UNTANGLING PLASTICS

The Missing Link in Mitigating Climate Change

BOB GEDERT

RIVER GROVE
BOOKS

Published by River Grove Books
Austin, TX
www.rivergrovebooks.com

Copyright © 2026 Bob Gedert

All rights reserved.

Thank you for purchasing an authorized edition of this book and for complying with copyright law. No part of this book may be reproduced, stored in a retrieval system, used for training artificial intelligence technologies or systems, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the copyright holder.

Distributed by River Grove Books

Design and composition by Greenleaf Book Group
Cover design by Greenleaf Book Group
Cover images used under license from ©Shutterstock.com and ©stock.adobe.com

Publisher's Cataloging-in-Publication data is available.

Print ISBN: 978-1-966629-63-4

eBook ISBN: 978-1-966629-64-1

First Edition

To my wife, Kathy, for her love and patience while giving me time and encouragement to write this book.

To my former college students, who inspired me to take action toward addressing climate change.

To my grandfather, who taught me respect for our common home, Mother Earth.

"If it can't be reduced, reused, repaired,
rebuilt, refurbished, refinished, resold, recycled
or composted, then it should be restricted,
redesigned or removed from production."

—**BERKELEY ECOLOGY CENTER**

CONTENTS

FOREWORD ix
PREFACE xiii
ACKNOWLEDGMENTS xvii
INTRODUCTION 1

CHAPTER 1 Do No Harm 7
CHAPTER 2 Plastics: A Definition and History 19
CHAPTER 3 Plastic Resins and the Plastics Coding System 7
CHAPTER 4 Plastic Impacts on Humans and the Environment 53
CHAPTER 5 The Intersection of Plastics and Climate Change 81
CHAPTER 6 Challenges to Recycling Plastics 103
CHAPTER 7 Spaceship Earth 129
CHAPTER 8 A Contrarian Viewpoint 145
CHAPTER 9 Life Without Plastics 165
CHAPTER 10 Call to Action 207
EPILOGUE Do No Harm 229
APPENDIX Reflections 241

NOTES 247
ABOUT THE AUTHOR 281
ABOUT THE ARTISTS 283

FOREWORD

BOB GEDERT is one of the thought leaders of the U.S. recycling and Zero Waste movements. He is grounded by his practical experience working for the state government in Indiana, local governments in Fresno, California, and Austin, Texas, as executive director of the California Resource Recovery Association, and as a consultant to major cities throughout the country, including New York City and Boston, Massachusetts. He began working on this book while he was president of the National Recycling Coalition (NRC), although this book has not been adopted as the official policy of the NRC.

Bob provides an essential public policy perspective on plastics. He recognizes how challenging plastics have been to recycle throughout his career and that only a few types of the thousands of plastics that exist are currently being recycled. Most importantly, he highlights the impacts of plastics on the environment, climate change, and human health. He notes how recycling plastics is not sustainable for most plastics and that plastics production and consumption need to be reduced to decrease the significant impacts of plastics. He then methodically unlocks keys to phasing out plastics, providing a clear path forward for readers to follow as individuals and as policy and program advocates.

He proposes five specific actions regarding plastics in our environment and their impacts on human health:

1. Prevention of harm: Taking preventive action in the face of uncertainty (e.g., avoidance
~~2.~~ of CO_2 releases into the environment). This prevention is best achieved through the
3. reduction and avoidance of the use of plastics.
4. Burden of proof: Shifting the burden of proof to the advocates of a harmful activity
5. (e.g., production of fossil fuel products). The consumer should not be placed with the burden of proving harm; the burden of proof that a product is safe should be shifted to the producer.
6. Innovation of alternatives: Exploring a wide range of alternatives to harmful actions
7. through innovation, such as creating new replacement products through governmental
8. grants and business innovation centers.
9. Intentionality: Exploring—with a whole intent—to create a new world where humans
10. live in closer harmony with the environment.
11. Inclusion: Include in decision-making processes all those affected, including the disenfranchised poor and those whose health is affected by the fossil-fuel and plastic-making industries.

Bob asks, “Aren’t we being fed a plastic diet beyond our will?” He suggests, “It is time to act. Individual, collective, governmental, and global action are needed to turn the tide against the plastics invasion.”

This book will become an invaluable resource to provide direction for all those currently working on a global plastics treaty and local, state, and federal plastics policies. This authoritative work copiously links to many other resources that advocates can cite to support proposed policies.

—**GARY LISS,** vice president, Zero Waste USA and
NRC Lifetime Honorary Board member

PREFACE

My earliest memories in life taught me patience, perseverance, and appreciation for the support of friends and family. I was born with a "tied tongue," contributing to a heavy stutter. As I attempted to speak, nearly everyone had difficulty understanding me, except my mother, who exhibited great patience and care. To overcome this speech impairment, I attended weekly speech lessons from the time I was six years old through age seventeen. These lessons were life-giving, as I learned to communicate more clearly, suppress the stutter, and gain more command of my vocabulary. I value the time granted by each speech therapist over the years. I may stutter on occasion today. However, it is hardly noticed by those listening to me.

As I struggled to be understood, I often felt isolated from the busy world around me. I found comfort in the local library and became a ferocious reader. I enjoyed the humanities and the sciences and studied the world through books. My best friend, Mark, introduced to me the kindness of friendship. My grandfather also graced my life by introducing me to nature on his family farm and in the backwoods around the property.

The isolation of my childhood played a large role in my view of the world. At first, I viewed my handicap as an adversity to overcome. Through time, I learned that my speech impediment gave me a unique opportunity to view the world in a different manner than my siblings and friends. I was an observer in a world in turmoil, out of sync with its natural order. Through my interest in the natural world, my studies in the library, and my interactions with my grandfather, I became astutely concerned about how humans are directly affecting the balance of nature.

In my turbulent teenage years of rebellion, my grandfather listened to me. As a farmer, he lived and cared for the land he farmed. He played philosopher and counselor to me in his calm and grandfatherly manner. In his well-worn living room chair, smoking his pipe, he listened to my anger at how Earth was mistreated, with pollution seeping into Lake Erie. As we walked the woods behind the farmland, he taught me that an acorn grows into a mighty oak tree when cared for and nurtured. He taught me that nature's growth depends on the previous generation's care for its development and our commitment to do no harm. He also taught me to care for Earth as our collective home.

Grandfather showed me the beauty of fertile soil and the value of crop rotation long before the science books praised "green" farming techniques. Over time, I grew to value Earth and its natural means of recycling and composting "discards." "Waste not, want not" was the frugal lifestyle of past generations, modeled after nature. This respect for nature's renewal and composting cycles grew significantly in meaning to me, physically through nature and as a model for human lifestyles.

As I wondered what my place in this world would be, I felt a growing desire to be a change agent actively working to reverse the human harm placed upon the environment. On Earth Day 1975, I participated in a large tree planting activity, and thus begun my environmental activism.

Fast-forward to my forty-five-year career in the world of recycling. I promoted operational efficiencies in recycling in numerous communities across the United States. My approach involved detailed strategic planning processes, bridging recycling best practices and sustainability with local economic development practices. It has been an enriching career, and I have shared my learned experiences through presentations at hundreds of conferences. I have also proudly served as past president of the National Recycling Coalition and was honored to receive the NRC Lifetime Achievement in Recycling Award in 2019.

In my soft retirement, I am an adjunct professor at Xavier University in Cincinnati, Ohio, teaching classes on climate change. As I teach, my students actively engage me in conversation about the need to take action to address the ever-increasing warming of Earth due to greenhouse gas emissions. While their enthusiasm and urgency are well-placed, I have found that the research was weak on innovative actions that college students can engage in.

My students and I have been energized by Greta Thunberg's and other climate disrupters' leadership. Citizen engagement to challenge the status quo is necessary to address the existential threat we are facing. I teach the profiles of many climate voices from the last seven decades. Sadly, many of those outspoken voices are ignored by decision-makers and those in power.

Yet it cannot be said that they are unaware of the problem. Nearly two hundred nations meet each November to discuss the status of climate issues. The Conference of Parties (COP) meetings offer a platform for global discussions on national contributions and commitments to lower emissions. In addition, the Intergovernmental Panel on Climate Change (IPCC) offers scientific data and advice to the annual COP gatherings.

As I read these IPCC reports and summarize them for my classes, the discussion of this data inevitably leads to exploring how society can eliminate reliance on fossil fuels—the direct, human-made cause of climate change. A 2023 IPCC report notes, "Limiting human-caused global warming requires net zero CO_2 emissions. Cumulative carbon emissions until reaching net-zero CO_2 emissions and greenhouse gas emission reductions this decade largely determine whether warming can be limited to 1.5°C or 2°C."[1]

In translation, this statement—"requires net zero CO_2 emissions"—requires all nations to eliminate the burning of fossil fuels (which emits CO_2 emissions) and take other measures to replace the need for fossil fuels in transportation methods, the generation of electricity, and the production of plastics. Why? To limit Earth's excessive warming and avoid reaching numerous irreversible tipping points in global climate. Choosing a warmer planet is not an option. Continued greenhouse gas emissions will lead to increasing global warming . . . and every increment of global warming will intensify multiple and concurrent hazards.

That leads to why I wrote this book. Many books have been written on the need to transform the transportation system to electric and hydrogen vehicles, convert to renewable sources of electrical energy, and change out our building systems to eliminate reliance on carbon sources. Plastics are also a fossil fuel product that contributes to climate change, yet the connection of plastics to fossil fuels seems untouched. To reach net zero on CO_2 emissions, we need a game plan to migrate away from our reliance on plastics.

This book is written to address that missing connection: plastics' impacts on Planet Earth and how we can better care for our collective home.

INTRODUCTION

Most people consider plastic consumer items or packaging as beneficial and generally inert or innocuous—not harmful. Yet the plastic products in our household are made from hundreds of chemicals originating from petrochemical factories that also produce oil and gas products. The very companies that are directly impacting the warming of Earth and causing climate change are also producing plastics through the extraction, processing, and production of petrochemicals. What is the relationship between plastics and climate change? How are consumers of plastics complicit in the complicated web of environmental climate impacts? How can individuals change their consumer practices to slow the effects of climate change? These are all questions I hope to address in this book.

All forms of synthetic plastics are made from fossil fuels, and every step of the fossil fuel trail impacts the climate and degrades Earth's environment—from the extraction of minerals and gas; to transport, processing, and refining; to the manufacturing of plastics. Then there are environmental and climate impacts in the packaging and sales of plastic products, consumer usage and disposal habits, and the perpetual impact of plastics on the environment. From the moment of creation through the infinite lifespan of each plastic product, there are continuous environmental impacts that are unmitigated and infinitely ongoing—impacts that ultimately affect the climate and the livability of Planet Earth.

The precautionary principle must be applied here as a framework for public safety and public health. It encourages the pairing of the protection of human health and the environment's safety, where the risks may be difficult to identify or determine with certainty. What we do ~~is~~ know is that plastics are extensively harmful to human health and the environment. Applying the Do No Harm precautionary principle would require following the pathway toward eliminating plastics in our lives.

The precautionary principle should not be viewed as an adverse action but rather as a proactive, positive step forward in human relations. It creates a more holistic decision-making process that can create buy-in from citizens who have been harmed.

The plastic industry "has known for more than 30 years that recycling is not an economically or technically feasible plastic waste management solution," as demonstrated in a report from the Center for Climate Integrity (CCI)[1] and numerous other scientific reports. These reports validate what other investigations and news reports have been saying for decades: that the industry has long known that the vast amounts of plastics manufactured cannot be addressed through recycling. It's not a consumer problem; it's a plastics problem. These principles are explored in this book as I do a deep dive into the various harms plastics exhibit.

The starting point for this exploration in the world of plastics begins with the backdrop of our ability to harm—or not harm—Planet Earth, home to eight billion people, two million species of animals, and more than half a million plant species. Through human innovation and intentionality, the decision is to harm or to not harm, but often we don't see the choice.

We then take a journey into the basic definitions and components of plastics and a detailed study of the harms to the climate, the environment, and to humans caused by our collective use of plastics. This is important to understand how we as a society reached the decision point that we collectively stand at today—a decision to continue our current use of plastics and further harm Earth and humans or take a corrective course of action.

We have had voices in the wilderness offering warnings about the warming of the planet and concerns of excessive consumption of plastics. Yet society moved on with its love affair with plastics, until they have become so ubiquitous that you can spot at least a dozen plastic items in any room you walk into. We live on a very fragile planet, where the balance of nature is out of sync, causing ripple effects as we reach certain climate tipping points.

The optimist in me offers the thesis that if this balance was disrupted by humans, it can be reversed and repaired by humans. However, the distress signals from Earth offer a strong sense of urgency. Thus, I offer six societal action steps to address the cause, and multiple actions that individuals can take to assist in the reversal of human-induced climate change.

The following is a quick walk-through of how these themes unfold chapter by chapter.

Chapter One explores the concepts of the wasteful practices of our society, the Do No Harm concept with the precautionary principle, actions with intentionality, and the intersection of plastics with climate change. Chapter Two helps us understand plastics' origins, definitions, and the various "plastic ages" throughout the past century. Chapter Three dives into the technical definitions of plastic resins and the history of the plastic recycling symbol—the three chasing arrows with a number in the center. A call to action is requested regarding the resin coding system.

Chapter Four offers a deep dive into plastics' impacts on humans and the environment. Here, we learn about the chemical additives in plastics that affect our health, known as forever chemicals. There is also discussion about plastics in the natural environment and their effects on aquatic life. Finally, microplastics are defined and described in the human and natural environment.

Chapter Five ties the creation of plastics to climate change, including the extraction, transport, refining, manufacture, and use of plastic products and packaging. It also discusses the early voices of concern that have been dismissed. Chapter Six discusses the challenges of recycling plastics, including definitions and industry shifts in direction. The critical point is that the recycling industry cannot solve the plastics problem.

Chapter Seven shifts our mindset toward a fragile Earth, an inefficient means to produce plastic products, and a challenge to the legality of harming the population~~s~~ for profit. There is an urgent call for action to protect Planet Earth. Chapter Eight takes us into a paradigm shift: a contrarian viewpoint. The discussion leads toward rejection of compromise and toward patience and innovation. We must challenge conspicuous consumption and rethink our current lifestyle around plastic. I challenge the traditional definition of sustainability as economic interests override care for our common home.

Chapter Nine offers a bridge phase-out strategy: six large system steps necessary toward a full phase-out of plastics and a phase-in of environmentally safe substitutes. Chapter Ten calls for individual, collective, and national actions. All the suggested actions are realistic and feasible.

The Epilogue closes the book with a reminder of the Do No Harm philosophy, the need to restore and regenerate Earth from the harm imposed by plastics, and the need for transformative change through intentionality. Our collective actions will lead to hope for a safer, cleaner, more interconnected future: a Post Plastic Age.

Artwork by Pam Longobardi + Drifters Project

NEWER LAOCOÖN (VOICE OF WARNING), 2015

Ocean plastic from Greece, California, Alaska, Hawaii, and Costa Rica, 96” x 89” x 5”. This work updates an ancient Greek sculpture of the complex mythology of Laocoön, a priest of Poseidon who warned of the danger of the Trojan horse and was thus punished by an attack of two sea serpents sent by Poseidon that killed his two sons. Symbolizing a “voice of warning,” this work gives voice to the ocean, now sending plastic back to us to warn us of its damaging effect and her state of ill health. Here I envision black and white serpents representing a balance evocative of the yin-yang symbol as a necessary next step in humanity’s realignment with nature.

—PAM LONGOBARDI

Chapter 1

DO NO HARM

"It is essential to release humanity from the
false fixations of yesterday which seem now to bind it
to a rationale of action leading only to extinction."

—R. BUCKMINSTER FULLER[1]

I had two childhood heroes during my formative years, both shaping my personality and drive to make a difference. First, my grandfather taught me the farmer's ethic to do no harm to Earth, a primary tenant of the precautionary principle. Second, Neil Armstrong, the astronaut, taught me that if a human can walk on the moon, anything is possible when you set your goals toward achieving your dreams. (Hold in mind that thought about shooting for the moon; we'll revisit it again in Chapter 8.)

As a teenager, my grandfather was my hero. He was a family farmer in Northwest Ohio. He cared for the land he farmed through rotation of crops, protecting the soil from depletion. As we worked the land and reaped what we sowed, he taught me that plants will grow when cared for and nurtured. He taught me that nature's growth depends on each generation's care of nature's development and our care for Earth as our collective home.

My dad grew up on the farm, tending to its care. Then he moved to the city to raise his family. I am part of the first generation in our family history to live solely in the city—away from nature except for the squirrels and acorns in the neighborhood. Although my living world has been full of concrete and fences, I visited my grandfather on weekends, seeking a refuge from the city concrete jungle.

Through these visits to the farm, I learned to value Earth and the natural means of recycling and composting its "discards." The motto "Waste Not, Want Not" as the frugal lifestyle of past generations, modeled after nature, came to life. This respect for nature's recycling and composting cycles grew significantly in meaning to me, physically through nature and as a model for human lifestyles.

ZERO WASTE

Tradition tells us that each generation rebels against the previous one, wanting to improve on past mistakes. That is as it should be. Yet we carry forward to future generations the high values and lessons learned from the past. One such lasting value is caring for Earth. The multigenerational stewardship of Earth is humans' study of the natural recycling process, where no "waste" remains—all discards of nature are used to regenerate new plant growth.

I am reminded of a speech I was privileged to hear by R. Buckminster Fuller at a 1976 lecture he gave to business leaders in Chicago. He said: "Pollution and waste are nothing but resources we're not harvesting. We allow them to disperse because we've been ignorant of their value. Any waste as an output of a business is an operational inefficiency."

His point to these executives was that their businesses need to operate more efficiently and do away with the allowance of pollution and wasteful practices. Examples he provided included energy waste, water waste, lack of recycling and waste reduction efforts, and overreliance on long-distance transportation supply networks. He also noted that human "wastes" are due to business reliance on productivity measures rather than worker development and leadership skills. I believe that Buckminster Fuller's speech was the forerunner of the clean (green) manufacturing movement.

Consider the possibility of a waste-free office, school building, or home, where we reuse, recycle, or compost every discard. Zero waste is an approach to our human discard stream, where "waste" (discards) is regenerated—given a second life—through reuse, recycling, and composting. As defined by the Zero Waste International Alliance in 2008:

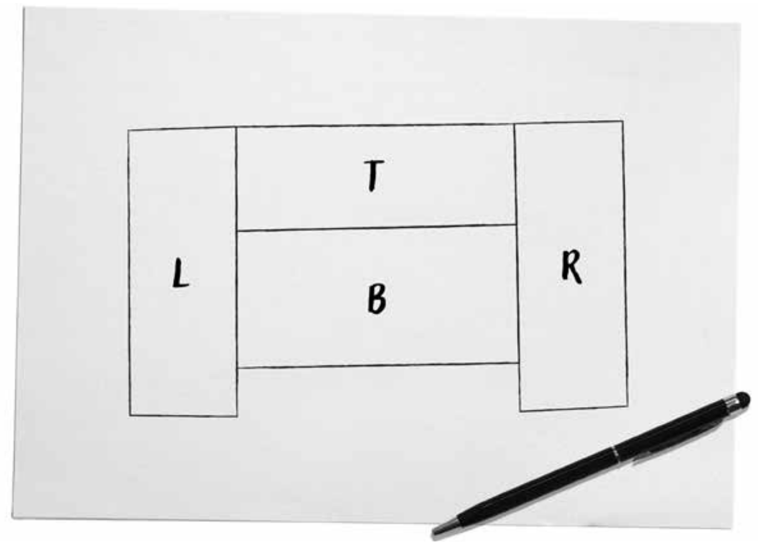
> Zero Waste is . . . the conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.[2]

Although we distinguish the human world from nature, we are inseparable from the natural world. Humans depend on Earth and the food supply from natural life cycles in order to live. All of nature involves complex and interwoven processes of life; we are part of those cycles, not distinctly different from them.

At present, our wasteful practices are out of sync with what nature teaches us. Zero waste is a descriptive term that applies to the natural cycles of growth, death, and regeneration into new life. We must learn this lesson of nature and work toward a less wasteful lifestyle, practicing the zero waste principle of nature. A new life begins as the little acorn falls from the mighty oak, not far from its trunk. So can our children also embrace the age-old value of "waste not" and integrate Zero Waste into their growth and life experiences.

GRANDFATHER'S LESSONS

Along with introducing me to the values and lessons of nature, my grandfather taught me that there are four approaches to a resolution when confronted with a contentious problem too big to resolve with simplistic answers. He'd draw four rectangle blocks: one top, one bottom, one left, and one right, like this:



Then he proceeded to explain the meaning of each rectangular cell. The left cell represents my viewpoint, the version of the story where I am right and all others are wrong. Although I may sound righteous and self-assured, that angle of argument will not likely win over many friends and alliances.

The right cell represents the opposite, the opposing viewpoint; I am wrong and the other side is right. Unfortunately, that position will likely be staked out if I take the self-righteous role noted in the left cell, creating the adversarial stalemate such as we find in Congress. Grandfather stated in his slow but confident voice that he had been down that road many times and can show the bruises but no victories.

The bottom cell denotes the compromise position. This fail-safe position is actively selected when all other staked-out positions fail. I give in on some; you give in on some, and we compromise in the middle. Most Congressional Acts have been passed through this compromise "sausage-making" process. Some praise the art of compromise, but Grandfather said not to stop there, as the easy pathway of compromise often brings dissatisfaction immediately after the agreement is made, with distrust boiling again.

He advised taking the long, rugged path toward the top box: the innovation position. When aiming for innovation, a solution satisfying all parties involved can appear and create mutual trust. However, innovation and trust are slow and require patience—compromise is the fast track most often taken when time is more important than quality.

Some may recognize Grandfather's teaching as being from Stephen Covey's *The 7 Habits of Highly Effective People,*[3] where the innovative cell is described as the Win/Win culture. This is a practical starting point for the discussion of this book. We are seeking a creative, trusting solution through a Win/Win culture and mindset. I ask the reader to leave behind the art of compromise solutions and start up that brilliant mind with the thought processes of innovation—we are on the pathway toward saving Earth through a Win/Win culture, and that journey starts now.

THE INNOVATION POSITION

We live in the age of climate change. This book is intended to address climate change from the perspective of plastics pollution. We have been down the warring paths of "I'm right, you're wrong" and vice versa regarding climate change. Has it provided any progress? Please show me where and how we have made any gains toward the objective of saving our planet from the destructive forces of the climate crisis. The arguments of who is right or wrong have cost us precious time in the war against climate change. In staking out a claim of "I'm right, you're wrong," we effectively display our insecurities about our positions. No ground is gained in this warfare, and meanwhile Earth, its environment, its biosphere, and its people suffer due to our inattention to the needed changes.[4]

Has compromise brought any light toward providing solutions that will slow the warming of Earth's temperature? Compromise is often viewed as a negotiated settlement among warring parties, yet meanwhile climate change continues to fester and grow in its devastating effects. When have you seen public policy from Congress, through the compromise process, bring about the real aggressive change we need to attack the issues head-on at their source? This "temporary balance" between sides has *not* brought about the new and innovative public programs and actions required to address real climate change. What we get through compromise is watered-down actions—yes, an action pathway, but a slow path that does not recognize the short-fused timeline we have to cool this planet from the harm imposed by hundreds of years of CO_2 warming effects.[5]

Climate change is a multi-issue, complicated web of chain reactions resulting in uncontrolled and ever-increasing warming in Earth's atmosphere. Climate Central offers this recent assessment: "The unprecedented rate of global warming observed since the 1950s, due primarily to emissions of heat-trapping gases from burning fossil fuels, is influencing long-term warming trends in each season."[6]

That warming brings increased natural disasters—more intense fires, rising ocean levels, more destructive hurricanes per year, more susceptibility to diseases, changes in the migration of birds and animals, and a faster pace of species extinction.[7] Many more effects of environmental damage on this planet due to accelerated climate change can be listed here. The results are growing exponentially as we waste time through our debates. This book does not debate the reality of climate change—it is real, and it is an ever-increasing threat as Earth's temperature rises. Unfortunately, debates and compromises slow us from finding and implementing the proper solutions we must urgently seek.

We have debated the effects of climate change in the federal government and the U.S. Congress since the 1960s. Naomi Oreskes, a historian of science at Harvard University, offers detailed research that "by the mid-1960s, climate change was already becoming a matter of concern to the federal government. . . . A 1965 report from the National Science Foundation found that the ways humans inadvertently changed the world—through urban development, agriculture, and fossil fuels—were 'becoming of sufficient consequence to affect the weather and climate of large areas and ultimately the entire planet.'"[8]

Carbon dioxide was recognized as a pollutant as early as the 1960s. By 1970, a task force on air pollution commissioned by President Richard Nixon proclaimed in a report that "the greatest consequences of air pollution for man's continued life on earth are its effects on the earth's climate."[9] In 1975, the term *global warming* appeared in print for the first time, in a journal article titled "Climate Change: Are We on the Brink of a Pronounced Global Warming?"[10]

Five decades later, humans are still grappling with climate change's causes and effects, with stalemated discussions in political arenas worldwide.

It's time to explore more innovative platforms and solutions that might help us resolve this stalemate. It's time to move past the decision patterns of the twentieth century and into the twenty-first century. That does not imply higher technology but higher thought processes. It's time to work *cooperatively and collectively* through trust relationships rather than staying forever at odds with one another. It's time to share resources and ideas rather than compete for the top prize. It's time to care for Mother Earth as ordinary people—together, with innovation, through collective modes of innovative thinking.

This book is intended to move in that direction, but it is only one part of the puzzle. There are no silver bullets here—no one has answered the riddle of how to solve the climate crisis. But we can be innovative in working together with many solutions toward the same end goal.

This book explores one of those solutions: the linkage of plastics to climate change and how each of us can take action to make a positive change, thus reducing our environmental impacts. Innovation will take us down that pathway.

INTENTIONALITY

Any list of the biggest, most memorable stories in TV media history is likely to include mankind's first moon landing on July 20, 1969. The unforgettable images of Neil Armstrong and Buzz Aldrin walking on the moon while Michael Collins circled in the command module are iconic. They've become synonymous with American innovation, human achievement, and the impossible made possible. So what happened a half-century ago that sprung this far-reaching scientific advancement? The answer is intentionality.

President John F. Kennedy stated his intent to reach the moon in a visionary speech in 1961: "First, I believe that this nation should commit itself to achieve the goal, before this decade is out, of landing a man on the Moon and returning him safely to Earth."[11]

This commitment turned America toward a then unimaginable goal, with full *intentions* of reaching that goal by the decade's end. Declaring that vision led to the landing on the moon in 1969. In addition, the space program is credited with thousands of scientific advancements in more than five hundred consumer products, including Velcro®,[12] microwavable meals, and the joystick controls we utilize to operate our games.

This American story is a classic example of intentionality—through the actions of scientists who believed in the mission and the visionary goal. It was the same act of intentionality that brought us many modern inventions in medicines, such as penicillin (Sir Alexander Fleming, 1928), the polio vaccine (Dr. Jonas Salk, 1955), and the smallpox vaccine (Edward Jenner, 1796). It was an act of intentionality to ban DDT from production and use (1972) after the publication of *Silent Spring* by Rachel Carson brought to light the deadly effects of the chemical on humans and the environment. Intentionality is at the heart of human progress. Whether we judge that progress to be supportive or harmful is an opinioned and debatable manner in each situation.[13]

We urgently need human imagination, intentionality, and innovation to protect our people, environment, and planet. As discussed in Chapters 8 and 11, it will take visionary goals, new missions, innovations, strong intentions, and a sense of urgency to change the course of the current climate crisis threatening Planet Earth.

DO NO HARM

I began this chapter with a quote from R. Buckminster Fuller regarding past decisions that have led us toward extinction. This fate he warns of becomes a reality only if we stay the course of our past choices and lifestyles. Another critical concept is Do No Harm, embodied in the precautionary principle.

As embraced by the United Nations in 1992, the precautionary principle declares that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[14] The UN statement also declares that "in order to protect the environment, the precautionary approach shall be widely applied by States [Nations] according to their capabilities."[15]

The concept of the precautionary principle dates back centuries. It is expressed well in the Hippocratic Oath—from the classical Greek to our modern American Medical Association's Code of Medical Ethics that doctors and nurses take as they enter their careers. The physician must first "do no harm" in treating a patient when the risks of treatment may be uncertain. Likewise, the precautionary principle applies to climate change, providing the framework for public safety and public health.

I propose five specific action values in the application of the precautionary principle: prevention of harm, burden of proof, innovation of alternatives, intentionality, and inclusion. (I offer more detail for applying these action values to plastics in the Epilogue.) By applying the precautionary principle within these five proactive values, we can advance the protection of humans, the environment, and the climate. As we proceed through this discussion in later chapters, there will be more on the precautionary principle.

PLASTICS, FOSSIL FUELS, AND CLIMATE CHANGE

The climate is impacted directly through the extraction of gas and oil to create plastics through the release of carbon dioxide (CO_2) and methane (CH_4). Throughout the creation and manufacturing of plastics, there are additional releases of CO_2 and CH_4. As plastic products and packaging are transported, marketed, consumed, and disposed of, there are additional releases of CO_2 and CH_4. These greenhouse gas releases impact climate change, human health, and the local environment.

Let us now move forward into Chapter Two to discuss the progression of plastics into our consumer lives. In Chapter Three, we will explore the interaction of plastics within the environment, and Chapter Four will introduce the connection of plastics to climate change.

Artwork by Pam Longobardi + Drifters Project

ANTHROPOCENE TIME CAPSULE, 2018

Ocean plastic, including thousands of cigarette butts, plastic beach toys, Mardi Gras beads, flip flops, collected by Fight Dirty Tybee and Tybee Clean Beach volunteers; vitrine; and wood pedestal. Collection of the Telfair Museum Jepson Center and donated to Tybee Island Marine Science Center.

—PAM LONGOBARDI