

Rebuilding Environmental Protection: Lessons from Rachel Carson

In consideration of Women's History Month, I am reflecting on Rachel Carson and her message of precaution in protecting the living earth.

Rachel Carson's challenge. Rachel Carson lived and wrote in a time before pollution was regulated at the federal level. Her work at the Bureau of Fisheries and in the Fish and Wildlife service documented the value of preserving natural places, enshrined in the National Wildlife Refuges and in the Endangered Species Act. Rachel Carson advocated for preserving all the parts of natural ecosystems and using the tools of natural systems for pest control and resource management. She wrote often of the need to take precaution in the broadscale dispersion of man-made chemicals. She wrote, in the formal language of the 1950s, of the trend of our society towards destruction:

Mankind has gone very far into an artificial world of his own creation. He has sought to insulate himself, in his cities of steel and concrete, from the realities of earth and water and the growing seed. Intoxicated with his own power, he seems to be going farther and farther into more experiments for the destruction of himself and his world.

Rachel Carson. Speech on receiving the John Burrows Medal. April 1952.¹

This describes the condition we face today. We see all around us the cumulative effects of pollution from burning fossil fuels to plastic waste, and forever chemicals created to control pests or for enhancements like “no-stick” pans. Rachel Carson raised concerns about the chemical stew resulting from the accumulation of materials from multiple sources and through concentration up the food chain. She documented how materials introduced into the environment migrate to unintended locations through the action of wind and water. Silent Spring was all about taking caution.²

But we have not taken caution. We have conducted a massive experiment upon ourselves and our children with no controls, and no anticipation of how to redress the harm. Rachel Carson perceived this potential for harm long before the voluminous scientific documentation of health harms of pollution mounted in evidence.³ She wrote from a deep knowledge of the delicate intricacies of the interconnected web of life. She knew in her bones of the absolute dependence of humankind upon the smooth functioning of the ecosystems that provide fresh water, oxygen-rich air and fertile ground. Our life support system depends on these natural systems, evolved over millennia, and stable for thousands of years. But that stability also depends on respecting the laws of nature and preserving the living systems that sustain us.⁴

Now the earth's ecosystems are subject to conditions that approach irreversible thresholds as the planet experiences warming effects not seen since the Pleistocene age.⁵ We face a moral obligation to the generations that may follow us. This was the soul searing conundrum Rachel Carson challenged all of us with:

*Underlying all of these problems of introducing contaminants into our world is the question of moral responsibility – responsibility, not only to our own generation, but to those of the future. We are properly concerned about damage to generations now alive; but the threat is infinitely greater to the generations yet unborn, **to those who have no voice in the decisions of today**, and that fact alone makes our responsibility a heavy one.*

Rachel Carson. “On the Pollution of Our Environment.” October 18, 1963⁶

We carry the moral imperative not only of the pollution and continued emissions to air, water and land but also of the need to remediate and repair the damage of our actions to protect the quality of the environment for future generations.

Lessons learned from fifty-six years of environmental regulation. The Environmental Protection Agency was established in 1970 under President Richard Nixon in response to an overwhelming outpouring of concern from the public about the effects of pollution to the air and water from industrial activity and toxic by-products. Between 1972 and 1977 the core of environmental laws were adopted establishing a base for environmental protection.

Core Environmental Laws of the Environmental Protection Agency⁷

- The 1970 amendments to the Clean Air Act;
- Environmental Impact Statements required by the National Environmental Policy Act (1970);
- The Resource Recovery Act (1970);- Amended to Resource Conservation and Recovery Act in 1976
- Guidelines for the limited control of radiation (1972);
- The Federal Environmental Pesticides Control Act (1972);
- Safety Standards for Farmworkers (1974);
- Regulation of land use (1972);
- Clean Water Act totally revised water pollution legislation (1972), shifting the control mechanism from "water quality" to "effluent limitations" with a goal of "zero discharge."
- Safe Drinking Water Act 1974
- Toxic Substances Control Act - 1976

These laws addressed the basic issues of air, water and land protection with a strong emphasis on preserving public health. Most were driven by dramatic incidents of contamination, such as the Love Canal, the Cuyahoga River fires, and massive fish kills. Worker safety and protections from occupational exposures also weighed heavily on the initial motivation for environmental regulation. From the beginning, there was tension between the industries under regulation and the various public interest and environmental interests. Over time, industry influence has increased with successful court challenges and direct influence on the regulatory process. The recent Supreme Court ruling withdrawing EPA administrative authority to interpret legislation based on expertise of scientists and topic experts (the Chevron ruling)⁸ has severely curtailed the effectiveness of regulatory enforcement. In the current EPA guidance:

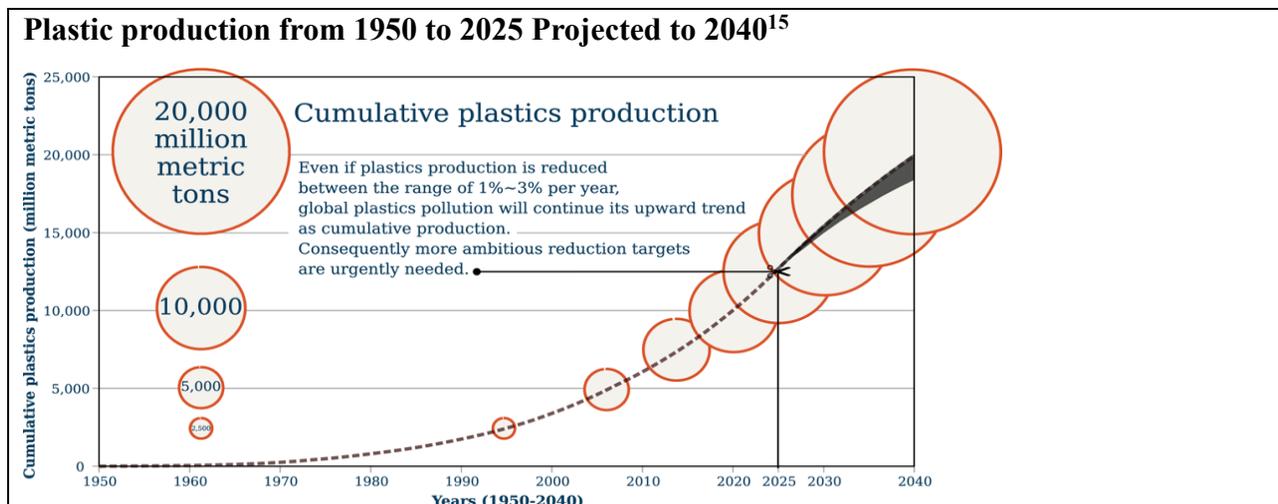
A number of laws serve as EPA's foundation for protecting the environment and public health. However, most laws do not have enough detail to be put into practice right away. EPA is called a regulatory agency because Congress authorizes us to write regulations that explain the critical details necessary to implement environmental laws. In addition, a number of Presidential Executive Orders (EOs) play a central role in our activities.⁹

In the current Trump Administration, a very narrow interpretation of environmental laws has been established, and enforcement has been curtailed by budget constraints and exemptions granted by Executive Orders.¹⁰

$$\text{Risk} = f\{\text{Hazard} \times \text{Exposure}\}$$

The regulatory approach to controlling pollution has rested on the concept of mitigating risk to the public and protecting the quality of air water and land from contamination. The level of total risk is defined as the combination of inherent hazard, or how toxic a substance is to living plants, animals and humans, and the amount of exposure.¹¹ Each regulated substance is evaluated separately in isolation, with a level of safe exposure determined as an emission limit. Each point source is defined in isolation as well. However, there is no assessment of the overall burden of contamination from the sum of all sources, nor is there any consideration of exposure over time.

“The solution to pollution is dilution” was the mantra of the regulatory process for many years. More recently, the concept has been displaced with the recognition of bio-accumulation through food chains and concentration in certain tissue, like fat and liver. In addition, current understanding of many pollutants shows that even very small concentrations can have negative health effects when the compounds simulate hormones, which act at very low concentrations in the endocrine system.¹² And levels deemed safe for the “average”, usually based on male adult populations, may be dangerous for children, the elderly, or people with underlying conditions such as asthma or autoimmune disorders.¹³ As industrialization has progressed in the last fifty years, the proliferation of materials with endocrine disrupting properties has expanded exponentially, especially from the proliferation of plastics.¹⁴



Consequences: total toxic emissions and health harms. In spite of the voluminous regulations, pollution is increasing not only in the US but globally. Because dispersion by wind and water makes it impossible to isolate contaminants to a specific location, contamination crosses all political boundaries. Even as Rachel Carson pointed out so many years ago, we now see contamination worldwide.

The public health implications of this proliferation of toxic contaminants are impossible to escape. The EPA Toxic Release Inventory tracks 685 distinct substances. The latest data (2019)

shows 1,690,240 tons of total toxic material emitted under permitted releases.¹⁶ This reflects the “safe exposure” level for each of the regulated substances. In the aggregate, this is an enormous burden on the air, water and land, and on the living things exposed to this contamination.

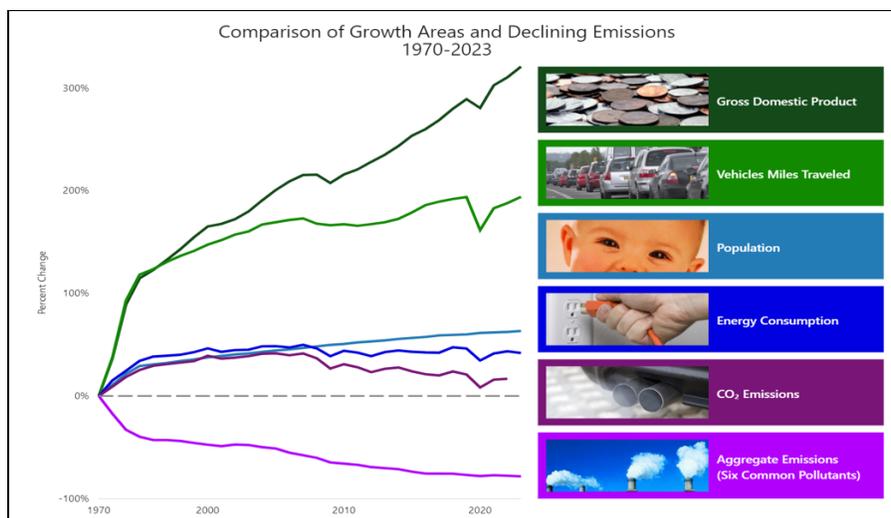
Biomonitoring reported in the National Report on Human Exposure to Environmental Chemicals shows that, on average, Americans have over 200 synthetic chemicals in their bodies.¹⁷ While some have been well-defined, such as lead and arsenic, for many environmental chemicals, threshold levels of exposure have not been determined. Organizations such as the Environmental Working Group have been studying the environmental chemicals in newborns and young children, finding that 414 industrial chemicals are detected in newborns.¹⁸

Another indication of environmental disruptions shows in the 50% decline in sperm count from 1950 to 2025 in the US and other Western countries.¹⁹ The decline is linked to exposure to chemicals, pesticides, smoking, stress and obesity.

Even after decades of successful efforts to reduce sources of air pollution, 46% of Americans—156.1 million people—are living in places that have unhealthy levels of ozone or particle pollution in the air.²⁰

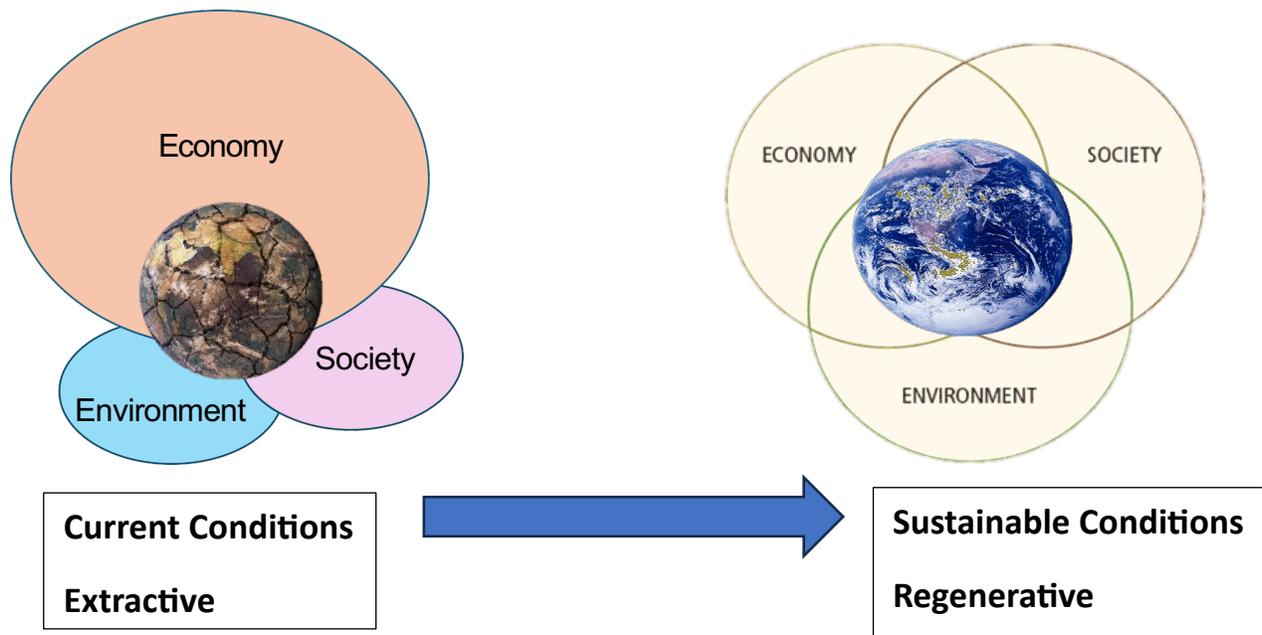
Nearly half of the population of the U.S., 176 million people, have drinking water contaminated by PFAS- forever chemicals – perfluoroalkyl and polyfluoroalkyl substances.²¹ These forever chemicals are found in hundreds of common materials such as firefighting foams, waterproof hiking boots, raincoats, nonstick cooking pans, dental floss, lipstick, and even the ink used to label packaging. Because they do not break down through normal biological degradation, they accumulate in the environment, and are not removed by normal water treatment processes. They have been linked to kidney and testicular cancer, decreased infant birthrates, high blood pressure and decreased infant birthrates.²²

Although environmental regulation has improved the quality of air and water overall since before enacting the regulations under the EPA, the results have not kept up with the challenges of modern industrial chemical contamination, nor have they prevented the effects of accumulation of man-made chemicals in the environment. The expectation and complaints from industry that environmental regulation hurts the economy has not been documented. In fact, economic growth has continued even as environmental controls have been enacted and enforced.²³



De-construction of environmental protections. Today we see the unravelling of the complex tapestry of regulatory controls on pollution, from Executive Orders granting absolution to 41 industries from emission constraints²⁴ to laws rescinding critical portions of the Clean Air Act.²⁵ The EPA under the Trump Administration has rescinded 31 regulations that protect water, air and land from industrial pollution and chemical contamination,²⁶ challenging Safe Drinking Water and Clean Water Act requirements, and curtailing enforcement actions. Rulemaking to control forever chemicals (PFAS) has been delayed or abandoned.²⁷ The Supreme Court has removed the science-based expert authority of regulatory agencies requiring a strict and narrow interpretation of authorizations stated in the enabling legislation.²⁸ ²⁹ The EPA revoked the Endangerment Finding of 2009 which put greenhouse gas emissions control under the Clean Air Act, effectively eliminating climate action controls.³⁰ The EPA has also declared that costs of health harms and deaths from pollution will no longer be calculated in the analysis of regulatory action on air emissions.³¹ Challenges to these actions have had some success in federal courts, including the declaration that rescinding congressionally approved grants for renewable energy are illegal.³² ³³

The cumulative effect of this systematic de-construction of regulatory control over pollution and greenhouse gas emissions will remove protections for clean water, air and land as industries unconstrained by regulatory controls take the short-term savings of reduced regulatory compliance. The EPA's new policy of eliminating deaths and health harms from the regulatory analysis of emissions is even more alarming. The costs in terms of health harms, lower quality of life and loss of natural amenities will be carried by the taxpayers, especially in local communities. Prioritizing extractive industries and hindering renewable resource development sends energy policy backwards toward a reality that no longer exists.



Rebuild Environmental Protection with Regenerative Thinking. The long-term implications of these policy changes alarm environmental organizations and people concerned with the health of communities who are looking toward a change of administration to correct the harms. But, at this point, simply reversing the actions taken so far will not address the underlying issues. Of all the environmental regulations adopted to date, only the Pollution Prevention Act of 1990 addresses the concept of designing to prevent pollution and encouraging recycling.³⁴ We can take lessons from the regulatory approach of the last 56 years and improve the outcome going forward. **This is the opportunity to move our system of laws and regulations through a transformation from an extractive fossil-based economy to a regenerative renewable resourced economy. There are at least five elements to this process.**

1. REACH: The first lesson would be to adopt the precautionary principle as the basis for evaluating the introduction of new man-made materials into large scale production. As is done in Europe, the chemicals introduced into the market and emissions into the environment must be shown to be safe by an independent entity before they can be produced. Health effects including endocrine disrupting properties, mutagenic or carcinogenic properties are prohibited, not titrated into “safe” exposure doses. This approach assures the public that materials and substances used in commercial production adhere to the precautionary principle- reduce the inherent hazard; prioritize health of ecosystems and people.

In the European Union, regulation (EC 1907/2006) requires REACH:

Registration: Companies must submit a dossier to the European Chemicals Association (ECHA) detailing properties, uses, and safe handling of substances.

Evaluation: ECHA and member states review dossiers and testing proposals to ensure compliance-independent of industry

Authorization: Substances of Very High Concern (SVHCs) require special authorization for use.

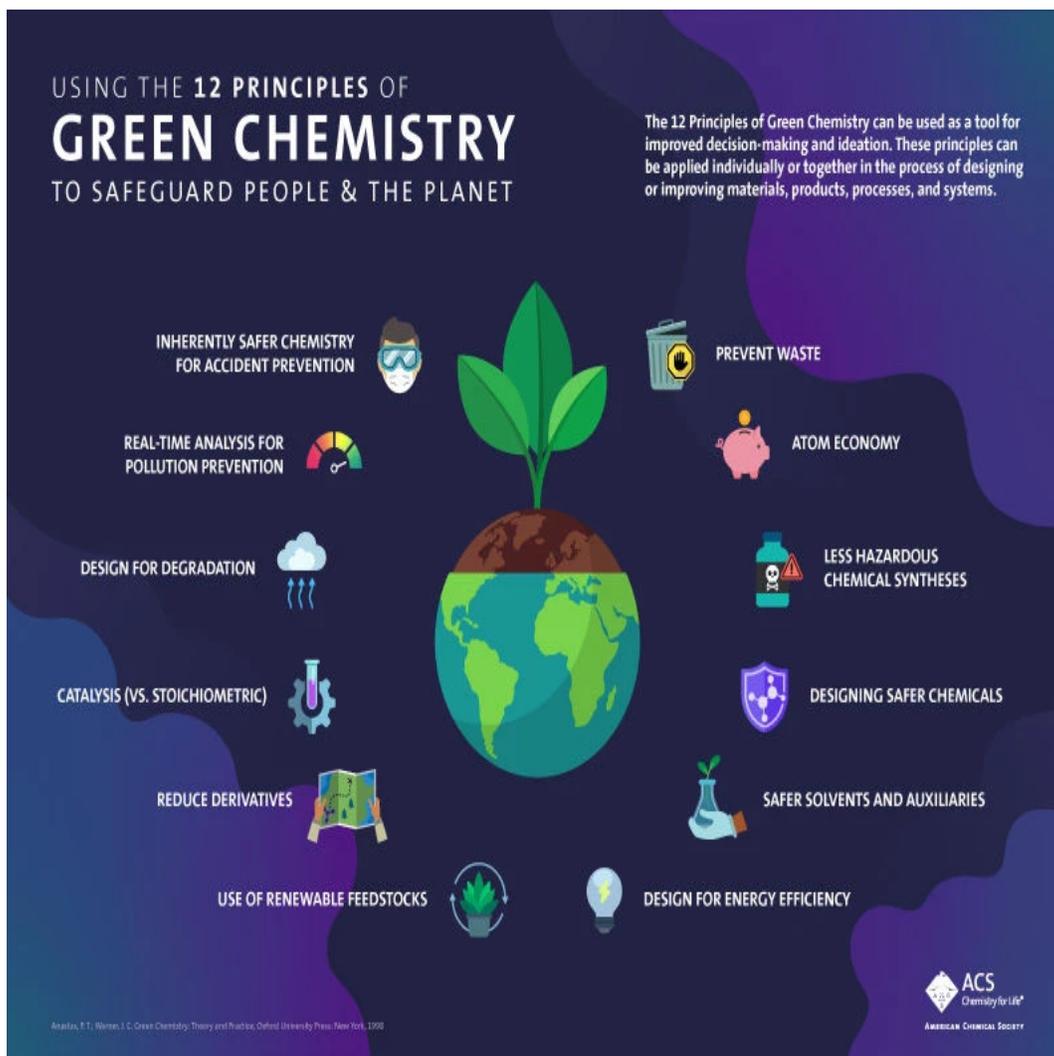
Restriction: Specific hazardous substances may be banned or limited in products.

Supply Chain Communication: Suppliers must provide safety data to recipients to ensure safe use; the database is open to the public.³⁵

2. Green Chemistry: Second, adopt a regulatory framework that emphasizes reduction or elimination of the inherent hazard, rather than computing the “safe” amount of toxicity for individual contaminants. Using the principles of green chemistry to develop materials and, pesticides, herbicides, pharmaceuticals and consumer products avoids the potential for health harms.

Sourcing raw materials from resources that can be grown from plants and animals instead of extracted from fossil methane, petroleum and coal eliminates materials that cannot be broken down by normal biological processes. This approach also incorporates the concept of “benign by design” that supports designing consumer products with the intention to re-use the components in a circular supply chain. This approach not only reduces the risk of health harms to consumers, workers and the public it conserves resources and reduces the need for virgin raw materials.

The Twelve Principles of Green Chemistry³⁶



Adopting these principles reduces waste, prioritizes energy efficiency, reduces the inherent toxicity of products, and creates products that degrade safely or can be easily re-used. Green chemistry processes take place at ambient temperature and pressure using catalysts instead of high temperature and pressure or harsh reagents.³⁷

3. Empower Renewable Resources. Third, adopt the regulatory infrastructure to empower distributed renewable energy systems. The energy sector produces 82% of the greenhouse gas emissions and air pollution in the United States (2024 data).³⁸ The critical need to address climate change mitigation directly in law can no longer be avoided. It is time to act. The technologies are available and in use at scale to implement the transformation from an extractive fossil-fueled energy system to a regenerative renewable energy.^{39 40}

The regulatory infrastructure to empower full deployment to a sustainable energy system is not established in law at the federal level. Across the states, many models of best practices are in place.⁴¹ It is time to codify the regulatory system to support a system of interconnected micro-grids, cogeneration and virtual community metering with shared long duration battery storage

systems. Integrating photovoltaic and wind generation into building structures and adopting a national passive solar design standard for all new residential and commercial structures can reduce the energy demand burden. Integrating electric vehicles into public systems for charging and perhaps returning to the electric streetcars in cities. This transformation will unleash volumes of creativity.

4. Heal damaged lands. Beyond preventing future pollution and damage, lies the responsibility to repair the scars and harms of legacy industries. Abandoned oil and gas wells continue to seep and leak into waterways and airsheds. Abandoned coal mines and closed mining operations contaminate thousands of miles of rivers with acid mine drainage as well as creating subsidence and high wall hazards across Appalachia. Reclaiming damaged lands also provides local jobs in extractive industry locations for workers in that industry. Investing in the reclamation of damaged lands builds communities and local economies.⁴² The ReImagine Appalachia Blueprint developed programs and templates for restoring damaged lands. Many of the proposals in the ReImagine Appalachia Blueprint were incorporated into the Inflation Reduction Act, but unfortunately, much of the funding was rescinded in the “Big Beautiful Budget Bill Act” of 2025. See <https://reimagineappalachia.org/portfolio/the-blueprint/>



Data Source: Appalachian Citizens Law Center⁴³

5. Remove fossil industry subsidies. The federal subsidies currently lavished on the fossil extractive industries can be shifted directly to fund the sustainable energy system. These fossil industry subsidies are ensconced in laws that would need to be rescinded by law as part of this reform.⁴⁴ Most recent estimates of the U.S. current subsidies to oil, gas and coal extractive industries across all levels of production amount to \$34 Billion annually, with increases expected for Carbon Capture and Sequestration and other fossil fuel based technologies.⁴⁵ The Biden administration attempted to scale back and phase out some subsidies to fossil industries as part of the Inflation Reduction Act provisions, but these efforts were thwarted. The fossil extractive

industries spent over \$450 million on lobbying to address protections for continued development.⁴⁶

Clearly, significant public pressure will need to come to bear on the existential crisis of climate change and global pollution attendant to continued fossil fuel combustion. However, failing to address this ongoing subsidy to well-established and market dominant industries is like trying to fill a bucket with a hole in the bottom. This system of subsidies forces all innovations and more sustainable technologies to compete with a highly subsidized entrenched industry. This is a mockery of the traditional concept of a subsidy intent to boost new market entrants to improve competitive position for innovation. The current system serves to suppress innovation instead.

A shared prosperity. It is time for bold action. It is time to recognize that the laws of nature are not negotiable, nor can they be rescinded by executive order or wishful thinking. The condition of our life support system requires both reduction in the levels and types of pollution as well as strong support for the known and available technical solutions. Burning fossil resources as the base for the economy drives the global warming that will make the planet uninhabitable to life as we know it.⁴⁷ By creating a new regulatory framework based on regenerative thinking and protection for our life support system, we can establish the conditions for a shared prosperity and sustainable growth within the constraints of our living earth.

Those who contemplate the beauty of the earth shall find reserves of strength that will endure as long as life lasts. Rachel Carson.⁴⁸



Citations

¹ Rachel Carson. "Design for Nature Writing." April 1952. Published in Linda J. Lear (Ed.) Lost Woods- The Discovered Writing of Rachel Carson. Beacon Press. Boston 1998. Page 94.

² Rachel L. Carson. Silent Spring. Houghton Mifflin Co. Boston. 1962. Pages 1-13.

³ Scott Barstow, MSc, Laura Kate Bender, Robert Brook, MD, Robert Byron, MD, MPH, Paige Knappenberger, Shyamala Rajan, Linda Rudolph, MD, MPH, Mona Sarfaty, MD, MPH, FAAFP, Joan Schiller, MD, Liz Scott, Caren Solomon, MD, MPH, Emily Thompson, George Thurston, ScD, Ernesto Villasensor, Diana van Vleet, Skye Wheeler. Fueling Sickness: The Hidden Health Costs of Fossil Fuel Pollution. Physicians for Social Responsibility. November 2025. <https://psr.org/wp-content/uploads/2025/11/fueling-sickness.pdf> Accessed March 13, 2026..

⁴ P. DeMarco. Gifts of the Living Earth. December 10, 2019. <https://patriciademarco.com/2019/12/10/gifts-of-the-living-earth/>

⁵ Robert Rhode. Global Temperature Report. Berkley Earth. January 14, 2026. <https://berkeleyearth.org/global-temperature-report-for-2025/> Accessed March 10, 2026.

⁶ Rachel L. Carson. “On the Pollution of Our Environment” speech to Kaiser Permanente Foundation. October 18, 1963. Published in *Lost Woods: The Discovered Writing of Rachel Carson*. Linda J. Lear (Ed) Beacon Press. Boston 1998. Pages 228-245.

⁷ Phil Wisman. EPA History (1970-1985) U.S. Environmental Protection Agency Archive. November 1985. <https://www.epa.gov/archive/epa/aboutepa/epa-history-1970-1985.html> Accessed March 10, 2026

⁸ Chevron U.S.A., Inc. v. NRDC, 467 U.S. 837 (1984) <https://supreme.justia.com/cases/federal/us/467/837/> Accessed March 10, 2026.

⁹ U.S. Environmental Protection Agency. Summaries of Laws and Executive Orders. <https://www.epa.gov/laws-regulations/laws-and-executive-orders> Accessed March 10, 2026.

¹⁰ U.S. Environmental Protection Agency. Press Release: “President Trump and Administrator Zeldin Deliver Single Largest Deregulatory Action in U.S. History.” February 12, 2026. <https://www.epa.gov/newsreleases/president-trump-and-administrator-zeldin-deliver-single-largest-deregulatory-action-us> Accessed March 10, 2026.

¹¹ Susan Goldhaber, John Lipscomb. “How toxicologists establish safe levels of chemicals.” Toxicology Education Foundation. 2025. <https://toxedfoundation.org/how-toxicologists-establish-safe-doses/> Accessed March 12, 2026.

¹² National Institute of Environmental Health Sciences. “Health and Education: Endocrine Disruptors.” <https://www.niehs.nih.gov/health/topics/agents/endocrine> Accessed March 11, 2026.

¹³ Tee L. Guidotti. Health and Sustainability. Chapter 4. Pollution and Contamination and Chapter 5. Chemical Pollution and Health. Oxford University Press. New York. 2015. Pages 115-195.

¹⁴ Baztan J, Jorgensen B, Carney Almroth B, et al. “Primary plastic polymers: Urgently needed upstream reduction.” *Cambridge Prisms: Plastics*. 2024;2:e7. doi:10.1017/plc.2024.8 <https://www.cambridge.org/core/journals/cambridge-prisms-plastics/article/primary-plastic-polymers-urgently-needed-upstream-reduction/84ACFD0CBBA182EC61AC26C061C4E6AC> Accessed March 12, 2026.

¹⁵ Ibid

¹⁶ U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion. Healthy People 2030 Objectives Overview. <https://odphp.health.gov/healthypeople/objectives-and-data/browse-objectives/environmental-health/reduce-amount-toxic-pollutants-released-environment-eh-06> Accessed March 13, 2026.

¹⁷ National Center for Environmental Health. National Report on Human Exposure to Environmental Chemicals. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. 2022. Updated December 2024. Accessed [month day, year]. <https://dx.doi.org/10.15620/cdc:133100> Accessed March 11, 2026.

¹⁸ Uloma Uche. “Pregnant with PFAS: The threat of ‘forever chemicals’ in cord blood.” Environmental Working Group. September 13, 2022. <https://www.ewg.org/news-insights/news/2022/09/pregnant-pfas-threat-forever-chemicals-cord-blood> and <https://www.ewg.org/news-insights/news-release/cdc-analyzes-toxics-humans#:~:text=%22Now%20that%20scientists%20can%20prove,children%20age%206%20and%20older.> Accessed March 14, 2026.

¹⁹ Kate Kelland and Reuters. “Sperm Count Dropping in Western World.” *Scientific American*. July 26, 2017. [https://www.scientificamerican.com/article/sperm-count-dropping-in-western-world/#:~:text=LONDON%20\(Reuters\)%20%2D%20Sperm%20counts.and%20Community%20Medicine%20in%20Jerusalem.](https://www.scientificamerican.com/article/sperm-count-dropping-in-western-world/#:~:text=LONDON%20(Reuters)%20%2D%20Sperm%20counts.and%20Community%20Medicine%20in%20Jerusalem.) Accessed March 11, 2026.

²⁰ American Lung Association. State of the Air Report 2025. <https://www.lung.org/getmedia/5d8035e5-4e86-4205-b408-865550860783/State-of-the-Air-2025.pdf>

²¹ U.S. Environmental Protection Agency. Fifth Unregulated Contaminant Monitoring Rule. “EPA Releases Initial Nationwide Monitoring Data on 29 PFAS and Lithium.” <https://www.epa.gov/newsreleases/epa-releases-initial-nationwide-monitoring-data-29-pfas-and-lithium> Accessed March 14, 2026.

²² John Wiegand. “The race to destroy PFAS, the forever chemicals.” *MIT Technology Review*. October 26, 2023. https://www.technologyreview.com/2023/10/26/1082292/the-race-to-destroy-pfas-the-forever-chemicals/?gad_source=1&gad_campaignid=20737314952&gbraid=0AAAAADgO_mgwwkMZqtMYzeshbSsnUz0ZcP&gclid=CjwKCAjwpcTNBhA5EiwAdO1S9rm9hSUgGxcMZxKI6v6WPe9IBDtMtTWbri1XlhYGtZN0-8XJpyeLJR0Cu_sQAvD_BwE Accessed March 14, 2026.

²³ U.S. Environmental Protection Agency. “Comparison of Growth Areas and Declining Emissions 1970-2023.” <https://www.epa.gov/transportation-air-pollution-and-climate-change/accomplishments-and-successes-reducing-air> Accessed March 14, 2026.

-
- ²⁴ U.S. Environmental Protection Agency. Stationary Sources of Air Pollution: Clean Air Act Section 112 Presidential Exemption Information. March 31, 2025. <https://www.epa.gov/stationary-sources-air-pollution/clean-air-act-section-112-presidential-exemption-information> Accessed March 9, 2026
- ²⁵ S.J. Res.31- A Joint resolution providing for Congressional disapproval under chapter 8 of title 5, United States Code, of the rule submitted by the Environmental Protection Agency relating to “Review of Final Rule Reclassification of Major Sources as Area Sources Under Section 112 of the Clean Air Act.” 119th Congress, 2025-2026. <https://www.congress.gov/bill/119th-congress/senate-joint-resolution/31/all-actions> Accessed March 9, 2026.
- ²⁶ U.S. Environmental Protection Agency. Press Release: EPA Launches Biggest Deregulatory Action in U.S. History.: March 12, 2025. <https://www.epa.gov/newsreleases/epa-launches-biggest-deregulatory-action-us-history> Accessed March 9, 2026.
- ²⁷ J.R. Culpepper. “New data shows 176 Million exposed to ‘forever chemicals’ as Trump EPA rolls back drinking water limits.” Environmental Working Group. March 10, 2026 <https://www.ewg.org/news-insights/news-release/2026/03/new-data-shows-176m-exposed-forever-chemicals-trump-epa-rolls> Accessed March 14, 2026.
- ²⁸ West Virginia et.al. v. Environmental Protection Agency et.al. Certiorari to the United States Court of Appeals for the District of Columbia. No. 20-1530. Argued February 28, 2022 – Decided June 30, 2022. https://www.supremecourt.gov/opinions/21pdf/20-1530_n758.pdf Accessed March 9, 2026.
- ²⁹ Coral Davenport, Christina Jewett, Alan Rappeport, Margot Sanger-Katz, Noam Scheiber and Noah Weiland. “Here’s What the Court’s Chevron Ruling Could Mean in Everyday Terms.” New York Times. June 28, 2024. <https://www.nytimes.com/2024/06/28/us/politics/chevron-deference-decision-meaning.html> Accessed March 9, 2026.
- ³⁰ U.S. Environmental Protection Agency. Final Rule: Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Emission Standards Under the Clean Air Act. February 12, 2026. <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-rescission-greenhouse-gas-endangerment> Accessed March 9, 2026.
- ³¹ U.S. Environmental Protection Agency. Economic Impact Analysis for the New Source Performance Standards Review for Stationary Combustion Turbines: Final Rule. EPA-452/R-26-002 January 2026. https://www.epa.gov/system/files/documents/2026-01/combustion_turbines_eia_final_2026-01.pdf March 10 2026.
- ³² Ashley Siefert Nunes. “Court Rules Trump Administration’s Secret “Climate Working Group” Violated Federal Law.” Union of Concerned Scientists. January 30, 2026. <https://www.ucs.org/about/news/court-rules-trump-administrations-secret-climate-working-group-violated-federal-law> Accessed March 9, 2026.
- ³³ Martina Igin. Two Courts Block Trump Administration’s Attempt to Halt Clean Energy Projects.” Earth.ORG January 14, 2026. <https://earth.org/two-courts-block-trump-administrations-attempt-to-halt-clean-energy-projects/> Accessed March 9, 2026.
- ³⁴ Environmental Protection Agency. Summary of the Pollution Prevention Act. 42 U.S.C. §13101 et.seq. (1990) <https://www.epa.gov/laws-regulations/summary-pollution-prevention-act> Accessed March 12, 2026.
- ³⁵ European Commission. REACH Regulation: Overview. https://environment.ec.europa.eu/topics/chemicals/reach-regulation_en Accessed March 14, 2026.
- ³⁶ Paul Anastas and John Warner. Green Chemistry : Theory and Practice. Oxford University Press. Oxford and New York. 1998. ISBN: 9780198506980
- ³⁷ P. DeMarco. Pathways to Our Sustainable Future- A Global Perspective from Pittsburgh. University of Pittsburgh Press. Pittsburgh. 2017. Pages 141-172. for examples of green chemistry products and systems.
- ³⁸ U.S. Environmental Protection Agency. Greenhouse Gas Inventory. Chapter 3. Energy. April 2024. <https://www.epa.gov/system/files/documents/2024-04/us-ghg-inventory-2024-chapter-3-energy.pdf> Accessed March 13, 2026.
- ³⁹ International Energy Agency. Electricity: Renewables 2024. Analysis and Forecast to 2030. October 2024. <https://www.iea.org/reports/renewables-2024/electricity> Accessed March 13, 2026.
- ⁴⁰ Kimberly Peterson and Chris Peterson. “Utility-scale U.S. solar electricity generation continues to grow in 2024.” U.S. Energy Information Administration. October 2024. <https://www.eia.gov/todayinenergy/detail.php?id=63324>
- ⁴¹ Database of State Incentives for Renewable Energy. North Carolina Clean Energy Technology Center. <https://www.dsireusa.org> Accessed March 13, 2026.
- ⁴² P. DeMarco (Ed.) Part II, Healing the Land, Chapters 6-9. ReImagine Appalachia- Healing the Land and Empowering the People. Springer Nature. Switzerland. 2024. Pages 71-248.
- ⁴³ Appalachian Citizens Law Center. “Two Bills Introduced in Congress to Address Abandoned Mine Lands – the RECLAIM Act and the Reauthorization of the AML Fund.” March 10, 2021. <https://aclc.org/2021/03/10/aclc->

[news-two-bills-introduced-in-congress-to-address-abandoned-mine-lands-the-reclaim-act-and-the-reauthorization-of-the-aml-fund/](#) Accessed March 14, 2026.

⁴⁴ U.S. Energy Information Administration. Federal Financial Interventions and Subsidies in Energy in Fiscal Years 2016-2022. Overview and Key Findings. August 1, 2023. <https://www.eia.gov/analysis/requests/subsidy/> Accessed March 14, 2026.

⁴⁵ Colin Reese, Doug Koplow, Allie Rosenbluth and Lorne Stockman. Paying for Climate Chaos: U.S. Federal Subsidies to Fossil Fuel Production. Oil Change International. September 2025. <https://oilchange.org/wp-content/uploads/2025/09/paying-for-climate-chaos.pdf> Accessed March 12, 2026.

⁴⁶ <https://climatepower.us/research-polling/big-oil-spent-450-million-to-influence-trump-the-119th-congress/>

⁴⁷ United Nations Environment Programme (2025). Emissions Gap Report 2025: Off target – Continued collective inaction puts global temperature goal at risk [Olhoff, A., chief editor; Lamb, W.; Kuramochi, T.; Rogelj, J.; den Elzen, M.; Christensen, J.; Fransen, T.; Pathak, M.; Tong, D. (eds)]. Nairobi. <https://doi.org/10.59117/20.500.11822/48854>. Accessed March 14, 2026.

⁴⁸ Rachel L. Carson. *The Sense of Wonder*. Harper & Row. 1965. P. 100.