Janet V. Keymetian
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Reduction of Endocrine Disrupting Agricultural Chemicals
and Federal Organic Farming Incentives

In the interest of the public welfare, the federal government should eliminate agricultural pollution of water from endocrine disrupting farm wastes at the source wherever practicable by creating a federal farm insurance program for organic farmers, thereby facilitating conversion from conventional farming methods to organic ones. At any one time there are more than 250 chemical contaminants in a person's system, regardless of where he or she lives on the planet.[1] Health issues of immediate concern arise because some of the synthetic chemicals present in our bodies are similar enough to our natural hormones to produce similar biological responses within us.[2] However, these responses do not occur precisely as they would with the natural catalysts; hence humans, wildlife, and their respective offspring are in danger of developing serious physical problems or defects.[3] These chemicals are referred to as "endocrine disruptors," or "EDCs." Some chemicals that fall into the EDC category are agricultural chemicals, particularly in the form of pesticides. Although its use was banned many years ago, the name "DDT" (the acronym for Dichlorodiphenyltrichloroethane) still conjures up images of ecological disaster such as mated eagle pairs whose eggs never hatch. DDT is probably the most widely-recognized

[1] *See* Mary O'Brien, *Book Review: Our Current Toxics Use Framework, Our Stolen Future, and Our Options,* 11 J. ENVTL. L. & LITIG. 331, at 337 (1996). "'[V]irtually anyone willing to put up the $2,000 for the tests will find at least 250 chemical contaminants in his or her body fat, regardless of whether he or she lives in Gary, Indiana, or on a remote island in the South Pacific.'" *Id.* (alterations mine).
[2] THEO COLBORN ET AL., OUR STOLEN FUTURE: ARE WE THREATENING OUR FERTILITY, INTELLIGENCE, AND SURVIVAL? – A SCIENTIFIC DETECTIVE STORY (1997).
[3] *See id.*

endocrine disruptor; it was used for agricultural purposes. Currently, the most widely used pesticide in U.S. agriculture is atrazine,[4] an endocrine disrupting chemical.[5]

The implications of spraying chemicals that threaten the health of humans on the foods we consume are frightening. Knowingly continuing to do so is, at best, reckless. The agricultural chemicals that contaminate food also contaminate soil, air, and water through evaporation, runoff, and soil erosion. Agricultural pollution "degrades more stream miles, more lakes, more ground-water aquifers, and more coastal areas of the United States than pollution from any other source."[6] Pesticide contamination in drinking water is becoming increasingly widespread and the ultimate effects of this contamination on humans is not known: "[p]esticide concentrations in drinking water are rarely high enough to cause acute effects; however, there is great uncertainty and concern about chronic effects such as cancer, miscarriage, and mutations."[7] Furthermore, once the pesticides are in the water, they "are difficult and expensive to detect and remove from drinking water supplies."[8] Conversely, organic farming methods generate healthier produce while simultaneously reducing human impact on the environment. Although it makes sense to switch our food production methods to organic practices whenever feasible, farmers currently lack incentive to do so. This is attributable to many factors, including the financial risks a farmer takes when switching from engineered to biological farming methods and the lack of government-backed incentive to make this change.

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[4] *See* Environmental Protection Agency website "Pesticide Industry Sales and Usage 1994 and 1995 Market Estimates – Highlights of Report" http://www.epa.gov/oppbead1/pestsales/95pestsales/intro.html (last visited 3/13/02).
[5] *See* World Wildlife Federation website "An Emerging Environmental & Human Health Issue" http://www.panda.org/resources/publications/sustainability/edo_disrupt/rv3_summary.htm (last visited 3/9/02).
[6] John B. Braden and Stephen B. Lovejoy, *Overview*, *in* AGRICULTURE & WATER QUALITY 1 (John B. Braden et al. eds. 1990).
[7] Lawrence W. Libby and William G. Boggess, *Agriculture and Water Quality: Where Are We and Why?*, *in* AGRICULTURE & WATER QUALITY 9, 17 (John B. Braden et al. eds. 1990). (alterations mine).
[8] *Id.*

This analysis will begin with a description of EDCs and the mechanisms by which they cause harm. A discussion of current agricultural practices and their combined effect on the environment and its occupants will follow. This will lead to an analysis of the need for total elimination of pesticide use as opposed to reduction of amounts used as well as the current legislative failure to effectively protect the public from agricultural pollutant effects. Finally, a discussion of organic farming techniques and their benefits will end in a recommendation for an organic farming transition insurance paradigm.

The Endocrine System:

The endocrine system is vital to the human body.[9] It is one of at least three important integrating and regulatory systems in humans and other animals, the other two being the nervous and immune systems.[10] The endocrine system is made up of a network of glands that produce or, in some cases, store their particular hormone and release them into the blood when needed.[11] Hormones are chemical messengers, transferring information and instructions between individual cells.[12] Hormones influence "reproductive structure and function, various glandular, muscular, and nervous system functions; maintenance of normal levels of glucose and ions in blood; control of general body metabolism; and blood pressure."[13] The three hormonal compounds that are most worthy of note are estrogen, thyroid hormone, and adrenocorticotrophin hormone (ACTH).[14] Endocrine system components are important to proper body functioning in that they generate hormones responsible for regulating the body's growth and development, controlling

[9] *See* Robin Fastenau, EPA's Investigation and Regulation of Endocrine Disruptors, 14 J. ENVTL. L. & LITIG. 53, 2 (1999).
[10] U.S. ENVIRONMENTAL PROTECTION AGENCY, SPECIAL REPORT ON ENVIRONMENTAL ENDOCRINE DISRUPTION: AN EFFECTS ASSESSMENT AND ANALYSIS, PREPARED FOR THE RISK ASSESSMENT FORUM EPA/630/R-96/012, at 1 (1997).
[11] *See* Fastenau, *supra* note 9 at 60.
[12] *See id.*
[13] *Id.*
[14] *See* Dr. Alan Hecht, Remarks at the U.N. Commission on Sustainable Development Seminar (April 30, 1996) (transcript available at <http://www.epa.gov/opptsfrs/home/spch0430.htm>). [slide 4].

the function of various tissues, supporting pregnancy and other reproductive functions, and regulating metabolism.[15]

EDCs and the Endocrine System:

The EPA's definition of endocrine disruptors is difficult for the non-scientist to understand.[16] A simpler definition/description of what endocrine disruptors are follows: "Endocrine disruptors are usually either natural products or synthetic chemicals that mimic, enhance (an agonist), or inhibit (antagonist) the action of hormones."[17] There are many factors that can affect the impact an EDC may have on the body, such as the time of exposure in the life cycle.[18]

There are a multitude of substances that interact with the endocrine system.[19] While some are beneficial to humans – such as those used for birth control, osteoporosis prevention, heart disease prevention, and cancer therapy for prostate and breast tumors[20] – some are not. Three main categories of EDCs that pertain to agricultural pollution are Organochlorine Pesticides,[21] Alkylphenol Ethoxylates (APEs),[22] and Phytoestrogens.[23] Any list of EDCs that anyone could

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[15] *See* Fastenau, *supra* note 9 at 60.

[16] *See* U.S. ENVIRONMENTAL PROTECTION AGENCY, SPECIAL REPORT ON ENVIRONMENTAL ENDOCRINE DISRUPTION: AN EFFECTS ASSESSMENT AND ANALYSIS, PREPARED FOR THE RISK ASSESSMENT FORUM EPA/630/R-96/012, at 1 (1997). An endocrine disruptor is defined as "an exogenous agent that interferes with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for the maintenance of homeostasis, reproduction, development, and/or behavior." *Id.*

[17] *See* Fastenau, *supra* note 9 at 60.

[18] *See id.*

[19] *See* Noah Sachs, *Blocked Pathways,* 24 Colum. J. Envtl. L. 289, 303-06 (1999).

[20] *See id.,* at 307.

[21] *See id.,*at 300-06:

> [1] Organochlorine Pesticides: This category includes DDT, DDE, and dicofol, as well as the pesticides perthane, aldrin, chlordane, heptachlor, and hexachlorobenzene. . . . While the EPA severely restricted the use of DDT in 1972, other countries still produce and use it. . . . DDT persists in the U.S. environment because it and its break-down products accumulate in wildlife and stay in the foodchain.

(author's footnotes omitted, alterations mine.) *Id.*

[22] *See id.,* at 300-06:

currently produce, no matter how comprehensive, would not be exhaustive because science has yet to identify the full range.[24] The universe of chemicals to be screened as EDCs includes more than 87,000 compounds, including those listed under the Toxic Substances Control Act (TSCA) Inventory, active pesticide ingredients, and ingredients in cosmetics and food additives.[25] The reason for the extensive number of chemicals to be tested stems from the fact that analysis of a chemical's structure is not a sufficient predictor of whether that chemical is endocrine disrupting.[26] The more science learns about endocrine disruptors, the clearer the danger becomes.[27]

EDCs disrupt the intended chemical messages within the body. More specifically, they "mimic the effects of hormones in mammalian endocrine systems."[28] This is a frightening

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> [3]Alkylphenol Ethoxylates (APEs): APEs, which are estrogenic, are used widely in detergents, paints, herbicides, pesticides, and cosmetics. Over 300 million kilograms of APEs are produced annually worldwide. APEs accumulate in rivers, entering the water directly from fields or through sewage treatment plants, and they also accumulate in the bodies of fish and birds. . . . One APE, nonylphenol ethoxylate, also known as nonoxynol-9, is widely used as a spermicide and condom lubricant.

(author's footnotes omitted, alterations mine.) *Id.*

[23] *See id.,* at 300-06:

> [6]Phytoestrogens: Phytoestrogens are naturally-occurring estrogenic and anti-estrogenic chemicals found in plants, including edible plants such as spinach, sprouts, and soybeans. Because soybeans are used so widely in food products, including infant formula, they may be a major source of human EDC intake.

(author's footnotes omitted, alterations mine.) *Id.*

[24] *See id.,* at 306.

[25] *See* ENDOCRINE DISRUPTOR SCREENING AND TESTING ADVISORY COMMITTEE, FINAL REPORT ES-1, (August 1998).

[26] *See* Mary O'Brien, *Book Review: Our Current Toxics Use Framework, Our Stolen Future, and Our Options,* 11 J. ENVTL. L. & LITIG. 331, at 342 (1996).

[27] *See* Hecht, *supra* note 14. [between slide 4 and 5]

> The potential implications of endocrine disruptors for wildlife and human populations and, for those yet unborn, are serious. The difficulty is that we do not currently know the extent to which problems exist. What's more, where they do exist, we do not know how widespread they may be. Nonetheless, in view of existing data, endocrine disruptors warrant priority attention now. *Id.*

[28] Debra Goldberg, *What You Don't Know About Chemicals Can Hurt You: EPA's Proposed Policy Statement for the Endocrine Disruptor Screening Program*, 6 ENVTL. LAW. 209, § II (1999).

prospect for the humans ingesting these chemicals.[29] It is also a relatively new thought because, "[o]ften toxicity is thought of as the killing of cells by poison, or an attack on DNA by mutagens or carcinogens. However, hormone-disrupting chemicals disrupt the endocrine system by mimicking hormones, blocking hormones, and scrambling messages of hormones."[30]

Not surprisingly, research has connected the chemicals in our bodies to health problems:[31] "Researchers link endocrine disruptors to diseases and impairments as diverse as cancer, infertility, immune suppression, and birth defects. . . . damage caused by endocrine disruptors is irreversible and may be widespread, affecting many different systems in the human body."[32] EDCs change the natural patterns of behavior, chemical balance, growth processes, and normal development.[33]

EDCs in Synergy:

It has been recently discovered that these endocrine disruptors can have synergistic and/or cumulative effects.[34] In support of the synergistic theory, a recent study found that "chlordane, an organochlorine pesticide that has no measurable estrogenic activity, significantly enhanced the potency of other weaker estrogenic pesticides (e.g., endosulfan, dieldrin, and toxaphene)."[35] The effect of endocrine disruptors on the immune system is an example of cumulative problems:[36] "If an endocrine disruptor compromises an organism's ability to fight off the effects of another toxic chemical, the endocrine disruptor is one of the 'causes' even if it is

[29] *See* THEO COLBORN ET AL., OUR STOLEN FUTURE: ARE WE THREATENING OUR FERTILITY, INTELLIGENCE, AND SURVIVAL? – A SCIENTIFIC DETECTIVE STORY (1997).
[30] O'Brien, *supra* note 26, at 339.
[31] *See* Goldberg, *supra* note 28. (author's footnotes omitted)
[32] *Id.*
[33] *See* Hecht, *supra* note 14.
[34] *See* O'Brien, *supra* note 26.
[35] Steven Arnold et al., *Synergistic Activation of Estrogen Receptor with Combinations of Environmental Chemicals*, 272 SCIENCE 1489, 1490 (1996).
[36] *See* O'Brien, *supra* note 26, at 340.

not identified as capable of causing that effect."[37] Detection of this helper-enabler role is very difficult.[38] Put simply, a person may be exposed to what has been deemed an acceptable level of EDC number one, which suppresses his/her resistance, then be exposed to an acceptable level of EDC number two, and wind up with a disease or birth defect. In laymen's terms, this could be referred to as the 1+1=3 effect. Although many pesticides may have already undergone extensive toxicological testing, conventional toxicity tests may be inadequate to determine whether these substances interact with specific components of the endocrine system and whether additional testing is needed for the EPA to assess and more fully characterize their impact on both human and ecological health.[39] In short, top chemists are not sure of the potential effects of these chemicals, yet society persists in allowing them to be spread on food crops in great volume.

EDCs, Pesticides, and Produce Importation:

Americans are being poisoned with chemicals banned by the U.S. government in produce aisles across the nation. Many of the fruits and vegetables Americans consume, such as bananas, are imported from foreign countries and may be contaminated by EDCs.[40] American consumers currently have no way of knowing which of these fruits and vegetables were treated with the 40 million pounds of endocrine disrupting chemicals that we export but have banned in this country.[41] Consumer concern has motivated some grocers to test for pesticide residue of their own accord;[42] when no residue is found, the grocer displays a sign adjacent to the produce

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[37] *Id.*
[38] *See id.* As some members of the scientific community have pointed out, "[g]iven the cumulative nature of exposure to hormone-disrupting chemicals and the potential for indirect role in causation, detection of this helper role is problematic at best." *Id.*
[39] *See* U.S. Environmental Protection Agency, ENDOCRINE DISRUPTOR SCREENING PROGRAM, REPORT TO CONGRESS, 4 (August 2000).
[40] *See* Robin L. Cowling, *PIC, POPS and the Mai Apocalypse: Our Environmental Future as a Function of Investor's Rights and Chemical Management Initiatives,* 21 HOUS. J. INT'L. 231, 235 (1999). "Pesticides such as Chlorotlalonil, Dithane, and DBCP [which is an EDC] are used to protect bananas which are exported to developed countries." (alterations mine). *Id.*
[41] *See* O'Brien, *supra* note 26, at 336-37.
[42] *See* 21 HOUS. J. INT'L. 231, 236 (1999).

touting the uncontaminated food as "clean."[43] U.S. chemical manufacturers are permitted to continue making toxic pesticides that have been banned for use by American farmers so long as they sell the banned pesticides to foreign buyers.[44] These foreign buyers then use the pesticides on harvests grown for import to the U.S.[45] Therefore, American consumers are eating poisons on their produce because the Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA") allows for the export of banned pesticides without providing for a ban on the import of foods upon which these pesticides were used.[46] Therefore, the only way for Americans to completely avoid this potential health hazard is to seek out, purchase, and consume organic produce. However, there is not a great abundance or wide availability of organic produce currently in circulation. Providing U.S. farmers with an incentive to grow more organic products would aid in solving this problem.

Agriculture, Pesticide Contamination, and Pesticide-Related Health Effects:

Agriculture is a significant source of EDCs due to the use of manufactured agricultural chemicals as well as naturally occurring estrogen hormones excreted in animal waste.[47] In fact, according to one author, "[c]hemical-intensive modern agriculture has become the single largest nonpoint source of pollution."[48] This includes water pollution.[49] Since agricultural wastes are

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[43] *Id.*

[44] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).

[45] *See id.*

[46] *See* 7 U.S.C.A. § 136o(a) through (a)(2), stating:

> [N]o pesticide or device or active ingredient used in producing a pesticide intended solely for export to any foreign country shall be deemed in violation of this subchapter - . . . if, prior to export, the foreign purchaser has signed a statement acknowledging that the purchaser understands that such pesticide is not registered for use in the United States and cannot be sold in the United States under this subchapter.

(alterations mine). *Id.*

[47] *See* Agriculture and Agri-Food Canada "Frequently Asked Questions About Endocrine Disrupting Chemicals (EDCs)" http://res2.agr.ca/london/pmrc/english/faq/edc.html (last visited 3/9/02).

[48] L. Alenna Bolin, *An Ounce of Prevention: The Need for Source Reduction in Agriculture,* 8 PACE ENVTL. L. REV. 63, 63 (1990). (alterations mine).

predominantly nonpoint source pollutants, and therefore not amenable to "end of pipe" treatment, use reduction or elimination is even more urgent then in the industrial waste realm.[50] Reduction initiatives for farm chemicals are akin to using control devices in other arenas;[51] it is simply a slower poisoning of the people and animals in the environment, and is therefore inevitably self-defeating.[52]

According to the World Wildlife Federation website, "every year US agriculture introduces into the environment over 900 million pounds of pesticides in producing food and fiber consumed worldwide."[53] The Natural Resources Defense Council gives the figure of 845 million pounds of pesticide and herbicide per year for U.S. production.[54] There are thirty-eight endocrine disrupting pesticides listed on the World Wildlife Federation (WWF) website.[55] According to the WWF, some of the effects EDCs may have on people include "motor dysfunction of varying severity including cerebral palsy, mental retardation, learning disability, attention deficit hyperactivity disorder, hydrocephalus, seizures and other permanent neurological abnormalities [and for humans in early stages of development, EDCs may] impair

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[49] *See id* at 64.
[50] *See id* at 73.
[51] *See id.*
[52] *See id.*
[53] World Wildlife Federation "Clean water and healthy soil are essential building blocks of a stable and functioning ecosystem" http://www.worldwildlife.org/toxics/progareas/ap/alternatives.htm (last visited 3/9/02).
[54] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[55] alachlor, aldicarb, amitrole, atrazine, benomyl, lindane, carbaryl, chlordane, cypermethrin, DBCP, DDT, dicofol, dieldrin, endosulfan, esfenvalerate, ethyl parathion, fenvalerate, heptachlor, hexachlorobenzene, malathion, mancozeb, maneb, methomyl, methoxychlor, metriam, metribuzin, mirex, nitrofen, oxychlordane, permethrin, pyrethroids, toxaphene, transnonachlor, tributyltin oxide, trifluralin, vinclozolin, zineb, ziram. "An Emerging Environmental & Human Health Issue" http://www.panda.org /resources/publications/sustainability/edo_disrupt/rv3_summary.htm (last visited 3/9/02).

motor function, spatial perception, learning, memory, auditory development, fine motor coordination, balance, and attentional processes. . . ."[56]

Pesticide poisoning of farm workers is the top occupational illness in California,[57] a state known for the amount of produce it grows annually. The farm workers, who come into direct contact with the chemicals, are most likely not alone in the pesticide poisoning category. The entirety of the groundwater-utilizing citizenry of California will likely join the plight of the farm workers as fifty-seven pesticides were found in Californian groundwater in 1985.[58] This is not surprising as California leads the nation in the amount of agricultural chemicals used per year.[59] Frighteningly, the EPA has confirmed the presence of forty-six pesticides in contaminated groundwater from twenty-six states – all of it related to normal agricultural use.[60]

There is evidence to support the assertion that EDCs have affected certain wildlife populations in potentially-devastating ways as well. According to Dr. Amy E. Brown, Coordinator of the Pesticide Education and Assessment Program at the University of Maryland, "effects observed have included abnormal thyroid function, sex alteration, poor hatching success, decreased fertility, reduced or stimulated growth, and developmental abnormalities."[61] In the case of water pollution, such as widely occurs with pesticide use, the effects on aquatic wildlife can be devastating: "Data from the U.S. Environmental Protection Agency (EPA) (1981), based on reported fish kills in the United States for which the causes were known, indicate that between 1961 and 1980 an average of 1.8 million fish were killed annually by agricultural

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[56] *Id.*
[57] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[58] *See* L. Alenna Bolin, *An Ounce of Prevention: The Need for Source Reduction in Agriculture,* 8 PACE ENVTL. L. REV. 63, 75 (1990).
[59] *See id* at 75.
[60] *See id* at 74.
[61] Amy E. Brown, Ph.D., "Pesticides and the Endocrine System" www.pesticide.umd.edu/Leaflets/pil34.pdf (last visited 3/9/02).

pesticides, nutrients or drainage from livestock areas. Two-thirds – an average of 1.2 million fish – were attributed to pesticide contamination."[62]

The connection between human action and its circular effect through nature, subsequently impacting the human population, is illustrated when one considers that even very low concentrations may bioaccumulate in aquatic animals and become a potential hazard to those consuming them: "Pesticides with low water solubilities and high fat solubilities, such as organochlorines [which are EDCs], can bioaccumulate in the fatty tissues of animals that ingest them. Shellfish have been reported to bioaccumulate pesticides up to 70,000 times the concentration in the surrounding water. . . ."[63] When the animal itself does not accumulate more then the environment surrounding it, some chemicals can be passed on to a predator animal if the source animal is eaten: "Concentrations of pesticides in animal tissues can also 'biomagnify' or become increasingly concentrated as they are passed up the food chain. A well-known example is DDT, which became concentrated at very high levels in fish-eating ospreys and eagles, causing them to lay thin-shelled eggs that could not hatch. . . ."[64]

Agricultural Chemical Inefficiency:

For all of the damage they cause, it may be argued that pesticides are inefficient, ineffective, and should therefore be eliminated whenever possible. It has been estimated that a mere one percent of pesticides applied to crops actually reaches the insects they are designed to eradicate.[65] Furthermore, a study concluded that farmers in one state unnecessarily spent $5 million per year on pesticides to deal with three pests on one crop.[66] The first widely-used

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[62] Lawrence W. Libby and William G. Boggess, *Agriculture and Water Quality: Where Are We and Why?*, *in* AGRICULTURE & WATER QUALITY 9, 16 (John B. Braden et al. eds. 1990).
[63] *Id* at 16-17. (alterations mine).
[64] *Id* at 17.
[65] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[66] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 67 (1990).

synthetic pesticide, DDT, became available to U.S. citizens in 1946.[67] Prior to its use, and the use of others that followed it, the combined effects of diseases, weeds, and pests claimed one third of American crops each year.[68] According to U.S. News & World Report, farmers still loose the same third of their crops – even with the use of pesticides, fungicides, and herbicides that cost more than four billion dollars each year.[69]

Use Reduction:

Some European countries, such as Sweden, Denmark, and the Netherlands, have demonstrated that pesticide use can be reduced by more than fifty percent.[70] The World Wildlife Federation suggests that national pesticide reduction programs should be started which employ a collaborative approach to reducing the amount of pesticides used.[71] They suggest that all interested parties "such as farmers, retailers, consumers groups, environmental groups, and agrochemical manufacturers" should have a voice in how the reduction is achieved.[72] Carol Browner, former Administrator of the U.S. Environmental Protection Agency, stated that "common sense tells us that rather than pouring nearly 3 billion pounds of pesticides on our food – and then trying to wash them off – commission scientific studies about them – worry about how risky they might be – we ought to be figuring out how to use fewer pesticides in the first place."[73] Some are advocating, not just for the reduction of pesticide use, but for total elimination. Noted scientist and activist Barry Commoner has stated that "the few real improvements have been achieved not by adding control devices. . . but simply by eliminating

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[67] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[68] *See id.*
[69] *See id.,* citing *U.S. News & World Report* on 9/14/92.
[70] *See* "An Emerging Environmental & Human Health Issue" http://www.panda.org /resources/publications/sustainability/edo_disrupt/rv3_summary.htm (last visited 3/9/02).
[71] *See id.*
[72] *See id.*
[73] World Wildlife Federation "Clean water and healthy soil are essential building blocks of a stable and functioning ecosystem" http://www.worldwildlife.org/toxics/progareas/ap/alternatives.htm (last visited 3/9/02).

the pollutants."[74] Source reduction or elimination of agricultural wastes is not likely to occur voluntarily. Government intervention will be necessary.[75] However, government participation in preventing agricultural pollutants from reaching the population has historically been weak.

Current Statutory Inefficacy:

The two statutes that one would expect to protect the public from pesticide contamination in groundwater, the CWA and the Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA"), have not had much effect.[76] The CWA, through its National Pollution Discharge Elimination System ("NPDES"), prohibits the discharge of pollution into American "navigable waters" absent a permit.[77] However, "the term 'navigable waters' is generally considered to mean surface waters. . . . [and] even if groundwater were included, the NPDES requirement is triggered only when there is a point source discharge."[78] The CWA provides a specific exemption from NPDES requirements for return flows from irrigated agriculture and agricultural stormwater discharges,[79] two forms of agricultural point source discharges. Thus, these discharges flow into our water supplies unchecked by NPDES regulation.

Nonpoint source pollution from agriculture is supposed to be regulated by the CWA in the form of the CWA planning process provisions.[80] These provisions instruct the Administrator of the EPA to develop and promulgate guidelines for the instruction of State officials (such as the governor or other elected officials) in the identification and designation of areas significantly affected by nonpoint source pollution.[81] While these provisions sound promising, it is important

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[74] Bolin, 8 PACE ENVTL. L. REV. 63, 64 (1990).
[75] *See id.*
[76] *See id.,* at 77-8.
[77] *See id.,* at 77.
[78] *Id.*
[79] *See* 33 U.S.C. § 1362(14) – the definition of the term "point source." *See also* 33 U.S.C. § 1342(l)(1) – "Agricultural return flows" which exempts "discharges composed entirely of return flows from irrigated agriculture" from permitting.
[80] *See* 33 U.S.C. § 1288(b)(2)(F).
[81] *See* 33 U.S.C. § 1288(a)&(b).

to realize that the Administrator of the EPA has the authority to approve or reject the plans submitted by state officials,[82] but has no power to compel state officials to create said plans.[83] As one may expect, these provisions have not significantly impacted agricultural nonpoint source pollution.[84] As a consequence of the specific exemptions for agricultural point source discharges and the failure of Congress to provide the EPA sufficient power to compel state government cooperation for nonpoint agricultural pollution sources, "fewer than 10,000 out of 1.1 million American farms are subject to the Clean Water Act."[85]

FIFRA is similarly ineffective in protecting the public from the toxicity of pesticides in water.[86] FIFRA, which provides the system for classifying, labeling, and registering pesticides, states that a pesticide may be registered and used if "when used in accordance with widespread and commonly recognized practice, it will not generally cause unreasonable adverse effects on the environment."[87] Pesticides pollute groundwater under normal agricultural use. Thus, FIFRA fails to provide any protection to the water supply and therefore to humans.[88]

As for other statutes that one may think of regarding pesticide contamination in groundwater, such as the Resource Conservation and Recovery Act ("RCRA"), the Safe Drinking Water Act ("SDWA"), the Toxic Substances Control Act ("TSCA"), and the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), each fails as either the substance does not fall within its realm of authority or the statute is not effectively enforced by EPA.[89] The SDWA[90] mentions pesticides in several of its provisions[91]

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[82] *See* 33 U.S.C. § 1288(a)(7)&(b)(3)&(b)(4).
[83] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 77 (1990).
[84] *See* John C. Keene, *Managing Agricultural Pollution*, 11 ECOLOGY L.Q. 135, 154 (1983).
[85] C. Ford Runge, *Environmental Protection from Farm to Market*, *in* THINKING ECOLOGICALLY 200, 201 (Marian R. Chertow et al. eds. 1997).
[86] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 78 (1990).
[87] FIFRA § 3, 7 U.S.C. § 136a(c)(5)(D).
[88] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 78 (1990).
[89] *See id.,* at 79.
[90] 42 U.S.C. §§ 300f-300j.

but the EPA is not enforcing them.[92] The TSCA,[93] which regulates "chemical substance[s],"[94] specifically states that the term "chemical substance" does *not* mean "pesticide."[95] The SWDA,[96] which deals with "hazardous waste,"[97] does not mention pesticides at all. CERCLA[98] specifically mentions pesticides, exempting farmers from the responsibility of notifying authorities when pesticides are released and exempting them from liability relating to application of pesticides.[99]

Organic Farming Techniques & Benefits:

The employment of organic farming methods would serve the goal of source reduction by eliminating the use of agricultural chemicals.[100] Organic farms produce food and fiber through management practices that exclude the use of agrochemicals, including pesticides.[101] The main weapon against pests and diseases in an organic farmer's arsenal is prevention.[102] Healthy plants

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[91] Pesticides are mentioned in the following provisions:
1. § 300g-1(b)(1)(B)(i)(II)
2. § 300g-7(a)(2)
3. § 300j-1(a)(8)
4. § 300j-13(a)(6)(c)
5. § 300j-14(b)(2)(B)(vi)

[92] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 79 (1990).
[93] 15 U.S.C. §§ 2601-2671.
[94] *Id.,* (alterations mine).
[95] *Id*. at § 2602(2)(B)(ii).
[96] 42 U.S.C. §§ 6901-6992(k).
[97] *Id.*
[98] 42 U.S.C. §§ 9601-9675(c).
[99] 42 U.S.C. 9603 – "Notification requirements respecting released substances" – subsection (e) states that this section does not apply to the application of pesticides registered under FIFRA or the handling or storage of pesticides by a farmer. 42 U.S.C. 9607 – "Liability" – subsection (i) "application of registered pesticide product" states that "no person. . . may recover under authority of this section for any response costs or damages resulting from the application of a pesticide product registered under [FIFRA]." (alterations mine).
[100] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 80 (1990).
[101] *See* England Rural Development Programme "Organic Farming Scheme" http://www.defra.gov.uk/erdp/schemes/landbased/ofs/ofsindex.htm (last visited 3/9/02). *See also* About Organic "Organic Defined…" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).
[102] *See* About Organic "How do organic farmers control pests, diseases, and weeds? How do they fertilize?" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).

are obtained by building a healthy soil through the use of compost, the planting of cover crops, and spreading biologically based soil amendments.[103] Plants produced in healthy soil have a better chance of resisting disease and insect infestation.[104] One author analogizes healthy plants to healthy people: "plant pests don't occur because of a lack of pesticides on your vegetables anymore than headaches occur because of a lack of aspirin. If the vitality and health of crops are improved, they become naturally resistant to pests and disease just like a healthy human mind/body will resist affliction."[105]

Organic producers also rely on diverse species such as soil organisms, birds, and beneficial insects to keep crop pests at bay.[106] If pests persist despite these safeguards, farmers attempt to correct the balance by using various techniques, including: releasing insect predators, disrupting pest insect mating patterns, setting pest traps, and erecting barriers to contain the pest infested area.[107] If all of these techniques fail, the organic farmer may use botanical or other non-toxic pesticides.[108] Organic farmers try to minimize impact to the land they rely on as well as the environment as a whole and the wildlife contained therein.[109] Organic farmers attempt to "use materials and practices that enhance the ecological balance of natural systems" and "integrate the parts of the farming system into an ecological whole."[110] The goal of organic farming is to "optimize the health and productivity of interdependent communities of soil life,

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[103] *See* About Organic "Is there a national standard for organic?" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).
[104] *See id.*
[105] Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[106] *See* About Organic "Is there a national standard for organic?" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).
[107] *See id.*
[108] *See id.*
[109] *See* England Rural Development Programme "Organic Farming Scheme" http://www.defra.gov.uk/erdp/schemes/landbased/ofs/ofsindex.htm (last visited 3/9/02). *See also* About Organic "Organic Defined…" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).
[110] About Organic "Organic Defined…" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).

plants, animals, and people."[111] Fertility of the cultivated land is achieved through the use of manures and composts.[112] Weeds are managed through primarily mechanical means such as "increased cultivation, . . . cover crops, mulches, flame weeding, [and] crop rotation."[113] Crop rotation practices and tillage procedures are employed both to maximize soil fertility and minimize soil erosion.[114] Avenues of trees are planted on organic farms to serve as windbreaks and moisture retainers for the benefit of the crops.[115]

When the farm produces livestock or livestock products, such as eggs or milk, the animals are not given antibiotics or hormones.[116] They must be feed pure organic feed to ensure that pesticides do not pass through their systems into the "certified organic" products they produce.[117] If an animal becomes ill, they may be treated with natural remedies when possible.[118] If these remedies are insufficient to heal the animal or prevent its suffering, conventional veterinary practices such as antibiotics will be used, but the animal will not be returned to the production process.[119]

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[111] *Id.*
[112] *See* England Rural Development Programme "Organic Farming Scheme" http://www.defra.gov.uk/erdp/schemes/landbased/ofs/ofsindex.htm (last visited 3/9/02).
[113] About Organic "How do organic farmers control pests, diseases, and weeds? How do they fertilize?" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).
[114] *See* Horizon Organic Dairy website "Our farming practices" http://www.horizonorganic.com/about/farming.html (last visited 3/9/02).
[115] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[116] *See* England Rural Development Programme "Organic Farming Scheme" http://www.defra.gov.uk/erdp/schemes/landbased/ofs/ofsindex.htm (last visited 3/9/02). *See also* Horizon Organic Dairy website "Our farming practices" http://www.horizonorganic.com/about/farming.html (last visited 3/9/02).
[117] *See* Horizon Organic Dairy website "Our farming practices" http://www.horizonorganic.com/about/farming.html(last visited 3/9/02).
[118] *See id.*
[119] *See id.*

Financial Viability of Organic Operations:

Currently, about one percent of the food supply in the United States is produced through organic means.[120] The dollar figure this percentage represents is impressive: "in 1996, this represented over $3.5 billion in retail sales."[121] American acceptance and consumption of organic foods is on the increase. During the past six years there has been an annual increase in the consumption of organic foods of at least twenty percent.[122] Produce grown through organic means may actually be more profitable for an organic farmer then the same produce grown using conventional techniques. An example of this phenomenon is organic wheat, which obtains up to seventy cents more per bushel then its chemical-laden counterpart does.[123] As production rates for organic wheat are comparable, acre for acre, to conventional wheat, the organic farmer turns a far higher profit for the same good – particularly when the gain achieved in not having purchased the agrochemicals is factored in.[124]

While organic farming achieves a modest sixty to eighty percent of the yield that high intensity conventional farming does, the savings on expensive chemical fertilizers and insecticides may balance some of the loss.[125] As agricultural chemicals are a large portion of conventional farming expenses, the absence of a need for them would make farmers "'less dependant on bank loans and therefore less vulnerable to bankruptcy.'"[126] In fact, in 1989, a study by the National Academy of Sciences concluded that organic farming is economically

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[120] *See* About Organic "Is organic food really a significant industry?" http://www.ofrf.org/general/about_organic/ (last visited 3/9/02).
[121] *Id.*
[122] *See id.*
[123] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).
[124] *See id.*
[125] *See* BBC News "Organic farming can `feed the world'" by Corinne Podger, http://news.bbc.co.uk/hi/english/sci/tech/specials/shetfield_99/newsid_447000/447337.stm (last visited 3/9/02).
[126] Bolin, 8 PACE ENVTL. L. REV. 63, 81-82 (1990).

viable and confers additional benefits on society,[127] some of which can be calculated monetarily in terms of post-pollution cleanup costs and the expense of testing well water for contamination.

The interdependence of organic producers aids in the financial practicability of organic farming as a whole. For example, Horizon Organic Dairy – an operation based in Maryland and Idaho – purchases organic feed for its cows as well as organic blueberries for yogurt and organic cocoa for chocolate milk from other organic farms.[128] Horizon also purchases additional organic milk from family-owned organic dairy farms across the nation.[129] Horizon's purchases of additional cattle feed and supplemental milk supplies "help to support over 150,000 acres of organic farmland on 600 family farms."[130]

Federal Crop Insurance Disincentive for Conversion to Organic Farming:

Evidence of organic farm interdependence is not likely to sway any current conventional farmer to convert his land to more eco-friendly practices. Currently, conventional farmers fear that switching to organic methods will subject their crops to insect damage, and therefore crop loss, which translates into financial disaster for the farmer.[131] These fears are justified, as current federal crop insurance would not protect them from such losses.[132] The current crop insurance system, administered under the authority of the Federal Crop Insurance Act of 1938, insures against crop losses from "unavoidable causes" such as flood, sudden insect or plant disease infestations, or any other cause determined to be unavoidable by the Federal Crop Insurance Corporation.[133] In the event of an unavoidable loss, the conventional farmer would be paid

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[127] *See id.,* at 81.
[128] *See* Horizon Organic Dairy website "Our farming practices" http://www.horizonorganic.com/about/farming.html (last visited 3/9/02).
[129] *See id.*
[130] *Id.*
[131] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 83 (1990).
[132] *See id.*
[133] *See id.*

seventy-five percent of what the crop would have been worth at harvest time.[134] Under the present system, an organic farmer's loss may not be considered unavoidable because the loss might have been avoided had chemical treatments been applied.[135] Furthermore, the present system excludes insect damage on certain types of fruits, vegetables, and specialty items that organic farmers typically grow.[136]

Conventional farming methods strip the land of the essential biological diversity, soil biota, and natural predators present in its pristine state.[137] Therefore, the land takes several seasons of failed crop production to completely recover from its former state,[138] which could be dubbed "chemical dependency." A farmer without insurance to support him through these first years of reclamation will certainly go bankrupt. However, these interim years are vital for reestablishing the natural balance necessary to organically farm and would also serve as an opportune time to educate the farmer in organic practices.

Proposed Organic Insurance Program:

One author outlines her proposed insurance plan as follows:

> Ideally, crop insurance would provide one hundred percent coverage – a form of indemnification – for crop losses that would have been avoided or mitigated with the use of pesticides during the transitional period. . . The period of transition. . . should be limited in duration, from at least three to perhaps five years. . . . After the transition period, farmers should be able to obtain crop insurance for a reasonable premium. . . The insurance would specifically cover crop loss due to pests that would have been avoided or mitigated by chemical use. . . The premiums should be based on risk factors just as is done for conventional crops. . . The production history of organic farms should include post transition history only for insurance purposes.[139]

Thus, organic crop insurance would facilitate conversion from conventional to organic farming methods, would protect the environment by eliminating agricultural nonpoint source pollution,

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[134] *See id.*
[135] *See id.*
[136] *See id.*
[137] *See* Bolin, 8 PACE ENVTL. L. REV. 63, 86 (1990).
[138] *See id.*
[139] *Id* at 87.

would offset the costs of groundwater monitoring and decontamination, would decrease the industrial pollution caused by the manufacture of agricultural chemicals, and could potentially wean farmers from current federal farm subsidies when they become successful operations and do not need to purchase expensive agrochemicals.[140] The financial savings alone could be the deciding factor; it has been "estimated that first-time monitoring costs for the 50 million people in the United States that depend on ground water would range from $1.0 billion to $2.3 billion."[141]

Success under this sort of incentive insurance plan has already been witnessed in England. The British Government has a program that gives farmers financial support while they convert from conventional farming practices to organic farming.[142] Each farmer accepted into the program receives up to 225 pounds per hectare of farming land during the first year.[143] The amount of money per hectare steadily decreases with every additional year for up to five years.[144] Presumably, the farmer will have successfully converted his/her operation within that time.

Conclusion:

The time for an incentive-based agricultural pollution elimination measure has arrived. The current statutory scheme has failed to protect the water supply from pesticide contamination; indeed, some of these statutes carve out specific exemptions for agricultural pollution. As one author put it, "[n]ot one of the expensive schemes that have characterized agricultural policy since the 1930s has adequately controlled water pollution, pesticide overuse, or species

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[140] *See id.,* at 85.
[141] Lawrence W. Libby and William G. Boggess, *Agriculture and Water Quality: Where Are We and Why?*, *in* AGRICULTURE & WATER QUALITY 9, 18 (John B. Braden et al. eds. 1990).
[142] *See* England Rural Development Programme "Organic Farming Scheme" http://www.defra.gov.uk/erdp/schemes/landbased/ofs/ofsindex.htm (last visited 3/9/02).
[143] *See id.*
[144] *See id.*

losses."[145] From the specific statutory exemptions provided to the agricultural industry illustrated above, it is apparent that Congress favors the interests of farmers. It follows that Congress might be open to providing a means to support farmers by reducing their exposure to harmful agricultural chemicals and simultaneously providing a financial boon by creating a greater need for more American farms. Between 1981 and 1988, over 600,000 farmers left their farms.[146] Due to the smaller size of organic farm operations, primarily attributable to the amount of oversight required, more farmers per capita would be necessary to produce the same amount of food as current conventional methods do. In bringing a broader employment opportunity to farmers, Congress would also further the interconnected goals of protecting the environment and providing for the well-being of the citizenry of the United States. Hopefully, reducing the probability of harm to humans and wildlife from EDCs in the pesticide realm, (the synergistic effects of which we cannot even begin to fathom), and boosting the failing economies in farm communities across the nation will be enough to overcome the powerful lobbying effort that the chemical industry will surely put forth. Perhaps disenfranchised farmers would return to the industry if this initiative created an opportunity and an employment vacuum for them to do so. The resultant changes to the agricultural industry, our water supplies, and therefore our health, would benefit us all.

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[145] C. Ford Runge, *Environmental Protection from Farm to Market*, *in* THINKING ECOLOGICALLY 200, 200 (Marian R. Chertow et al. eds. 1997). (alterations mine).
[146] *See* Melvin D. Saunders "Can Organic Farming Be Profitable?" http://www.tiac.net/users/seeker/organic.html (last visited 3/9/02).