacts of endocrine-disrupting chemicals have been well-established. In addition to hermaphroditic deformities in frogs, pseudo-hermaphrodite polar bears with penis-like stumps, panthers with atrophied testicles, and intersex fish have all been documented as the probable result of endocrine-disrupting chemicals in the environment. Many scientists believe that wildlife pro-



Frogs and other amphibians are declining at alarming rates and scientists believe that endocrine-disrupting pesticides may be partially to blame.

vides early warnings of effects produced by endocrine disruptors, which may as yet be unobserved in humans.

Dr. Hayes discusses his latest research on endocrine disrupting chemicals and the dangers of pesticide combinations at the 25th National Pesticide Forum, *Changing Course in a Changing Climate: Solutions for health and the environment*, June 1-3, 2007 in Chicago, see [www.beyondpesticides.org/forum](http://www.beyondpesticides.org/forum) for details.

## More Evidence Links Common Chemicals to Obesity

According to new research, "Perinatal Programming of Obesity: Interaction of Nutrition and Environmental Exposures," presented to the annual meeting of the American Association for the Advancement of Science (AAAS) in San Francisco in February 2007, exposure to environmental chemicals found in everyday plastics and pesticides while in the womb may make a person more prone to obesity later in life. The research, conducted by Frederick vom Saal, Ph.D, professor of biological sciences at University of Missouri-Columbia's College of Arts and Science, finds that when fetuses are exposed to endocrine-disrupting chemicals their gene function may be altered to make them more prone to obesity and disease. Dr. vom Saal found that bisphenol-A and other endocrine-disrupting chemicals cause mice to be born at very low birth weights and then gain abnormally large amounts of weight in a short period of time, more than doubling their body weight in just seven days. The mice remained obese throughout their lives. Obesity puts people at risk for other problems, including cancer, diabetes, cardiovascular disease and hypertension. Between the periods of 1976-1980 and 2003-2004, the prevalence of obesity among adults aged 20-74 years doubled, increasing from 15.0 to 32.9 percent.



## Alaska Says Railroad Spraying Is Off Track

In a victory for Alaska's environment, the state's Department of Environmental Conservation (DEC) has denied the Alaska Railroad Corporation's (ARRC) application to spray herbicides along its tracks, citing water quality concerns. The decision effectively maintains a record of over 20 years of non-chemical vegetation management of Alaska's railways. According to DEC, ARRC applied to use glyphosate, 2,4-D, sulfometuron methyl and metsulfuron methyl on approximately 500 miles of track and 100 miles of rail yard. ARRC says it has tried unsuccessfully to control vegetation along its track with non-chemical methods. Several governments, tribal associations and environmental organizations opposed ARRC's proposal. Pamela Miller, executive director of Alaska Community Action on Toxics, told the *Anchorage Daily News*, "We felt the chemical mixture proposed by the railroad would harm water quality, salmon habitat and people's health."

The decision to deny the application was made on the grounds that: 1) all three herbicide products are not allowed to be directly applied to water; 2) ARRC did not adequately identify all water resources in and adjacent to the proposed spray areas; 3) concerns were raised by other agencies and through public comment regarding the possibility of water pollution; 4) the proposal may result in unreasonable adverse effects to environmental and human health; and, 5) the ten-foot spray buffer zone proposed by ARRC is inadequate.

## Campaign Updates

### National Coalition for Pesticide-Free Lawns

Seventy-six municipal officials and transitioning landscapers attended the National Coalition for Pesticide-Free Lawns first Basic Organic Land Care online course this winter. Representing 18 states, the District of Columbia and Canada, the participants were highly complimentary of the instructor, Chip Osborne, and the material they learned. Over sixty percent are ready to implement what they learned and several landscape company owners vowed to begin transitioning their entire businesses. A follow-up technical assistance workgroup will assist them all in their transition this coming year.

If your town land manager or landscaper was not able to attend the training, it's not too late. They can register to listen to the recorded sessions at [www.pesticidefreelawn.org/training](http://www.pesticidefreelawn.org/training). Homeowners are welcome too. This month's Action Alert distributes our new spring factsheet Read Your "Weeds" – A Simple Guide to Creating a Healthy Lawn at [www.beyondpesticides.org/lawn](http://www.beyondpesticides.org/lawn) throughout your community.

### Children and Schools Campaign

The children and schools campaign anticipates that the School Environment Protection Act (SEPA) will be introduced in the 110th Congress. Meanwhile, given the numerous studies published on the impacts of pesticides on pre-school children, school activist groups are beginning to organize around the need to adopt childcare IPM policies. Parents continue to deliver the "For My Child's Health" postcard to the school nurse. The strategy has been tweaked to include a signature on the card from the child's pediatrician for a more powerful effect. For more information, visit [www.beyondpesticides.org/schools](http://www.beyondpesticides.org/schools).



# Climate Change, Plant Biology and Public Health

## Impacts of elevated temperature and CO<sub>2</sub> on agriculture and beyond

by Lewis Ziska, Ph.D.

**Eds. Note.** *The impact of global warming will have consequences that increase the pressure for herbicide use. In his research, Lewis H. Ziska, Ph.D., with USDA's Alternate Crop and Systems Laboratory, finds increased pressure from invasive plant species ("undesirable plants") because of rising carbon dioxide, as well as increases in insect-borne diseases due to rising temperatures.*

### Abstract

In addition to being the principle greenhouse gas, carbon dioxide (CO<sub>2</sub>) is also the principle source of carbon for photosynthesis. Although the stimulation of plant growth by rising CO<sub>2</sub> is usually viewed as a positive aspect of climate change, the rise in CO<sub>2</sub> is indiscriminate with respect to the stimulation of both anthropogenically important and deleterious plant species. Here we present laboratory and *in situ* data from studies that have examined the response of undesirable plants to CO<sub>2</sub> increases during the 20th century (from 290 to 375 parts per million by volume, ppmv), as well as that projected for the mid-21st century (500-1000 ppmv). Data from these studies indicate a number of potential indirect effects (changes in nutritional content of foods, increased use of herbicides) as well as potential direct effects (increased ragweed pollen) on public health. These initial results regarding CO<sub>2</sub> and/or temperature-induced changes in plant biology suggest a number of potentially unfavorable and some favorable consequences in human systems.

### Introduction

Documented and projected changes in the concentration of atmospheric carbon dioxide (CO<sub>2</sub>) and other gases suggest potential changes in temperature and global climate that could negatively impact human health. Public health concerns related to climate stability include changes in the range of insect- or rodent-borne diseases (malaria, yellow fever, dengue); changes in waterborne and seafood-borne disease outbreaks; increasing ground-level ozone and respiratory ailments; contamination of drinking water due to increased flooding; and, heat-related deaths (stroke). At present, there is a concerted effort among academic and government institutions to both recognize the degree of health risk and to formulate strategies to minimize adverse impacts.

The implications of a changing climate with respect to floods, storms, range of disease vectors, etc. are well recognized. However, less attention has been given to potential associations between climate, plant biology and human health. Plant biology is directly affected by rising CO<sub>2</sub>, since CO<sub>2</sub> is the sole supplier of carbon for photosynthesis. Because 96% of all plant species are deficient in the amount of CO<sub>2</sub> needed to operate at maximum efficiency, recent increases in CO<sub>2</sub> and future projections have already, and will continue, to stimulate plant growth, with the degree of stimulation being at least, potentially, temperature dependent. Critics of the role of carbon dioxide as a greenhouse warming gas have stressed that

CO<sub>2</sub>-induced stimulation of plant growth will result in a lush plant environment; indeed, much of the literature has focused on anthropogenically beneficial species. However, it should be emphasized that CO<sub>2</sub> does not discriminate between desirable and undesirable plant species.

### **Direct Effects of CO<sub>2</sub>/Temperature on Plant Biology and Potential Public Health Consequences**

While we generally think of plants in positive terms, there are a number of species whose presence is considered undesirable or even dangerous. We call such plants “weeds” as a means to denote their undesirability with respect to human activity. Although weeds are often associated with cultivated situations, they may also impact human health.

**Allergies.** At present it is estimated that approximately 10% of the U.S. population -or 30 million people- suffer from hay fever or allergic rhinitis. Symptoms include sneezing, inflammation of nose and eye membranes, and wheezing. Complications such as nasal polyps or secondary infections of the ears, nose and throat may also be common. Severe complications, such as asthma, permanent bronchial obstructions, and damage to the lungs and heart can occur in extreme cases. Although there are over four dozen plant species that produce allergic reactions, common ragweed, a ubiquitous weed, causes more problems than all other allergenic plants combined.

Environmental growth chambers (EGC) studies of common ragweed indicate that exposure to concentrations of current CO<sub>2</sub> (ca 370 ppmv) and that projected for the mid-21st century (ca 600 ppmv) increased ragweed pollen productivity by 131% and 320% respectively, compared to ragweed grown at pre-industrial CO<sub>2</sub> levels (ca 280 ppmv). The finding regarding the response of ragweed pollen to future CO<sub>2</sub> (relative to current levels) was later confirmed by a different group in a greenhouse (GH) study.

A recent two-year transect study of ragweed also found that urbanization-induced increases in CO<sub>2</sub> and temperature are associated with increased ragweed growth,

pollen production and pollen allergenicity, suggesting a probable link between rising CO<sub>2</sub> levels, global change and public health. While most of the work regarding weeds, pollen production and climate have focused on common rising CO<sub>2</sub> and/or temperature, these factors would also be expected to influence seasonal pollen production of other allergenic plants, including tree and grass species.

**Poison/Toxicology.** Ingestion of poisonous plants can result in serious illness or death. There are over 700 plant species that are known to induce illness in humans. Similar to dermatitis, toxicology is related to specific plant organs (fruit, leaf, stem), as well as stage of growth, soil and eco-type. Both edible and poisonous parts can exist on the same plant (rhubarb, potato). Bracken may represent a toxicological threat due to production of potential carcinogenic spores or exudates. Poison hemlock, oleander, jimsonweed and castor bean (ricin) are so poisonous that tiny amounts can be fatal if eaten. For 2001, approximately 73,000 cases of accidental plant ingestion were reported for children in the U.S. under the age of six.

Although quantification of particular compounds such as ricin have not been determined, the response of a number of poisonous/toxicological plant species to rising CO<sub>2</sub> and/or temperature have been reported. For bracken, GH studies indicate a significant stimulation of photosynthesis with an increase in



Ragweed pollen, an allergen for millions of people, is expected to thrive in an environment with elevated carbon dioxide.

CO<sub>2</sub> concentration 200 ppmv above current ambient at two levels of nitrogen supply, although, curiously, no significant effect on growth was observed. For castor bean in EGCs, the net gain of carbon per leaf was approximately double at projected CO<sub>2</sub> concentrations of 700 ppmv. For jimsonweed, a 300 ppmv increase in CO<sub>2</sub> resulted in a 2-3x increase in seed capsules and dry weight in GH experiments; and, a CO<sub>2</sub> increase from preindustrial levels (ca 280 ppmv) to 460 ppmv in EGC trials resulted in an approximate doubling of dry mass. Lambsquarters, which produce nitrates and soluble oxalates with subsequent photosensitization in humans, has shown a 115% increase in above ground biomass with a 75 ppmv increase in CO<sub>2</sub> and 3.3°C increase in temperature along a rural-urban transect. Overall, it is clear that for

both laboratory and field, a number of poisonous species will show significant growth increases in response to CO<sub>2</sub> and temperature.

**Contact Dermatitis.** Another common weed-induced health effect is contact dermatitis, which is associated with over 100 plant species. These chemical irritants can be present on all plant parts, including leaves, flowers and roots, or can appear on the plant surface when plant injury occurs. Toxicity may vary with a range of factors including maturity, weather, soil and eco-type. Most reactions caused by these chemicals usually occur within a few minutes of exposure. The type of dermatitis produced is species dependent. For example, the milky sap in spurge can be chemically irritating, whereas some species such as the stinging nettle are both mechanically and chemically irritating. One well-known chemical is urushiol, a mixture of catchol derivatives. This is the compound that induces contact dermatitis in the poison ivy group. Sensitivity to urushiol occurs in about two of every three people, and amounts as small as one nanogram (ng) are sufficient to induce a rash. Over two million people in the U.S. suffer from annual contact with members of the poison ivy group (poison ivy, poison oak, or poison sumac).

Unfortunately, the growth and qualitative response of these species to increasing CO<sub>2</sub> and/or temperature is unknown. Other vines similar in morphology, such as kudzu, have shown relatively strong response to future CO<sub>2</sub> levels in EGC experiments. GH data is available for stinging nettle however, showing a 30% increase in biomass at projected CO<sub>2</sub> levels of 700 ppmv. Data for leafy spurge showed a 85% stimulation of vegetative biomass to past increases in CO<sub>2</sub> (285-380 ppmv) and a smaller increase (32%) to projected CO<sub>2</sub> (380-720 ppmv) in recent EGC studies.

### **Indirect Effects of CO<sub>2</sub>/Temperature on Plant Biology and Potential Public Health Consequences**

The direct effect of CO<sub>2</sub>/temperature on specific weedy species whose biology directly impacts human health is straightforward. Less evident are the means by which plant biology can indirectly impact public well-being. Overall, indirect effects may include CO<sub>2</sub>-induced changes in plant nutrition, plant-derived pharmaceuticals, plants needed for disease vectors, and pesticide use.

**Nutrition/food quality.** With a global population exceeding 6 billion, people rely on grain cereals as their principle source of calories. Two principle cereals, wheat and rice, supply the bulk of the caloric intake for over 4 billion people. Although wheat and rice have shown a positive growth response to increasing CO<sub>2</sub>, yields may actually decline with concurrent increases in



Unfortunately for millions of gardeners and hikers, poison ivy is also expected to increase in a high carbon dioxide environment.

both CO<sub>2</sub> and temperature due to greater sensitivity of floral sterility to temperature as CO<sub>2</sub> increases. In addition, increasing CO<sub>2</sub> may also affect food quality. In general, plants are anticipated to become more starchy, but protein-poor, with a subsequent decline in digestibility as CO<sub>2</sub> increases. In rice, percent protein decreases with both increasing air temperature and increasing CO<sub>2</sub> concentration over a two-year period in an open top container (OTC) study conducted for tropical paddy rice in the Philippines. For wheat, increasing CO<sub>2</sub> from pre-industrial to current levels results in decreased protein in both Spring and Winter wheat in a GH experiment. Free Air CO<sub>2</sub> Enrichment (FACE) experiments with wheat in Maricopa, AZ show significant effects on flour protein concentration, optimum mixing time for bread dough and bread loaf volume with increasing CO<sub>2</sub> (550 ppmv), which are exacerbated if nitrogen is limited. Although qualitative changes in rice and wheat have been well-documented, less is known regarding nutritional impacts on other crops. Lu et al. reported decreased protein content in sweet potato in response to CO<sub>2</sub>. In contrast, Rogers



Studies show that rice decreases in protein content in environments with elevated carbon dioxide and temperatures.

et al. reported no response in protein content of maize to CO<sub>2</sub> in GH experiments. Recent OTC data for strawberries, which are a good source of natural anti-oxidants, show a positive increase in antioxidant capacity and flavanoid content in response to increased CO<sub>2</sub> (300 and 600 ppmv above current levels). Overall, these data indicate both positive and negative changes in the quality of common food sources in response to CO<sub>2</sub>/temperature.



Scientists theorize that plant-derived drugs, such as Lapachol - an anti-cancer drug from *Tabebuia* spp. (pictured), may have its pharmacological metabolites impacted by climate change.

**Medicine.** The use of plants as herbal remedies for human ailments dates to the beginning of civilization. Modern plant biochemists have long recognized that plant species synthesize a wide range of secondary metabolites. One of the most compelling explanations for the degree of chemical diversity is that plants have evolved toxicological strategies to protect themselves from viral diseases, fungal pathogens, and herbivory. Interestingly, a number of these secondary metabolites also constitute a principle source for established medicines and potential new drugs. Although it is estimated that there are roughly 400,000 terrestrial plant species, at present, less than 1% of these species have been examined in-depth for their possible pharmacological use.

An OTC study shows a significant increase in leaf photosynthesis and plant growth in *Brassica nigra* L. with increasing CO<sub>2</sub> (300 ppmv above ambient), but the effect of CO<sub>2</sub> on its secondary metabolite, allyl isothiocyanate, was not determined. Similarly, a doubling of atmospheric CO<sub>2</sub> above current ambient resulted in a doubling of dry weight in *Tabebuia rosea*, but the effect of CO<sub>2</sub> on levels the secondary metabolite lapachol was unknown.

At present, few studies are available which have assessed the quantitative or qualitative CO<sub>2</sub> response of secondary metabolites of pharmacological interest. Most secondary metabolites have been evaluated in terms of plant-insect interactions with projected CO<sub>2</sub> levels either stimulating or decreasing the production of secondary compounds. One exception has been woolly foxglove, which produces digoxin, a pharmaceutical glycoside which helps the heart pump blood. In GH experiments, plant growth and digoxin production are significantly

increased at 1000 ppmv relative to ambient CO<sub>2</sub> conditions.

Interestingly, while the relative proportion of digoxin among glycosides does not change, the relative amount of digitoxigenin, another glycoside, is considerably reduced in response to CO<sub>2</sub>. Similarly to digoxin in *D. Lanats*, projected CO<sub>2</sub> has also been shown to increase the growth of tropical spider lily, a plant whose bulbs may produce secondary compounds with potential anti-cancer

and anti-viral activities.

**Disease Vectors and Plant Biology.** Adult mosquitoes do not feed on blood (although the female requires blood proteins in order to successfully lay eggs); rather, they rely on flower nectar, phloem, and decaying plant matter for flight energy. Rodents also depend in large part on plant material as a principle food source (seed). In general, plant growth and seed production are anticipated to increase in response to rising CO<sub>2</sub>. Potentially, because of CO<sub>2</sub>-induced increases in their food sources, populations of these disease carrying vectors could be stimulated.

**Herbicide Efficacy and Usage.** Any resource which affects the growth of an individual alters its ability to compete with individuals of the same or different species. Differential inter- and intra-specific responses to CO<sub>2</sub> have been observed for the increase in atmospheric carbon dioxide which has already occurred during the 20th century and that projected for the end of the 21st century. If differential responses to increasing CO<sub>2</sub> occur between crops and weeds, will crop losses due to weedy competition increase or decrease? This will depend in part on the photosynthetic pathway, but there are a number of GH and OTC experiments indicating a greater response of weeds. Such a response is consistent with the suggestion of Treharne that the physiological plasticity and greater genetic diversity of weed species relative to modern crops would provide a greater competitive advantage as atmospheric CO<sub>2</sub> increases.

But even if CO<sub>2</sub> stimulates the growth of agronomic weeds, won't we still be able to limit where and when such spe-

cies grow with herbicides? A single herbicide, glyphosate is so widespread that more than half of the current U.S. soybean and a third of the U.S. corn crop have been genetically modified to be glyphosate resistant.

This assumes however, that increasing CO<sub>2</sub> will not affect herbicide efficacy. Yet, there is increasing evidence from GH and OTC studies that CO<sub>2</sub> decreases chemical efficacy for annual and perennial weeds. It can be argued that CO<sub>2</sub>-induced changes in herbicide tolerance are irrelevant given the rate of atmospheric CO<sub>2</sub> increase (other herbicides will be developed in the future). However, herbicides can persist over decades (2,4-D), coinciding with significant increases in atmospheric CO<sub>2</sub> (300-372 ppmv since the introduction of 2,4-D in the 1940's). Given the investment of large companies in genetically modified crops and their associated herbicides, it seems more likely that use of current herbicide will persist for longer periods. Obviously, chemical control can still be obtained if additional sprayings occur, or if concentration increases, but this could potentially, alter the environmental and subsequent health costs associated with pesticide usage.

In addition to any direct effect of CO<sub>2</sub> on efficacy, climatic change *per se* can alter abiotic variables such as temperature, wind speed, soil moisture, and atmospheric humidity. Alteration of such variables can also influence the efficacy of herbicide applications. These same environmental variables can affect crop injury due to herbicide application. A recent economic evaluation based on anticipated climate change suggested that increasing temperature increases pesticide cost variance for corn, potatoes and wheat, while decreasing it for soybean. Overall, existing data suggest that CO<sub>2</sub> and potential changes in climate could reduce efficacy with a subsequent increase in spraying frequency or herbicide concentration. The overall consequences of such an increase have not been specifically evaluated with respect to human health.

## Conclusions

Plant biology impacts every aspect of our lives. As carbon dioxide continues to increase, we can anticipate fundamental changes in plant biology either from anticipated changes in temperature or, directly from CO<sub>2</sub>-induced changes in physiology and growth. From the initial studies described here, it is evident that there are a number of potential means by which plant biology will directly or indirectly affect human health. This includes changes in allergenic pollen, contact dermatitis, physical damage, and poisons; as well as potential changes in nutrition, medicines, disease vectors and pesticide usage.

Unfortunately, there is much we still don't know. If CO<sub>2</sub> and/or temperature influence ragweed pollen production, are there qualitative (allergenicity) changes in the pollen? What other allergenic species are affected? Will the level of urishiol, or other chemicals which cause contact dermatitis increase with increasing CO<sub>2</sub>? Can we expect toxicological changes in poisonous plants? How will CO<sub>2</sub>-induced changes in proteins or antioxidants alter human nutrition? Is the nutrient content of foods increasing or decreasing in response to CO<sub>2</sub>? Is the quality of medicines derived from botanical sources improving? If more food is made available, will populations of disease carrying mosquitoes or rodents increase? If weed growth is improved and herbicide usage increases, will the CO<sub>2</sub>-induced reductions in efficacy result in increased pesticide use? If so, what are the long-term implications for human health? None of these questions have been addressed in depth. Few, if any field data are available which assess both CO<sub>2</sub> and temperature concurrently in regard to these questions.

The potential consequences of a warmer planet with respect to disease outbreaks, air and water quality, and respiratory disease are well recognized by the health care community. Less recognized or evaluated are the direct and indirect consequences of CO<sub>2</sub> on plant biology and human health. Yet, the environmental and health costs of not understanding these consequences may be substantial. It is hoped that this review will both emphasize the critical nature of this issue and serve as a guide for interested medical researchers and policy makers in assessing the separate importance of atmospheric CO<sub>2</sub> to plant biology and public health.

*Lewis H. Ziska, Ph.D. is a plant physiologist with the USDA Agricultural Research Service's Crop Systems and Global Change Lab. This piece is excerpted from a larger article that was published in World Resource Review (Vol. 15, No. 3), 2003.*

### Glyphosate Efficacy Under Elevated CO<sub>2</sub>

Unwanted Plant	CO <sub>2</sub> (ppmv)	Growth (g/day)
lambquarters	365	0.09 (death)
	723	1.37
red-root pigweed	365	0.04 (death)
	723	0.18
quackgrass	388	-0.05 (death)
	721	1.14
Canada thistle	421	0.55
	771	1.37

Changes in efficacy determined as changes in growth following glyphosate application for weeds grown at current or projected future levels of carbon dioxide. Plants were followed for 2-4 weeks.

# The Organic Farming Response to Climate Change

*One of the most powerful tools in fighting global warming sequesters atmospheric carbon, data suggests a new worldwide urgency for the transition from chemical to organic agriculture*

by Paul Hepperly, Ph.D.

Organic farming may be one of the most powerful tools in the fight against global warming. Findings from The Rodale Institute's Farming Systems Trial® (FST), which began in 1981 as the longest running agronomic experiment designed to compare organic and conventional cropping systems, show that organic/regenerative agriculture systems reduce carbon dioxide, a major greenhouse gas. This data positions organic farming as a major player in efforts to slow climate change from increases in runaway greenhouse gases.

Besides being a significant underutilized carbon sink, organic systems use about one-third less fossil fuel energy than that used in the conventional corn/soybean cropping systems. According to studies of the FST in collaboration with David Pimentel, Ph.D. of Cornell University, this translates to less greenhouse gases emissions as farmers shift to organic production. The ability of organic agriculture to be both a significant carbon sink and to be less dependent on fossil fuel inputs has long-term implications for global agriculture and its role in air quality policies and programs. The Rodale Institute drew these conclusions in a white paper that was released in 2003.

## Organic shows dramatic increases in carbon sequestration

Since 1981, data from the FST has revealed that soil under organic agriculture management can accumulate about 1,000 pounds of carbon per acre foot of soil each year (1,123 kg/ha/yr metric). This accumulation is equal to about 3,500 pounds of carbon dioxide per acre taken from the air and sequestered into soil organic matter. When multiplied over the 160 million acres of corn and soybeans grown nationally, a potential for 580 billion pounds of excess carbon dioxide per year can be

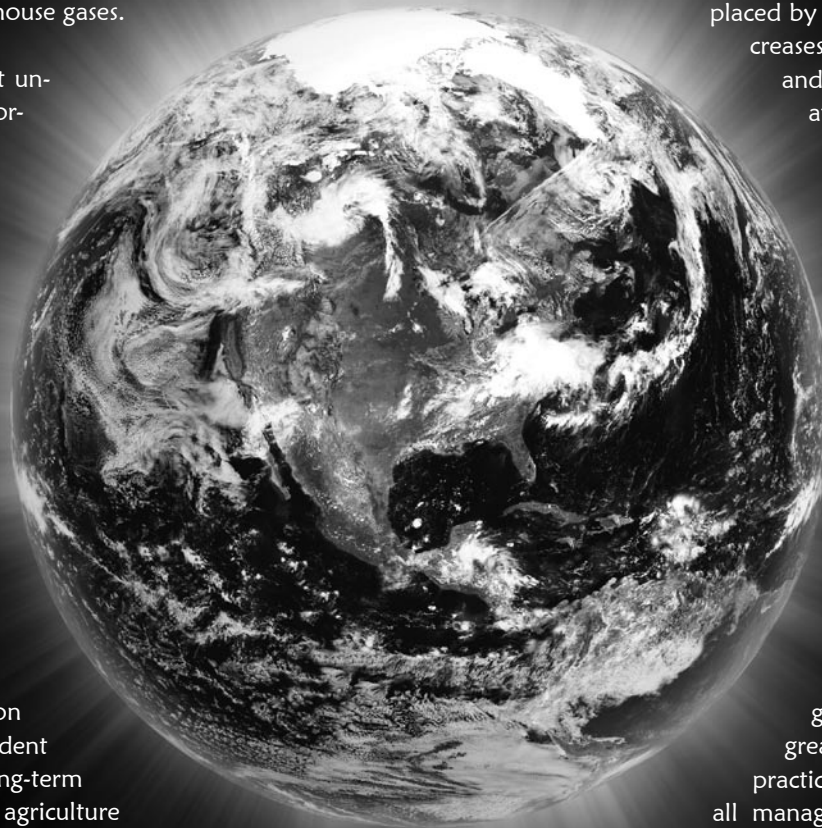
sequestered when farmers transition to organic grain systems.

Since the release of this data in 2003, there are now more dramatic findings. Figure 1 shows a more complete assessment of greenhouse gas sequestration in our long-term trial. In our comparison of soil in organic and conventional systems, we found greater levels of soil carbon in organic systems to a depth of two feet, about 60 cm. Conventional no till (or no tillage where plowing is replaced by herbicides) soil carbon increases in just the first few inches and this effect is extinguished at 3 to 6 inches (5 to 10 cm) or before this level, according to published results from several authors doing long-term trials. Organic no till is typically incorporated into organic agriculture production as a supplementary practice to cover cropping, rotation and organic amendment or fertilization.

Our take home message is: (i) non till is great, (ii) cover crops are greater, and (iii) combined practices offer the best overall management systems but need greater verification for their interaction.

The data demonstrates that organic farming methods increase stored carbon and retain other nutrients and organically improved soils better hold these nutrients in place for uptake by plants. In the process, organic methods reduce nitrate and other nutrient runoff into streams and water aquifers. These findings can be beneficial to all farmers by helping them to increase crop yields while decreasing energy, fuel and irrigation costs.

The 1995 Kyoto Protocol references the potential of soil to sequester carbon without emphasizing its capacity nor the importance of organic agriculture management for this purpose. Since then, researchers have moved forward strongly





with investigations to support agriculture's real potential to sequester carbon. The Rodale Institute's farm manager, Jeff Moyer, has invented and developed an innovative planter and roller for use in an organic no till system. (See at [www.newfarm.org](http://www.newfarm.org) and Google "No Till Plus.")

In 2003, The Rodale Institute's findings show that organic grain production systems increase soil carbon 15% to 28%. Moreover, soil nitrogen in the organic systems increases 8% to 15%. Our 2006 deep profile carbon readings on soils receiving compost raises the carbon bar to 40% improvement. The conventional system shows no significant increases in either soil carbon or nitrogen in the same time period. Soil carbon and nitrogen are major determinants of soil productivity.

### Why the increase in soil carbon in organic systems?

Why does the soil carbon level increase in organic systems but not in conventional systems when crop biomass is so similar? We believe the answer lies in the different decay rates of soil organic matter under different management systems. In the conventional system the application of soluble nitrogen fertilizers stimulates more rapid and complete decay of organic

matter, sending carbon into the atmosphere instead of retaining it in the soil as the organic systems do.

Additionally, soil microbial activity, specifically the work of mycorrhiza fungi, plays an important role in helping conserve and slow down the decay of organic matter. Collaborative studies in our FST with the United States Department of Agriculture (USDA) Research Service (ARS) researchers, led by David Douds, Ph.D., show that mycorrhiza fungi are more prevalent in the FST organic systems. These fungi work to conserve organic matter by aggregating organic matter with clay and minerals. In soil aggregates, carbon is more resistant to degradation than in free form and therefore more likely to be

conserved. Support for this work comes from USDA researchers at the Eastern Regional Research Center and Sustainable Agriculture Research Laboratory in Wyndmoor, Pennsylvania and Beltsville, Maryland. Their findings demonstrate that mycorrhizal fungi produce a potent glue-like substance called glomalin that is crucial for maximizing soil aggregation. We believe that glomalin is an important component for carbon soil retention and encourage increased investigation of this mechanism in carbon sequestration. In addition, in organic production systems, increased mycorrhiza fungal activity allows plants to increase their access to soil resources, thereby stimulating plants to increase their nutrient uptake, water absorption, and their ability to suppress certain



Now in its 27th season, The Rodale Institute Farming Systems Trial® is the longest running comparison of conventional corn and soybean row crop farming to organic production systems of corn and soybean.

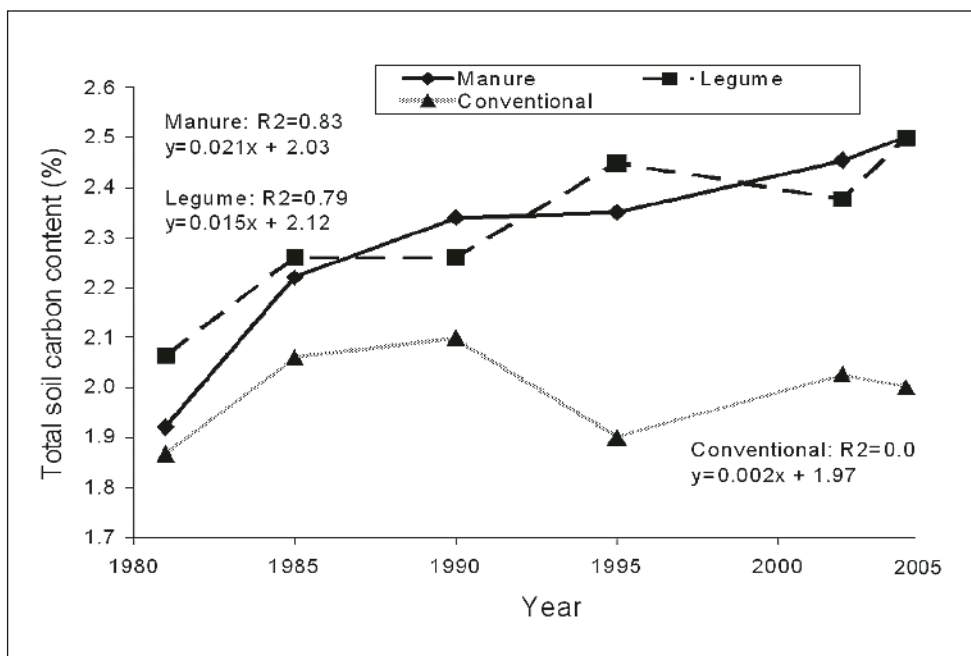


Figure 1: Linear regression of soil carbon rise with time in both organic treatments; while, no increase is found in the conventional system.

plant pathogens. Research shows 12% of the carbon captured in photosynthesis can be shunted to soil mycorrhizae. Synthetic chemical fertilizers and pesticides inhibit mycorrhizae and turn off a key mechanism by which plants naturally feed the soil through their support of beneficial fungi.

Increasing soil organic matter for the soil's carbon bank is a principle goal of organic agriculture. Organic agriculture relies on the carbon bank and stimulated soil microbial communities to increase soil fertility, improve plant health, and support competitive crop yields. This approach utilizes the natural carbon cycle to reduce the use of purchased synthetic inputs, increase energy resource efficiency, improve economic returns for farmers, and reduce toxic effects of fertilizers and pesticides on human health and the environment.

Former U.S. Secretary of Agriculture, Ann Veneman, put it this way: "The technologies and practices that reduce greenhouse gases emissions and increase carbon sequestration also address conservation objectives, such as improving water and air quality and enhancing wildlife habitat. This is good for the environment and good for agriculture."

### **Background and impact**

In 1938, G. Callendar published findings suggesting that the burning of fossil fuels, such as coal, oil and natural gases, would likely increase world temperatures. Since 1958, continuous carbon dioxide measurements on Mount Mauna Loa in Hawaii confirm that carbon dioxide is increasing in the atmosphere at a rate of about 1.3 parts per million (ppm) per year. Atmospheric scientists believe that although several other gases contribute to the greenhouse effect in the Earth's atmosphere, carbon dioxide is responsible for over 80% of po-



tential warming. NASA scientist James Hansen, Ph.D. tracked temperature changes in relation to past carbon dioxide levels and he correlated the 25% increase in carbon dioxide over the last 100 years with a 0.7° C warming of the atmosphere. A number of models have predicted that at current rates of carbon dioxide emission the Earth will warm 2.5° C in the next 100 years.

According to climatic change models, agriculture could be seriously affected by global warming. It is estimated that 20% of potential food crop production is lost each year due to unfavorable weather patterns (drought, flood, severe heat and cold, strong storms, etc.). The deterioration of weather patterns in North America could have devastating effects on world supplies of basic food grains such as wheat and corn. Climate change modelers predict that higher temperatures will generate more extreme weather events, such as severe

### **Answering The Critics**

Upon the release of our original findings, a challenge immediately arose from Rattan Lal, Ph.D. in Ohio and Goro Uehara, Ph.D. in Hawaii (see Lewerenz, 2004). These scientists suggested that our estimates for carbon sequestration were too high, based on their personal research experience on conventional no till and reports in the literature showing conventional no till practice might sequester in soil a maximum of only about 200 to 500 pounds of carbon per year.

Conventional no till emphasizes tillage elimination. It does not, however, generally use live cover crops between cash crops. Under the organic farming systems, however, tillage is commonly used but live cover crops are normally established as the key biological drivers of the organic system. These drivers are what account for the 2 to 4 times greater carbon sequestration than that determined in conventional no till without cover crops as practiced by the critics. In conventional no till the ground can be covered with dead decaying crop residue for 4 to 8 months, while in organic farming cover crops provide live growing plants on the ground virtually all year long.

Veenstra, Ph.D. and co-workers (2006) at the University of California have reported on an experiment in the San Joaquin Valley that evaluated the levels of tillage vs. no tillage and cover cropping vs. without in cotton and tomato cropping systems. This work confirmed our 1,000 pounds of carbon per year soil sequestration level that we obtained under their very different California environment. Moreover, it also confirmed that tillage was of less importance compared to cover crop use in terms of improving soil and increasing carbon sequestration.



droughts and torrential rains. A shift of 1 to 2° C in summer temperatures at pollination season can cause a loss of pollen viability, resulting in male sterility of many plant species such as oats and tomatoes.

As global temperatures rise, the glaciers and polar icecaps will melt, leading to major island- and coastal-flooding. About 50% of the United States population lives within 50 miles of a coastline. As coastlines move inland, uncontrolled carbon dioxide levels will directly affect coastal dwellers. If greenhouse gases continue to increase in the next several hundred years, the rise of global temperature is estimated at 7° C, or almost 15° F, and the sea level would rise over 2 meters, or in excess of 6 feet.

### **Soil organic matter is the key to sequestration**

Agricultural and forest carbon sequestration will reduce the dangers that carbon dioxide currently presents to our atmosphere and world climatic patterns. These benefits will complement energy conservation and emission control efforts.

Normal seasonal carbon dioxide fluctuations in the atmosphere demonstrate that plant growth governs major amounts of carbon dioxide, enough to change atmospheric concentration by up to 10 ppm. By increasing plant production, we can reduce carbon dioxide concentrations in the atmosphere. Carbon dioxide levels are minimized in summer when vegetation is lush, and maximized in winter when plants die or go dormant. The fluctuation of carbon dioxide from season to season is about 7 times greater than the yearly average increase in atmospheric carbon from fossil fuel burning and deforestation (1.3 ppm). Plants serve as sinks for atmospheric carbon dioxide. Carbon stored in vegetation, soil, or the ocean, which is not readily released as carbon dioxide, is said to be sequestered. To balance the global carbon budget, we need to increase carbon

sequestration and reduce carbon emissions. While carbon can cycle in and out of soil or biomass material, there are methods for building up what are called soil “humic” substances (also known as organic matter) that can remain as stable carbon compounds for thousands of years.

Before forests and grasslands were converted to field agriculture, soil organic matter generally composed 6 to 10% of the soil mass, well over the 1 to 3% levels typical of today’s agricultural field systems. The conversion of natural grasslands and forests around the globe works to elevate atmospheric carbon dioxide levels significantly. Building soil organic matter by better nurturing of our forest and agricultural lands can capture this excess atmospheric carbon dioxide, and preserve more natural landscapes.

Soil, agriculture, and forests are essential natural resources for sequestering runaway greenhouse gases, helping to derail drastic climate changes. The amount of carbon in forests (610 gigatons) is about 85% of the amount in the atmosphere.

### **Less energy use and consistent yields**

With the Institute’s organic no till system, we have shown that diesel fuel needs can be reduced by about 75%, as trips through the field are reduced from 9 to 2. We have shown that high consistent yields are possible for corn, soybean, and pumpkins without chemical inputs.

In addition to capturing more carbon as soil organic matter, organic agricultural production methods also emit less greenhouse gases through more efficient use of fuels. Energy analysis of the FST by Dr. Pimentel show that organic systems use only 63% of the energy input used by the conventional corn



Notice the difference in the richness of the soil at 1% (left) and 5% (right) carbon.



In addition to capturing less carbon in soil, conventional agricultural production methods also emit greater greenhouse gases and require the hazardous use of chemical fertilizers and pesticides.

and soybean production system. Dr. David Pimentel's findings show that the biggest energy input, by far, in the conventional corn and soybean system is nitrogen fertilizer for corn, followed by herbicides for both corn and soybean production. In our organic approach, winter annual legumes provide the nitrogen naturally at a small fraction of the chemical cost in all its facets -economically, environmentally and to our health.

### **Organic systems are economically viable**

Organic farming also makes economic sense. In addition to reducing input costs, economic analysis by James Hanson, Ph.D. of the University of Maryland has shown that organic systems in the FST are competitive in returns with conventional corn and soybean farming, even without organic price premiums. Numerous studies point to long term organic corn yield surpassing conventional ones. Perhaps just as important, all our yields have exceeded the country conventional farmer average.

### **International and state response**

Calls for an African Green Revolution based on conventional farming methods will only make matters worse. We are losing ground as the Sahara Desert continues to expand southward because of misdirected land management and it is time to shift the chemical paradigm. In Zimbabwe, the droughts that cause famine are clearly associated with El Nino effects. Unfortunately, problems which are rooted in the soil are now being attributed to lack of synthetic fertilizer, insufficient genetically modified food crop varieties, and lack of pesticide availability. The call for a Green Revolution must be rooted in the soil and not in false hopes and promises based on magical potions with their proven history of health and environmental destruction. We can, and indeed we must, do better.

However, in Europe, scientist consultant groups from Neth-

erlands and Germany have reviewed our findings and use them to incorporate organic farming targets as a part of their greenhouse gas targets for their road-map and strategies.

In addition, we have been actively involved with Pennsylvania, New Mexico, and Northeast Regional Greenhouse Gas Working Groups. We intend to be at the table to have a positive impact on agriculture and food policies in relation to greenhouse gas issues. This is particularly important because business as usual will not resolve the challenges we have ahead of us.

### **Conclusion**

The presence of sequestered carbon in FST organic field trials is an indicator of healthy soil that has an abundance of carbonaceous matter, in particular the organic material humus. It is humus that enables healthy soils to retain water during periods of drought. Each pound or kilogram of dry soil organic matter can absorb 20 times its weight in water. It is humus that retains mobile nutrients found in soils such as phosphates and nitrates, that would otherwise be lost as runoff to streams and aquifers.

These trials illustrate that economic benefit as well as environmental protection can and should work together hand in hand. The economic benefits are realized by farmers and landowners who see reduced costs for fertilizer, energy and fuels requirement, irrigation needs, and increased crop yields and quality at the same time. It is also economically beneficial to the agricultural business economy, and an environmental benefit to all of us, that specific soil management and tillage practices can help to sequester or retain carbon in the soil – carbon that would otherwise be lost to the atmosphere as a component of the growing greenhouse gas menace.

In conclusion, organic farming can reduce the output of carbon dioxide by 37-50%, reduce costs for the farmer, and increase our planet's ability to positively absorb and utilize greenhouse gases. These methods maximize benefits for the individual farmer as well as for society as a whole. It is a winning strategy with multiple benefits and low comparative risk. These proven approaches mitigate current environmental damages and promote a cleaner and safer world for future generations.

### **Creating incentives and taking action**

While credits for no till farming are now fully established, to

elevate the response to climate change we must extend those credits to organic practices, including cover cropping, compost addition, rotation and other methods. There is a continuing need to develop verified methods and real time estimation of sequestration rates. We believe that this can be achieved by utilizing a combination of process- and performance-based standards as a way of confirming and conferring greenhouse gas credits.

Each and every one of us needs to look ourselves in the mirror and ask, "How can I contribute to easing the burden of our collective planetary debt?" In terms of the food system, it can start with consumers consciously eating local organic, producing their own food wherever possible, and even reducing feedlot beef consumption. As individuals, let us start this journey to the future by dedicating ourselves to doing the small things we can do. Then, as a collective, let us work together to do the rest of the job. We can and we must.

*Paul Hepperly, Ph.D., the New Farm research and training manager at the The Rodale Insti-*

### **Local Organic: The Best Approach**

Part of the problem in our present food system is its centralized nature. Spinach can grow fine in Pennsylvania, but it usually is shipped from California where it is grown on subsidized water shipped hundreds of miles from its source. In the transformation of this inefficient and often unhealthy system of food, we need to engage consumers in the values local organic food resources represent. Combining organic and local is the strongest tandem concept for improving the food system, people's health, and the health of the air, water, and soil.



*tute in Kutztown, Pennsylvania, is an expert in the field of carbon sequestration in organic systems. He grew up on a family farm in Illinois and holds Ph.D. and M.Sc. degrees in plant pathology and crop sciences from the University of Illinois at Champaign-Urbana.*

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# Fighting Fumigation

## How two renters fought the fumigation of their townhome community

By Ron & Anna Winship

The story starts when a neighbor decided to renovate their condo, and during this process discovered that their unit had a terrible termite infestation problem. Shortly thereafter the Home Owners Association (HOA) for our 121 unit townhome community announced that the entire complex was going to be tented and fumigated with Vikane (sulfuryl fluoride) gas, manufactured by Dow Chemical Company. The HOA also said a chloropicrin agent was going to be used to identify the “gassed buildings,” because Vikane is odorless, tasteless and could not be seen. Chloropicrin got our attention since it was used as a poison gas (it breaks down into phosgene gas) in World War I and infirmed many a soldier in the trenches.

### We began researching

We began looking into it further and discovered that Vikane was created in 1959 and first used commercially in 1961 as an alternative to DDT and methyl bromide. Both of these bad actors (Vikane and chloropicrin) cause birth defects, brain inflammation, lung and heart edema, as well as nerve damage and diminished capacity. We later found that sulfuryl fluoride was named a Toxic Air Contaminant by the State of California. After nearly 48 years, this poison was finally called what it truly is: one of the worst contaminants of our air possible, responsible for the killing of native birds and lizards and for endangering the health of the public.

Within several weeks, we had collected 40 pages of negative information regarding both Vikane and chloropicrin. We had delivered the package to our friends, who immediately became defensive. We were told that our information was pure nonsense and that Vikane was perfectly safe. So, we got to work making copies of our 40-page report, as well as a shorter version and handed them out to as many neighbors as we could find.

Three fumigation “familiarization” meetings were held at odd times, giving the fumigators an opportunity to tell the community a variety of lies and misrepresentations regarding possible health and environmental effects. They said that off-gassing from tenting in close proximity posed no problems, that they would blow out most of the Vikane in the attics and that no Vikane would remain in the walls, pillows, bedding, electronics, toiletries or other fluids.

### Fight fumigation PR

Because we were renters in this condo community, there were attempts to exclude us from the deliberations of the HOA. The HOA president said, “Only owners will be allowed to speak!” We objected since the decision of the HOA would directly affect the health of our family. With support from most of the owners in attendance, we were eventually allowed to speak.

We pointed out that non-toxic alternatives had not been offered to anyone in the complex, even those with severe health problems. One resident is on dialysis and has renal failure. Others have severe allergy problems. There are even some chemo patients and some people with nerve damage from prior fumigations.

One board member stated that they had spent two years researching the process, and that a non-toxic alternative, heat treatment (a certified and state-approved method), could not be done. We countered that two days before we had a different company give us a bid for heat treatment with a two-year guarantee.

We made our final argument. “If you do not offer a non-toxic alternative for people with serious health problems or concerns and anything goes wrong, then people will say that you did not do your due diligence...that you were negligent in your duties. And in the event that any dog, cat



A laborer tents a house for Vikane fumigation.

or person is affected seriously, each of you could in fact be held personally responsible.” At that point they all went into closed executive session. After the meeting, we heard from neighbors that they were going ahead with the fumigation—no matter what!

### **Petitioning the decision makers**

We decided to circulate a petition to the board and the management company, asking them to offer a non-toxic alternative for at least those with health concerns. Out of the 121 units, we got 71 signatures. We put together 10 packages of 63 pages, including copies of the petition, and delivered them to the HOA, the property management company, our county agricultural commissioner, California EPA’s Department of Pesticide Regulation, the city manager, the county supervisor, our state assemblyman, and U.S. Representative.

We were told by our landlord, “You’ve lost—your 71 signatures mean nothing and, unless you can recall the board, they would go ahead with the fumigation.” Apparently the HOA attorney had called him and threatened to file a cease and desist order, sue our landlord and us for \$350 dollars an hour—until it hurt. Accepting defeat, we told our landlord that we wouldn’t put him in jeopardy.

By this time, however, our work was paying off and several other people had become engaged in the fumigation battle. Home owners were willing to stand up and be counted.

It should be noted that we contacted over 15 attorneys, including some environmental types. While some of the attorneys were helpful, some seemed to be paid off by the chemical companies. They all stated in a variety of ways that a temporary restraining order to stop the fumigation would cost anywhere from \$10,000 to \$15,000.

A final home owners meeting occurred just before the fumigation was to take place. At the HOA meeting, the turnout was over 60 people, including the attorney for the HOA and the president of the management company. We had finally gotten their attention—they now realized that trying to push the fumigation without doing their “due diligence” put them at risk for liability.

A local representative for Dow Chemical was brought to the HOA meeting to answer questions. We asked him, “When was Vikane first used (1961) and when was it placed on the Toxic Air Contamination List?” (February 2007). To his credit, he answered honestly. We had also found a wonderful lady



A large-scale Vikane fumigation at the University of Florida.

who had fought fumigation in her neighborhood for two years before she finally lost the battle. During the meeting she made mention of how her school for disabled children, which she ran out of her home, was put at risk. She spoke about her two-year battle, about how she had to move out for two weeks and remove and replace carpets, drapes, and anything that could hold the Vikane gas. (Which is anything!)

**Success!** At the end of the meeting, the HOA attorney finally stated that they would create a ballot for all home owners to decide which treatment they wanted: local treatment, heat treatment or fumigation. They called off the fumigation, saying that they would take the necessary steps for the home owners to assess the various treatment options. We were truly amazed, and quite exhausted from all the hard work.

**Epilogue:** By the time we heard of their decision, we had already found a new place to live. We had burned too many bridges. There is little doubt that the public needs a state or federal law that brings oversight of local agencies and bureaucracies. We need cities and counties, the Air Quality Management District (AQMD), Department of Pesticide Regulation and other state agencies responsible for pollution in our environment to be the watchdogs over these fumigators and pesticide applicators.

*Ron and Anna Winship are producers for Parker-Longbow productions and for Cutting Edge – a talk show. Feel free to contact them with your comments. [cuttingedgetalk@aol.com](mailto:cuttingedgetalk@aol.com); [www.cuttingedge-atalkshow.com](http://www.cuttingedge-atalkshow.com).*

*For information on termite prevention and management and the range of least toxic options, see *Beyond Pesticides'* termite factsheet at [www.beyondpesticides.org](http://www.beyondpesticides.org), under *Issues, Alternatives Factsheets*.*

# Nanotechnology's Invisible Threat

## Small Science, Big Consequences

by Jennifer Sass, Ph.D.

**Editor's Note:** The following is adapted from a Natural Resources Defense Council (NRDC) "Health Facts" factsheet, published in December 2006. For more information on NRDC's nanotechnology program, visit [www.nrdc.org/policy](http://www.nrdc.org/policy).


From mascara to tennis balls to baby wipes, tiny nanoparticles are hidden in many of the products we use every day. But nanotechnologies are still new, and there are big unanswered questions about their potentially harmful effects on our health and the environment. Current regulations fail to guarantee consumers that these new technologies are safe to use. That's why NRDC and others are pushing the government to move quickly to catch up to the technology and ensure the safety of consumer products.

### The Potential Health Risks

Nanotechnologies involve manipulating ultrafine particles in a size range of 1 to 100 nanometers; the head of a pin is comparatively large at about 1 million nanometers across. Nanoparticles are increasingly finding uses as ingredients in commercial products. But the very qualities that make nanoparticles commercially desirable can also render them more toxic than their normal-sized counterparts. Because they are so small, nanoparticles are extremely mobile; they are able to enter the lungs, pass through cell membranes, and possibly penetrate the skin. Once inside the body, they seem to have

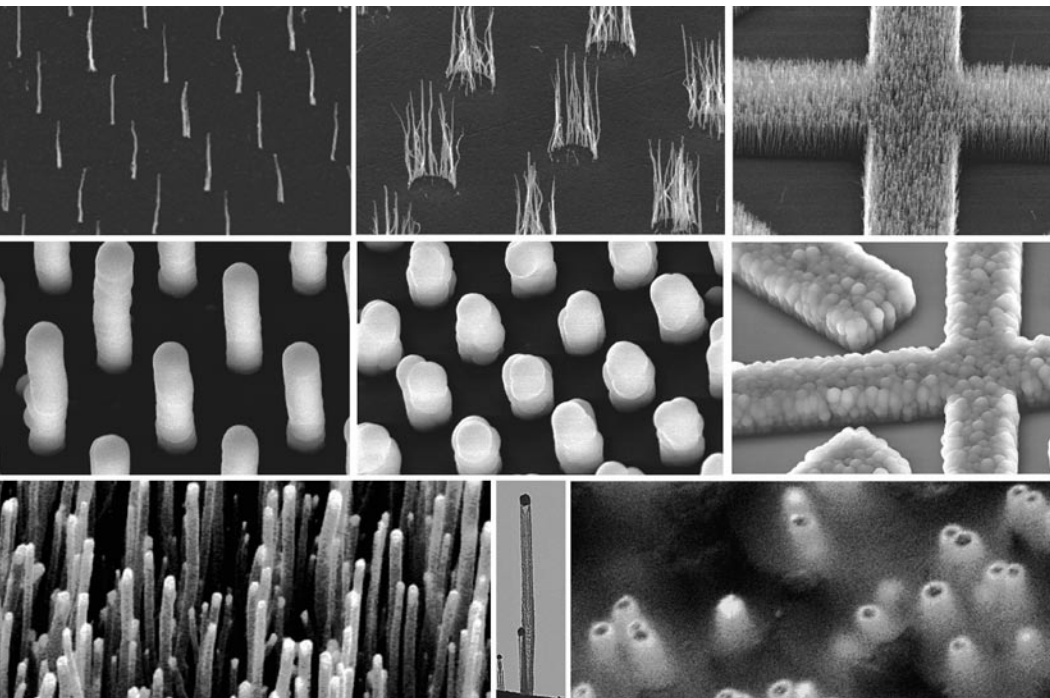
**What to look for on the label**

The words "nano" and "ultrafine" on a list of ingredients indicate that a product contains nanomaterials, and is potentially unsafe.



unlimited access to all tissues and organs, including the brain, and likely also the fetal circulation, and may cause cell damage that we don't yet understand. Studies of ultrafine air pollution have shown that inhalation of nano-sized particles increases the risk of asthma attacks and of death from heart attacks, strokes, and respiratory disease.

Until we know the risks of nanomaterials, these products remain potentially dangerous to consumers. They also pose a potential hazard to the workers who are exposed to them during product development, production, use, and disposal. To this end, labor unions and environmental justice advocates have joined together to call on the EPA to move quickly to fully disclose hazards and take protective action to prevent harm to workers and their families from nanomaterials.<sup>1</sup>



Carbon-based nanotubes, pictured above, may cause damage to the brain, lungs, cardiovascular and nervous systems. Photo courtesy of NASA.

*"The potential danger to human beings and the environment is literally incalculable if we don't understand how nanotechnology can interact with our bodies and our world." - Rep. S. Boehlert (R-NY) September 2006*



## The Nanotechnology Boom

Nanotechnologies are very likely the future of chemistry. Despite the as-yet-unknown effects of nanotechnologies on human health, manufacturers are already incorporating nanoscale particles into hundreds of consumer products. Products as diverse as suntan lotion, house paint, and stain-proof clothing already contain nanoparticles. Future nano-engineering techniques are likely to produce hybrid combinations of nano-sized, chemical-biological and chemical-mechanical substances.



### Nanosilver pesticides

In December 2006, EPA announced that it will regulate a large class of consumer items made with microscopic silver, referred to as nanosilver, which is incorporated to kill bacteria into a wide range of consumer items, including shoe liners, socks, toothpaste, pillows, food storage containers, bandages and air fresheners. Silver has been known for years for its biocidal properties in its bulk form, as well as for its hazardous health effects. It is more efficient as nanoparticles.

Any company that makes a claim that its product will kill bacteria with nanosilver should, under EPA guidelines, subject its products to the risk assessment review created by the "unreasonable risk" standard in the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA). However, as with traditional pesticides, manufacturers that do not make pesticidal claims will not be subject to EPA regulation.

### Demand Regulation of Potentially Harmful Substances

It is crucial that regulation of these nanosubstances advances as quickly as the technologies that are generating them. But the current approach to chemical regulation is slow, costly, and has failed to prevent deadly chemical exposures. NRDC has developed a four-part framework for how nanomaterials should be regulated to protect consumers who use these products and the workers who manufacture them.

- **Prohibit the untested or unsafe use of nanomaterials.**

This places the burden on industry to provide assurances of safety, rather than on regulators to prove harm.

- **Act on early warnings to protect communities and workers.**

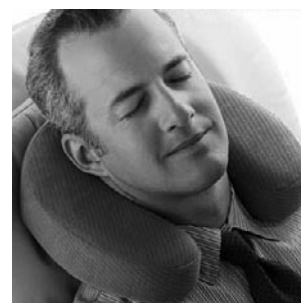
Health-protective regulations should be set if there is any evidence of risk, even if uncertainty remains regarding the nature and magnitude of the harm.<sup>3</sup>

- **Conduct full life-cycle environment, health, and safety (EHS) impact assessments before putting nanotechnologies on the market; assess nanomaterials as new substances, since their unique physical properties impart unique hazard profiles.**

Independent testing is urgently needed to understand the hazards of nanomaterial exposure across the lifecycle of a product. The results of these tests should be made available to the public.

- **Facilitate full and meaningful participation by public and workers in nanotechnology development and control; consider the social and ethical impacts of nanotechnologies.**

The potential of nanotechnologies to transform the global social, economic, and political landscape means we must move the decision making out of corporate boardrooms and into the public realm.



## References

- 1 Comments on risk management practices for nanomaterials, especially as it relates to exposure of workers. K. Burns, Docket ID Number EPA-HQ-OPPT-2004-0122, October 27, 2006.
- 2 See [www.nanotechproject.org](http://www.nanotechproject.org) for a more complete consumer inventory.
- 3 The Louisville Charter for Safer Chemicals, [www.louisvillecharter.org](http://www.louisvillecharter.org).

From top: Antibacterial Water Tap by Nano Care Technology, Ltd., Antibacterial Tableware by Nano Care Technology, Ltd., Antibacterial Lock by Nano Care Technology, Ltd., Antibacterial Kitchenware by Nano Care Technology, Ltd., Contour-Foam Silver Crescent Travel and Nap Pillow by Sharper Image.

## The Omnivore's Dilemma: A natural history of four meals

Michael Pollan, *The Penguin Press, 2006 (450pp), \$26.95.* This book hits you in the stomach and the head, raising serious questions about our food choices and how they affect the environment, animals, health, energy consumption and global warming, farmworkers, and the future of the family farm. Choices: organic or chemical-intensive; organic from local farms, agribusiness, or imported; whole organic or processed organic with synthetics; wild fish or farmed, to name a few.

That deciding what we should eat raises anxiety is nothing new. Mr. Pollan, in writing this book, is hopefully facilitating a broad and urgently needed national dialogue on the environmental and health impacts of our food choices. The author recognizes that Wendell Berry began this discussion, saying, "Eating is an agricultural act." "It is an ecological act, and a political act, too," says Mr. Pollan.

For the most part, the vast majority of Americans are engaged in what the author calls "ignorant eating." While "the act of eating represents the most profound engagement of the natural world," Mr. Pollan says most of us, unwittingly, are actually engaged in "industrial eating" –eating food produced by a manipulation of nature that has dire consequences. Mr. Pollan constructs the dilemma of our food choices and fills the pages with historical and scientific facts, woven into a personal account in which he traces the path of his food (from corn to beef) and what exactly it went through to reach his dinner table. For example, Mr. Pollan actually tracked down a calf he had purchased in South Dakota to a Kansas feedlot.

During Mr. Pollan's food chain journey, we learn about key historical turning points in U.S. agriculture as part of a visit with an Iowa corn farmer. Corn, the basis of industrial food, feeds the steer, chicken, pig, turkey, lamb, catfish, tilapia and salmon, which are being reengineered to be able to perform this unnatural act. "The milk and cheese and yogurt, which once came from dairy that grazed on grass, now typically come from Holsteins that spend their working lives indoors tethered to machines, eating corn." Corn is in our sweeteners, such as high fructose corn syrup (HFCS). Corn, an efficient and productive plant, became even more productive when agriculture transitioned from natural fertilization ("sun-driven cycle of fertility in which the legumes, by fixing nitrogen, fed the corn which fed the livestock which in turn (with their manure) fed the corn") to fossil fuel intensive chemical (ammonium nitrate) fertilization. Using a World War II munitions technology based on nitrate, synthetically fixing nitrogen "allowed the food chain to turn from the logic of biology and embrace the logic of chemistry. Instead of eating exclusively from the sun, humanity now began to sip petroleum." Corn, with more fertilization

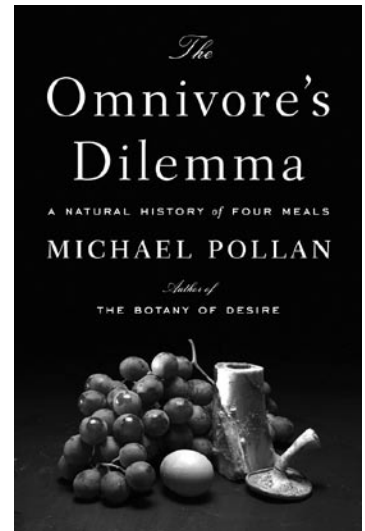
and pesticides, converts fossil fuel to food. Synthetic chemical fertilization's focus on nitrogen, phosphorus and potassium (N-P-K) ignores the importance of soil health, humus, soil organisms, water retention, and more.

In addition to chemical fertilization's high energy cost (estimates are 50 gallons of oil per acre), the ecological costs mount. Ammonium nitrate transforms to nitrous oxide, a greenhouse gas that contributes to global warming, and nitrate runoff pollutes waterways poisoning marine ecosystems and threatening biodiversity. Yet, U.S. farm policy supports the race for increased corn production to the benefit of Cargill and Coca Cola, not farmers.

There are some health benefits of grass fed animals: higher levels of Omega-3. And serious health problems associated with corn fed cows: E-coli resistance to human stomach acid. Other corn-related problems: HFCS is tied to obesity. Meanwhile, organically grown food is showing health benefits, such as better nutrition associated with higher levels of polyphenols.

The author critiques "industrial organic" agriculture and raises critical issues for the local and national dialogue regarding organic practices and labeling, including issues such as pasture and outdoor access for animals, grass-fed, and synthetic ingredients in processed foods labeled organic.

Consumers say trusting their source of food is critically important. Organic was originally conceived to be a transparent system based on disclosure (labeling), plans, inspections and certification. But, the author points out, the growing industrial organic sector is increasingly removed from the values that birthed the organic movement. For instance, some feel it is enough that organic reduces pesticides and synthetic fertilizers and don't worry about the other core values that attract organic consumers, such as natural and humane. Others say that the food system must be decentralized and offer consumers the opportunity to have a relationship with the earth and those who grow the food, through farmstands, consumer supported agriculture (CSAs), buying clubs, and cooperatives. The important thing, as the author points out, is that people understand the effect of their choices.



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Acute medical problems caused by pesticides are often misdiagnosed. Studies link pesticide exposures to increased risks of cancer, birth defects, reproductive and developmental disorders, neurological and behavioral problems as well as respiratory and immune system disorders.

This course, featuring nine experts, was originally a symposium co-sponsored by MedChi and Maryland Pesticide Network at the Johns Hopkins School of Public Health, April 2006.

Presenters include James Roberts, M.D., Associate Professor, Dept. of Pediatrics, Medical University of South Carolina and co-editor of US EPA Recognition and Management of Pesticide Poisoning, 5th edition; Richard L. Humphrey, M.D., Associate Professor of Medicine, Oncology and Pathology, Johns Hopkins Hospital and University of Medicine; Lorne Garrettson, M.D., Medical Toxicologist; Cindy Parker, M.D, Training Specialist, Johns Hopkins Center for Public Health Preparedness and Jay Feldman, M.A., Executive Director of Beyond Pesticides. The course was designed by experts in the field to enable health care providers to more accurately diagnose, treat, report and prevent acute and chronic pesticide-related illness. It is a great tool for educating health care providers.

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education.

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■ *Asthma, Pesticides and Children: What you should know to protect your family.* Since the mid-1980s, asthma rates in the United States have skyrocketed to epidemic levels, particularly in young children. Asthma is a serious chronic disorder of the lungs characterized by recurrent attacks of bronchial constriction, which cause breathlessness, wheezing, and coughing. Researchers have found that pesticide exposure can induce a poisoning effect linked to asthma.



■ *The Safer Choice: How to Avoid Hazardous Home, Garden, Community and Food Use Pesticides.* The Dow Chemical Company produces some of the most hazardous pesticides that invade our lives on a daily basis. Safer alternative practices and products are widely available. This booklet focuses on seven toxic Dow pesticides, summarizing the health and environmental effects and offering suggestions on alternatives to using these toxic chemicals.



■ *Threatened Waters: Turning the Tide on Pesticide Contamination.* Water is the most basic building block of life. Yet, water is being polluted at unprecedented rates, with pesticides and other contaminants. Studies find that 90% of fish, 100% of surface water samples, and 33% of major aquifers contain one or more pesticide at detectable levels. With a crisis in safety looming, steps can and must be taken to protect the nation's waterways.



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On her 100<sup>th</sup> birthday

# Rachel Carson Continuing the Legacy

## Celebrate Rachel Carson's 100<sup>th</sup> birthday with Beyond Pesticides:

■ **Take action** on important pesticide issues. See "Alerts and Actions" at [www.beyondpesticides.org](http://www.beyondpesticides.org).

■ **Blog with us.** Share the knowledge for effective action on Beyond Pesticides Daily News Blog.

■ **Join the National Coalition for Pesticide-Free Lawns.** Sign the Declaration and join in grassroots actions to educate your community from landscapers to policy makers.

■ **Become Beyond Pesticides' friend on MySpace.** Join us on the social networking website to get the latest pesticide information and connect with other pesticide activists around the country. Visit [www.myspace.com/beyondpesticides](http://www.myspace.com/beyondpesticides).

■ **Give a Beyond Pesticides Gift Membership** to a friend or family member. Membership dues help us work to eliminate toxic pesticides in our homes, communities, air, food and water, and includes a subscription to Pesticides and You.

■ **Make Pesticide Free Zones (PFZ)** at your home, school, park, hospital, and other places; post a PFZ sign, start a local group.



Rachel Carson and U.S. Fish and Wildlife Service (FWS)  
artist Robert Hines. Photo courtesy of U.S. FWS.



## BEYOND PESTICIDES

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