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Statement of
Jay Feldman, Executive Director, Beyond Pesticides
on
Local Pesticide Ordinance
to
Falmouth Town Council, Maine

April 24, 2024

Honorable Members of the Town Council. Thank you for the opportunity to testify on the adoption of the pesticide ordinance, and the critical need to protect the Falmouth community from toxic pesticide use, while cultivating beautiful landscapes with organic land management practices.

Beyond Pesticides is 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.

Beyond Pesticides Urges the Adoption of a Comprehensive Approach to Land Management, Safe for People and the Environment

We support the intent of the ordinance restricting synthetic pesticide and fertilizer use and urge the Council to embrace a comprehensive approach that ensures the protection of those at greatest risk from pesticide exposure—children, pregnant individuals, those with preexisting health conditions, essential workers, and landscapers**.** As we have learned from the effects of Covid-19, the virus is especially threatening to those with respiratory, immunological, and neurological illnesses. Similarly with pesticides, all these harmful conditions are exacerbated by exposure to toxic pesticides. Given that we have proven land management practices that do not require these chemicals to achieve pest management goals and community expectations for aesthetics, we believe it is critical that the Town of Falmouth moves quickly to adopt this the ordinance with our suggested changes.

In light of the health and environmental concerns that are discussed in this statement and supported by the attachments, we respectfully suggest that the Town Council consider several areas of improvement, both in clarity and content, noted below.

1. **The ordinance should apply to all land within the town.** In this context, we believe that recreational areas, including playing fields are critical areas of pesticide exposure and therefore urge that the Town consider the viability of organic land management practices on athletic fields managed by the Town of Falmouth and Falmouth School Department. These are areas where children congregate and therefore should be a high priority, we believe, for the transition to organic practices. To this end, we urge that the athletic field exemption in Section 21-6, Pesticide and Fertilizer Use and Sale Exemptions, be stricken. We urge the Council to consider applying the ordinance to all land under its jurisdiction, even it requires a phased-in approach.
2. **Clearly state "allowed" substances that may be used in land management.** To meet the spirit and intent of legislation to move all land within the jurisdiction of Falmouth to sustainable practices, the language of the ordinance must, from our perspective, embrace the horticultural principles that replace toxic substances with a management system that supports healthy soils and plants. To this end, we would suggest greater clarity in two areas : 1. Section 21-3, Prohibition and Limitation of Pesticide Use and Application, paragraph 1 should be clarified to establish an "allowable list" of substances that may be used under the law, utilizing the organic standards and capture in the National List of Allowed an Prohibited Substances. This can be achieved by adding the word "allowed or" after the words "substance that is." We typically include the citation as a reference with the following language: **a pesticide the active ingredients of which are recommended by the National Organic Standards Board (NOSB) pursuant to 7 U.S.C §6518, as amended, and published as the National List at 7 C.F.R §§ 205.601 and 205.602.**
3. **Prohibit all synthetic fertilizers.** In alignment with the allowed substances authorized under organic standards, we recommend that all petrochemical synthetic fertilizers, including but not limited to those containing urea, are prohibited. These materials are not allowed in organic systems because they are detrimental to soil organisms and health soil biology and damage the natural cycling of nutrients and the nurturing of organic matter that are central to an organic system.
4. **Narrow the waiver for "invasives."** The goal of any invasive management program should be to determine the underlying conditions that contribute to the problem and develop a tiered approach with various forms of clearance. Therefore, we urge that assessment be conducted before wholesale allowance of chemicals that are detrimental to the ecosystem and harmful to human and aquatic life.

The good news is that the organic practices and products that are utilized in an organic system are now widely available in the market, improving turf resiliency and aesthetics. A shift to sustainable land management practices ensures that the products and practices used in Falmouth are compatible with an approach that protects people and local ecology. It is this approach that will stop the unnecessary use of hazardous chemicals applied for aesthetic purposes on landscapes.

Falmouth Has the Authority to Protect Its Residents from Toxic Pesticides

As you know, the city is empowered under state law to exercise its democratic authority to protect its residents from toxic pesticides, despite an attempt by the chemical lawn care industry and the chemical manufacturing industry to take this power away from local jurisdictions in the state. We should note that the very groups that are before this Council asking you to ignore the science and inadequate protections afforded this community by federal, and by association state, pesticide law are the same ones that have sought unsuccessfully to take away your local authority to protect your residents and the local environment. Yes, that same groups in the chemical industry are asking you to do what it could not achieve in the state legislature—ignore the science, ignore documented failures in federal protection by the U.S. Environmental Protection Agency, and reject cost-effective and improved land management practices and products—and move to allow continued use of hazardous chemicals that are not needed for beautiful lawns, parks, and playing fields.

Those in opposition to your authority to protect public health and welfare want you to believe that lawns and sports fields cannot be managed without toxic pesticides and with organic practices. They want you to believe that their businesses will fail. The evidence shows this is not the truth, not only in the state of Maine, but across the country. In fact, these businesses are adapting to public concern about safer practices that eliminate toxic pesticides and adopting organic practices and products, transitioning business models that not only care for family and community health, but are part of community and national initiatives to mitigate the climate crisis and dramatic biodiversity decline by eliminating petrochemical pesticides and fertilizers. Please do not let those in the industry who are holding on to outdated and harmful practices and products influence adversely the future health of the state's and Falmouth's children and families. (See Appendix A, Myths and Facts about Lawn Care Restrictions, and attached cost factsheet.)

Why Is An Ordinance Needed to Protect Falmouth

Pesticides are an umbrella term that includes herbicides, insecticides, fungicides, and other biocides. Each category of pesticide has the potential to cause significant harm to human health and the wider environment (See Appendix B and C for more information). Herbicides, such as glyphosate (and its formulated products (Roundup) and 2,4-D, both widely used on turf and lawns, can also be tracked indoors where they settle in dust, air and on surfaces and may remain in carpets, resulting in long-term exposures.[1,2] In these environments, exposure may increase the risk of developing asthma, exacerbate a previous asthmatic condition, or even trigger asthma attacks by increasing bronchial hyper-responsiveness.[3] 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,

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[1] Nishioka, M., et al. 1996. Measuring lawn transport of lawn-applied herbicide acids from turf. Env Science Technology, 30:3313-3320.
[2] Nishioka, M., et al. 2001. "Distribution of 2,4-D in Air and on Surfaces Inside Residences. Environmental Health Perspectives 109(11).
[3] Hernández, AF., Parrón, T. and Alarcón, R. 2011. Pesticides and asthma. Curr Opin Allergy Clin Immunol.11(2):90-6.

lawns, and soil.[4]

Insecticides pose similar concerns to public health. Synthetic pyrethroids, a class of neurotoxic chemicals commonly used on lawns and landscapes, have been repeatedly linked by peer-reviewed studies to neurological issues such as learning disabilities in children. A 2015 study by Cincinnati Children's Hospital Medical Center found a strong association between urinary concentrations of synthetic pyrethroids and the development of ADHD, primarily in boys (aged 8 to 15). Any concentrations found above the level of detection corresponded to a three-fold increase in the chance of developing ADHD, when compared to boys without detectable levels.[5]

Fungicide use results in significant risks to community health, particularly for the most sensitive, such as young children and the elderly. The use of a certain class of fungicides, the strobilurins, has been linked in peer-reviewed research to the development of autism in children and Alzheimer's in older adults.[6] Drug-resistant fungal infections are on the rise, and many researchers indicate the use of fungicides is likely playing a role.[7]

While the effects of different pesticide types can be delineated, a significant body of research finds that pesticide use in general is hazardous to health. A study published in the *Journal of the National Cancer Institute* finds that household and garden pesticide use, in general, can increase the risk of childhood leukemia as much as seven-fold.[8] Women who are exposed to pesticides in homes and yards are more than two times more likely to give birth to children with neural tube defects than those who do not use pesticides, according to one study.[9] A meta-analysis investigating years of previous research on residential pesticide use and childhood leukemia finds associations with exposure during pregnancy. [10]

Inaction by State and Federal Regulators Necessitates Town Council Action

EPA has undergone a severe reduction in programmatic work and adequate scientific assessment over the last several decades. This is an urgent problem, given that the state regulatory system (Maine Board of Pesticide Control) relies almost exclusively on the underlying scientific determinations of EPA when it registers pesticides in the state.

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[4] 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.
[5] Wagner-Schuman, et al. 2015. Association of pyrethroid pesticide exposure with attention-deficit/hyperactivity disorder in a nationally representative sample of U.S. children. Environmental Health 14, 44. https://ehjournal.biomedcentral.com/articles/10.1186/s12940-015-0030-y.
[6] Pearson et al. 2016. Identification of chemicals that mimic transcriptional changes associated with autism, brain aging and neurodegeneration. *Nature Communications* **volume 7**, Article number: 11173 https://www.nature.com/articles/ncomms11173.
[7] Richtel, Matt and Jacobs, Andrew. 2019. A Mysterious Infection, Spanning the Globe in a Climate of Secrecy https://www.nytimes.com/2019/04/06/health/drug-resistant-candida-auris.html
[8] Lowengart, R. et al. 1987. Childhood Leukemia and Parent's Occupational and Home Exposures. Journal of the National Cancer Institute. 79:39.
[9]Brender, JD., et al. 2010. Maternal Pesticide Exposure and Neural Tube Defects in Mexican Americans. Ann Epidemiol. 20(1):16-22.
[10] Turner, M.C., et al. 2010. Residential pesticides and childhood leukemia: a systematic review and meta-analysis. Environ Health Perspect 118(1):33-41.

In recent years, there as been a reversal by federal regulators, which sheds light on a deeper problem that calls for local action on all pesticides in the absence of federal and state protections:

- PFAS contamination and the fact that pesticides have been shown in some cases to be contaminated with PFAS tells a story of inadequate regulation that calls for a precautionary approach to toxic chemical use that you have the power to effect.
- When EPA reversed a decision in 2015 to ban the use of the insecticide chlorpyrifos, which is a neurological toxicant that damages children's brains, it took over five years to get EPA to act.[11]
- That set the tone for the agency's decision to take no action on the weed killer glyphosate/Roundup, despite the independent science and the World Health Organization's 2015 finding on its cancer-causing properties, and other science on it causing liver and kidney damage and endocrine disrupting effects.[12]
- EPA, in recent years, further weakened protections for 23 synthetic pyrethroid insecticides. Pyrethroids are a common class of neurotoxic insecticides that have been repeatedly linked by peer-reviewed studies to neurological issues such as learning disabilities in children.[13] The agency allowed a three-fold increase in exposure to the chemical, when the data indicates that children are more susceptible to the impacts of toxic pesticides.[14]
- U.S. regulators at the U.S. Department of Agriculture were influenced by representatives of Bayer to pressure a United Nations Task Force to drop any reference of "fungicides" or "crops" from a document intended to counter the rising number of drug-resistant fungal infections.

Given disturbing trends toward fewer, not more, protections for residents, local action is needed to fill in gaps left by a deficient state and federal regulatory apparatus.

Healthy Lawn Practices Gaining Momentum

Beyond Pesticides has been involved in the implementation of organic land care programs by conducting soil analyses on demonstration sites to evaluate soil biology, holding training seminars to teach cultural practices and organic compatible materials (See Products Compatible with Organic Land Management[15]), and producing organic land management plans that build soil microbial life to cycle nutrients naturally. This approach supports turf systems in parks and on playing fields that are more resilient, better able to withstand stress, and less dependent on water resources. **Beyond Pesticides is happy to assist Falmouth's transition to organic land**

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[11] Levin, Sam. 2019. Trump Administration won't ban pesticide tied to childhood rain damage. The Guardian. https://www.theguardian.com/us-news/2019/jul/18/epa-chlorpyrifos-ban-children-brain-damage-trump.

[12] International Agency for Research on Cancer. 2015. Monograph on Glyphosate. https://monographs.iarc.fr/wp-content/uploads/2018/06/mono112-10.pdf.

[13] Dalsager, L. et al. Maternal urinary concentrations of pyrethroid and chlorpyrifos metabolites and attention deficit hyperactivity disorder (ADHD) symptoms in 2-4-year-old children from the Odense Child Cohort. Environmental Research, 10 Jun 2019, 176:108533.

[14] Jacobs, Andrew. 2020. Emails Show How Pesticide Industry Influenced U.S. Position in Health Talks. New York Times. https://www.nytimes.com/2020/09/24/health/pesticides-drug-resistance-trump-anifungals.html.

[15] Beyond Pesticides Organic Compatible Product List. 2020. bit.ly/OrganicCompatible.

care through consultations with natural land care experts, free of charge.

While conventional, chemical-intensive turf and landscape management programs are generally centered on a synthetic product approach that continually treats the symptoms of turf problems with toxic chemicals, the alternative, systems-based approach focuses on the root causes of pest problems, which lie in the soil. These cutting edge land management techniques reveal that toxic pesticides of any kind are not needed for successful turf management. Rather, this approach incorporates preventive steps based on supporting soil biology to improve soil fertility and turf grass health, natural or organic products based on a soil analysis that determines need, and specific cultural practices, including mowing height, aeration, dethatching, and overseeding.

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

Although there is often significant discussion over the expense of transitioning to an organic land care program, the cost of implementing an organic systems approach is not likely to be substantially more than current costs (assuming a reasonable budget is in place), and there is likely to be savings in the long-term. In considering cost, local governments should reflect not only on budget expenditures, but also on the externalities associated with pesticide use, including its effect of eliminating the risk of exposure to carcinogens, preventing the contamination of groundwater and surface water, and protecting wildlife from poisoning. These are costs that residents are already paying for, through hospital visits, expensive clean-ups, and the need for species conservation and habitat restoration. An organic 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.

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

- A report produced by nationally renowned turfgrass expert and Beyond Pesticides' board member Chip Osborne in coordination with Grassroots Environmental Education 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.[16]
- There is also the 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,[17] 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

[16] 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 .
[17] Raver, Anne. 2009. The Grass is Greener at Harvard. http://www.nytimes.com/2009/09/24/garden/24garden.html?_r=2

and has saved an additional $10k/year due to the decreased cost and need to purchase fertilizer from off-campus sources. [18]

- 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, 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."[19]
- The experience in South Miami, FL may also be instructive. The city completed a two-year pilot program that limited toxic pesticide use only to organic certified products, the city codified the practice into law. memorandum codifying these practices into law. A memo by the city describes the success of this approach regarding cost. It reads, “Thus-far this initiative has been a qualified success, allowing the city to cut down on its waste-footprint significantly at relatively little expense, and providing a model for other local government to use as guidance.”[20]
- One year after passing and implementing an organic landscape management policy, the City of Irvine California’s fields look “as pristine as ever,” according to the Orange County Register.[21] It notes further, “Weeding by hand and using organic pesticides, which must be applied more frequently, will increase costs by about 5.6 percent in a $21.2 million landscaping budget, according to a city report on implementation of the program.”

While a decade ago the natural systems approach required slightly increased up-front costs and saw savings in the long run, technology and practices have now progressed to the point where parity can often be achieved from the outset. (See Beyond Pesticides Cost Comparison: Chemical vs Organic Land Management[22] and attached.)

Communities around the country are institutionalizing safer practices by passing organic ordinances. Beyond Pesticides’ *Map of Pesticide Reform Policies* highlights over 180 communities that have enacted some level of lawn and landscape pesticide reduction policy.[23]

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[18] 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.

[19] 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.

[20] City of South Miami. 2019. City Commission Agenda Item Report: Inter-office Memorandum. https://beyondpesticides.org/assets/media/documents/SouthMiami_FL_Organicordinance.pdf.

[21] Perkes, Courtney. 2017. Irvine Little League mom leads charge to wipe out pesticides on ball fields nationwide. Orange County Register. http://www.ocregister.com/2017/05/24/irvine-group-working-to-get-pesticides-off-city-baseball-fields-nationwide/.

[22] Beyond Pesticides. 2020. Cost Comparison: Chemical vs Organic Land Management. https://beyondpesticides.org/assets/media/documents/documents/Cost%20Comparison.pdf.

[23] Beyond Pesticides Map of Pesticide Reform Policies. 2020.

Establish Public Oversight and Accountability

It is important that an organic land care ordinance contain aspects that are focused on continuous improvement. To that end, establishing an oversight committee consisting of experts in natural land care and public health, and including residents with similar experience and from disproportionately affected communities can help ensure accountability (see Appendix A for suggested language). This committee will assist city officials in implementing the policy, educating the public on its benefits, and staying up to date with experts on the latest, cutting edge approaches to natural land management. The waiver subcommittee will ensure that any toxic pesticide use is conducted truly as a last resort after all other practices that are not organic compatible are tried and follows the spirit and intent of the law.

A waiver process ensures accountability to the public, as well as the spirit and intent of the law. While the vast majority of pest management can be achieved through natural practices that foster healthy soil biology, there are rare situations where public health or the overall health of ecosystems are threatened. In these instances, it is critical that due diligence and proper consideration be given before a toxic pesticide is used. A waiver review process that requires reporting on past management practices, and evidence that all other options were exhausted, overseen by a subcommittee within a resident oversight committee, is a robust process that will ensure responsibility to both public lands and public health. This way, Falmouth residents can have confidence that any waiver that is provided for toxic pesticide use is truly in the public interest, rather than the quickest or most convenient approach at the time.

Conclusion

In light of the success and urgent need to move toward safe land management practices, we urge the Falmouth Town Council to a strong ordinance that limits materials in lawn and landscape care to those allowed under federal organic law—the very standards that the Maine Organic Farmers and Gardeners Association use for certification.

In addition to safeguarding residents of the city and the surrounding ecosystem that Falmouth shares with other communities, as elected officials you play an instrumental role in tackling critical issues of community health, devastating declines in biodiversity, and climate change.

Thank you for consideration of our comments. We remain available to answer any questions on the hazards of pesticides and the benefits of organic land management.

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https://www.google.com/maps/d/viewer?mid=1VLpVWvifO2JOrgxf1-d1DLyDruE&ll=39.03573413957711%2C-94.19459570507814&z=5.

Appendix A. Myths and Facts about Lawn Care Restrictions

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Myths and Facts about Lawn Care Restrictions

Those with vested interests in the sale of toxic pesticides or users of pesticides often make claims that belie the science on the hazards of these toxic chemicals, ignore independent scientific findings and seek to misrepresent the experience of numerous jurisdictions and landscapers throughout the country who have stopped the use of toxic pesticides. Some of the myths and facts follow:

Myth: Federal and state pesticide law provides adequate protections from toxic pesticides.
Fact: Deficiencies in the federal regulatory process are well documented, dating back decades in the recently disclosed "poison papers,"[24] and prevalent today with the dismantling of the U.S. Environmental Protection Agency (EPA). The agency has worked in favor of the pesticide industry to permit continued use of pesticides widely used in Falmouth, including carcinogenic weed killer glyphosate, developmentally damaging synthetic pyrethoid insecticides, and bee-killing neonicotinoid insecticides. EPA defied its own scientists by allowing continued use of highly neurotoxic chlorpyrifos on golf courses and in agriculture. This is an urgent problem, given that the state regulatory system (Maryland Department of Agriculture) relies almost exclusively on the underlying determinations of EPA when it registers pesticides for use in the state and local communities.

Myth: Pesticides are adequately regulated to protect vulnerable population groups, people with preexisting conditions or comorbidities, and people of color.
Fact: As the coronavirus hit, we quickly saw disparities in who is at highest risk of infection, not just in age groups, but along racial lines. In every state, we see that people of color suffer higher rates of infection, illness, and death than their percentage of the population. In addition, with people of color being proportionately essential workers, this also means that the health conditions or vulnerabilities brought on by Covid-19 are exacerbated by pesticide exposure—illnesses to the respiratory and neurological systems, among others. The Black Institute's report, *Poison Parks*[25] (January 2020), The Black notes, "Minority and low-income communities suffer from the use of this chemical [glyphosate] and have become victims of environmental racism." However, this is not limited to one or several herbicides.

Myth: Restrictions on toxic pesticide use will lead to an increase in residential pesticide use by

[24] See: https://www.poisonpapers.org/.
[25] The Black Institute. 2020. Poison Parks. https://theblackinstitute.org/wp-content/uploads/2020/01/TBI_Poison_Parks_Report._010820_FINAL.pdf.

homeowners.
Fact: As residents and land managers learn the horticultural techniques utilized by natural land managers, including cultural practices and organic compatible products, people appreciate the benefits of moving to these common sense, sustainable approaches to land care. Typically, those who have not practiced organic land management and/or have a vested interest in selling chemicals or pesticide-intensive services are the most vocal opponents of legislation to stop toxic pesticide use and replace it with cost-effective organic management practices. Studies that have been conducted on local pesticide restrictions show significant declines in household pesticide use, decreases in waterway pesticide contamination, and increases in natural lawn care companies following implementation.

Myth: Listed pesticides do not face regulatory scrutiny.
Fact: Listed pesticides within the organic standards (National List of Allowed and Prohibited Substances) are the least-toxic, yet still effective, pest management products on the market, ensuring the protection of children, pregnant mothers and other vulnerable populations, as well as safeguarding birds, pollinators, other wildlife and local water quality. Organic compliant products are required to undergo another level of review by an independent board of experts under federal organic law, and minimum risk pesticides are of a characteristic having such low toxicity that these substances do not need to undergo the formal EPA registration process.

Myth: Lawn care legislation will result in landscaping companies losing business.
Fact: Lawn care companies business increased up to 30% in Toronto where cosmetic pesticides have been banned, according to an analysis of the policy.[26] Organic lawn care is a large and growing market with strong demand. Trainings and educational events, which Beyond Pesticides can provide at no cost, assist with the transition. This legislation will incentivize businesses to modernize and transition to practices and products that meet the health and environmental needs of the community.

Myth: Signage requirements at point of purchase place an undue burden on retailers.
Fact: Education at point of sale is a low entry/high reward scenario for public education. Other communities have adopted this approach to community education. In Montgomery County, Maryland for example, a website has been set up to post retailer signage.[27] A wide range of resources are available to meet this requirement.

Myth: Natural and organic land management costs too much.
Fact: Cost concerns of switching from chemical to organic land management are negligible over the long-term. There may be some initial upfront costs for staff training, or the purchase of new material or equipment, but these costs decline significantly as focus shifts to building soil biology, preventing disease and infestation, and contributing to ecological balance, rather than harming nature and all the ecosystem services it provides.. The transition to organic also captures additional external health and environmental costs, resulting from a deficient regulatory process, that are currently borne by the public. Numerous communities and

[26] Cole, D.C.; Vanderlinden, L.; Leah, J.; Whate, R.; Mee, C.; Bienefeld, M.; Wanigaratne, S.; Campbell, M. Municipal bylaw to reduce cosmetic/non-essential pesticide use on household lawns—A policy implementation evaluation. Environ. Health 2011, 10.
[27] Montgomery County. 2020. Department of Environmental Protection: Retail Requirements. https://www.montgomerycountymd.gov/lawns/law/retail-requirements.html.

institutions are making cost-effective transition to organic land care, including nearby Portland and South Portland. Experience across Maryland and the country show organic methods of managing landscapes is able to meet community expectations within the budgets for local governments. (See cost comparison fact sheet for additional resources.[28])

Conclusion: Addressing Public Health, Climate Change, and Biodiversity Decline

The proposed Pesticide and Fertilizer Regulation, under Chapter 11-21, moves the community toward safe organic land management practices at a time when community health and the larger environment is threatened by toxic pesticide use. In addition to protecting the residents of the town and the surrounding ecosystem that Falmouth shares with other communities, town lawmakers, with this legislation, play an instrumental role in advancing a climate action strategy that recognizes the value of soil systems in sequestering atmospheric carbon and by helping to mitigate the devastating decline in biodiversity by eliminating toxic pesticides. Across the board, the regulation is a win-win piece of legislation for community and environmental health.

[28] Beyond Pesticides. 2020. Cost Comparison: Organic vs Chemical Land Management. https://beyondpesticides.org/assets/media/documents/documents/Cost%20Comparison.pdf.

Appendix B. Key Areas of Concern with Toxic Pesticides

Pesticide-Induced Diseases

The scientific literature documents elevated rates of chronic diseases among people exposed to pesticides, with increasing numbers of studies associated with both specific illnesses and a range of illnesses. Beyond Pesticides' Pesticide-Induced Diseases Database[29] documents over 750 studies linked to human health effects. Of which, there are 359 studies on cancer; 107 studies on sexual and reproductive dysfunction; 102 studies on Parkinson's disease; 87 studies on learning and developmental disorders; 33 studies on birth defects; 32 studies on asthma; 18 studies on diabetes; and 12 studies on Alzheimer's disease.

The studies in the database show that our current approach to restricting pesticide use through risk assessment-based mitigation measures is not working. This failed human experiment must be ended. The warnings of those who have expressed concerns about risk assessment, such as U.S. Environmental Protection Agency (EPA) Administrator under Presidents Nixon and Reagan, William Ruckelshaus, have been borne out by three decades of use and study. Mr. Ruckelshaus in 1984 said, "We should remember that risk assessment data can be like the captured spy: If you torture it long enough, it will tell you anything you want to know." EPA's risk assessment fails to look at chemical mixtures, synergistic effects, certain health endpoints (such as endocrine disruption), disproportionate effects to vulnerable population groups, and regular noncompliance with product label directions. These deficiencies contribute to its severe limitations in defining real world poisoning, as captured by epidemiologic studies in the database.

Children's Vulnerability

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.[30] In fact, studies show children's developing organs create "early windows of great vulnerability" during which exposure to pesticides can cause great damage.[31] For example, according to researchers at the University of California-Berkeley School of Public Health, exposure to pesticides while in the womb increases the odds that a child will have attention deficit hyperactivity disorder (ADHD).[32] Likewise, Cincinnati Children's Hospital Medical Center found a strong association between urinary concentrations of pyrethroids, a commonly used lawn care pesticide, and the development of ADHD, primarily in boys (aged 8 to 15). Any concentrations found above the level of detection corresponded to a three-fold increase in the chance of developing ADHD,

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[29] Beyond Pesticides. 2020. Pesticide Induced Diseases Database. http://www.beyondpesticides.org/resources/pesticide-induced-diseases-database/overview.

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

[31] 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.

[32] 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.

when compared to boys without detectable levels.[33]

As EPA points out in its document, *Pesticides and Their Impact on Children: Key Facts and Talking Points*:[34]

- "Due to key differences in physiology and behavior, children are more susceptible to environmental hazards than adults."
- "Children spend more time outdoors on grass, playing fields, and play equipment where pesticides may be present."
- "Children's hand-to-mouth contact is more frequent, exposing them to toxins through ingestion."

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.[35] 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.[36,37] 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.[38] 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.[39]

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.[40]

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[33] Wagner-Schuman, et al. 2015. Association of pyrethroid pesticide exposure with attention-deficit/hyperactivity disorder in a nationally representative sample of U.S. children. Environmental Health 14, 44. https://ehjournal.biomedcentral.com/articles/10.1186/s12940-015-0030-y

[34] See: https://www.epa.gov/sites/production/files/2015-12/documents/pest-impact-hsstaff.pdf.

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

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

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

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

[39] 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.

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

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.[41]

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.[42] 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.[43] Studies also find that pesticides, like 2,4-D, can also pass from mother to child through umbilical cord blood and breast milk.[44,45]

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.[46] In one study, children in areas where glyphosate is routinely applied were found to have detectable concentrations in their urine.[47] 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.[48]

Pesticides and Pets

Studies find that dogs exposed to herbicide-treated lawns and gardens can double their chance of developing canine lymphoma (1) and may increase the risk of bladder cancer in certain breeds by four to seven times (2).

(1) Scottish Terriers exposed to pesticide-treated lawns and gardens are more likely to develop transitional cell carcinoma of the bladder, a type of cancer.[49]

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

[42] 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.

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

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

[45] 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.

[46] 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.

[47] 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.

[48] 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.

[49] Hayes, H. et al., 1991. “Case-control study of canine malignant lymphoma: positive association with dog owner’s use of 2,4-D acid herbicides,” Journal of the National Cancer Institute, 83(17):1226.

(2) “Statistically significant” increase in the risk of canine malignant lymphoma in dogs when exposed to herbicides, particularly 2,4-D, commonly used on lawns and in “weed and feed” products.[50]

Adverse Effects to Wildlife

While the data is pouring in on intersex species in waterways that surround urban and suburban areas and there are certainly a mix of factors, the contribution of runoff from suburban landscapes are seen as an important contributor. In *Suburbanization, estrogen contamination, and sex ratio in wild amphibian populations,* the authors from Yale University’s School of Forestry and Environmental Studies and the U.S. Geological Survey (USGS) find the following: “While there is evidence that such endocrine disruption can result from the application of agricultural pesticides and through exposure to wastewater effluent, we have identified a diversity of endocrine disrupting chemicals within suburban neighborhoods. Sampling populations of a local frog species, we found a strong association between the degree of landscape development and frog offspring sex ratio. Our study points to rarely studied contamination sources, like vegetation landscaping and impervious surface runoff, that may be associated with endocrine disruption environments around suburban homes.”[51]

[50] Glickman, Lawrence, et al. 2004. "Herbicide exposure and the risk of transitional cell carcinoma of the urinary bladder in Scottish Terriers," Journal of the American Veterinary Medical Association 224(8):1290-1297.

[51] Lambert, M.R., Giller, G.S.J., Barber, L.B., Fitzgerald, K.C., Skelly, D.K., 2015. Suburbanization, estrogen contamination, and sex ratio in wild amphibian populations. Proc. Natl. Acad. Sci. 112, 11881e11886.

Appendix C. The Failure of EPA's 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, and supports action to 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,*[52] 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 organophosphate insecticide, which is associated with numerous adverse health effects, including reproductive and neurotoxic effects, had its residential uses canceled in 2001. 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.[53] 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

[52] 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.
[53] Environmental Protection Agency. June 2012. Imprelis and Investigation of Damage to Trees. http://www.epa.gov/pesticides/regulating/imprelis.html.

therefore granting the conditional registration."[54]

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,[55] creosols, chemicals listed as hazardous waste under Superfund regulations and considered possible human carcinogens by EPA,[56] 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*,[57] 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 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.

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,

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[54] 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.

[55] 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.

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

[57] 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*.

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,[58] learning disabilities,[59] or behavioral disorders,[60] this information is not disclosed on the label. Furthermore, data gaps for certain health endpoints are also not disclosed.

Mixtures and Synergism. 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 study by Warren Porter, PhD., professor of zoology and environmental toxicology at the University of Wisconsin, Madison, examined the effect of fetal exposures to a mixture of 2,4-D, mecoprop, and dicamba exposure —frequently used together in lawn products like Weed B Gone Max and Trillion— on the mother's ability to successfully bring young to birth and weaning.[61] A 2011 study, entitled *Additivity of pyrethroid actions on sodium influx in cerebrocotorial neurons in primary culture,*[62] 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*.[63] 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.

Research by Tyrone Hayes, PhD, professor of integrative biology at UC Berkeley has compared the impact of exposure to realistic combinations of small concentrations of pesticides on frogs, finding that frog tadpoles exposed to mixtures of pesticides took longer to metamorphose to adults and were smaller at metamorphosis than those exposed to single pesticides, with consequences for frog survival. The study revealed that "estimating ecological risk and the impact of pesticides on amphibians using studies that examine only single pesticides at high concentrations may lead to gross underestimations of the role of pesticides in amphibian declines."[64]

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

[59] 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.

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

[61] Cavieres MF, Jaeger J, Porter W. Developmental toxicity of a commercial herbicide mixture in mice: I. Effects on embryo implantation and litter size. Environmental Health Perspectives. 2002;110(11):1081-1085.

[62] 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/.*

[63] 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.

[64] Hayes TB, Case P, Chui S, et al. Pesticide Mixtures, Endocrine Disruption, and Amphibian Declines: Are We Underestimating the Impact? *Environmental Health Perspectives*. 2006;114(Suppl 1):40-50. doi:10.1289/ehp.8051.

Appendix D. Benefits of Organic Management

Incentivizing a Systems Approach that Eliminates the Need for Toxic Pesticides

By limiting the use of pesticides linked to adverse health and environmental outcomes, local pesticide ordinances can incentivize land managers to transition to practices that have been shown to maintain turf expectations with *de minimis* financial implications. While conventional, chemical-intensive turf and landscape management programs are generally centered on a synthetic product approach that continually treats the symptoms of turf problems with toxic chemicals, the alternative, systems-based approach focuses on the root causes of pest problems, which lie in the soil. These cutting edge land management techniques reveal that toxic pesticides are not needed for successful turf management. Rather, this approach incorporates preventive steps based on supporting soil biology to improve soil fertility and turf grass health, natural or organic products based on a soil analysis that determines need, and specific cultural practices, including mowing height, aeration, dethatching, and over-seeding.

Research from the University of Maryland finds that proper mowing height alone can reduce weed and diseases by 50 to 80% in fescue grass.[65] In the case of mowing high, the natural system supported by this practice is an increase in the root depth of grass. Deeper roots provide greater capacity for the grass to draw water and nutrients from the soil, and stronger grass plants are better able to crowd out weeds or slough off pest pressure. Thus, the practices incorporated as part of a systems approach build resiliency, a term used to describe the ability for an environment to bounce back to its previous state after a disturbance. By fostering healthy soil biology, this approach leads to less need for outside inputs, such as synthetic pesticides and fertilizers. And when properly maintained, lawns and playing fields cared for in this way meet the same expectations of conventional, chemically managed turf.

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

Although there is often significant discussion over the expense of transitioning to an organic land care program, the 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. This is because chemical-intensive turf and landscape management programs are generally centered on an approach reliant on costly synthetic products that continually treat symptoms with toxic chemicals, rather than focus on the root causes of pest problems, which lie in the soil. Experience finds that an organic systems approach will 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.

In considering cost, local governments should reflect on the externalities associated with pesticide use, including its effect to reduce the risk of exposure to carcinogens, prevent the contamination of groundwater and surface water, and the poisoning 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. An organic land care program is not only

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[65] University of Maryland. 2016. Mowing/Grasscycling.. https://extension.umd.edu/hgic/mowinggrasscycling-lawns.

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.

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

- There is report produced by nationally renowned turfgrass expert and Beyond Pesticides' board member Chip Osborne 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.[66]
- There is also the 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,[67] 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. [68]
- 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, 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."[69]
- The experience in South Miami, FL may also be instructive. The city completed a two-year pilot program that limited toxic pesticide use only to organic certified products, the city codified the practice into law. memorandum codifying these practices into law. A memo by the city describes the success of this approach regarding cost. It reads,"Thus-far this initiative has been a qualified success, allowing the city to cut down on its waste-footprint significantly at relatively little expense, and providing a model for other local government to use as guidance."[70]
- One year after passing and implementing an organic landscape management policy, the City of Irvine California's fields look "as pristine as ever," according to the Orange

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[66] 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

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

[68] 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.

[69] 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.

[70] City of South Miami. 2019. City Commission Agenda Item Report: Inter-office Memorandum. https://beyondpesticides.org/assets/media/documents/SouthMiami_FL_Organicordinance.pdf.

> County Register.[71] It notes further, "Weeding by hand and using organic pesticides, which must be applied more frequently, will increase costs by about 5.6 percent in a $21.2 million landscaping budget, according to a city report on implementation of the program."

While a decade ago the natural systems approach required slightly increased up-front costs and saw savings in the long run, technology and practices have now progressed to the point where parity can often be achieved from the outset.

[71] Perkes, Courtney. 2017. Irvine Little League mom leads charge to wipe out pesticides on ball fields nationwide. Orange County Register. http://www.ocregister.com/2017/05/24/irvine-group-working-to-get-pesticides-off-city-baseball-fields-nationwide/.

40 Common Lawn and Landscape Chemicals

Pesticides for aesthetic purposes are widely used on lawns, landscapes, parks, playing fields, and open space by the general public, city/town/county gov- ernments, and commercial companies. Many of these chemicals harm health and the environment with both immediate and long-term effects. The "40 Most Commonly Used Lawn and Landscape Pesticides" factsheets make the science on pesticide hazardous to people, pets, and the environment accessible and easy to understand. When used with information on organic land management practices (see Lawns and Landscape webpage and ManageSafe), land managers can adopt a healthy approach to lawn and land- scape care.

Using the Tables

Empty cells in the factsheets may refer to either (i) insufficient data or (ii) a determination, based on currently available data, that the chemical is relatively nontoxic. The key following the chart includes information on how to interpret the categorization of specific compounds. The analysis supporting the adverse health and environmental effects identified in the factsheets are based on toxicity determinations in government reviews and university studies and databases. More in-depth information on the specific chemicals is available on the Gateway on Pesticide Hazards and Safe Pest Management. The factsheets and Gateway are organized by active ingredients in pesticides products (trade names; for example, glyphosate is the active ingredient in the product Roundup™), so identify the active ingredients in the product(s) of concern by searching the web for the product label or company information and then find that active ingredient in the factsheets or the Gateway.

Chemical Exposure and Underlying Conditions

Acute and chronic exposure to chemicals like pesticides can cause a range of harmful effects. Even use in accordance with the pesticide product label directions can cause or promote:

- Cancer
- Neurotoxicity/Developmental and Learning Disabilities
- Reproductive and Birth Defects
- Respiratory Illnesses
- Endocrine/Immune Disruption
- Skin irritation/headaches/disorientation

Additionally, exposure to these toxic pesticides can weaken the body's immune response to illnesses and initiate or promote underlying conditions and vulnerabilities—like respiratory issues such as asthma or endocrine disruption problems like diabetes.

The onset of the coronavirus pandemic in late 2019 further demonstrates (in even more jarring form) the harsh reality of pesticide exposure—as we learn that those with comorbidities are more vulnerable to the virus, resulting in disproportionate impact in essential workers and those with underlying conditions. With COVID-19 plaguing global health, it is especially important to eliminate exposure to toxic chemicals that pose the same health hazard or elevate pre-existing health conditions. Most pesticides (including disinfectants), similar to COVID-19, act on the respiratory system, exacerbating adverse inflammatory responses, and impair the immune and nervous systems. Therefore, a serious cumulative and in some cases synergistic effect may occur between the disease and toxic chemicals, worsening disease outcomes. (See Beyond Pesticides' webpage on Safer Disinfectants and Sanitizers, Pesticide-Induced Diseases Database, and Gateway on Pesticide Hazards and Safe Pest Management.)

Organic Land Management

While chemical land management focuses on treating problems caused by conventional management practices and chemical use, the organic approach is a preventive system that addresses root causes. In this context, unwanted organisms (pests, including insects and weeds) are the symptoms of a problem caused by poor soil health and management practices.

The key to a healthy lawn is healthy soil and proper mowing, watering, fertilizing and other cultural practices. Healthy soil contains high organic content and is teeming with biological life. Healthy soil supports the development of healthy and resilient turf and landscapes that naturally manage weeds, insects, and fungal diseases.

Furthermore, organic land management represents an economically viable approach for individual homeowners, landscapers, local parks departments, and school districts committed to the adoption of practices that protect health and the environment. (See Beyond Pesticides' Cost Comparison Document.)

HEALTH EFFECTS OF 40 COMMONLY USED LAWN 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]
Atrazine¥	X[9]	X[6]	X[8]	X[11]	X[11]	X[11]	X[8]
Benfluralin	X[1]	X[1]			X[1]	X[1]	
Bensulide				X[2]	X[1]	X[2]	
Clopyralid			X[7]			X[7]	X[7]
Dicamba*	Possible[15]		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]	X[7]
Imazapyr	Suggestive[7,8]				X[7]	X[2]	
Isoxaben	X[3]				X[2]		Possible[21]
MCPA	Possible[3]	X[6]	X[2]	X[2]	X[11]	X[1]	
Mecoprop (MCPP)*	Possible[3]	X[6]	X[2]	X[1]	X[9]	X[1]	X[1]
Oxadiazon	X[3]	X[1]	X[1]	Possible[22]	X[1]		X[1]
Oxyfluorfen	X[3]		X[11]		X[11]	X[11]	X[11]
Pendimethalin*	Possible[3]		X[1]		X[9]	X[2]	X[2]
Prodiamine	X[1]	Suggestive[1]	Possible[16]	X[1]			Possible[16]
Sulfentrazone			X[13]	Possible[13]		X[13]	X[13]
Triclopyr			X[7]		X[9]	X[1]	X[7]
Trifluralin	Possible[3]	X[9]	X[1]	X[23]	X[2]	X[1]	
Insecticides							
Abamectin/Avermectin B1			X[11]	X[11]			X[9]
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]
Cyfluthrin†		Possible[17]	X[9]	X[9]	X[9]	X[9]	
Deltamethrin†		X[10]		X[8]		X[9]	
Fipronil	Possible[3]	X[6]	X[8]	X[8]	X[8]	X[8]	
Imidacloprid ‡		X[6]	X[7]	Possible[18]	X[2]		X[7]
Malathion*	Probable[12]	X[10]	X[11]	X[9]	X[2]	X[2]	X[2]
Permethrin*†	X[3]	Suspected[6,10]	X[1,7]	X[7,9]	X[9]	X[1]	
Trichlorfon	X[3]	X[6]	X[11]	X[2]	X[2]	X[11]	X[2]
Fungicides							
Azoxystrobin					X[2]	X[2]	
Chlorothalonil	X[3]		X[7]	X[14]	X[9]	X[1]	
Metalaxyl	Possible[20]	Possible[20]			X[9]	X[1]	
Myclobutanil		Probable[6]	X[2]		X[2]		
Propiconazole	Possible[3]	X[6]	X[2]		X[1]	X[1]	
Sulfur β						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	21	24	28	39	33	18	Totals

Please see following page for notes, key, description, and citations.

HEALTH EFFECTS OF 40 COMMONLY USED LAWN PESTICIDES

Key

- * These pesticides are among the top 10 most heavily used pesticides in the home and garden sector from 2008–2012, according to the latest sales and usage data available from EPA (2017), available at https://www.epa.gov/sites/default/files/2017-01/documents/pesticides-industry-sales-usage-2016_0.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.
- ¥ Atrazine has residential uses in Southeast United States.
- ß Least Toxic

Suggestive = Suspected

Description

This chart bases most toxicity determination on interpretations and conclusions of studies by university, government, or organization databases that classify chemical compounds and supports the strongest evidence. However, there is a body of scientific literature which aims to resolve discrepancies in health effects through the Beyond Pesticides' Gateway on Pesticide Hazards and Safe Pest Management. 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 40 commonly used lawn chemicals is based on informa-tion 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, including peer-reviewed studies not incorporated in this document, 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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ENVIRONMENTAL EFFECTS OF 40 COMMONLY USED LAWN PESTICIDES

	Environmental Effects					
	Detected in Groundwater	Potential Leacher	Toxic to Birds	Toxic to Fish/ Aquatic Organisms	Toxic to Bees	Toxic to Mammals
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]
Atrazine¥	X[1]	X[1]	Possible[10]	X[1]		
Benfluralin	X[7]		X[3,11]	X[3,11]	X[5,11]	
Bensulide			X[3]	X[3]	X[3]	
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]
Oxadiazon			Possible[3]	X[3]	Possible[3]	
Oxyfluorfen				X[1]		Possible[3]
Pendimethalin*	X[3,7]		X[1,3,11]	X[1,3,11]	X[5,11]	X[3]
Prodiamine		X[3]		X[3]		
Sulfentrazone			Possible[3]	X[13]		X[3]α
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						
Abamectin/ Avermectin B1				X[1,3]	X[1,3]	X[3]
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]
Cyfluthrin†			Possible[14]	X[1]	X[1]	
Deltamethrin†				X[1]	X[1]	
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[9]	X[3,4,11]	X[11]	X[3,11]	X[11]	
Chlorothalonil	X[2]	X[1]	X[3]	X[1]		Possible[3]α
Metalaxyl			Possible[14]			
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	21	24	28	39	33	18

Please see following page for notes, key, description, and citations.

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

// Based on in-vitro mammalian cell study.

α Dietary Exposure

¥ Atrazine has residential uses in Southeast United States.

ß Least Toxic

Description

This chart bases most toxicity determination on interpretations and conclusions of studies by university, government, or organization databases that classify chemical compounds and supports the strongest evidence. However, there is a body of scientific literature which aims to resolve discrepancies in health effects through the Beyond Pesticides' Gateway on Pesticide Hazards and Safe Pest Management. 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 40 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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Cost Comparison

Organic Vs Chemical Land Management

SYMPTOM

Dandelions

CAUSE

Compacted soil
Low pH
Nutrient Imbalance

An organic approach corrects nutrient and pH per a soil test and focuses on soil aeration.

A chemical approach focuses on killing the weed. However, this is only a short-term solution.

Unless the reason why dandelions are in the turf is addressed, chemical land managers will more likely than not be back next season to spray again.

The organic approach saves money on material inputs like pesticides, by providing long-term solutions.

DIFFERENTIATING TWO APPROACHES

While chemical land management focuses on treating symptoms, the organic approach is a preventive approach that addresses root causes. In this context, unwanted organisms (pests, including insects and weeds) are the symptoms of a problem caused by poor soil health.

Organic land management emphasizes managing weeds and insects through the building of soil conditions and employing cultural practices, such as aeration, overseeding, dethatching, and proper mowing and watering. Nutrients are cycled naturally and, if determined to be necessary by a soil test, soil amendments are used to feed biological life in the soil, which in turn feeds the plant.

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With the **chemical approach**, focus is placed on using synthetic, petrochemical pesticides and fertilizers that adversely affect life in the soil. These chemicals are typically applied based on a calendar date, or by a "see and spray" approach to weed and insect management. Soil tests and cultural practices are not prioritized.

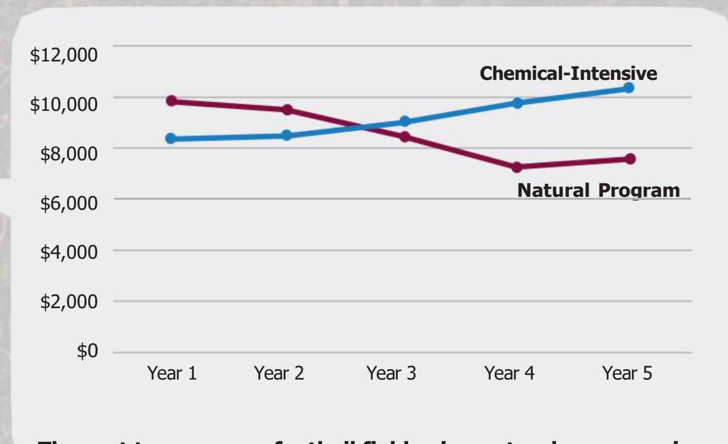
CHEMICAL-INTENSIVE	ORGANIC
• Treats **symptoms**; "see and spray," ignore underlying conditions that contribute to pest issue.	• Addresses **root causes**; focus on **soil health** through testing and analysis.
• Pesticides and fertilizers are fossil fuel-based **synthetics** that are harmful to to soil biology and biodiversity.	• Uses **naturally derived** fertilizers and pesticides with a systems-based approach, nurturing soil biology and biodiversity.
• Does **not** often focus on cultural practices.	• Prioritizes **cultural practices** for turf management, such as aeration, overseeding, dethatching, and proper watering.

ORGANIC SAVES OVER TIME

Healthy soil reduces the need for expensive outside inputs

COST COMPARISONS

A report from the non-profit Grassroots environmental education and organic turf expert Chip Osborne, with Osborne Organics, concludes that, once established, ***an organic turf management approach results in savings greater than 25% over chemical management.***[1] While initial expenditures over the first two years may be slightly higher, ***costs decrease as soil biology improves.*** healthy soil reduces the need for expensive outside inputs.



The cost to manage a football field using natural programs is less expensive than chemical-intensive programs over time.

Harvard University's experience with the organic approach on its campus found similar results. There were initial costs required to train staff, purchase equipment, and improve soil health, but at ***maturity costs are now expected to stay the same as its previous chemical-based program.***[2]

Connecticut's Department of Energy and Environmental Protection (encourages residents to maintain landscapes with organic practices. They note, "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 less money. Once established, an organic lawn uses less water and fertilizers, and requires less labor for mowing and maintenance.***"[3]

Healthy soil has a rich diversity of microbial life. Feed the soil, not the plant for long-lasting, resilient ecosystems!

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ORGANIC TRENDS ARE EMERGING NATIONWIDE

In 2019, the City of South Miami completed a two-year pilot program that required city staff and contractors to follow practices intended to eliminate toxic pesticide use, and limited inputs only to organic-certified products. A city memorandum codifying these practices into law describes the success of this approach regarding cost. It reads, "Thus-far, this initiative has been a qualified success, allowing the city to cut down on its waste-footprint significantly at relatively little expense, and providing a model for other local government to use as guidance."[4]

[1] Osborne, Charles and Wood, Doug. 2010. A cost comparison of Conventional (Chemical) Turf Management and Natural (Organic) Turf Management for School Athletic Fields. *http://www.grassrootsinfo.org/pdf/turfcomparisonreport.pdf*.

[2] Harvard Facilities Operations Maintenance. 2009. Harvard Yard Soils Restoration Project—Summary Report. See slide 26. *http://www.treewiseorganics.com/HarvardYardProject2-25-09.pdf*.

[3] Connecticut Department of Energy and Environmental Protection. 2019. Organic Lawn Care: Your neighbors will "go green" with envy! *https://www.ct.gov/deep/cwp/view.asp?a=2708&q=382644#Expensive*.

[4] Alexander, Steven: City Manager. 2019. City of South Miami Inter-Office Memorandum. *https://beyondpesticides.org/assets/media/documents/SouthMiami_FL_Organicordinance.pdf*.

CONSIDERING EXTERNALITIES

There are costs from the chemical approach not captured by the shelf price of a pesticide bottle or bag of synthetic fertilizer. While chemical manufacturers profit, the public pays a steep price through increased health care expenditures and the need to clean up environmental contamination.

A 2016 literature review determined **the health costs from pesticide use in the U.S. to be $15 billion annually**. The most significant cost is death due to chronic pesticide exposure, such as fatal outcomes after contracting cancer.[5] The authors indicate that **environmental costs of pesticide use total roughly $8 billion**, but that is likely an underestimate due to the difficulty in pricing ecosystem services (economic value of nature, such as pollination and nutrient cycling) and obtaining accurate data on wildlife mortality.[6]

A study from Seattle Public Utilities determined that, by moving toward natural and organic practices, some of these external costs can be recouped. Households switching from synthetic to natural practices generate roughly $75 in ongoing public health, ecological, water conservation, and hazardous waste management benefits each year.[7] Cost savings came primarily from reducing the use of chemical pesticides and fertilizers and the need for irrigation.[8]

$15
BILLION
The health costs of pesticides

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CONCLUSION: ORGANIC IS WORTH IT

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Cost concerns of switching from chemical to organic land management should be considered negligible over the long-term. There may be some initial upfront costs for staff training, or the purchase of new material or equipment, but these costs decline significantly as focus shifts to root causes and soil health improves. The transition to organic also captures additional external health and environmental costs that are currently borne by the public at-large.

Organic land management represents an economically viable approach for individual homeowners, landscapers, local parks departments, and school districts willing to commit to the change in practices organic land management entails.

[5] Bourguet, Denis and Guillemaud, Thomas. 2016. The Hidden and External Costs of Pesticide Use. *Sustainable Agriculture Reviews*. Vol 19, pp 35-120. *https://link.springer.com/chapter/10.1007/978-3-319-26777-7_2*.

[6] Ibid.

[7] Morris, Jeffery and Bagby, Jennifer. 2008. Measuring environmental value for Natural Lawn and Garden Care practices. *The International Journal of Lifecycle Assessment*. Vol 13, Issue 3, pp226–234. *https://link.springer.com/article/10.1065/lca2007.07.350*.

[8] Ibid.