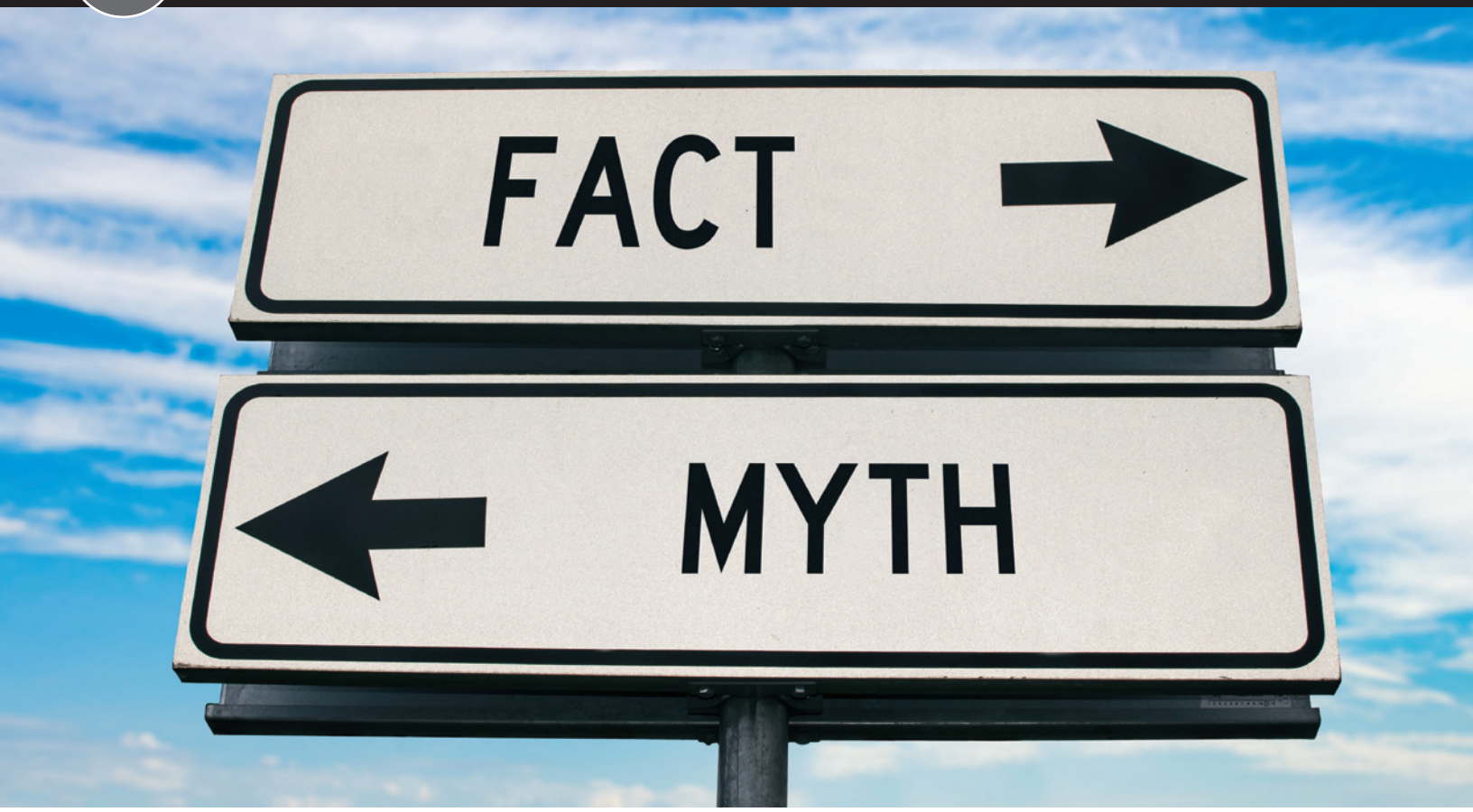

Research Shatters Myth of Pesticide Benefits

DOCUMENTING UNREASONABLE RISKS: SUSTAINABLE ALTERNATIVES

The presumption that pesticides have benefits is not independently evaluated by the U.S. Environmental Protection Agency (EPA). Instead, the agency assumes that pesticide users would not buy pesticides if they did not perform as intended. How can the agency determine that a pesticide's risks are reasonable under federal law without evaluating chemical efficacy, especially after pest resistance appears, or as new products and practices emerge on the market that present no or a much-reduced hazard? Moreover, because farmers know that, if their pesticide fails, they will be allowed to use another pesticide not currently registered for use on their crop under an emergency exemption, the agency disincentivizes the adoption of alternative practices and products.

When determining the economic benefit of pesticides, the true cost of pesticide use must be a part of the overall benefit calculation. However, many of these costs are not borne by the pesticide user, but by society or taxpayers who pay for cleanup, lost ecosystem services such as pollinators, water purification, and the cost of fighting climate-induced fires and flooding. A study in this section "connects financial outcomes with ecological, human, and socio-economic well-being." The authors, in their study *A Tale of Two Food Chains*, say that in the conventional food supply chains "the many hidden costs are cumulative and have broad

deleterious consequences; however, in the regenerative, organic food value chains, pollution is shunned and "taxed," and sustainability, as a public good, is rewarded by sequestering greenhouse gas emissions and maintaining biodiversity, living soil, as well as clean air and water."

The most heralded chemical-intensive practice that is often characterized as a pesticide-reduction strategy, Integrated Pest Management (IPM), was studied, with authors concluding that it has not achieved its goals, including a significant reduction of synthetic pesticide use, and health, environmental, and ecosystemic benefits. The research team, all of whom have worked as IPM scientists and proponents, conclude that IPM has "lost its way over the decades—moving from ecological and health concerns as primary to its current state in which (usually chemical) control methods are central."

Pesticide dependency has real costs, as discussed in a paper by the French-based Bureau for the Appraisal of Social Impacts, which writes: "While the profits of [the agricultural] sector are becoming increasingly concentrated in the hands of a few multinationals, society faces a considerable bill to pay each year to cover the costs linked to pesticide use. But even those amounts will not be able to repair the irreversible damage caused to humans and the environment. In contrast, the varied agroecological models have proven to be more sustainable. While transition to these also requires investments, the latter will be smaller and above all more sustainable." The Rockefeller Foundation in its report, *The True Cost of Food,* says, "The sum of all the externalized costs that are not covered in the price of food was roughly $2.1 trillion." [2019]

Working with nature and deriving the benefits as ecosystem services is well-researched. While institutions teach the pesticide "toolbox" and regulators accept this as conventional wisdom, numerous studies are reaching similar conclusions to the ones covered in this section, in which researchers find that a diverse population of fungi in soils is highly likely to be effective in managing nematodes that may threaten crops—thus eliminating among the most toxic fumigants and chemicals known to humankind.

Eliminating Pesticides Increases Crop Yields, Debunking Myth of Pesticide Benefits

FEBRUARY 12, 2021 | Being many decades down the path of chemical-intensive agriculture, growers and other land managers (and all the industries that influence them) have come largely to ignore the efficacy of healthy, functioning natural systems to maintain ecological equilibrium, i.e., not letting any one pest or disease proliferate. Recent research points to an example of such ecosystem efficacy. The study, by researchers in California and China, sought to evaluate whether increased population densities of fungi might be suppressing nematode populations in California production fields frequently planted with the cole crops (such as brussels sprouts and broccoli) they favor. The research finds that a diverse population of fungi in soils is highly likely to be effectively killing nematodes that threaten such crops.

Thirty years ago, these nematodes were dealt with by application of soil fumigants and nematicides, because at sufficient population levels, the nematodes can destroy cole crops. During the following three decades, state-mandated monitoring showed that use of those chemical controls was diminishing and, by 2014, had been

eliminated—even as yields rose. The coauthors point out that it is California's relatively robust pesticide-use reporting program that surfaced information on the amounts of fumigants and nematicides used to control cyst nematodes since the early 1990s. The plummeting use of these compounds during that period suggested to the scientists a decline in nematode disease pressure and prompted them to investigate why this unusual trajectory was happening. The study evaluated nematode populations in 152 crop fields in 2016, finding that 62% of the soils harbored no detectable cyst nematodes, and only a few samples reached populations sufficient to cause any crop damage. The researchers used cyst nematodes as bait and determined that broadly present hyperparasitic fungi were likely biologically suppressing the nematodes below a damaging level. [Chen, Ying-Yu et al. Detection of Nematophagous Fungi from Heterodera schachtii Females Using a Baiting Experiment with Soils Cropped to Brassica Species from California's Central Coast. *PhytoFrontiers*. 1:4-12, 2021.]

Report Finds True Cost of Food in 2019 Was $2.1 Trillion in Adverse Health, Environmental, and Other Effects

JULY 23, 2021 | The Rockefeller Foundation report, *True Cost of Food: Measuring What Matters to Transform the U.S. Food System*, identifies the real-but-under-recognized downsides of the U.S. food system. The report notes that, for all its reputed bounty, the food system "comes with hidden costs—to our health, to our climate," and to the many people who make sure that food reaches the population. According to the report, "The sum of all the externalized costs that are not covered in the price of food was roughly $2.1 trillion. [2019]" The report calls for a true accounting of the costs of food in the U.S. Beyond Pesticides welcomes the broad framework of the report, but notes that a true accounting would necessarily include the costs of the externalities of conventional agriculture, including those related to pesticides: the costs of pollution and its cleanup (when that even happens), of lost pollination and biodiversity, of lost productivity from illness, and of health care costs related to pesticide use. Remarkably, for all its repetition of deleterious impacts on climate, biodiversity, and health, the report barely mentions either pesticides' roles in causing such impacts, or the clear solution to so many of the negatives in the food system—organic, regenerative agriculture. The report's economic analysis applies a true cost accounting (TCA) framework to assessing the real costs and impacts of the current system. It asserts, "Our food system is failing us, and too few people understand the true cost of the food we consume, and lack clear incentives to change a system that is costing us dearly. That's why accounting for the true cost of the food we eat is the first, necessary step towards remaking the incentive structure that drives our food system today."

The report identifies primary areas impacted by food production and consumption: environment, human health, biodiversity, livelihoods, and the economy. By its own admission, the report's analysis focuses only on primary impacts of the food system; thus, it did not include downstream impacts, such as secondary impacts on the environment, national security, or educational outcomes (due to nutrition insecurity). It also sought to explore the impacts of both animal welfare and resilience, and to examine ways in which equity issues impact true costs. The report says that communities of color bear disproportionately the costs of the food system, particularly in health outcomes related to pollution, nutrition insecurity, and environmental injustices. It notes that black and brown Americans, who work disproportionately in the food system, shoulder greater proportional burdens related to exposures to pesticides and synthetic fertilizers, and bear greater economic impacts related to livelihoods (e.g., lower typical wages than for white Americans), as well as discriminatory impacts of agricultural subsidies. [The Rockefeller Foundation. True Cost of Food: Measuring What Matters to Transform the U.S. Food System. July 2021.]

Study Underscores Chemical-Intensive Farming Hazards and Need To Shift to Regenerative Organic Models

AUGUST 31, 2021 | To ensure long-term ecological, human health, and socioeconomic benefits, food production, distribution and consumption must transition from conventional to regenerative, organic food value chains, as outlined in research published in *Productions and Operations Management*. "We are paying a high price for a lack of transparency in our food supply and realize that taking shortcuts, or efficiencies, is not sustainable," said Aleda Roth, PhD, study coauthor and professor in the Wilbur O. and Ann Powers College of Business at Clemson University.

"We need to look at multiple performance outcomes, and in doing so, it will become evident that a regenerative, socially responsible approach to agriculture is imperative to a sustainable food supply, but it also extends across other business sectors." This research is the latest to underscore the importance of revamping the U.S. food system toward a focus on organic practices that account for externalities and provide multiple add-on benefits for society at large.

To make the case, Dr. Roth and her coauthor Yanchong Zheng, PhD, an associate professor in the Sloan School of Management at MIT, define and contrast conventional and regenerative, organic food value chains, with an eye toward "quadruple aim performance (QAP)." This is defined as a supply chain outcome that synergizes positive financial results with benefits to human, ecological and socioeconomic well-being. A range of deleterious "upstream" production practices are identified within each QAP component. To begin, the authors make the case that "squeezing market prices and rising expenses" within conventional chemical agriculture are causing significant financial strain on most farmers. The data show that the wealthy top 1% of farmers accepted nearly $2 million in federal subsidies on average while the bottom 80% garnered an average of only $8,000. Genetically engineered crops are singled out for their poor financial record with farmers, noting that patent holders, not farmers, own GE seeds, and must repurchase them every year, putting most farmers in a "financial straight jacket." Further, farmers that develop a pesticide-induced disease after growing pesticide-tolerant GE crops are unlikely to find quick financial restitution and thus are likely to suffer lost income, increased health care costs, and other expenses.

In outlining the human and ecological impacts of conventional chemical food production, Rachael Carson is used to frame the discussion, highlighting the prophetic nature of her work and the frustrating reality that the situation today is in many ways worse than in Ms. Carson's era. Excessive use of nitrogen fertilizers and significant release of greenhouse gasses, the rampant poisoning of the earth through toxic pesticide use, contributing to a worldwide insect decline are cited as evidence that, "Time is running out, as we cannot escape the accelerated rate and magnitude of conventional farming on the destruction of our planet's natural ecosystem." It is noted that the discussion around pesticide impacts in conventional agriculture pit federal regulators and the chemical industry against public health scientists and the nonprofit sector. Federal regulators are cited for allowing a range of pesticides restricted in other countries, as well as chemicals like glyphosate, putting human health at increased risk. [Roth, Aleda and Zheng, Yanchong. A Tale of Two Food Chains: The Duality of Practices on Well-being. *Production and Operations Management*. November 2020.]

IPM (Integrated Pest Management) Fails To Stop Toxic Pesticide Use

OCTOBER 15, 2021 | Integrated Pest Management (IPM) is a 60-year-old approach to agricultural practice that, when first conceived and implemented, had among its goals a significant reduction of synthetic pesticide use, and the health, environmental, and ecosystemic benefits that would flow from that. However, as a study published in *Agronomy for Sustainable Development* concludes, IPM has overall been unsuccessful in achieving those goals. The researchers propose to replace IPM with "Agroecological Crop Protection [ACP]," the application of agroecology to protecting crops from damage (usually by insects or weeds). Beyond Pesticides has long embraced the foundations of ACP, which focus on cooperation with natural systems that keep all organisms in healthy, dynamic balance (and avoid overpopulation and trophic cascades). The research was conducted by scientists from France, Cambodia, and Vietnam.

The authors offer myriad reasons for their conclusion that, "More than half a century after its conception, IPM has not been adopted to a satisfactory extent and has largely failed to deliver on its promise.... Despite six decades of good intentions, harsh realities need to be faced for the future.... IPM has arguably reached its limits." The research team, all of whom have worked as IPM scientists and proponents, seems to mourn that IPM has "lost its way" over the decades —moving from ecological and health concerns as primary to its current state, in which (usually chemical) control methods are central. They note, "In cases where the concept of ecology is used in IPM, environmentalism is referenced more often than ecology, i.e., the aim to reduce negative environmental impacts, rather than using ecological processes to replace chemical pesticides."

The explanations for IPM's failure to be adopted effectively and to achieve its goals, as yielded by their research, include: (1) the plethora of definitions of IPM has meant confusion and varying interpretations of the concept by practitioners; (2) there have been inconsistencies between IPM concepts and practices, and public policies; (3) commonly, there is a lack of basic understanding by farmers of the ecological concepts behind IPM; (4) in many IPM programs, chemical controls remain a cornerstone, and that use as a "last resort" is rarely adopted by farmers; (5) IPM research has been paltry, both in scientific and programmatic realms; and (6) "ecology" has been inadequately

prioritized in IPM. Other factors contributing to IPM's poor record include termination of programs that trained, supported, and guided practitioners; industry meddling; farmer perception of IPM as risky (and therefore not adopting it and/or returning to intensive chemical inputs); lack of effective decision thresholds established for specific crops in specific geographic and pest contexts, and; shifting political realities. Overall, once supportive training and funding disappears, the authors assert, pesticide use again surges. The researchers also write, "In settings with resource-poor smallholders, subsistence farming systems, no organic certification schemes, or lagging demand for high-value commodities, the availability of cheap pesticides hinders adoption of IPM."

There have been some successes with IPM, such as Southeast Asian farmer training programs yielding a 92% pesticide reduction in rice production in Bangladesh, and a 50–70% reduction in tea and cabbage in Vietnam (in the early 2000s). In 2014, research showed that in 500+ IPM programs across the globe, 13% increases in crop yields and 19% increases in farm profits were realized. Although many years ago, Beyond Pesticides was prepared to consider IPM a tool in the kit bag of reducing pesticide use, even then it recognized the problem of "varied [IPM] definitions and policies . . . numerous perspectives, and critical disagreements among public health and environmental advocates, regulators, and the pesticide and pest management industry." But currently, given what the study authors call "a quasi-infinite number of definitions and interpretations" of IPM, this absence of any standardized definition for IPM means that in the U.S., *any* registered pesticide can be used and the management system can still be considered "IPM."

Organic agriculture, on the other hand, operates within the codified organic regulations of the National Organic Program (NOP), is bound by a plan and the National List of Allowed and Prohibited Substances, and is subject to inspection to ensure compliance with NOP standards. Beyond Pesticides understood years ago, and continues to maintain, that organic land management and agriculture are the solution to the agrochemically induced crises—in health, in ecosystem degradation, in biodiversity loss and potential pollinator collapse, in depleted soils, and in water, air, and soil pollution, among others. [Deguine, Jean-Philippe et al. Integrated pest management: good intentions, hard realities. A review. *Agronomy for Sustainable Development.* 41(38), 2021.]

The Expense of Pesticides Significantly Outweighs Economic Benefits

DECEMBER 9, 2021 | The cost to maintain crops using conventional pesticides outweighs the economic benefits from crop production and yield, according to a report, which concludes that pesticides "cost double the amount they yield," by the French-based organization Bureau for the Appraisal of Social Impacts for Citizen Information (BASIC). Moreover, the annual cost of increasing organic farms three-fold by 2030 is less than the cost of pesticides to society (i.e., adverse health and ecological effects from pesticide use and contamination). However, the price to pay from pesticide use encompasses much more than the products themselves. Researchers point to the need for government and health officials to consider the billion-dollar costs associated with adverse health effects from pesticide use, especially as studies confirm that pesticides cause cancer, Parkinson's, and other diseases that are increasing. Thus, this report adds to the growing body of research demonstrating the unsustainability of conventional, chemical-intensive agricultural practices. The National Academy of Sciences identifies four goals of sustainable agriculture—productivity, economics, environment, and social well-being for future generations. However, current chemical pesticide use threatens sustainable agriculture. Although the primary concerns about

pesticide usage centers on health and ecological concerns, including food security, this report provides an economic assessment that offers an important holistic perspective on real costs and food sovereignty.

The report notes, "In a few decades, and thanks to the constant support of public authorities, the agricultural world has invested massively in the use of pesticides. While the profits of this sector are becoming increasingly concentrated in the hands of a few multinationals, society faces a considerable bill to pay each year to cover the costs linked to pesticide use. But even those amounts will not be able to repair the irreversible damage caused to humans and the environment. In contrast, the varied agroecological models have proven to be more sustainable. While transition to these also requires investments, the latter will be smaller and above all more sustainable. . . . [I]n 2022, Member States [in the EU] will have to assume their responsibility and choose between a costly, polluting model concentrated in the hands of a few players whose decision-making centers are outside Europe, and a sustainable agro-ecological model championed by citizens and farmers. It is the future food sovereignty for the EU—and, more broadly, for the planet—that is at stake." The study offers insight into the social and economic costs and benefits of the pesticide industry (i.e., production and use). BASIC investigates the current agricultural model that relies on

conventional toxic chemical use involving four primary manufacturers: BASF, Bayer/Monsanto, Corteva, Syngenta/ChemChina. Although the study's focus is the European market, pesticide exposure is widespread, and residues can travel across the globe. Thus, researchers analyze new pesticide data to evaluate the repercussions on the ecosystem, including effects on species health, diversity, and services (e.g., pest control, pollination, water/soil/climate regulation). The researchers then establish the cost from pesticide use and paid for by European citizens regarding these repercussions. Lastly, the organization evaluates the profits of the four major pesticide producers through pesticide use. The United Nations' 1987 report, *Our Common Future* (the Brundtland Report), outlines the benefits of sustainable agriculture in protecting the Earth's natural resources for future generations, advancing equal income allocation from food production, and supporting small-scale farming. The report emphasizes the challenges of sustainable agriculture, highlighting, "[it] is to raise not just average productivity and incomes [from resources], but also the productivity and incomes of those poor in resources.... Land use in agriculture and forestry must [use] scientific assessment of land capacity, and the annual depletion of topsoil, fish stock, or forest resources must not exceed the rate of regeneration." [Bureau for the Appraisal of Social Impacts (Basic). Pesticides: A model that's costing us dearly. Paris, France. November 2021.]

ACTIONS OF THE WEEK

Shift to Organic Farming, Not Carbon Trading, Is Critical To Thwart the Climate Crisis and Biodiversity Collapse

FEBRUARY 16, 2021 | The climate crisis, with unprecedented temperature shifts, storms, and wildfires, and the devastating decline in biodiversity are escalating as a result of uncontrolled and unnecessary reliance on toxic chemicals. These existential crises that threaten life, to be successfully thwarted, require a meaningful holistic strategy that commits our nation to ending our fossil fuel-based economy and use of petroleum-based materials that release harmful levels of carbon and noxious gases (including greenhouse gases/GHG) into the environment. The proposals now in Congress and the administration require close attention and scrutiny if we are to meet the urgency of the moment. The carbon market approach embodied in the *Growing Climate Solutions Act* and President Biden's Climate 21 Project does not adequately and comprehensively respond to the current and looming interconnected threats to public health and the environment.

The focus on carbon to the exclusion of a holistic approach that addresses complex life-supporting biological communities allows the continuation of disproportionate hazards to people of color and communities living adjacent to toxic sites. The mechanisms of carbon trading or the purchasing of carbon offsets under consideration do not establish an end date for admittedly unacceptable materials and practices, nor do they ensure a transition to life-sustaining practices. Just as there are proposals to end production of the combustion engine and move to electric vehicles, we must demand that agriculture—across the board and on an expedited five-year schedule—shift to organic practices, whose standards are already codified in federal law. Organic production and handling practices have a proven, commercially viable, track record and both sequester carbon and eliminate petroleum-based pesticides and synthetic fertilizers. And, importantly, the data shows that this sector of agriculture is now operating without sacrificing productivity or profitability. The only problem: the vested economic interests in the petroleum and chemical industry are holding on to the status-quo. The good news: there are good jobs and money to be made in a green economy. **Tell your Congressional Representatives and Senators to support a holistic approach to the existential threats of the climate crisis and biodiversity collapse.**

Take Action: Tell EPA Not To Allow Unnecessary Pesticide Risks

JULY 26, 2021 | Despite federal law that directs the U.S. Environmental Protection Agency (EPA) to register pesticides only if they do not cause unreasonable adverse effects on humans or the environment, EPA allows pesticides known to cause many adverse effects in humans and the environment. These include health effects such as asthma, autism and learning disabilities, birth defects and reproductive dysfunction, diabetes, Parkinson's and Alzheimer's diseases, and several types of cancer—and environmental effects such as decimation of pollinator populations, direct

and indirect killing of wildlife, reducing carbon sequestration in the soil, and poisoning air, water, and land. The risks are particularly high for farmworkers and fenceline communities. Why does EPA consider these effects "reasonable" when the pesticides are not necessary to achieve pest management or prevention goals?

Tell EPA not to allow unnecessary pesticide risks. When evaluating pesticide registration applications, EPA does not require data demonstrating "benefits" against which these risks may be weighed. That kind of calculation only takes place years down the line, if EPA believes there is reason to consider canceling a pesticide's registration. On the other hand, the existence of organic producers fueling $62 billion in organic sales in the U.S., with virtually all commodities being now grown and processed without toxic pesticides, indicates that a true cost accounting of pesticide use would find these risks unreasonable. This month, the Rockefeller Foundation released a report estimating that the true cost of food is about three times the $1.1 trillion that consumers pay annually. The report says, "Of the impact areas we assessed in our study, the costs related to human health were by far the most significant driver of unaccounted-for costs, at roughly $1.1 trillion per year. That figure alone nearly doubles the cost of our food system—our national 'bill' for the diet-related disease is equal to all the money we currently pay for the food itself." An additional $100 billion is attributed to the "unaccounted livelihood costs" to the "food workers and producers—who are overwhelmingly from marginalized communities, and in particular from communities of color." The report also calculates that the "unaccounted costs of the food system on the environment and biodiversity add up to almost $900 billion per year. These costs are mainly attributable to two areas: greenhouse gas (GHG) emissions and biodiversity costs." Although not all of the unaccounted costs identified by the Rockefeller Foundation are directly attributable to pesticide use, many are and should factor into EPA's pesticide registration process. That process should compare those costs, as well as those already identified by EPA, to the organic farming alternative. If the risks can be eliminated by organic farming, then they are unnecessary—and, therefore, unreasonable.

The United Nations Environment Program Summary for Policy Makers

- Summary for Policy Makers, January 27, 2021
- Excerpts from Environmental and health impacts of pesticides and fertilizers and ways of minimizing them

The report acknowledges the global goal to minimize adverse impacts of chemicals and waste by 2020 was not achieved for pesticides and fertilizers.

Pesticide use efficiency has not improved
While global pesticide use has steadily increased during the past decades, both in total volumes and the amounts applied per hectare of cropland, pesticide use per unit crop output has remained unchanged. This indicates that pesticide use efficiency has not improved at the global level even though modern pesticides are more biologically active per gram of active ingredient applied.

Significant amounts of nutrients are lost to the environment
Nutrient use efficiencies are less than 40–65 per cent for nitrogen, 15–25 percent for phosphorus and 30–50 per cent for potassium in the first year of application. Subsequent crops benefit from some of the fertilizer nutrients left in the soil by the first crop. For example, most of the phosphorus applied can be used by subsequent crops. However, nutrients are lost to the environment and may result in environmental and health impacts and economic losses to farmers. During the past decades nitrogen use efficiency has improved in some countries, but has declined in others.

Global instruments and agreements
[T]he conventions [Stockholm Convention, the Rotterdam Convention and the Basel Convention] cover a limited number of chemicals, while effective implementation of codes presents challenges with respect to addressing all important aspects of managing pesticides and fertilizers and minimizing their adverse environmental and health impacts.

Priority transformative actions
- Incentivize healthy and sustainable consumer choices and consumption
- Fundamentally change crop management and adopt ecosystem-based approaches
- Use economic instruments to create a level playing field for greener products and approaches
- Promote the use of direct finance to encourage sustainable agriculture
- Adopt integrated and life cycle approaches for sound pesticide and fertilizer management
- Strengthen standards and adopt corporate policies for sustainable supply chain management