IEM-52

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Statement of
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on
Integrated Pest and Environmental Management on County Property (IEM-52)
to
Maui, Hawaii County Council

March 22, 2016

Thank you for the opportunity to address the Council. I am Jay Feldman, Executive Director of Beyond Pesticides, a national, grassroots, membership organization that represents community-based organizations and a range of people seeking to improve protections from pesticides and promote alternative pest management strategies that reduce or eliminate a reliance on toxic pesticides. Our membership spans the 50 states, the District of Columbia, and groups around the world. We are submitting this statement on behalf of our supporters who are residents of Maui, Hawaii.

**We Support Policies that Reduce Toxic Pesticide Use**

Beyond Pesticides strongly encourages lawn care practices that stop the unnecessary use of hazardous pesticides applied for aesthetic purposes. This approach to pesticide law is critical to the protection of community health, particularly children and elderly, and vulnerable population groups that suffer from compromised immune and neurological systems, cancer, reproductive problems, respiratory illness and asthma, Parkinson's, Alzheimer's, diabetes, and learning disabilities in and around Maui County.

**Adverse Effects of Chemical Pesticides**

Our country's appetite for pesticides raises grave concerns about the effects of chemical-intensive practices, our relationship to nature, chemical effects at the cellular level, and insect and weed resistance to chemical controls. Of the 30 most commonly used lawn pesticides, 16 are linked to cancer, 17 are endocrine disruptors, 21 are reproductive toxicants, 12 are linked to birth defects, 14 are neurotoxic, 25 cause kidney liver effects, and 26 are irritants.[1] The U.S. Geological Survey has linked pesticide use in urban areas to runoff and pesticide contamination of local waterways.[2] Of the 30 most commonly used lawn pesticides, 20 have a high potential

[1] Health Effects of 30 Commonly Used Pesticides. 2015. Beyond Pesticides. http://www.beyondpesticides.org/lawn/factsheets/30health.pdf (See Appendix C for a fully cited copy of the fact sheet)

[2] United States Geological Survey. 2007. Pesticides in US Streams and Groundwater. *Environmental Science and*



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to leach into waterways, 19 have been detected seeping into groundwater, 22 are toxic to birds, 14 are toxic to mammals, 29 are toxic to bees, and all 30 of these chemicals present toxicity concerns for fish or other aquatic organisms. [3] The charts in Appendix A highlight salient health and environmental concerns regarding pesticides used regularly by Maui County public departments.

Rachel Carson wrote in *Silent Spring*, "By their very nature, chemical controls are self-defeating, for they have been devised and applied without taking into account the complex biological systems against which they have been blindly hurled. The chemicals may have been pretested against a few individual species, but not against living communities." She warned us to protect the diverse organisms that make up a healthy ecosystem, including bees, birds, butterflies and other pollinators.

It should be noted that two of the most commonly used pesticides, glyphosate (a weed killer) and neonicotoinoids (insecticides), are embroiled in controversy and, while used in the U.S., have been banned in many countries around the world because of the adverse effects to people and pollinators, respectively. Glyphosate has recently been classified as a carcinogen by the International Agency for Research on Cancer, World Health Organization, and the neonicotinoids are highly toxic, persistent and systemic (contaminates pollen and nectar) insecticides that are linked to declines in the populations of bees, butterflies, and birds. (See Appendix A)

**A Systems Approach without Toxic Chemicals**

Chemical-intensive turf and landscape management programs are generally centered on a synthetic product approach that continually treats symptoms with toxic chemicals. In fact, toxic pesticides are not needed for successful turf management. Rather, a systems approach incorporates preventive steps based on building soil biomass to improve soil fertility and turf grass health, organic products based on a soil analysis that determines need, and specific cultural practices, including mowing height, aeration, dethatching, and over-seeding.

Organic turf management, which meets the standards of the *Organic Foods Production Act*, is a "feed-the-soil" approach that centers on natural, organic fertilization, microbial inoculants, compost teas, and compost topdressing as needed. This approach builds a soil environment rich in microbiology that will produce strong, healthy turf able to withstand stress. The aim of a natural approach to land care is not to simply swap one herbicide or insecticide for another, but instead build a soil environment rich in microbial diversity that will produce strong, healthy landscapes able to withstand stress from weeds, pests, fungus and other disease.

The great aspect about an organic approach to turf care is that its principles are universally applicable. Yes, timing, application rates, and specific site conditions are critical to understanding the specific chemistry, biology, and structure of a soil so that it can be

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*Technology.* http://water.usgs.gov/nawqa/pnsp/pubs/files/051507.ESTfeature_gilliom.pdf

[3] Environmental Effects of 30 Commonly Used Lawn Pesticides. 2015. Beyond Pesticides. http://www.beyondpesticides.org/lawn/factsheets/30enviro.pdf (See Appendix D for a fully cited copy of the fact sheet.)

transitioned from conventional to organic care appropriately, but this is the case in any part of the country. Further, this is the reason why a soil sample is a critical first step within an organic management plan. Based on a list of weeds provided, that the Park's department is currently controlling with toxic pesticides, most of these are also a problem in areas of the mainland United States. Clover, for instance, can be easily controlled by supplying adequate nitrogen to soils, and should never need be sprayed with a toxic pesticide. Promoting stable soil chemistry and natural soil microbial biodiversity will address weed and pest problems regardless of the environment. We don't promise to provide a panacea, and cannot guarantee that there won't be instances of weed and pest outbreaks, but experience shows that once healthy soil is in place, these problems decrease dramatically. We are willing to work with the County to address weed and pest issues specific to the island and adjust products and practices accordingly.

**Beyond Pesticides' Resources Are Available for Maui County**

Beyond Pesticides will underwrite up to 100% of the cost for Osborne Organics to evaluation the soil, develop and organic management plan, and train County land care officials in organic practices. This training is intended to provide officials with the knowledge and skills necessary to prepare to move forward with an organic land management policy. We wish to support County efforts to eliminate hazardous pesticides use by providing employees and local practitioners with the tools necessary to successfully implement natural pest and weed management practices.

Beyond Pesticides and Osborne Organics encourage and prepare municipal officials to transition to a systems-based approach to land care. This includes a reorientation to soil management, the nurturing of beneficial organisms in the soil food web, and limited use of organic compatible products when necessary. As a part of this program, in addition to training, as part of Beyond Pesticides' assistance to support a new policy, the county is asked to select a number of pilot/demonstration sites for implementation of the proposed organic land management plan. For those sites, the soil sample will be taken and analyzed for structural, chemical, and biological composition, and based on this analysis, a specified management plan is crafted to assist in the transition from a conventional to an organic approach.

**Cost of Organic is on Par with Conventional in the Long Term**

Cost of implementing an organic systems approach is not likely to be substantially more than current costs, and there is likely to be savings in the long-term. However, there is the possibility that some new equipment may be needed, such as a core aerator.

In considering cost, a natural land care program is not only generally on par with and in the long run less expensive than a conventional chemical based program, it also reduces and in many cases eliminates costly externalities borne by the community at large. Benefits associated with moving away for toxic pesticide use include reduction in the risk of exposure to carcinogens and other chemicals associated with adverse health effects, and the prevention of the contamination of ground and surface water, and the improved protection of wildlife. These are costs that residents are already paying for, through hospital visits, expensive clean-ups, and the need for species conservation and habitat restoration.

The following provide select examples of the experience of towns and institutions with organic land care programs:

- Chip Osborne's report produced in coordination with Grassroots Environmental Education, which looks specifically at the cost of conventional and organic turf management on school athletic fields. The report concludes that once established, a natural turf management program can result in savings of greater than 25% compared to a conventional turf management program.[4]
- Research from Harvard University which determined that, ultimately, total operating costs of its organic maintenance program are expected to be the same as the conventionally based program. In a 2009 *New York Times* article,[5] the school determined that irrigation was reduced by 30%, saving 2 million gallons of water a year as a result of reduced irrigation needs. The school was also spending $35,000/year trucking yard waste off site. The university can now use those materials for composting and has saved an additional $10k/year due to the decreased cost and need to purchase fertilizer from off-campus sources. [6]
- The Department of Energy and Environmental Protection in the state of Connecticut, which itself has a successful ban on pesticide use in school playing fields up to 8th grade, notes in its information on organic lawn care that "If your lawn is currently chemically dependent, initially it may be more expensive to restore it. But in the long term, an organic lawn will actually cost you less money. Once established, an organic lawn uses less water and fertilizers, and requires less labor for mowing and maintenance."[7]

**Local Success Stories**

Beyond Pesticides has seen firsthand the success of this approach in communities throughout the country. Beyond Pesticides' Tools for Change[8] webpage highlights over 50 communities that have enacted some level of lawn and landscape pesticide reduction policy. The vast majority of these policies occurred in states subject to pesticide preemption on private property. This list is also not comprehensive. The following are select examples of the towns, cities, and counties that have enacted laws which promote lawn care practices which protect their resident's health

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[4] Osborne, Charles and Doug Wood. 2010. A cost Comparison of Conventional (Chemical) Turf Management and Natural (Organic) Turf Management on School Athletic Fields. Grassroots Environmental Education. http://www.grassrootsinfo.org/pdf/turfcomparisonreport.pdf

[5] Raver, Anne. 2009. The Grass is Greener at Harvard. http://www.nytimes.com/2009/09/24/garden/24garden.html?_r=2

[6] Harvard University. 2009. Harvard Yard Soils Restoration Project Summary Report. http://www.slideshare.net/harvard_uos/harvard-yard-soils-restoration-project-summary-report-22509-4936446

[7] Connecticut Department of Energy and Environmental Protection. 2016. Organic Land Care: Your neighbors will "go green" with envy. http://www.ct.gov/deep/cwp/view.asp?a=2708&q=382644#Expensive

[8] Beyond Pesticides. 2016. Tools for Change. http://beyondpesticides.org/programs/lawns-and-landscapes/tools-for-change

from toxic pesticides.[9]

- **Montgomery County, Maryland** passed legislation known as the *Safe Grow Act* in 2015, following the passage of similar legislation in the City of Takoma Park, MD. The act generally restricts the use of cosmetic lawn pesticides on both private and public property throughout the city. The Act does this by creating a list of allowed materials that conform to the National List of Allow and Prohibited Substances, managed by the U.S. Department of Agriculture. The law focuses on turf and exempts control of poisonous plants, venomous insects, and invasive species. Takoma Park developed a website that includes educational materials to help homeowners maintain a healthy lawn without the use of toxic pesticides.[10] Montgomery County is in the process of developing a similar webpage.

- **Ogunquit, Maine** voters went to the polls in November 2014 and passed a pesticide ordinance with a similar scope to law adopted in Takoma Park. This ordinance amended a previous law that restricted pesticide use only on town-owned property, allowing it to expand pesticide restrictions to public and private property. Agricultural activities, control of poisonous plants, invasive species applications mandated by state or federal law, and applications to control venomous or disease carry insects are exempted by the law.[11]

- **Cuyahoga County, Ohio's** Organic Pest Management ordinance was passed in 2012. The ordinance prohibits the use of synthetic pesticides on property owned by the county. The ordinance does exempt the use of larvicides and rodenticides as public health measures or by a mandatory finding by the Department of Public Works (DPW). It also adopted an Integrated Pest Management program for all county-own properties, which requires that "all non-chemical and organic treatments available for the targeted pest should be exhausted prior to the use of synthetic chemical treatments."[12]

- **Irvine, CA** recently amended the City's Integrated Pest Management Policy as a result of significant community concern regarding the pesticides used on public property within City limits. The amendments ensure the city will prioritize the use of organic pesticides on parks, fields, playgrounds, and other City properties and rights of way. EPA registered pesticides will be used only when deemed necessary to protect public health or economic loss, and other methods have proven ineffective

- **Marblehead, Massachusetts** adopted Organic Pest Management Regulations in 2005 for all turf and land management. According to the regulations, the use and application of

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[9] A longer list of communities which have enacted pesticide restrictions is available on Beyond Pesticides' Tools for Change webpage: http://www.beyondpesticides.org/lawn/activist/index.php
[10] City of Takoma Park, Maryland. 2013. Safe Grow Act. http://www.codepublishing.com/MD/TakomaPark/?TakomaPark14/TakomaPark1428.html
[11] Ogunquit Conservation Commission. 2014. http://ogunquitconservation.org/ogunquitconservation.org/PROPOSED_PESTICIDE_ORDINANCE.html
[12] County Council of Cuyahoga County, Ohio. 2012. Ordinance No 02011-0047. http://council.cuyahogacounty.us/pdf_council/en-US/Legislation/Ordinances/2012/O2011-0047.pdf

toxic chemical pesticides, either by Town of Marblehead employees or by private contractors, is prohibited on all Town-owned lands. The town employees who work with turf grass and the landscape receive education and training in natural, organic turf and landscape management. This ordinance was forwarded by the Chairman of Marblehead's Recreation and Parks Department and National Turfgrass Expert Chip Osborne.[13]

These examples prove in practice that organic, least-toxic methods of managing landscapes are feasible and cost-effective for local governments of all sizes, and responsive to community interest in protect the health of children, the community and its environment. As land managers are trained in organic methods and new practices and products continue to emerge, more and more communities are moving toward common-sense, sustainable approaches to land care. These practices do not put humans, pets, and the environment, particularly pollinators and other wildlife at risk of non-target pesticide impacts, in unnecessary danger.[14] (See Appendix A) Furthermore, the current and past pesticide testing and labeling protocols used by the U.S. Environmental Protection Agency have failed to address full range of hazards and allow for too many data gaps to adequately protect against harm. The hazards and uncertainties that put people and the environment in harm's way are, in our view, unreasonable given that they are unnecessary to achieve beautiful lawns and gardens.

Thank you for the opportunity to present this statement to the City Council. We appreciate your consideration of the information and citations presented here in support of organic and sustainable turf and landscape practices.

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[13] Town of Marblehead Board of Health. 2005. Organic Pest Management Regulations. http://www.beyondpesticides.org/documents/MarbleheadOPM%20REGS%2012%2022%2005.pdf

[14] (See Appendix A for additional information about these issues).

## Appendix A. Maui County Pesticide Use Toxicity Data[15]

### 1. Pesticides Used by Maui County Parks and Recreation

| Product | Active Ingredient | Cancer | Endocrine Disruption | Reproductive Effects | Neurotoxicity | Kidney/Liver Damage | Birth/ Develop-mental impacts | Groundwater Contamination (or runoff) | Toxic to Wildlife |
|---|---|---|---|---|---|---|---|---|---|
| **Celsius** | *Dicamba* | | | X | X | X | X | X | X |
| | *Thiencarbazone-methyl* | | | | | X | | | |
| | *Napthalene* | X | | | | X | | X | |
| **Certainty** | *Metribuzin* | | X | X | | | X | | X |
| **Dismiss** | *Sulfentrazone* | | | X | | | X | | X |
| **Revolver** | *Formasulfuron* | | | | | X | | X | X (non-target) |
| | *Napthlene* | X | | | | X | | X | |
| **Sencor** | *Metribuzin* | | X | X | | | X | | X |
| **Speedzone Southern** | *Dicamba* | | | X | X | X | X | X | X |
| | *2,4-D* | X | | X | X | X | X | X | X |
| | *Carfentrazone-ethyl* | | | | | | | | X |
| | *Mecoprop* | X | | X | X | X | X | X | X |

[15] Sourced from: Beyond Pesticides. 2016. Gateway on Pesticide Hazards and Safe Pest Management. http://beyondpesticides.org/resources/pesticide-gateway

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|---|---|---|---|---|---|---|---|---|---|
| **Surflan Preemergent** | *Oryzalin* | | | | | X | X | X | X |

## 2. Pesticides Used on Maui County Public Golf Courses

| Product | Active Ingredient | Cancer | Endocrine Disruption | Reproductive Effects | Neurotoxicity | Kidney/Liver Damage | Birth/ Develop-mental Impacts | Groundwater Contamination | Toxic to Wildlife |
|---|---|---|---|---|---|---|---|---|---|
| **Evade Preemergent** | ***Prodiamide*** | X | | | X | | | | |
| **Dismiss** | ***Sulfentrazone*** | | | X | | | X | | X |
| **MSMA** | ***Monosodium methanearsonate*** | X | | X | | X | | X | X |
| **Revolver** | ***Formasulfuron*** | | | | | X | | X (or runoff) | X (non-target) |
| | ***Napthlene*** | X | | | X | X | | X | |
| **Sencor** | ***Metribuzin*** | | X | X | | X | X | | X |
| **Specticle Preemergent** | ***Indaziflam*** | | | | X | X | X | X | X |

## 3. Pesticides Used by Maui County Public Works Department

| Product | Active Ingredient | Cancer | Endocrine Disruption | Reproductive Effects | Neurotoxicity | Kidney/Liver Damage | Birth/ Develop-mental Impacts | Groundwater Contamination | Toxic to Wildlife |
|---|---|---|---|---|---|---|---|---|---|
| **Roundup/Aqua-master/Kleen Up Pro** | ***Glyphosate*** | X | X | X | | X | | | X |

**Appendix B. Key Areas of Concern**

Children and Pesticides Don't Mix

Children face unique dangers from pesticide exposure. The National Academy of Sciences reports that children are more susceptible to chemicals than adults and estimates that 50% of lifetime pesticide exposures occur during the first five years of life.[16] In fact, studies show children's developing organs create "early windows of great vulnerability" during which exposure to pesticides can cause great damage.[17] Additionally, according to researchers at the University of California-Berkeley School of Public Health, exposure to pesticides while in the womb may increase the odds that a child will have attention deficit hyperactivity disorder (ADHD).[18]

In 2012, the American Academy of Pediatrics (AAP) released a landmark policy statement, *Pesticide Exposure in Children*, on the effects of pesticide exposure in children, acknowledging the risks to children from both acute and chronic effects.[19] AAP's statement notes that, "Children encounter pesticides daily and have unique susceptibilities to their potential toxicity." The report discusses how kids are exposed to pesticides every day in air, food, dust, and soil. Children also frequently come into contact with pesticide residue on pets and treated lawns, gardens, and indoor spaces.

Pesticides, such as glyphosate and its formulated products (Roundup) and 2,4-D, both widely used on turf and lawns, can be tracked indoors resulting in long-term exposures. Scientific studies show that pesticides, like 2,4-D, that are applied to lawns drift and are tracked indoors where they settle in dust, air and on surfaces and may remain in carpets.[20,21] Pesticides in these environments may increase the risk of developing asthma, exacerbate a previous asthmatic condition, or even trigger asthma attacks by increasing bronchial hyper-responsiveness.[22] This is especially important as infants crawling behavior and proximity to the floor account for a greater potential than adults for dermal and inhalation exposure to contaminants on carpets, floors, lawns, and soil.[23]

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[16] National Research Council, National Academy of Sciences. 1993. Pesticides in the Diets of Infants and Children, National Academy Press, Washington, DC: 184-185.

[17] Landrigan, P.J., L Claudio, SB Markowitz, et al. 1999. "Pesticides and inner-city children: exposures, risks, and prevention." Environmental Health Perspectives 107 (Suppl 3): 431-437.

[18] Marks AR, Harley K, Bradman A, Kogut K, Barr DB, Johnson C, et al. 2010. Organophosphate Pesticide Exposure and Attention in Young Mexican-American Children: The CHAMACOS Study. Environ Health Perspect 118:1768-1774.

[19] Roberts JR, Karr CJ; Council On Environmental Health. 2012. Pesticide exposure in children. Pediatrics. 2012 Dec; 130(6):e1765-88.

[20] Nishioka, M., et al. 1996. Measuring lawn transport of lawn-applied herbicide acids from turf. Env Science Technology, 30:3313-3320.

[21] Nishioka, M., et al. 2001. "Distribution of 2,4-D in Air and on Surfaces Inside Residences. Environmental Health Perspectives 109(11).

[22] Hernández, AF., Parrón, T. and Alarcón, R. 2011. Pesticides and asthma. Curr Opin Allergy Clin Immunol.11(2):90-6.

[23] Bearer, CF. 2000. The special and unique vulnerability of children to environmental hazards. Neurotoxicology 21: 925-934; and Fenske, R., et al. 1990. Potential Exposure and Health Risks of Infants following Indoor Residential Pesticide Applications. Am J. Public Health. 80:689-693.

On March 20, 2014, the International Agency for Research on Cancer (IARC) released its finding that concludes there is sufficient evidence that glyphosate (Roundup™) causes cancer in humans based on laboratory animal studies.[24] By assigning glyphosate a 2A rating, the agency gave this toxic herbicide the highest possible rating for carcinogenicity based on standardized scientific testing methods for identifying cancer effects to prevent human exposure. The only higher cancer rating possible is derived from after-the-fact human data, usually based on occupational exposure test data. Meanwhile, it may be years before EPA considers this finding and takes appropriate regulatory action.

A study published in the Journal of the National Cancer Institute finds that household and garden pesticide use can increase the risk of childhood leukemia as much as seven-fold.[25] Similarly, a 2010 meta-analysis on residential pesticide use and childhood leukemia finds an association with exposure during pregnancy, as well as to insecticides and herbicides. An association is also found for exposure to insecticides during childhood.[26]

Prenatal exposures to pesticides can also have long-lasting impacts on infants and children. Herbicides, like glyphosate, can adversely affect embryonic, placental and umbilical cord cells, and can impact fetal development. Preconception exposures to glyphosate were found to moderately increase the risk for spontaneous abortions in mothers exposed to glyphosate products.[27] One 2010 analysis observed that women who use pesticides in their homes or yards were two times more likely to have offspring with neural tube defects than women who did not use pesticides.[28] Studies also find that pesticides, like 2,4-D, can also pass from mother to child through umbilical cord blood and breast milk.[29,30]

Biomonitoring testing has also documented pesticide residues in children. Residues of lawn pesticides, like 2,4-D and mecoprop, were found in 15 percent of children tested, ages three to seven, whose parents had recently applied the lawn chemicals. Breakdown products of organophosphate insecticides were present in 98.7 percent of children tested.[31] In one study, children in areas where glyphosate is routinely applied were found to have detectable

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[24] International Agency for Research on Cancer, World Health Organization. 2015. IARC Monographs Volume 112: evaluation of five organophosphate insecticides and herbicides. http://www.iarc.fr/en/media-centre/iarcnews/pdf/MonographVolume112.pdf.

[25] Lowengart, R. et al. 1987. Childhood Leukemia and Parent's Occupational and Home Exposures. Journal of the National Cancer Institute. 79:39.

[26] Turner, M.C., et al. 2010. Residential pesticides and childhood leukemia: a systematic review and meta-analysis. Environ Health Perspect 118(1):33-41.

[27] Arbuckle, T. E., Lin, Z., & Mery, L. S. (2001). An Exploratory Analysis of the Effect of Pesticide Exposure on the Risk of Spontaneous Abortion in an Ontario Farm Population. Environ Health Perspect, 109, 851–857.

[28] Brender, JD., et al. 2010. Maternal Pesticide Exposure and Neural Tube Defects in Mexican Americans. Ann Epidemiol. 20(1):16-22.

[29] Pohl, HR., et al. 2000. Breast-feeding exposure of infants to selected pesticides. Toxicol Ind Health. 16:65-77.

[30] Sturtz, N., et al. 2000. Detection of 2,4-dichlorophenoxyacetic acid (2,4-D) residues in neonates breast-fed by 2,4-D exposed dams. Neurotoxicology 21(1-2): 147-54.

[31] Valcke, Mathieu, et al. 2004. Characterization of exposure to pesticides used in average residential homes with children ages 3 to 7 in Quebec. National Institute of Public Health, Québec.

concentrations in their urine.[32] While glyphosate is excreted quickly from the body, it was concluded, "a part may be retained or conjugated with other compounds that can stimulate biochemical and physiological responses." A 2002 study finds children born to parents exposed to glyphosate show a higher incidence of attention deficit disorder and hyperactivity.[33]

Systemic Pesticides, Neonicotinoids and the Health of Pollinators and Other Non-Target Organisms

Since 2006, honey bees and other pollinators in the U.S. and throughout the world have experienced ongoing and rapid population declines. The continuation of this crisis threatens the stability of ecosystems, the economy, and our food supply, as one in three bites of food are dependent on pollinator services. Pollination services are valued at over $125 billion globally. According to a 2014 Presidential Memorandum, pollinators provide $24 billion annually to the economy and honey bees account for $15 billion of that amount.[34] Similarly, native pollinators (such as bumblebees, squash bees, and mason bees) contribute over $3 billion in pollination services to the U.S. agricultural economy, and contribution to pollination of garden plants.

A recent government-sponsored national survey indicates that U.S. beekeepers experienced a 42.1% annual mortality rate with their hives between April 2014 and March 2015.[35] During the winter of 2013/14, two-thirds of beekeepers experienced loss rates greater than the established acceptable winter mortality rate.[36]

Systemic pesticides like the neonicotinoid class of insecticides, have been shown, even at low levels, to impair foraging, navigational, and learning behavior in bees, as well as suppress their immune system to the point of increasing their susceptibility to pathogens and disease.[37] Concentrations of neonicotinoids in soils, waterways, field margin plants, and floral resources overlap substantially with concentrations that control pests in crops, and commonly exceed levels that are known to kill beneficial organisms.[38] Because these chemicals are broad-spectrum insecticides, beneficial soil dwelling insects, benthic aquatic insects, grain-eating vertebrates, along with pollinators are also victims of these systemic chemicals. Birds are also at risk from neonicotinoids, as one study demonstrates that a single corn kernel coated with a

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[32] Acquavella, J. F., et al. (2004). Glyphosate Biomonitoring for Farmers and Their Families: Results from the Farm Family Exposure Study. Environ Health Perspect. 112(3), 321-326.

[33] Cox C. 2004. Journal of Pesticide Reform. Vol. 24 (4) citing: Garry, V.F. et al. 2002. "Birth defects, season of conception, and sex of children born to pesticide applicators living in the Red River Valley of Minnesota." Environ. Health Persp. 110 (Suppl. 3):441-449.

[34] White House Blog: New Steps to Protect Pollinators, Critical Contributors to Our Nation's Economy http://www.whitehouse.gov/blog/2014/06/20/new-steps-protect-pollinators-critical-contributors-our-nation-s-economy

[35] Bee Informed Partnership. Preliminary Results: Honey Bee Colony Losses in the United States, 2014-2015. http://beeinformed.org/2015/05/colony-loss-2014-2015-preliminary-results/

[36] Bee Informed Partnership. Preliminary Results: Honey Bee Colony Losses in the United States, 2013-2014. http://beeinformed.org/results/colony-loss-2013-2014/.

[37] Harriott, N. 2014, Bees, Birds and Beneficials: How fields of poison adversely affect non-target organisms. Pesticides and You. Vol. 33, No. 4 Winter 2013-14.

[38] Goulson, D. 2013. REVIEW: An overview of the environmental risks posed by neonicotinoid insecticides. *Journal of Applied Ecology*. 50: 977–987. doi: 10.1111/1365-2664.12111

neonicotinoid is toxic enough to kill a songbird.[39] Further, research from the Netherlands has showed that the most severe bird population declines occur in those areas where neonicotinoid pollution is highest.[40] To compound these findings, new research by the U.S. Geological Survey (USGS), also documents similar risks from neonicotinoids in the rivers and streams of the Midwest.[41] Morrissey at al. confirms all this in a review which finds that neonicotinoid concentrations detected in aquatic environments pose risks to aquatic invertebrates and the ecosystems they support.[42]

In 2014, an international meta-analysis of approximately 800 peer-reviewed studies on the impact of systemic pesticides, conducted by the International Union for the Conservation of Nature, known as the Task Force on Systemic Pesticides (IUCN Task Force) found that:[43]

- Neonicotinoids are present in the environment "at levels that are known to cause lethal and sublethal effects on a wide range of terrestrial (including soil) and aquatic microorganisms, invertebrates and vertebrates."
- The active ingredients persist, particularly in soils, with half-lives of months and, in some cases, years, and they accumulate. This increases their toxicity by increasing the duration of exposure of non-target species.
- The metabolites of neonicotinoids are often as or more toxic than the active ingredients.
- The weight of the published evidence is very strong that the acute and chronic effects pose a serious risk of harm to colonies/populations of honey bees, bumblebees, and other pollinators.
- The most affected group of species include soil invertebrates and insect pollinators, with high exposure through air and plants and medium exposure through water. Invertebrates exposed to contaminated pollen, nectar and fluids are harmed at "field-realistic" concentrations.

The European Food Safety Authority (EFSA) determined that the most widely used neonicotinoids –imidacloprid, clothianidin and thiamethoxam– pose unacceptable hazards to bees, prompting the European Union to suspend their use on agricultural crops in 2013. This agency also published an opinion report linking two neonicotinoids to adverse effects on the developing human nervous system.[44] According to the report, data suggests that the neonicotinoid chemicals (imidacloprid, acetamiprid) under review are responsible for the

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[39] Mineau P, Whiteside M. 2013. Pesticide Acute Toxicity Is a Better Correlate of U.S. Grassland Bird Declines than Agricultural Intensification. PLoS ONE 8(2): e57457.
[40] Hallmann CA, et al. 2014. Declines in insectivorous birds are associated with high neonicotinoid concentrations. *Nature* doi:10.1038/nature13531.
[41] Hladik ML, et al. 2014. Widespread occurrence of neonicotinoid insecticides in streams in a high corn and soybean producing region, USA. *Env. Poll.* 193:189-196.
[42] Morrissey, C. et al. 2015. Neonicotinoid contamination of global surface waters and associated risk to aquatic invertebrates: A review. *Environment International*. doi:10.1016/j.envint.2014.10.024.
[43] Van der Sluijs JP, et al. 2014. Conclusions of the Worldwide Integrated Assessment on the risks of neonicotinoids and fipronil to biodiversity and ecosystem functioning. *Environ Sci Pollut Res.* doi:10.1007/s11356-014-3229-5.
[44] EFSA Panel on Plant Protection Products and their Residues (PPR). Scientific Opinion on the developmental neurotoxicity potential of acetamiprid and imidacloprid. EFSA Journal 2013;11(12):3471. doi:10.2903/j.efsa.2013.3471.

excitation or desensitization or both of nicotinic acetylcholine receptors (nAChRs), which may affect the developing mammalian nervous system, as is known to occur with nicotine. The agency concludes that the two neonicotinoid compounds may affect neuronal development and function.

In recognition of the long-term impacts systemic pesticides have on the environment, the U.S., the Fish and Wildlife Service (FWS) announced in June 2014 its decision to phase out neonicotinoid use. The service states that neonicotinoids "can be effective against targeted pests, but may also adversely impact many non-target insects," and that "the prophylactic use of neonicotinoids and the potential broad-spectrum adverse effects to non-target species do not meet the intent of IPM principles or the Service's Biological Integrity, Diversity, and Environmental Health (BIDEH) policy.

**The Failure of EPA Regulatory System**

Pesticides are, by their very nature, poisons. The *Federal Insecticide Fungicide and Rodenticide Act* (FIFRA), the law governing pesticide registration and use in the U.S., relies on a risk-benefit assessment, which allows the use of pesticides with known hazards based on the judgment that certain levels of risk are acceptable. However, EPA, which performs risk assessments, assumes that a pesticide would not be marketed if there were no benefits to using it and therefore no risk/benefit analysis is conducted or evaluated by the agency "up front." Registration of a pesticide by EPA does not guarantee that the chemical is "safe," particularly for vulnerable populations such as pregnant mothers, children, pets, and those with chemical sensitivities. Below are examples of concern within the pesticide registration process. These factors should give pause to lawmakers tasked with protecting public and environmental health, provide additional support for actions which prohibit toxic pesticides and, in so doing, encourage alternatives.

**Conditional Registration.** EPA will often approve the use of a pesticide without all of the necessary data required to fully register the chemical, and will assign it a "conditional" registration. The agency assumes that while it waits for additional data the product would not cause adverse impacts that would prevent an eventual full registration. A recent report (2013) from the Government Accountability Office, entitled *EPA Should Take Steps to improve Its Oversight of Conditional Registrations,*[45] strongly criticizes this process, citing poor internal management of data requirements, constituting an "internal control weakness." The report states, "The extent to which EPA ensures that companies submit additional required data and EPA reviews these data is unknown. Specifically, EPA does not have a reliable system, such as an automated data system, to track key information related to conditional registrations, including whether companies have submitted additional data within required time frames." However, these recommendations do not go far enough. Pesticides without all the data required for a full understanding of human and environmental toxicity should not be allowed on the market. Several historic examples exist of pesticides that have been restricted or canceled due to health or environmental risks decades after first registration. Chlorpyrifos, an

[45] Government Accountability Office. August 2013. EPA Should Take Steps to Improve Its Oversight of Conditional Registrations. GAO-13-145. http://www.gao.gov/products/GAO-13-145.

organophosphate insecticide, which is associated with numerous adverse health effects, including reproductive and neurotoxic effects, had its residential uses canceled in 2001, nearly half a decade after it was first registered by EPA in 1965. Others, like propoxur, diazinon, carbaryl, aldicarb, carbofuran, and most recently endosulfan, have seen their uses restricted or canceled after years on the market due to unreasonable human and environmental effects. Recently, a product manufactured by DuPont, Imprelis, with the active ingredient aminocyclopyrachlor, was removed from the market only two years after EPA approval under conditional registration.[46] Marketed as a broadleaf weed killer, Imprelis was found to damage and kill trees. However, in EPA's registration of the chemical, the agency noted, "In accordance with FIFRA Section 3(c)(7)(C), the Agency believes that the conditional registration of aminocyclopyrachlor will not cause any unreasonable adverse effects to human health or to the environment and that the use of the pesticide is in the public's interest; and is therefore granting the conditional registration."[47]

**Failure to test or disclose inert ingredients.** Despite their innocuous name, inert ingredients in pesticide formulations are neither chemically, biologically, or toxicologically inert; in fact they can be just as toxic as the active ingredient. Quite often, inert ingredients constitute over 95% of the pesticide product. In general, inert ingredients are minimally evaluated, even though many are known to state, federal, and international agencies to be hazardous to human health. For example, until October 23, 2014,[48] creosols, chemicals listed as hazardous waste under Superfund regulations and considered possible human carcinogens by EPA,[49] were allowed in pesticide formulations without any disclosure requirement. EPA recently took action to remove cresols and 71 other inert ingredients from inclusion in pesticide formulations as a result of petitions from health and consumer groups. However, numerous hazardous inerts remain. For example, a 2009 study, entitled *Glyphosate Formulations Induce Apoptosis and Necrosis in Human Umbilical, Embryonic, and Placental Cells*,[50] found that an inert ingredient in formulations of the weed killer Roundup (glyphosate), polyethoxlated tallowamine (POEA), is more toxic to human cells than the active ingredient glyphosate, and, in fact, amplifies the toxicity of the product – an effect not tested or accounted for by the pesticide registration process. A 2014 study, *Major pesticides are more toxic to human cells than their declared active principle*, found inert ingredients had the potential to magnify the effects of active ingredients

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[46] Environmental Protection Agency. June 2012. Imprelis and Investigation of Damage to Trees. http://www.epa.gov/pesticides/regulating/imprelis.html.

[47] Environmental Protection Agency. August 2010. Registration of the New Active Ingredient Aminocyclopyrachlor for Use on Non-Crop Areas, Sod Farms, Turf, and Residential Lawns. http://www.regulations.gov/contentStreamer?objectId=0900006480b405d8&disposition=attachment&contentType=pdf.

[48] Environmental Protection Agency. October 2014. EPA Proposes to Remove 72 Chemicals from Approved Pesticide Inert Ingredient List. http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/3397554fa65588d685257d7a0061a300!OpenDocument

[49] Environmental Protectin Agency. October 2013. Cresol/Cresylic Acid. http://www.epa.gov/ttnatw01/hlthef/cresols.html.

[50] Benachour and Seralini. 2009. Glyposate Formulations Induce Apoptosis and Necrosis in Human Umbilical, Embryonic, and Placental Cells. *Chemical Research and Toxicology. http://pubs.acs.org/doi/abs/10.1021/tx800218n.*

by 1,000 fold.

Pesticide manufacturers argue against the disclosure of inert ingredients on pesticide product labels, maintaining that this information is proprietary. Limited review of inert ingredients in pesticide products highlights a significant flaw with the regulatory process. Rather than adopt a precautionary approach when it comes to chemicals with unknown toxicity, EPA allows uncertainties and relies on flawed risk assessments that do not adequately address exposure and hazard. Then, when data becomes available on hazards, these pesticides, both active ingredients and inerts, have already left a toxic trail on the environment and people's well-being.

**Pesticide Mixtures, Synergism Untested.** In addition to gaps in testing inert ingredients and their mixture with active ingredients in pesticide products, there is an absence of review of the health and environmental impacts of pesticides used in combination. A 2011 study, entitled *Additivity of pyrethroid actions on sodium influx in cerebrocotorial neurons in primary culture,*[51] finds that the combined mixture's effect is equal to the sum of the effects of individual pyrethoids. This equates to a cumulative toxic loading for exposed individuals. Similarly, researchers looked at the cumulative impact the numerous pesticides that may be found in honey bee hives in the 2014 paper *Four Common Pesticides, Their Mixtures and a Formulation Solvent in the Hive Environment Have High Oral Toxicity to Honey Bee Larvae*.[52] The findings of the study send no mixed messages —pesticides, whether looked at individually, in different combinations, or even broken down into their allegedly inert component parts have serious consequences on the bee larvae survival rates. The synergistic effects in most combinations of the pesticides amplify these mortality rates around the four-day mark.

**Label Restrictions Inadequate.** From a public health perspective, an inadequate regulatory system results in a pesticide product label that is also inadequate, failing to restrict use or convey hazard information. While a resident may be able to glean some acute toxicity data, chronic or long-term effects will not be found on products' labels. Despite certain pesticides being linked to health endpoints, such as exacerbation of asthma,[53] learning disabilities,[54] or behavioral disorders,[55] this information is not disclosed on the label. Furthermore, data gaps for certain health endpoints are also not disclosed.

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[51] Cao et al. 2011. Additivity of Pyrethroid Actions on Sodium Influx in Cerebrocortical Neurons in Primary Culture. *Environmental Health Perspectives. http://ehp.niehs.nih.gov/1003394/.*

[52] Zhu et al. 2014. Four Common Pesticides, Their Mixtures and a Formulation Solvent in the Hive Environment Have High Oral Toxicity to Honey Bee Larvae. PLOS One. http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0077547

[53] Hernandez et al. 2011. Pesticides and Asthma. *Current opinion in allergy and clinical immunology*. http://www.ncbi.nlm.nih.gov/pubmed/21368619.

[54] Horton et al. 2011. Impact of Prenatal Exposure to Piperonyl Butoxide and Permethrin on 36-Month Neurodevelopment. *Pediatrics*. http://www.ncbi.nlm.nih.gov/pubmed/21300677

[55] Furlong et al. 2014. Prenatal exposure to organophosphate pesticides and reciprocal social behavior in childhood.

## Appendix C. Health Effects of 30 Commonly Used Pesticides

A Beyond Pesticides Factsheet – A Beyond Pesticides Factsheet – A Beyond Pesticides Factsheet – A Beyond Pesticides Factsheet

# Health Effects of 30 Commonly Used Pesticides

| Pesticides | Health Effects | | | | | | |
|---|---|---|---|---|---|---|---|
| | Cancer | Endocrine Disruption | Reproductive Effects | Neurotoxicity | Kidney/Liver Damage | Sensitizer/ Irritant | Birth Defects |
| **Herbicides** | | | | | | | |
| 2,4-D* | X[4] | X[10] | X[7] | X[8] | X[8] | X[1] | X[11] |
| Benfluralin | | | | | X[1] | X[1] | |
| Bensulide | | | | X[2] | X[1] | X[2] | |
| Clopyralid | | | X[7] | | | X[2] | X[7] |
| Dicamba* | | | X[1] | X[2] | X[2] | X[1] | X[1] |
| Diquat Dibromide | | | X[12] | | X[11] | X[1] | |
| Dithiopyr | | | | | X[1] | X[1] | |
| Fluazipop-p-butyl | | | X[1] | | X[1] | | X[1] |
| Glyphosate* | X[12] | X[8] | X[1] | | X[8] | X[1] | |
| Imazapyr | | | | | X[7] | X[2] | |
| Isoxaben | X[3] | | | | X[2] | | |
| MCPA | | X[6] | X[2] | X[2] | X[11] | X[1] | |
| Mecroporp (MCPP)* | Possible[3] | X[6] | X[2] | X[1] | X[9] | X[1] | X[1] |
| Pelargonic Acid* | | | | | | X[1] | |
| Pendimethalin* | Possible[3] | X[6] | X[1] | | | X[2] | |
| Triclopyr | | | X[7] | | X[9] | X[1] | X[7] |
| Trifluralin* | Possible[3] | X[6] | X[1] | | X[2] | X[1] | |
| **Insecticides** | | | | | | | |
| Acephate | Possible[3] | X[6] | X[11] | X[9] | | X[2] | |
| Bifenthrin*† | Possible[3] | Suspected[6,10] | | X[8] | | X[1] | X[9] |
| Carbaryl | X[3] | X[10] | X[8] | X[1] | X[11] | X[11] | X[7] |
| Fipronil | Possible[3] | X[6] | X[8] | X[8] | X[8] | X[8] | |
| Imidacloprid ‡ | | | X[7] | | X[2] | | X[7] |
| Malathion* | Possible[3] | X[10] | X[11] | X[9] | X[2] | X[2] | X[2] |
| Permethrin*† | X[3] | Suspected[6,10] | X[1,7] | X[1,7] | X[9] | X[1] | |
| Trichlorfon | X[3] | X[6] | X[11] | X[2] | X[2] | | X[2] |
| **Fungicides** | | | | | | | |
| Azoxystrobin | | | | | X[2] | X[2] | |
| Myclobutanil | | Probable[6] | X[2] | | X[2] | | |
| Propiconazole | Possible[1] | X[6] | X[2] | | X[1] | X[1] | |
| Sulfur | | | | | | X[1] | |
| Thiophanate methyl | X[3] | X[1] | X[1] | Suspected[1] | X[1] | X[2] | X[1] |
| Ziram | Suggestive[3] | Suspected[6] | | X[2] | X[2] | X[2] | |
| Totals: | 16 | 17 | 21 | 14 | 25 | 26 | 12 |

**These pesticides are among the top 10 most heavily used pesticides in the home and garden sector from 2006-2007, according to the latest sales and usage data available from EPA (2011), available at http://www.epa.gov/opp00001/pestsales/07pestsales/market_estimates2007.pdf.*

*† EPA lists all synthetic pyrethroids under the same category. While all synthetic pyrethroids have similar toxicological profiles, some may be more or less toxic in certain categories than others. See Beyond Pesticides' synthetic pyrethroid fact sheet at bit.ly/TLBuPB for additional information.*

*‡ Imidacloprid is a systemic insecticide in the neonicotinoid chemical class, which is linked to bee decline.*

### Description

Most toxicity determinations based on interpretations and conclusions of studies by university, government, or organization databases. Empty cells may refer to either insufficient data or if the chemical is considered relatively non-toxic based on currently available data.

The list of 30 commonly used lawn chemicals is based on information provided by the General Accounting Office 1990 Report, "Lawn Care Pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue," U.S. Environmental Protection Agency (EPA) National Pesticide Survey (1990), Farm Chemicals Handbook (1989), The National Home and Garden Pesticide Use Survey by Research Triangle Institute, NC (1992), multiple state reports, current EPA Environmental Impact Statements, and Risk Assessments, EPA national sales and usage data, best-selling products at Lowe's and Home Depot, and Beyond Pesticides' information requests.

For more information on hazards associated with pesticides, please see Beyond Pesticides' *Gateway on Pesticide Hazards and Safe Pest Management* at www.beyondpesticides.org/gateway. For questions and other inquiries, please contact our office at 202-543-5450, email info@beyondpesticides.org or visit us on the web at www.beyondpesticides.org.

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## Appendix D. Environmental Effects of 30 Commonly Used Lawn Pesticides

A Beyond Pesticides Factsheet – A Beyond Pesticides Factsheet – A Beyond Pesticides Factsheet – A Beyond Pesticides Factsheet

# Environmental Effects of 30 Commonly Used Lawn Pesticides

| | Health Effects | | | | | |
|---|---|---|---|---|---|---|
| | Detected in Groundwater | Potential Leacher | Toxic to Birds | Toxic to Fish/ Aquatic Organisms | Toxic to Bees | Toxic to Mammals |
| **Pesticides** | | | | | | |
| **Herbicides** | | | | | | |
| 2,4-D* | X[1,2,3,4,7] | X[3,4] | X[1,2,3,11] | X[1,2,3,11] | X[1,11] | X[3,4,12] |
| Benfluralin | X[7] | | X[3,11] | X[3,11] | X[5,11] | |
| Clopyralid | X[2,7] | X[2,11] | X[11] | X[11] | X[11] | |
| Dicamba | X[2,7] | X[1,2,3] | X[10,11] | X[1,2,3,11] | X[5,10,11] | |
| Diquat Dibromide | | X[5] | X[1,3,11] | X[1,3,11] | X[5,11] | X[1] |
| Dithiopyr | | | | X[5,6,11] | X[5,11] | |
| Fluazipop-p-butyl | | | | X[1,4,6,11] | X[1,4] | |
| Glyphosate* | X[8] | X[5] | X[1,3,11] | X[1,2,11] | X[11] | X[4] |
| Imazapyr | X[2] | X[2,3] | | X[2,5,11] | X[5,11] | |
| Isoxaben | | X[11] | X[11] | X[3,11] | X[11] | |
| MCPA | X[4,7] | X[1,4,11] | X[1,3,11] | X[1,3,11] | X[5] | X[3] |
| Mecoprop (MCPP)* | X[4] | X[1,2,3,11] | X[3,11] | X[2] | X[11] | X[3] |
| Pelargonic Acid* | | | X[3,§] | X[3,§] | X[5] | |
| Pendimethalin* | X[3,7] | | X[1,3,11] | X[1,3,11] | X[5,11] | X[3] |
| Triclopyr | X[2,7] | X[1,2,3,11] | X[2,3,11] | X[2,3,11] | X[5,11] | |
| Trifluralin* | X[4,7] | | | X[3,11] | X[5,11,12] | |
| **Insecticides** | | | | | | |
| Acephate | | X[1] | X[1,3,10,11] | X[3,11] | X[1,3,10,11] | X[3] |
| Bifenthrin*† | | | X[1,10,11] | X[1,10,11] | X[1,10,11] | X[1,4] |
| Carbaryl | X[1,3,7] | X[11] | X[2,11] | X[1,2,3,11] | X[1,2,3,11] | X[3,11] |
| Fipronil | X[7] | X[5,11] | X[2,4,10,11] | X[2,4,10,11] | X[2,4,10,11] | X[4] |
| Imidacloprid ‡ | X[7] | X[1,2,10,11] | X[1,2,11] | X[1,2,11] | X[1,2,10,11] | |
| Malathion* | X[1,2,3,7] | X[1,3,5] | X[1,2,3,10,11] | X[1,2,3,10,11] | X[1,3,10,11] | X[3] |
| Permethrin*† | X[2,7] | | | X[1,2,3,11] | X[1,2,3,11] | |
| Trichlorfon | | X[1,3,11] | X[1,3,11] | X[1,3,11] | X[1,11] | X[4,‖] |
| **Fungicides** | | | | | | |
| Azoxystrobin | X[3] | X[3,4,11] | X[11] | X[3,11] | X[11] | |
| Myclobutanil | X[7] | | | X[5] | | |
| Propiconazole | X[7] | X[3] | | X[3,11] | X[5,11] | X[11] |
| Sulfur | | X[1] | X[11] | X[11] | X[11] | |
| Thiophanate methyl | | X[3] | | X[3,11] | X[11] | |
| Ziram | | X[3,4] | X[1,3,11] | X[1,3,11] | X[11] | X[3] |
| Totals: | 19 | 20 | 22 | 30 | 29 | 14 |

*These pesticides are among the top 10 most heavily used pesticides in the home and garden sector from 2006-2007, according to the latest sales and usage data available from EPA (2011), available at http://www.epa.gov/opp00001/pestsales/07pestsales/market_estimates2007.pdf.

*† EPA lists all synthetic pyrethroids under the same category. While all synthetic pyrethroids have similar toxicological profiles, some may be more or less toxic in certain categories than others. See Beyond Pesticides' synthetic pyrethroid fact sheet at bit.ly/TLBuP8 for additional information.*

*‡ Imidacloprid is a systemic insecticide in the neonicotinoid chemical class, which is linked to bee decline.*

*§ Based on soap salts.*

*‖ Based on in-vitro mammalian cell study.*

## Description

Most toxicity determinations based on interpretations and conclusions of studies by university, government, or organization databases. Empty cells may refer to either insufficient data or if the chemical is considered relatively non-toxic based on currently available data. The column labeled "Potential to Leach" refers to a chemical's potential to move into deeper soil layers and eventually into groundwater. The column labeled "Toxic to Mammals" refers to conclusions based on evidence from studies done on non-human mammals.

The list of 30 commonly used lawn chemicals is based on information provided by the General Accounting Office 1990 Report, "Lawn Care Pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue," U.S. Environmental Protection Agency (EPA) National Pesticide Survey (1990), Farm Chemicals Handbook (1989), The National Home and Garden Pesticide Use Survey by Research Triangle Institute, NC (1992), multiple state reports, current EPA Environmental Impact Statements, and Risk Assessments, EPA national sales and usage data, best-selling products at Lowe's and Home Depot, and Beyond Pesticides' information requests.

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