

Organic for All

Results of the Organic Diet Biomonitoring Study





Friends of the Earth

ACKNOWLEDGEMENTS

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The study summarized in this report, *Organic Diet Intervention Significantly Reduces Urinary Pesticide Levels in U.S. Children and Adults*, was published in the peer-reviewed scientific journal Environmental Research. Pesticide analysis was conducted by independent laboratories at University of California at San Francisco and the Québec National Institute of Public Health.

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ABOUT FRIENDS OF THE EARTH:

Friends of the Earth U.S., founded by David Brower in 1969, strives for a more healthy and just world. Together we speak truth to power and expose those who endanger the health of people and the planet for corporate profit. We organize to build long-term political power and campaign to change the rules of our economic and political systems that create injustice and destroy our environment. Friends of the Earth has more than 1.5 million members and supporters in all 50 states, and we are the U.S. voice of the world's largest federation of grassroots environmental groups, with a presence in 75 countries.

Friends of the Earth's Food and Agriculture program works via policy advocacy, market transformation, organizing, science and storytelling to advance three fundamental shifts in our food system: from chemical-intensive to organic, ecological and regenerative; from corporate-controlled to democratically governed; and from a system that embodies the deepest inequities in our society to one that advances social justice and fulfills the needs of all eaters now and into the future.

Any errors or omissions in this report are the responsibility of Friends of the Earth U.S.

For full results, study methods and ways to take action, visit

www.OrganicforAll.org

What happens when we eat **organic**?

Can eating organic really reduce levels of pesticides in our bodies? We tested four American families to find out.

For full study results see: Hyland, C., A. Bradman, R. Gerona, S. Patton, I. Zakharevich, R. Gunier, and K. Klein. 2019. Organic Diet Intervention Significantly Reduces Urinary Pesticide Levels in U.S. Children and Adults. *Environmental Research*. For more information, go to **www.OrganicforAll.org**

What happens when we eat **organic**?

All of us are exposed to a cocktail of toxic synthetic pesticides linked to a range of health problems from our daily diets. Certified organic food is produced without these pesticides.

But can eating organic *really* reduce levels of pesticides in our bodies? We tested four American families that don't typically eat organic food to find out.

First, we tested the levels of pesticides in their bodies on a non-organic diet for six days. We found 14 chemicals representing potential exposure to 40 different pesticides in every study participant. These included organophosphates, pyrethroids, neonicotinoids and the phenoxy herbicide 2,4-D. Some of the pesticides we found are linked to increased risk of cancer, infertility, learning disabilities, Parkinson's, Alzheimer's and more.

An organic diet rapidly and dramatically reduces exposure to pesticides

Then, we tested them on an all-organic diet. We found that eating organic works. An organic diet rapidly and dramatically reduced their exposure to pesticides. In fact, levels of all detected chemicals dropped an average of 60.5% in just six days on an organic diet.

The most significant drops occurred in a class of nerve agent pesticides called organophosphates. This class includes chlorpyrifos, a highly toxic pesticide linked to increased rates of autism, learning disabilities and reduced IQ in children. Organophosphates are so harmful to children's developing brains that scientists have called for a full ban.[1]

The neonicotinoid pesticide clothianidin also dropped significantly. Neonicotinoids are a key contributor to massive pollinator losses and bee die-offs,[2] are among the most commonly reported pesticide residues in infant and toddler foods[3] and may affect the developing fetus and child, possibly leading to changes in behavior and attention, including an association with autism spectrum disorder.[4]

> ***"Everyone has the right to clean organic food. That is a human right."***
>
> Tara, study participant, Baltimore

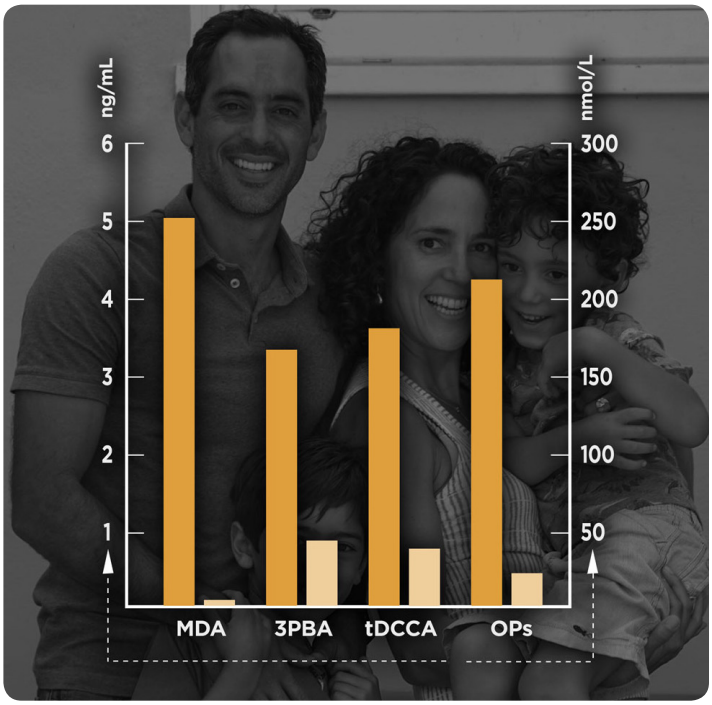
In addition to reducing eaters' exposure to toxic pesticides, organic farming systems protect the health of farmworkers, farmers and rural communities, and safeguard our air, water, soil, pollinators and other critical species.

We need organic for all. No one should be exposed to toxic pesticides in the food they eat. No farmer or farmworker should have to sacrifice their health or their children's health to grow the food we all eat. And the way we grow food should protect rather than harm the ecosystems that sustain all life.

Top four pesticide decreases in each family

All detected pesticides dropped in each family, these charts show the top four decreases per family.

OAKLAND, CA



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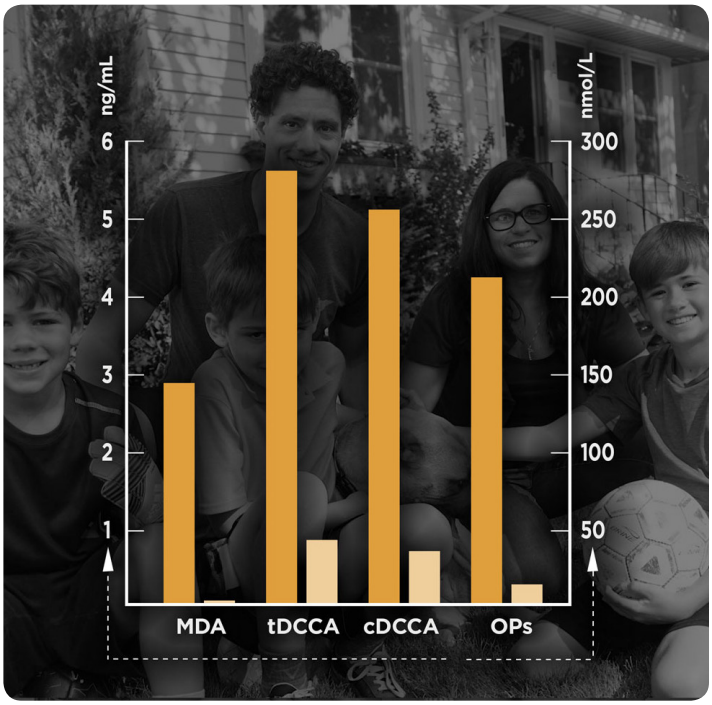
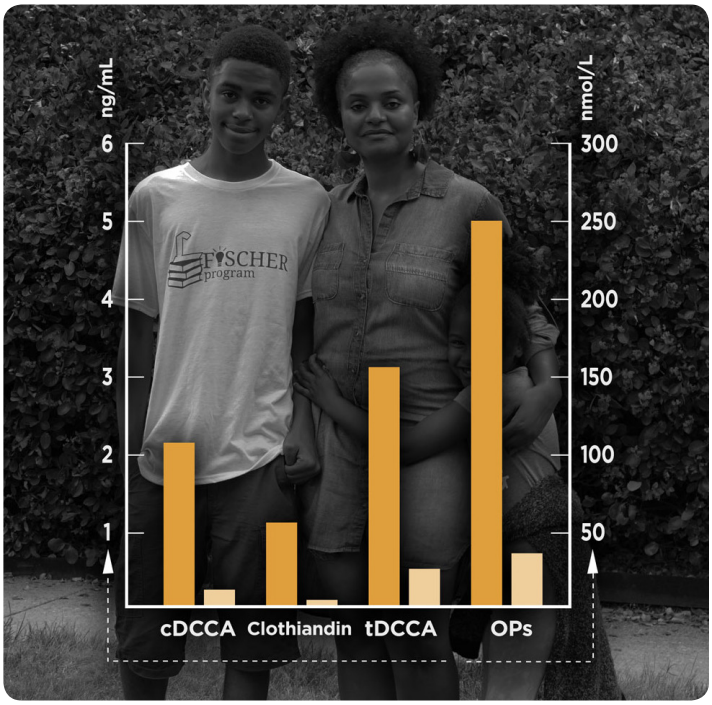
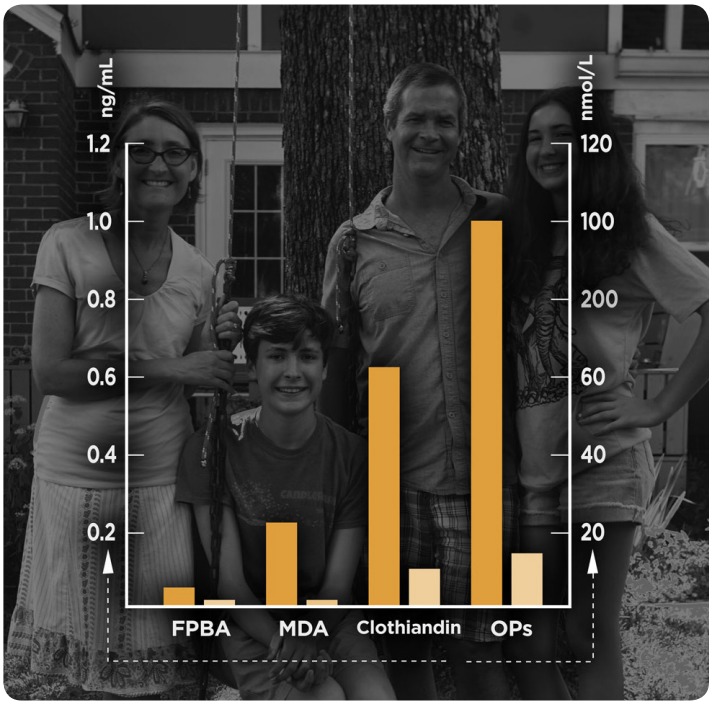


BALTIMORE, MD



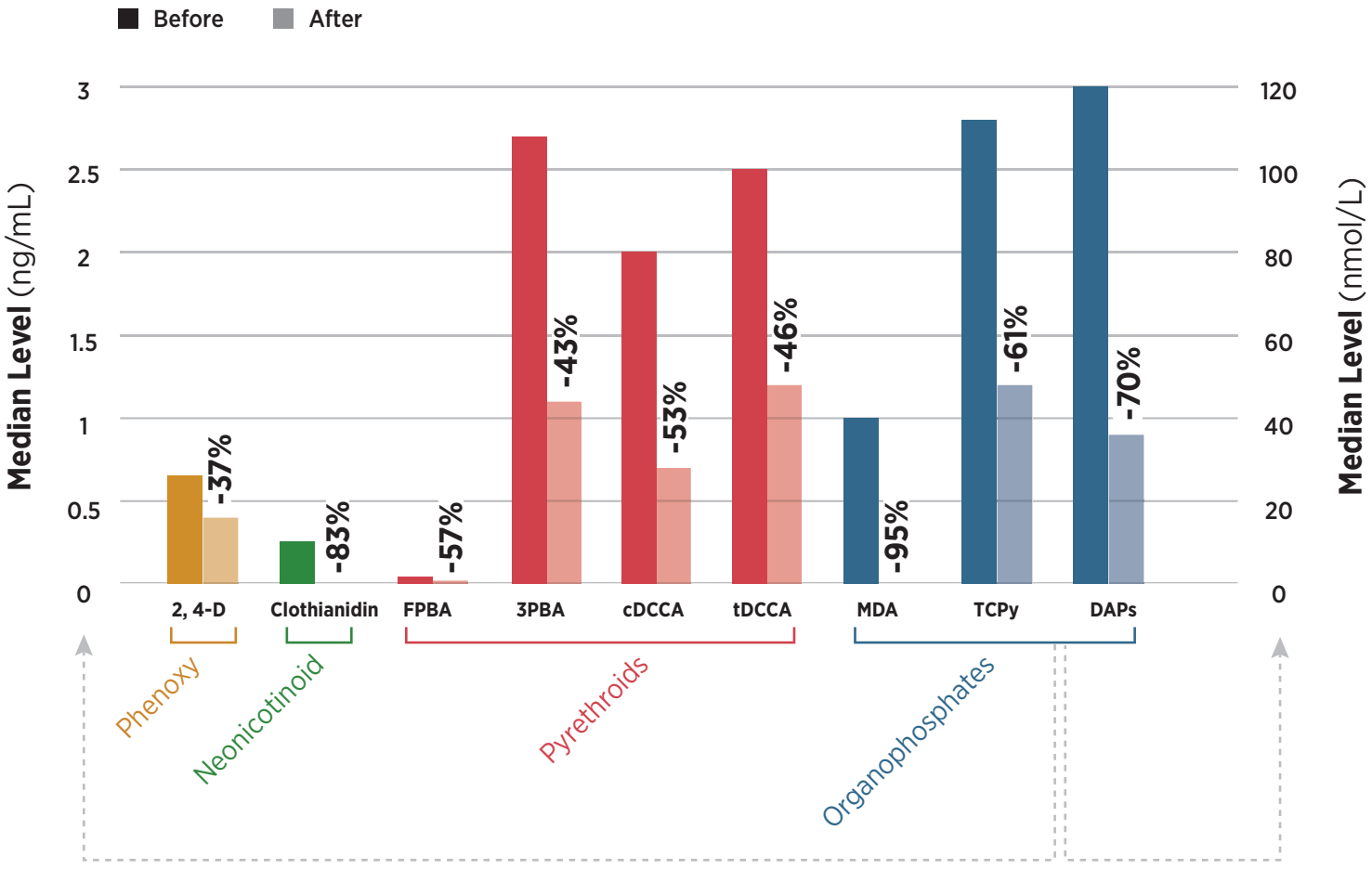
ATLANTA, GA



Before After

OPs = organophosphate metabolites DMP + DMTP + DMDTP
MDA = malathion; FPBA, 3PBA, cDCCA, and tDCCA = pyrethroid metabolites

Pesticide levels before and after switching to an organic diet



Pesticides detected in the Organic for All study

Analysis was conducted by independent laboratories at University of California at San Francisco and the Québec National Institute of Public Health.

Kind of pesticide		Chemical we tested	Pesticides associated with the chemical we tested	Maximum level detected	Percent decrease
Organophosphate Insecticides		MDA	Malathion	1.04 ppb	95%
		TCPY	Chlorpyrifos	19.48 ppb	61%
	DAPs	DMP DMTP DMDTP	Azinphos-methyl, chlorpyrifos-methyl, dichlorvos, dicrotophos, dimethoate, fenitrothion, fenthion, isazofos-methyl, malathion, methidathion, methyl parathion, naled, oxydemeton-methyl, phosmet, pirimiphos-methyl, temephos, tetrachlorvinphos, trichlorfon	2,040 nmol/L	70%
	DAPs	DEP DETP DEDTP	Chlorethoxyphos, chlorpyrifos, coumaphos, diazinon, disulfoton, ethion, phorate, sulfotepp, terbufos		
Pyrethroid Insecticides		3-PBA	Allethrin, cyhalothrin, cypermethrin deltamethrin, fenpropathrin, permethrin, trialomethrin	47.7 ppb	43%
		F-PBA	B-cyfluthrin	7.1 ppb	57%
		***cis*-DCCA**	*cis*-Cypermethrin, *cis*-cyfluthrin, *cis*-permethrin	39.64 ppb	53%
		***trans*-DCCA**	*trans*-Cypermethrin, *trans*-cyfluthrin, *trans*-permethrin	47.2 ppb	46%
Neonicotinoid Insecticide		Clothianidin	Clothianidin	6.6 ppb	84%
Phenoxy Herbicide		2,4-D	2,4-D	2.4 ppb	37%

Why it matters

YOUR HEALTH

Pesticides are poisons. The properties that make pesticides toxic to insects and weeds can also make them toxic to other forms of life, including humans. More than 90 percent of Americans have detectable pesticides in their bodies,[5] and government testing finds at least 29 different pesticides in the average American.[6] Decades of data clearly shows that pesticides can disrupt and derail the healthy functioning of our bodies.[7] Pesticide exposure is linked to cancers, asthma, neurodevelopmental disorders like autism and ADHD and to adult neurological diseases like Alzheimer's and Parkinson's.[8,9,10,11] Pesticide exposure is also associated with reproductive disorders like infertility and other disorders related to the endocrine system.[12,13]

Over 50 pesticides are associated with endocrine disruption.[14] Endocrine disrupting chemicals, even at extremely small doses, can scramble, block or mimic the cellular mechanisms responsible for developing and managing the body's reproductive, neurological, metabolic or immunological systems.[15] Endocrine disruptors are associated with hormone-influenced cancers such as thyroid, breast and prostate, as well as learning disabilities, brain development problems, birth defects, obesity, diabetes and reproductive disorders.[16]

"Small exposures matter. These small amounts add up, because we are exposed to multiple pesticides throughout our daily lives."

Dr. Devon Payne-Sturges
Assistant Professor of Public Health,
University of Maryland

An organic diet is a proven way to reduce exposure to pesticides and can help protect your health. Organic farmers produce abundant food without the use of an estimated 17,000 pesticide products approved for use in conventional farming in the U.S.[17] An organic diet has been shown to reduce overall risk of developing cancer by 25 percent.[18] Another study found fertility benefits for women who ate more organic food.[19]

Health impacts of pesticides detected in the Organic for All study

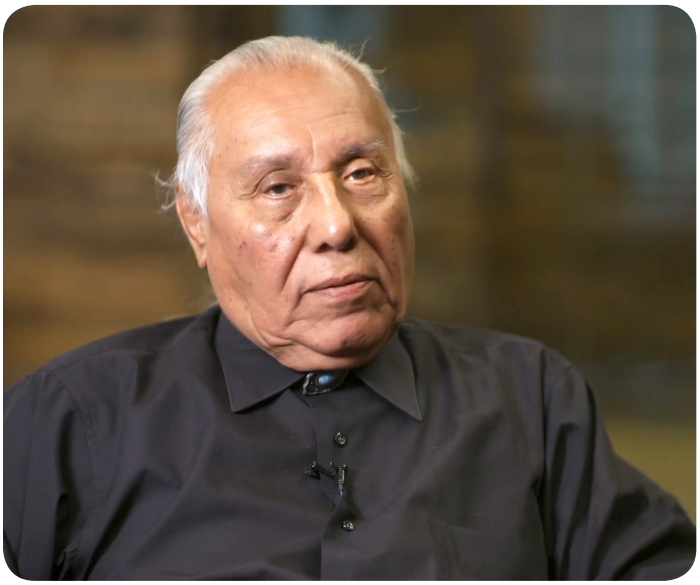
Pesticide Class	Associated Health Problems
Organophosphate	◆ Developed during World War II as toxic nerve agent weapons.[20] ◆ So toxic to developing brains, even at extremely low levels of exposure, that scientists have called for a complete ban.[21] ◆ Associated with endocrine disruption, autism, learning disabilities, reduced IQ, attention disorders, delayed motor development, Alzheimer's, Parkinson's, decreased sperm quality and cancers.[22,23,24,25,26] ◆ Children ages 1 to 2 are exposed to chlorpyrifos, a pesticide in this class, at levels 140 times those deemed to be safe.[27]
Neonicotinoids	◆ Food residues cannot be washed off because the pesticide penetrates the tissue of plants.[28] ◆ Among the most commonly reported pesticide residues in infant and toddler foods.[29] ◆ Associated with endocrine disruption and may affect the developing fetus and child, possibly leading to changes in behavior and attention, including an association with autism spectrum disorder.[30]
Pyrethroids	◆ Associated with endocrine disruption and adverse neurodevelopmental, immunological and reproductive effects.[31,32] ◆ Associated with learning disabilities and behavioral and attention problems in children, increased risk of Parkinson's and sperm DNA damage.[33,34,35,36]
2,4-D Herbicide	◆ One of two ingredients in the Vietnam War defoliant Agent Orange.[37] ◆ Among the top five most commonly used pesticides in the U.S.[38] ◆ Associated with endocrine disruption, thyroid disorders, damage to the liver, immune system and semen quality, a three-fold increased risk of Parkinson's, increased risk of non-Hodgkin's lymphoma and developmental and reproductive toxicity.[39,40]

FETAL DEVELOPMENT, INFANTS AND CHILDREN

Research has found over 20 pesticides in infant umbilical cord blood in the U.S.,[41] and nearly all children are exposed to pesticides through the foods they eat. Children have unique susceptibilities to the harms of pesticides during fetal development and the early years of life because their brains and bodies are developing so rapidly. Early exposure can impact children for life. It can permanently decrease a child's IQ, increase the risk of autism, birth defects and asthma, and lead to cancers in childhood or later in life.[42]

"Children's exposure to pesticides should be limited as much as possible."

The American Academy of Pediatrics



"Farmworkers are on the frontlines. We're the first to go into the field. We have entire communities that have suffered the consequences of pesticides."

Rudy Arredondo
President, National Latino Farmers and Ranchers Trade Association and former farmworker

FARMERS, FARMWORKERS AND RURAL COMMUNITIES

Often the most vocal advocates for a toxic-free food system are those on the frontlines of pesticide exposure: farmers, farmworkers and pesticide applicators who are exposed to toxic pesticides directly; rural communities whose children live and go to school near farms where toxic pesticides are sprayed; and low-income communities in the shadow of chemical manufacturing plants. Farmworkers can be exposed at levels hundreds of times higher than consumers' exposure to pesticides.[43] Farmers, farmworkers and their families have higher rates of acute poisonings, cancers, birth defects, asthma, infertility, autism and other neurological and reproductive effects.[44] Organic farming reduces farmer, farmworker and rural community exposure to toxic synthetic pesticides.[45]

Pesticide health risks to farmers, farmworkers and rural communities

Agricultural workers	◆ EPA estimates 20,000 acute pesticide poisonings each year among agricultural workers, resulting in rashes, blisters, blindness, nausea, dizziness, coma or death.[46] This number is likely an underestimate.[47] ◆ Pesticide exposure among agricultural workers is associated with increased risk of a large range of chronic diseases including: non-Hodgkin's lymphoma; leukemia; prostate, brain, lung, pancreas, colorectal, renal and breast cancer; infertility; endocrine disruption; Parkinson's and neurodegenerative diseases; bronchitis, asthma and other respiratory problems; and thyroid disease.[48,49,50] ◆ Farmworkers are excluded from many U.S. labor laws and worker protection laws do not focus on reducing use of toxic pesticides.[51,52]
Agricultural communities	◆ Agricultural communities are exposed to higher rates of pesticides in drinking water and air.[53,54] ◆ Rural residents have higher risk of developing Alzheimer's, Parkinson's and multiple sclerosis.[55] ◆ Children living in agricultural areas are at higher risk for leukemia, brain cancer, autism, neurodevelopmental delays, attention problems, reduced IQ and birth defects.[56,57,58]

The United Nations asserts that pesticides have "catastrophic impacts on the environment, human healt and society as a whole" in a report that debunks the myth that pesticides are necessary to feed a growing world population.[59]

POLLINATORS AND THE ENVIRONMENT

Chemical agriculture is destroying the ecosystems that sustain all life. Pesticides are a key culprit in the decline of bees, butterflies and other pollinators, leading some scientists to warn of a "second silent spring."[60,61] Pesticides wreak havoc on the soil by killing the organisms that are the basis of soil life.[62] And they pollute rivers, lakes and oceans, leading to fish die-offs.[63] Pesticides are the cornerstone of an industrial agriculture system that consumes fossil fuels, water and topsoil at unsustainable rates.[64] The United Nations estimates that industrial agriculture costs the world $3 trillion annually in environmental damage.[65] Eliminating dangerous chemicals and polluting practices from our food system is key to protecting vital natural resources like clean water and soil, healthy oceans and the biodiversity that is essential for producing food now and in the future.

Experts agree that we need a rapid transition to organic and ecological farming in order to protect the ecosystems we depend on to grow food.[66] Research shows that organic agriculture can be an important climate solution. Organic farming systems use less energy, emit fewer greenhouse gases and help pull carbon dioxide from the atmosphere — where it drives climate change — into the soil where it belongs.[67,68,69,70] Organic farming has also been shown to yield more food in times of weather extremes like drought and floods, and it conserves water resources, which means organic farmers are more resilient to the impacts of climate change.[71,72]

"Pesticides can totally knock out bee populations and pollinators. Organic farming systems are healthier for not only the pollinators, but beneficial insects as well. Organic farming practices go beyond the farm, we become caretakers of a better food system."

Jennifer Taylor
Organic Farmer, Lola's Organic Farm, Georgia

Organic farmers also foster biodiversity above ground and in the soil beneath our feet.[73] Organic farms help protect pollinators like bees and butterflies, essential to one in three bites of food we eat.[74] They support up to 50 percent more pollinating species than pesticide-intensive farms and help other beneficial insects flourish.[75] Below ground, just one teaspoon of compost-rich organic soil can host as many as one *billion* helpful bacteria from 15,000 species. On the flip side, one teaspoon of soil treated with synthetic pesticides and fertilizers may have as few as 100 helpful bacteria — that's 10 million times less.[76] Organic farming also protects waterways and helps conserve water resources.[77,78]

Environmental impacts of pesticides detected in the Organic for All study

Pesticide Class	Environmental Impacts
Organophosphates	◆ Toxic to wildlife, including pollinators, birds and aquatic organisms.[79] ◆ Toxic to non-target and beneficial insects.
Neonicotinoids	◆ Deadly to insects and aquatic organisms at tiny concentrations, including endangered species.[80] ◆ Scientists warn of a "second silent spring" due to massive declines in insect and bird populations linked to neonicotinoids.[81,82] ◆ Persist in the environment, creating long-term toxicity in ecosystems.[83] ◆ Toxic to non-target and beneficial insects
Pyrethroids	◆ Extremely toxic to aquatic organisms.[84] ◆ Moderately toxic to birds.[85] ◆ Toxic to non-target and beneficial insects.
2,4-D Herbicide	◆ Can harm salmon and other aquatic organisms and is moderately toxic to birds.[86] ◆ Toxic to aquatic plants and can negatively impact wetlands.[87] ◆ Toxic to non-target and beneficial insects.

PESTICIDE CORPORATIONS ARE SPENDING BIG TO PREVENT ORGANIC FOR ALL

Organic food should be the norm, but the pesticide industry has a major financial interest in keeping their toxic products on the market. The estimated environmental and health care costs of pesticide use in the U.S. is estimated to be upwards of $12 billion every year.[88] Meanwhile, the top four pesticide manufacturers reap over $150 billion in profit each year from pesticides and other agricultural technologies.[89]

The pesticide industry has undergone massive consolidation in the past five years, and just four corporations now control over 84 percent of the market for pesticides: Bayer-Monsanto, DowDuPont, Syngenta-ChemChina and BASF. These companies spend tens of millions of dollars lobbying legislators and funding false science and front groups that mislead the public about the harms of pesticides.[90,91] A United Nations report accuses pesticide corporations of the "systematic denial of harms," "aggressive, unethical marketing tactics" and heavy lobbying of governments which has "obstructed reforms and paralyzed global pesticide restrictions."[92]

The estimated environmental and health care costs of pesticide use in the U.S. is estimated at $12 billion annually. Meanwhile, the top pesticide companies reap over $150 billion in combined profit each year.

The European Union has banned or restricted 246 pesticides, many of which are widely used in the United States. These include the hormone-disrupting weed-killer atrazine and the class of chemicals known as neonicotinoids, which have been connected to massive pollinator losses and bee die-offs.

Some of the most widely used pesticides today, which we found in the participants of our study, originated as weapons of war. A class of the most commonly used insecticides, called organophosphates, were developed as toxic nerve agents during World War II. And 2,4-D, one of the five most commonly used pesticides in the U.S., made up half of the notorious Agent Orange used as a defoliant in the Vietnam War and is linked to cancer in veterans and the Vietnamese.[93] Their formulations have not substantially changed in the ensuing years.

If we want to create a healthy food system that provides for everyone and protects the health of people and the planet, we must put an end to the pesticide industry's outsized influence. The more we expand organic farming, the more we take back our food system from pesticide companies.

Together, we can make organic for all

Many people across the country still don't have access to or can't afford organic food. This is unacceptable. We all have the right to food that is free of toxic pesticides. And the farmers and farmworkers who grow our nation's food, and their communities, have a right to not be exposed day in and day out to chemicals linked to cancer, asthma, reproductive and developmental harm and other serious health problems.

We should not have to "shop our way out" of exposures to toxic pesticides

We should not have to "shop our way out" of exposures to toxic pesticides. Elected officials must protect the health of people and the planet and stand up to corporate influence. And the food industry has a responsibility to consumers, the environment and society at large. Together, we can demand government and corporations step up to create a healthier world for all people.

With smarter food and farming policies, we can expand organic farming across the country and make organic for all. It will take shifting our public tax dollars away from pesticide-intensive industrial agriculture to organic and regenerative farming. Congress subsidizes chemical-intensive industrial agriculture to the tune of billions of dollars while organic programs are woefully underfunded.[94] For example, less than one percent of federal agricultural research dollars go to organic farming.[95]

As a result, U.S. farmers are losing out on the chance to feed Americans' growing appetite for organic food, and our farms, rivers and rural communities remain soaked in toxic pesticides even as consumer demand for organic booms.[96] Organic remains the fastest-growing sector of the food industry; its growth far outpaces the overall food market.[97,98] And the latest data shows that the demographics of organic buyers matches the diversity of the American population.[99] Over 80 percent of U.S. households report buying organic at least sometimes, and a growing number of black and Hispanic families are choosing organic.[100]

Together, we can make organic for all

Data shows that more U.S. farmers want to transition to organic, but they need government policies and research that support organic farming.[101] Along with creating a healthier rural environment, organic agriculture can bring economic wealth to farm country as well. Data shows that organic farming is more profitable for farmers and provides greater economic stability and well-being.[102] Organic farms also create more jobs than their conventional counterparts,[103] and organic "hotspots" across the country are boosting household incomes and reducing rural poverty.[104]

Together, we have the power to make organic for all. We can work together to pass laws in our cities, states and nationally that decrease pesticide use and expand organic farming. We can change the national Farm Bill — a major piece of legislation that determines how food is grown in the U.S. and what food is available to us as eaters. And, we can tell food companies and grocery stores to end the use of toxic pesticides in their supply chains and expand organic offerings.

Right now, farming with toxic pesticides is the norm. But, we can turn the system around. The science is clear that we can grow abundant food without pesticides. We need to organize, raise our voices, demand that our leaders step up and shift support, research and policies to create a system where organic is for all. The solution is here — we just have to grow it.

For more information and
to take action, go to
www.OrganicforAll.org

ENDNOTES

1. Hertz-Picciotto, I., Sass, J. B., Engel, S., Bennett, D. H., Bradman, A., Eskenazi, B. and Whyatt, R. 2018. Organophosphate exposures during pregnancy and child neurodevelopment: Recommendations for essential policy reforms. PLoS medicine, 15(10), e1002671.
2. Bijleveld van Lexmond, Maarten *et al.* 2015. Worldwide Integrated Assessment of the Impact of Systemic Pesticides on Biodiversity and Ecosystems. *Environmental Science and Pollution Research*. 2(1).
3. Cimino, A.M., et al. 2017. Effects of Neonicotinoid Pesticide Exposure on Human Health: A Systematic Review. *Environ Health Perspectives*. 125(2): p. 155-162.
4. *Ibid*
5. CDC. 2018. National Report on Human Exposure to Environmental Chemicals. Online. https://www.cdc.gov/exposurereport/index.html
6. U.S. Centers for Disease Control. National Health and Nutrition Examination Survey. Online. https://www.cdc.gov/nchs/nhanes/index.htm
7. Gilden, R. C., Huffling, K., & Sattler, B. 2010. Pesticides and health risks. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 39*(1):103-110.
8. Gilden, R. C., Huffling, K., & Sattler, B. 2010. Pesticides and health risks. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 39*(1), 103-110.
9. Bassil, K. L., Vakil, C., Sanborn, M., Cole, D. C., Kaur, J. S., & Kerr, K. J. 2007. Cancer health effects of pesticides: systematic review. *Canadian Family Physician, 53*(10), 1704-1711.
10. Alavanja, M. C., Hoppin, J. A., & Kamel, F. 2004. Health effects of chronic pesticide exposure: cancer and neurotoxicity. *Annu. Rev. Public Health, 25*, 155-197.
11. Eskenazi, B., Marks, A. R., Bradman, A., Harley, K., Barr, D. B., Johnson, C and Jewell, N. P. 2007. Organophosphate pesticide exposure and neurodevelopment in young Mexican-American children. *Environmental health perspectives, 115*(5), 792.
12. Mendola, P., Messer, L. C., & Rappazzo, K. 2008. Science linking environmental contaminant exposures with fertility and reproductive health impacts in the adult female. *Fertility and sterility, 89*(2), e81-e94.
13. Holtcamp, W. 2012. Obesogens: an environmental link to obesity. *Environmental health perspectives, 120*(2), a62.
14. Beyond Pesticides. Pesticides that Disrupt Endocrine System Still Unregulated by EPA. Online. https://www.beyondpesticides.org/assets/media/documents/gateway/health%20effects/endocrine%20cited.pdf
15. Endocrine Society. Endocrine Disrupting Chemicals. Online. https://www.endocrine.org/topics/edc
16. *Ibid*
17. Pesticide Action Network. Pesticides 101. Online. 17,000 pesticide products allowed in chemical farming
18. Baudry, J., Assmann, K.E., Touvier, M., Allès, B., Seconda, L., Latino-Martel, P., Ezzedine, K., Galan, P., Hercberg, S., Lairon, D. and Kesse-Guyot, E., 2018. Association of frequency of organic food consumption with cancer risk: findings from the NutriNet-Santé prospective cohort study. JAMA internal medicine.
19. Chiu, Y.H., *et al.*, 2018. Association between pesticide residue intake from consumption of fruits and vegetables and pregnancy outcomes among women undergoing infertility treatment with assisted reproductive technology. JAMA internal medicine, 178(1), pp.17-26.
20. Soltaninejad, K. and Shadnia, S., (2014). History of the use and epidemiology of organophosphorus poisoning. In Basic and Clinical Toxicology of Organophosphorus Compounds (pp. 25-43). Springer, London.
21. Hertz-Picciotto, I., Sass, J.B., Engel, S., Bennett, D.H., Bradman, A., Eskenazi, B., Lanphear, B. and Whyatt, R., (2018). Organophosphate exposures during pregnancy and child neurodevelopment: Recommendations for essential policy reforms. *PLoS medicine. 15*(10), p.e1002671.
22. *Ibid.*
23. UC Berkeley. Center for the Health Assessment of Mothers and Children in Salinas. Online. https://cerch.berkeley.edu/research-programs/chamacos-study
24. Le Couteur, D.G., McLean, A.J., Taylor, M.C., Woodham, B.L. and Board, P.G., (1999). Pesticides and Parkinson's disease. Biomedicine & pharmacotherapy, 53(3), pp.122-130.
25. World Health Organization. International Agency for Research on Cancer. Monograph 112: Evaluation of five organophosphate insecticides and herbicides. Online. https://www-prod.iarc.fr/wp-content/uploads/2018/07/MonographVolume112-1.pdf
26. Recio-Vega, R., Ocampo-Gómez, G., Borja-Aburto, V.H., Moran-Martínez, J. and Cebrian-Garcia, M.E., 2008. Organophosphorus pesticide exposure decreases sperm quality: association between sperm parameters and urinary pesticide levels. Journal of Applied Toxicology, 28(5), pp.674-680.
27. EPA. 2017. Revised Human Health Risk Assessment on Chlorpyrifos. Online. https://www.epa.gov/ingredients-used-pesticide-products/revised-human-health-risk-assessment-chlorpyrifos.

28. Chen, M., et al., 2014. Quantitative Analysis of Neonicotinoid Insecticide Residues in Foods: Implication for Dietary Exposures. *Journal of Agricultural and Food Chemistry.* 62(26): p. 6082-6090.

29. Cimino, A.M., *et al.* 2017. Effects of Neonicotinoid Pesticide Exposure on Human Health: A Systematic Review. *Environ Health Perspectives.* 125(2): p. 155-162.

30. *Ibid*

31. Go, V., Garey, J., Wolff, M.S. and Pogo, B.G., 1999. Estrogenic potential of certain pyrethroid compounds in the MCF-7 human breast carcinoma cell line. Environmental health perspectives, 107(3), p.173.

32. Marettova, E., Maretta, M. and Legáth, J., 2017. Effect of pyrethroids on female genital system. Review. Animal reproduction science, 184, pp.132-138.

33. Quiros-Alcala, L., S. Mehta, and B. Eskenazi, 2014. Pyrethroid Pesticide Exposure and Parental Report of Learning Disability and Attention Deficit/Hyperactivity Disorder in U.S. Children: NHANES 1999–2002. *Environ Health Perspect.*

34. Beyond Pesticides. Pesticides Trigger Parkinson's Disease. Online. https://www.beyondpesticides.org/assets/media/documents/gateway/health%20effects/parkinson%27s%20cited.pdf

35. Jurewicz, J., Radwan, M., Wielgomas, B., Sobala, W., Piskunowicz, M., Radwan, P., Bochenek, M. and Hanke, W., 2015. The effect of environmental exposure to pyrethroids and DNA damage in human sperm. Systems biology in reproductive medicine, 61(1), pp.37-43.

36. Sanchez-Santed, F., Colomina, M.T. and Hernandez, E.H., 2016. Organophosphate pesticide exposure and neurodegeneration. Cortex, 74, pp.417-426.

37. Beyond Pesticides. Chemical Watch Factsheet: 2,4-D. Online. https://www.beyondpesticides.org/assets/media/documents/pesticides/factsheets/2-4-D.pdf

38. US Environmental Protection Agency. 2017. Pesticides Industry Sales and Usage: 2008 – 2012 Market Estimates. Online. https://www.epa.gov/sites/production/files/2017-01/documents/pesticides-industry-sales-usage-2016_0.pdf

39. Beyond Pesticides. Pesticides that Disrupt Endocrine System Still Unregulated by EPA. Online. https://www.beyondpesticides.org/assets/media/documents/gateway/health%20effects/endocrine%20cited.pdf

40. Beyond Pesticides. Chemical Watch Factsheet: 2,4-D. Online. https://www.beyondpesticides.org/assets/media/documents/pesticides/factsheets/2-4-D.pdf

41. Environmental Working Group. 2005. Body Burden: The pollution in newborns. https://www.ewg.org/research/body-burden-pollution-newborns#.WpSaTIMbPeZ

42. Roberts, J.R. and Karr, C.J., 2012. Pesticide exposure in children. Pediatrics, pp.peds-2012.

43. Farmworker Justice. 2013. Exposed and Ignored: How pesticides are endangering our nation's farmworkers. Washington DC. Online.

44. *Ibid*. https://www.farmworkerjustice.org/sites/default/files/aExposed%20and%20Ignored%20by%20Farmworker%20Justice%20singles%20compressed.pdf

45. Misiewicz, Tracy and Jessica Shade. 2018. *Organic Agriculture: Reducing occupational pesticide exposure in farmers and farmworkers*. The Organic Center. September. https://www.organic-center.org/wp-content/uploads/2018/09/Reducing-Occupational-Pesticide-Exposure.pdf

46. Centers for Disease Control and Prevention. Pesticide Illness and Injury Surveillance. NIOSH workplace safety and health. Online. https://www.cdc.gov/niosh/topics/pesticides/default.html

47. Environmental Protection Agency. 2014. 40 CFR Part 170. Pesticides: Agricultural Worker Protection Standards Revisoins. Federal Register 79(53): 15444-15531.

48. Goldner, W.S., Sandler, D.P., Yu, F., Shostrom, V., Hoppin, J.A., Kamel, F. and LeVan, T.D., 2013. Hypothyroidism and pesticide use among male private pesticide applicators in the agricultural health study. Journal of occupational and environmental medicine/American College of Occupational and Environmental Medicine, 55(10), p.1171.

49. Misiewicz, Tracy and Jessica Shade. 2018. Organic Agriculture: Reducing occupational pesticide exposure to farmers and farmworkers. September. Online. https://www.organic-center.org/wp-content/uploads/2018/09/Reducing-Occupational-Pesticide-Exposure.pdf

50. Sanborn, M., Cole, D., Kerr, K., Vakil, C., Sanin, L.H., & Bassil, K. 2004. *Pesticides Literature Review: Systematic Review of Pesticide Human Health Effects*. Online. http://www.bvsde.paho.org/bvstox/fulltext/rpesticides.pdf.

51. Consumer Reports. 2-15. *From Crop to Table: Pesticide Report. March*. Online. https://www.consumerreports.org/content/dam/cro/magazine-articles/2015/May/Consumer%20Reports_From%20Crop%20to%20Table%20Report_March%202015.pdf

52. National Farmworker Ministry. Labor Laws. Online. http://nfwm.org/resources/labor-laws/

53. Coronado, G.D., Holte, S., Vigoren, E., Griffith, W.C., Faustman, E. and Thompson, B., 2011. Organophosphate pesticide exposure and residential proximity to nearby fields: evidence for the drift pathway. Journal of occupational and environmental medicine/American College of Occupational and Environmental Medicine, 53(8), p.884.

54. Harrison, J., 2008. Abandoned bodies and spaces of sacrifice: Pesticide drift activism and the contestation of neoliberal environmental politics in California. Geoforum, 39(3), pp.1197-1214.

55. Parrón, T., Requena, M., Hernández, A.F. and Alarcón, R., 2011. Association between environmental exposure to pesticides and neurodegenerative diseases. Toxicology and applied pharmacology, 256(3), pp.379-385.

56. UC Berkeley. Center for Health Assessment of Mothers and Children of Salinas. Online. https://cerch.berkeley.edu/research-programs/chamacos-study

57. Shelton, J.F., Geraghty, E.M., Tancredi, D.J., Delwiche, L.D., Schmidt, R.J., Ritz, B., Hansen, R.L. and Hertz-Picciotto, I., 2014. Neurodevelopmental disorders and prenatal residential proximity to agricultural pesticides: the CHARGE study. Environmental health perspectives, 122(10), p.1103.

58. Farmworker Justice. *Exposed and Ignored: How Pesticides Are Endangering Our Nation's Farmworkers.* Online. https://www.farmworkerjustice.org/sites/default/files/aExposed%20and%20Ignored%20by%20Farmworker%20Justice%20singles%20compressed.pdf

59. Carrington, Danian. 2017. UN experts denounce 'myth' pesticides are necessary to feed the world. *The Guardian*. March 7. https://www.theguardian.com/environment/2017/mar/07/un-experts-denounce-myth-pesticides-are-necessary-to-feed-the-world

60. Finck-Haynes, Tiffany, Jason Davidson, Kendra Klein and Antonio Roman-Alcala. 2016. *Swarming the Aisles.* Friends of the Earth. https://foe.org/resources/swarming-the-aisles-rating-top-retailers-on-bee-friendly-and-organic-food/

61. New York Times Editorial Board. 2017. Insect Armadeggon.*New York Time*s. October 29. https://www.nytimes.com/2017/10/29/opinion/insect-armageddon-ecosystem-.html

62. Lo, C. C. (2010). Effect of pesticides on soil microbial community. *Journal of Environmental Science and Health Part B, 45*(5), 348-359.

63. Science Daily. 2008. Chemicals in our Waters are Affecting Humans and Aquatic Life in Unanticipated Ways. February 21. Online. https://www.sciencedaily.com/releases/2008/02/080216095740.htm

64. Horrigan, L., Lawrence, R. S., & Walker, P. (2002). How sustainable agriculture can address the environmental and human health harms of industrial agriculture. *Environmental health perspectives, 110*(5), 445.

65. UN Food and Agriculture Organization. 2015. Natural Capital Impacts in Agriculture: Supporting Better Decision Making. UN FAO: Rome, Italy. June. http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Final_Natural_Capital_Impacts_in_Agriculture_-_Supporting_Better_Business_Descision-Making_v5.0.pdf

66. UNDP, WHO, *et al.* 2009. Agriculture at a Crossroads: International Assessment of Agricultural Knowledge, Science, and Technology for Development. Washington DC: Island Press. http://www.fao.org/fileadmin/templates/est/Investment/Agriculture_at_a_Crossroads_Global_Report_IAASTD.pdf

67. Gattinger, Andreas *et al.* 2012. Enhanced top soil carbon stocks under organic farming. *Proceedings of the National Academy of Sciences. 109*(44), 18226-18231.

68. Ghabbour, E.A. *et al.*, 2017. National Comparison of the Total and Sequestered Organic Matter Contents of Conventional and Organic Farm Soils. *Advances in Agronomy.* 146[1-35]..

69. Grace Communications Foundation. *Energy in Agriculture.* http://www.gracelinks.org/118/energy-and-agriculture

70. Niles, M. (2008). Sustainable soils: reducing, mitigating, and adapting to climate change with organic agriculture. Sustainable Dev. L. & Pol'y, 9, 19.

71. Lotter, D. W., Seidel, R., & Liebhardt, W. (2003). The performance of organic and conventional cropping systems in an extreme climate year. American Journal of Alternative Agriculture, 18(3), 146-154.

72. Borron, S. (2006). Building resilience for an unpredictable future: how organic agriculture can help farmers adapt to climate change. Food and Agriculture Organization of the United Nations, Rome.

73. Bartram, H., & Perkins, A. (2003). The biodiversity benefits of organic farming. *Organic Agriculture: Sustainability, Markets and Policies, 77*.

74. The Organic Center. 2010. The Biodiversity Benefits of Organic Farming. December. http://www.organicresearchcentre.com/manage/authincludes/article_uploads/ORC%20Biodiversity%20benefits%20of%20organic%20farming%20v4.pdf

75. University of Oxford. "Organic farms support more species. 2014. University of Oxford. University of Oxford. 4 February. Web. http://www.ox.ac.uk/news/2014-02-04-organic-farms-support-more-species

76. Ingham, Elaine. Online. Soil Foodweb Inc. https://soilfoodweb.mykajabi.com/p/contact-us

77. Cambardella, C., K. Delate and D. Jaynes. 2015. Water quality in organic systems. *Sustainable Agriculture Research.* Vol 4(3). http://www.ccsenet.org/journal/index.php/sar/article/view/50106

78. Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants,* 2(2), 15221.

79. Mineau, P. (ed.) 1991. Cholinesterase-inhibiting Insecticides: Their Impact on Wildlife and the Environment. New York, Elsevier

80. Bijleveld van Lexmond, Maarten *et al*. 2015. Worldwide Integrated Assessment of the Impact of Systemic Pesticides on Biodiversity and Ecosystems. *Environmental Science and Pollution Research.* 2(1).

81. Bittel, Jason. 2014. Second Silent Spring? Bird Declines Linked to Popular Pesticides. *National Geographic*. July 9.

82. New York Times Editorial Board. 2017. Insect Armageddon. *New York Times*. October 29.

83. Bijleveld van Lexmond, Maarten *et al*. 2015. Worldwide Integrated Assessment of the Impact of Systemic Pesticides on Biodiversity and Ecosystems. *Environmental Science and Pollution Research*. 2(1).

84. Hénault-Ethier, Louise. 2016. Health and Environmental Impacts of Pyrethroid Insecticides. Online. https://equiterre.org/sites/fichiers/health_and_environmental_impacts_of_pyrethroid_insecticides_full_report_en.pdf

85. Beyond Pesticides. Chemical Watch Factsheet: Synthetic Pyrethroids. Online. https://www.beyondpesticides.org/assets/media/documents/pesticides/factsheets/Synthetic.Pyrethroids.Factsheet.pdf

86. Beyond Pesticides. Chemical Watch Factsheet: 2,4-D. Online. https://www.beyondpesticides.org/assets/media/documents/pesticides/factsheets/2-4-D.pdf

87. *Ibid.*

88. Pimentel, D., 2005. Environmental and economic costs of the application of pesticides primarily in the United States. Environment, development and sustainability, 7(2), pp.229-252.

89. Finck-Haynes, Tiffany and Christopher Cook. 2016. Buzz Kill: How the Pesticide Industry is Clipping the Wings of Bee Protection Efforts Across the U.S. Prepared for Friends of the Earth. Online. https://foe.org/resources/buzz-kill-how-the-pesticide-industry-is-clipping-the-wings-of-bee-protection-efforts-across-the-u-s/

90. Hammerschalg, Kari, Anna Lappe, and Stacy Malkan. 2015. Spinning Food: How Food Industry Front Groups and Covert Communications are Shaping the Story of Food. Prepared for Friends of the Earth. Online. https://foe.org/resources/spinning-food-how-food-industry-front-groups-and-covert-communications-are-shaping-the-story-of-food/

91. Finck-Haynes, Tiffany and Christopher Cook. 2016. Buzz Kill: How the Pesticide Industry is Clipping the Wings of Bee Protection Efforts Across the U.S. Prepared for Friends of the Earth. Online. https://foe.org/resources/buzz-kill-how-the-pesticide-industry-is-clipping-the-wings-of-bee-protection-efforts-across-the-u-s/

92. United Nations General Assembly. 2017. Human Rights Council. Report of the Special Rapporteur on the right to food. February 27. Online. https://documents-dds-ny.un.org/doc/UNDOC/GEN/G17/017/85/PDF/G1701785.pdf?OpenElement

93. Institute of Medicine. Veterans and Agent Orange. Update 2000. Online. http://nationalacademies.org/hmd/~/media/Files/Report%20Files/2003/Veterans-and-Agent-Orange-Update-2000/AOrange20004pager.pdf

94. Hammerschlag, Kari. 2013. Fairness for Small Farmers; A missing ingredient in the U.S. Farm Bill. Fair World Project. March 6. Online. https://fairworldproject.org/fairness-for-small-farmers-a-missing-ingredient-in-the-u-s-farm-bill/

95. DeLonge, M.S., Miles, A. and Carlisle, L., 2016. Investing in the transition to sustainable agriculture. Environmental Science & Policy, 55, pp.266-273.

96. Reidy, Susan. 2017. U.S. Organic feed industry dangerously dependent on imports. *World Grain News*. November 8. Online. https://www.world-grain.com/articles/8900-u-s-organic-feed-industry-dangerously-dependent-on-imports

97. Organic Trade Association. 2017. Organic Industry Survey. https://ota.com/resources/organic-industry-survey

98. Greene, Catherine. "Consumer Demand Bolstering Organic Production and Markets in the U.S." Web blog post. USDA Blog. United States Department of Agriculture. 16 February 2016. http://blogs.usda.gov/2016/02/16/consumer-demand-bolstering-organic-production-and-markets-in-the-u-s/

99. Organic Trade Association. 2015. Organic looks like America, new survey shows. https://ota.com/news/press-releases/17972

100. Organic Trade Association. "U.S. Families' Organic Attitudes and Beliefs Study." Organic Trade Association. Organic Trade Association. 2013. https://www.ota.com/news/press-releases/17124

101. National Organic Coalition.2016. *Expanding Organic Production in the United States: Challenges and Policy Recommendations.* November. http://www.nationalorganiccoalition.org/LiteratureRetrieve.aspx?ID=135516

102. Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants*.

103. Finley, L., Chappell, M.J., Thiers, P. and Moore, J.R., 2018. Does organic farming present greater opportunities for employment and community development than conventional farming? A survey-based investigation in California and Washington. Agroecology and Sustainable Food Systems, 42(5), pp.552-572.

104. Marasteanu, I. J., & Jaenicke, E. C. 2016. The role of US organic certifiers in organic hotspot formation. *Renewable Agriculture and Food Systems*, 31(3):230-245.