

Part Two ENVIRONMENT

Healing the Web of Life

CLIMATE CHANGE

Life in a Warming World

Our culture is based on a principle that directs us to constantly think about the welfare of seven generations into the future.

—Iroquois Confederacy

“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change.”

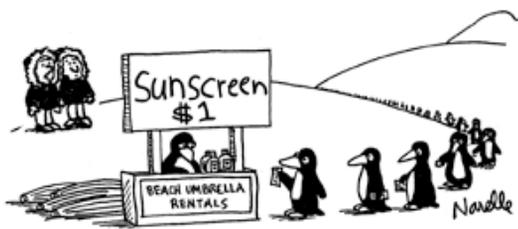
—Charles Darwin,
19th-century English naturalist

The human race may one day deeply regret its slow response to the millennial challenge of climate change facing us right now. While paid-off politicians dither so that sectors of the oil and energy industry can protect their profits—and a complacent, confused, and argument-wary public lets them—the actions we must take to reverse the crisis languish on someone’s desk. With 5% of the world’s population, the US is responsible for at least 18% of global greenhouse gas emissions (GHGs).¹ That this country lags so far behind on this issue is unconscionable.

Humans’ impact on the Earth’s climate is everywhere, if you look, and increasingly severe changes are predicted for the future. If the increase in human-made GHG emissions continues unabated, temperatures will rise even more than they have, and the damage will be irreversible. Water table levels will continue to dwindle while snow evaporates and ice and glaciers melt into oceans. Sea levels are already on the rise. Adapting to unavoidable climate change while simultaneously reducing emissions requires unprecedented global cooperation. Many aspects of climate change are happening earlier and more rapidly than climate models and experts initially predicted.

It’s no longer appropriate to keep one’s head in the sand by claiming that there is not yet scientific consensus on the existence or causes of global climate change. Scientists have called the warming trend “unequivocal” on the basis of multiple lines of physical evidence, including the obvious melting of ice caps and glaciers and the rising sea level.²

Among those who understand the science of long-term climate processes, this is not a debate. The challenge apparently lies in convincing the public of this, since confusion and wild claims seem to be a common mischaracterization of serious efforts to rein in global



“So *that’s* where they’re all going!”

warming. Such inaccurate perceptions are no doubt fueled by vocal opponents from a scientific and political fringe group backed by industries with the most to lose by mandated emissions reductions and appropriately allocated responsibility for them.

The Verdict Is In: We Are the Source of Global Warming

Various factors cause climate to change over the millennia; some are natural, some human-caused. Experts generally agree now that recent increases in global temperatures result mostly from higher levels of heat-trapping gases in the atmosphere, which have been increasing because of human activities since roughly 1750, or the dawn of the Industrial Revolution. Scientists have demonstrated that the primary human source (80%) is the burning of coal, oil, and natural gas (fossil fuels), and the second human source implicated (20%) is deforestation and other land use changes.³

The ten warmest years in the 150-year thermometer record have all occurred in the twelve years between 1997 and 2008; thus none of the previous fifteen decades have been as warm on average as this one.⁴ 2005 was one of the hottest years in more than a century.

In January 2008 scientists indicated that recent warm summers have caused the most extreme glacial melting in Greenland in 50 years.⁵ The US West is apparently warming at nearly twice the rate of the rest of the world and is likely to face more drought conditions in many of its fast-growing cities.⁶

Among these serious concerns is the fact that global ecosystems have feedback loops and *tipping points*, not all of which we understand (to say the least). It is now clear

that several phenomena are self-sustaining, amplifying cycles—for example, melting ice and glaciers, melting tundra and other methane sources, and increasing ocean saturation with CO₂, which leads to increases in atmospheric CO₂. Once a tipping point or change state is reached, climate feedback mechanisms rapidly speed warming. These processes are non-linear and largely unpredictable. For all we know, tipping points may be long past or just around the corner. We are unable to accurately specify what quantity of GHGs will be dangerous, though many agree it is much lower than commonly assumed.

According to models, global temperatures could rise by 4 degrees C (7.2 degrees F) by 2100. Some scientists fear that we may get there as soon as 2050. If we continue on our current trajectory of rapid fossil-fuel growth, over the next century the “perfect storm” of population growth, resource depletion, and climate change will have catastrophic results. Even in the most optimistic scenario (assuming rapid and deep changes in our economic structure), temperatures are likely to increase by 1.1 to 2.9 degrees C by 2100, according to the International Panel on Climate Change (IPCC).⁷

There is a time lag in seeing the effects of our actions in regard to global warming. Even if we ended all emissions tomorrow, additional warming is on the way thanks to the momentum built into the Earth’s intricate climate system. The oceans, for example, have yet to come into equilibrium with the extra heat-trapping capacity of the atmosphere. As the oceans continue to warm, so will the land around them. The velocity and extent of recent changes inform us that our “climate models” are much more conservative than nature itself. Thus this is truly a millennial challenge!

Addressing Climate Change: An Urgent Imperative

Government Action Needed Now!

Given the uncertainties, a public response has been difficult to formulate. The US has a duty to provide leadership on policy shifts because it bears considerable historical responsibility for the problem and has the capability for action. The lack of leadership on the part of the US (just behind China,

now the world’s top emitter of greenhouse gases), has hampered global progress on all fronts. Moreover, the oil and coal industries, among other parties, are actively working to defeat effective climate change legislation because it threatens their large profits. Yet the US must be held accountable for emissions, which are close to double the per-capita level in Europe. The European Union has made a much stronger stand in its commitment to reduce total greenhouse gas emissions (80% by 2050). US carbon emissions continue to increase, albeit not as rapidly as in China, India, and other parts of Asia. Of course, without a US commitment to curbing emissions, persuading China and India to reduce their levels is unlikely.

“Weaker targets for 2020 increase the risk of crossing tipping points and make the task of meeting 2050 targets more difficult. Delay in initiating effective mitigation action increases significantly the long-term social and economic costs of both adaptation and mitigation.”

*—Rainforest Action Network,
Climate Change Action Manifesto*

Understanding the Greenhouse Effect

A fortuitous (for life as we know it) mix of naturally present gases in the Earth’s atmosphere has historically kept this upper part of our ecosystem in equilibrium and the planet habitable by trapping heat in the thin blanket of air surrounding us. The gases (with sources both natural and human-caused) absorb and re-emit radiation from the sun. This interplay of natural forces that result in warming is called the *greenhouse effect*. The substances now popularized as *greenhouse gases (GHGs)* include carbon dioxide, methane, nitrous oxide, ozone, and CFCs (chlorofluorocarbons, including aerosols). As one of the consequences of increased GHGs, water vapor increases in the atmosphere in response to rising CO₂ concentrations, and this greatly heightens the warming effect of manmade CO₂ emissions.

The greenhouse effect has been conducive to life on Earth, and for millennia the amount of the main GHG, carbon dioxide, remained fairly constant at about 280 parts per million (ppm). But since the Industrial



Revolution, beginning around 1750, the quantity of carbon dioxide and other gases being released into the air by human activity has greatly increased. These *emissions* from cars, jets, power plants, industry, etc., remain in the atmosphere for many decades, so they are sure to affect the climate far into the future. Today's level of carbon dioxide (CO₂) is 394 ppm—a 40% rise from pre-industrial times, in only a fraction of the time of humans on Earth! When the amount of GHGs exceeds the capacity of the ocean, forests, and soil to absorb it (these are our “carbon sinks”), more heat is retained in the atmosphere; then air, ocean, and land temperatures rise and *global warming* is said to occur. Climate change is a result.

The farming of animals produces GHGs that are more harmful than carbon dioxide, generating 65% of nitrous oxide (296 times as warming as carbon dioxide), as well as 37% of methane (23 times as warming as carbon dioxide); the latter is largely produced by the digestive system of the animals.

One-third of all the raw materials and fossil fuels used in the US go to raising animals for food. Worldwide petroleum reserves would be exhausted in 11 years if the rest of the world ate like the US. A nationwide switch to a vegetarian diet would allow the US to cut its oil imports by 60%.⁸

Go Climate-Neutral: How One Group Did It

The Center for Biological Diversity (CBD) chose to become climate-neutral with a program to explicitly track and then maximally reduce GHGs. They also purchased “carbon offsets” equal to the amount of all past emissions since the organization's inception in 1989. These offsets, which support forest conservation in Madagascar, produce many direct additional benefits to biodiver-

TERMINOLOGY FOR THE 21ST CENTURY

Global Warming: As more greenhouse gases are released into the atmosphere from the burning of fossil fuels than are trapped by ocean, forest, and soil sinks, more heat is trapped there, and the average global atmospheric temperature increases, a condition known as “global warming.”

Climate Change/Global Warming: Climate change results directly or indirectly from human activity that changes the composition of the global atmosphere (in addition to natural climate variability). The popular term “global warming” signifies the overall increase in global temperatures since the Industrial Revolution, but the climate will continue to change in many diverse and unpredictable ways.

Intergovernmental Panel on Climate Change (IPCC): A large, global scientific body tasked to evaluate the risk of climate change caused by human activity.

Kyoto Protocol: This international agreement is a protocol to the United Nations (UN) Framework Convention on Climate Change, an environmental treaty produced at the 1992 UN Conference on Environment and Development, informally known as the Earth Summit, held in Rio de Janeiro, Brazil. The Kyoto Protocol establishes legally binding commitments for the reduction of six greenhouse gases produced by industrialized nations, as well as general commitments for all member countries.

Copenhagen Accord: Although the signatories agreed that global temperatures should not rise above 2°C, the deal does not commit any nation to greenhouse gas emissions cuts. However, the Accord does state that wealthy nations will raise \$100 billion a year by 2020 to help poorer nations cope with the effects of climate change.

Fossil Fuels: Also known as mineral fuels, these fuel sources are derived from fossils, or hydrocarbons found within the top layer of the Earth's crust. Examples include coal, petroleum, and methane. Fossil fuels are non-renewable resources because they take millions of years to form, and fossil fuel reserves are being depleted far faster than new ones are being formed.

Carbon Dioxide (CO₂): The main greenhouse gas is released into the atmosphere largely through the combustion of fossil fuels. Atmospheric concentrations of CO₂ are estimated to be at their highest level in at least 800,000 years.

Methane (CH₄): This chemical compound is the principal component of natural gas. Burning methane in the presence of oxygen produces CO₂ and water. Methane emission has 23 times the impact of a CO₂ emission of the same mass.

sity and local communities. CBD used the Corporate Greenhouse Gas Accounting and Reporting Standard developed by the World Resources Institute and others to create an inventory of sources including all electricity and heating fuel used in offices, and all automobile and airplane travel on CBD business. They then calculated average emissions per staff member and multiplied this by the number of staff members in previous years to obtain an estimate of total emissions since 1989. This total is relatively small, about 480 tons of CO₂. After extensively researching carbon offset purchasing options, CBD chose to purchase 500 tons of CO₂ credits in the Makira Forest Conservation Project, Madagascar.

Notes Peter Galvin of CBD, “It needs to be pointed out that the entire offset concept is a controversial one. The key issue here is something called verifiable ‘additionality’—or removal of GHGs in ways that would not otherwise occur.”⁹

The island of Madagascar off the east coast of Africa is one of the world’s biodiversity hotspots. The Makira Forest Conservation Project, a joint project of Conservation International, the Wildlife Conservation Society, and the government of Madagascar, will mitigate 9.5 million tons of CO₂ emissions over the next 30 years through forest conservation, including replanting of cleared areas.

WHAT YOU CAN DO

Increasing awareness of the greenhouse gas consequences of our energy use, travel, food, and other choices is the first step toward reducing our own emissions. The average American generates approximately 24 tons of CO₂ annually, but this number can be drastically reduced with simple changes, many of which will also save you money. There are many resources available to further reduce your emissions. See “Getting Personal” for footprint information.

Once you have reduced your emissions as much as possible, you can go even further by supporting organizations working for policy change and purchasing offsets. Lend your vocal political and financial support to organizations that are serious, committed advocates for policies involving *mandatory reductions* in GHG emissions. Investing your offset dollars to sue polluters is dollar for dollar, GHG pound for pound, quite

arguably the most effective offset strategy to achieve the urgently needed massive GHG reductions the US must make.

Every individual’s footprint on the environment must be greatly reduced through conservation, improvements in technology, and potentially challenging changes in lifestyle. Start with the simple acts of energy conservation suggested in these pages. Electricity, natural gas, propane, and all forms of energy are as valuable as water and must not be wasted. There are environmental costs to their production, transport, and combustion. Be aware and conserve.

Think about your personal “carbon footprint” on the Earth: How much generated “juice” do you burn during your day? How much embodied energy goes into each product you buy? How much do you drive or fly in a given week? Try to carpool or use public transit at least part of the time!

Be active in the public dialogue, and talk about this problem to your friends. Help clear up public misperceptions that “no one really knows anything for sure; the Earth changes all the time.” Educate others that cutting or reducing emissions of GHGs is a change we all must support now.

Urge local, state, and federal government bodies to make appropriate legislation a priority. Tell your representatives at both federal and local government levels the following:

- Act now to limit potential damage from climate change rather than waiting and having to take more costly, reactive measures in the future. Timely action could ease the coming impacts of hotter weather, rising sea levels, and bigger storms.
- Adopt federal policies that establish mandatory limits on GHG emissions. Adhere to international agreements such as the Kyoto Protocol.
- Harness the power of markets to drive innovation and protect the climate. Subsidize renewable energy investments.
- Don’t make carbon-intensive investments in developing countries.
- Climate protection in developing countries must be supportive of economic and social development; foster technical cooperation programs.
- Financiers must devise new ways of investing in the needed global transition to a low-carbon “re-industrialization.”¹⁰



Focus the Nation

Many important decisions are made at local, state, and regional levels on the issues that most affect you. In fact, many cities and localities have begun to take action, not waiting for the federal government to do it for them. Locals can make the best local plans of action.¹¹

ARE YOU IN THE KNOW ABOUT 350?

Renowned American environmental activist and writer Bill McKibben is building a global-scale climate change movement, focused on the significance of the number 350. The 350.org campaign aims to involve everyone in realizing our collective effect on global warming.

According to McKibben, “350 is the most important number in the world”—the number determined to be the safe upper limit for carbon dioxide measured in parts per million in our atmosphere. “We need people to understand that 350 marks either success or failure for climate negotiations.”

With CO₂ levels already exceeding 350 parts per million, McKibben is traveling the world to awaken people to the dire threat of global warming and create a powerful and unified call to action.

On October 10, 2010 (10.10.10), people around the world came together in over 7000 local events to demonstrate the need to take action to deal with climate change, the most widespread environmental action event ever.



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THE OCEANS

Deep Problems on the Water Planet

“The frog does not drink up the pond in which s/he lives.”

—oral tradition, Teton Sioux

Vast as they are, covering three-quarters of the globe, the world’s oceans are not infinite. We are pushing up against limits by overfishing, as well as by polluting and dumping waste into waterways and seas, including non-biodegradable plastic. Current problems of acidification, pollution, and threats to fisheries stem from cumulative abuse. And only a serious culture-wide reduction in both pollutants generated and carbon dioxide (CO₂) emitted will stem this rising tide of death.

All life on Earth is connected to the oceans. They are our life support systems, from the food chain to the water cycle. Yet human activities are collectively driving the health of the world’s oceans down a rapid spiral.¹²

Global Warming

As a major carbon sink, or absorber of CO₂ and other greenhouse gases, the ocean is ultimately limited in this capacity. Though the response takes decades, the ocean’s average surface temperature and acidity are now rising, thereby contributing to weather changes, higher sea levels, current shifts, coastal erosion, and altered fish migration routes. The oceans have absorbed about half of the CO₂ we’ve emitted in the last 200 years as it accumulates in the atmosphere;¹³ this load is currently estimated at about

22 million tons per day.¹⁴ The CO₂ reacts in the oceans to form carbonic acid, which has greatly increased in concentration (by 30%) in the last two centuries.¹⁵ This is how higher levels of greenhouse gases acidify the oceans’ pH balance and threaten marine life, which is unable to adapt so quickly.

Ocean acidification has been called global warming’s evil twin.

Ocean acidification depletes seawater of compounds that organisms need to build shells and skeletons, impairing the calcium-building capacity of coral-forming polyps, crabs, seastars, sea urchins, plankton, and other marine creatures. In what could be one of the first indicators of an industry-wide if not ocean-wide effect, the Pacific Northwest oyster industry is collapsing because

the hatcheries can’t grow larvae anymore.¹⁶ Acidic waters may prevent coral reefs from surviving in most regions by mid-century if current GHG emissions trends continue, an international panel of marine scientists said in early 2009. The ripple effect throughout marine ecosystems could be disastrous, according to the Monaco Declaration, the science panel’s joint statement, which added: “The current increase in ocean acidity is a hundred times faster than any previous natural change that has occurred over the last many millions of years.”¹⁷

In one of the many *feedback loops* we are witnessing in this time of rapid environmental change, the rising ocean temperature interferes with established ocean currents that move vital nutrients upward from deep regions. Without these nutrients in abundance, the plankton do not thrive at the foundation of the ocean food chain. Furthermore, abundant plankton actually helps store CO₂ in the ocean floor as they die and decompose.¹⁸

Overfishing

The booming population of humans with our growing appetite for seafood is pushing many ocean species toward extinction. Global seafood consumption (per person average) has tripled since the 1950s,¹⁹ and fish stocks are already collapsing worldwide. Most of the ocean changes observable today—as well as immediate threats to marine species—are the result of unsustainable fishing. Scientists project that at today’s rates of withdrawal, all currently fished species of wild seafood could collapse (experiencing 90% depletion) by 2050.²⁰ This will not only affect the entire food chain, it will decimate the livelihood and sustenance of millions of people who depend directly on the ocean’s bounty, including some 100



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SUSTAINABILITY FOR OCEAN HEALTH

- **Choose Sustainable Fish or Farmed Seafood.** For information on ocean-friendly seafood, visit the Seafood Choices Alliance at www.seafoodchoices.org.
- **Buy Local Products.** Support local farmers and fishers. Eating local enhances your community's economy and our global ecosystem. seastheday.theoceanproject.org.
- **Be Trash-Conscious.** If you can't recycle it, be knowledgeable about what you throw away. For instance, flushing non-biodegradable products can damage the sewage treatment process and end up littering beaches and waters. For other tips on safe trash disposal, visit www.epa.gov/recyclecity/ or www.obviously.com/recycle.
- **Be Considerate of Ocean Wildlife.** Our trash can damage or kill ocean wildlife. Never dispose of fishing line or nets in the water. Don't release helium balloons outside. Minimize or reject use of styrofoam. Cut open plastic six-pack rings that can entangle ocean life.
- **Reduce Household Toxins.** By using natural fertilizer, phosphate-free detergents, and non-toxic cleaning products, you can ensure a healthier ocean and a cleaner overall environment. For more ideas on reducing pollution, see es.epa.gov/techinfo/facts/safe-fs.html.
- **Reduce Run-Off.** Avoid contributing to nonpoint source pollution. Use soap sparingly if you must wash your car. Don't use toxic chemicals on your lawn. And scoop pet waste—an estimated 15 tons flows into ocean waters every day! Other ways to reduce your run-off can be found at www.epa.gov/owow/nps/whatudo.html. Don't dispose of hazardous substance down storm drains.
- **Support or Volunteer for the Oceans.** Find a local nonprofit organization working to save the oceans and ocean life, and get involved. For international volunteer opportunities, see www.oceanicsociety.org.

—from the San Francisco-based Oceanic Society

million people in Southeast Asia²¹ and as many as 3 billion worldwide.²²

Fisheries have had many catastrophic effects on the oceans—disrupting the food chain, diminishing water quality, destroying habitat, harassing and displacing wildlife, and otherwise altering the overall marine ecosystem. And wherever there's fishing, there's *bycatch*—fisheries' wasteful and unintentional capture of unwanted species. Commercial fishing creates millions of tons of discarded catch annually, including not just fish species but turtles, marine mammals, sharks, and even seabirds.

Pollution

Wastes carried in the world's rivers and streams end up in coastal waterways and oceans, including sewage, industrial dumping, and agricultural run-off. Industrial pollutants like mercury or PCBs that end up in streams and oceans are absorbed by fish we

eat, thus adding to our toxic load.

The oceans' ability to dilute these substances is declining, but the amount of contaminants is not. In places like the Mississippi delta, the waters are *dead zones* for miles—uninhabitable for fish and shellfish. Nitrogen, phosphorus, and other nutrients from fertilizers, large livestock farms, and septic systems provoke explosive blooms of tiny plants known as phytoplankton, which die and sink to the bottom and then are eaten by bacteria that use up the oxygen in the water. This oxygen starvation makes it difficult for fish, oysters, sea grass beds, etc., to survive—hence the dead zones.²³ There are now at least 200 of these zones around the world, and they are increasingly rapidly.²⁴ The most severe cases exceed 20,000 square kilometers.²⁵

More than 1.2 trillion gallons of sewage (including human waste, excreted pharmaceuticals, detergents, and household



chemicals) and polluted storm water are discharged into American waters annually.²⁶ Around 60% of the wastewater discharged into the Caspian Sea is untreated, while in Latin America and the Caribbean the figure is close to 80%, and in large parts of Africa and the Indo-Pacific region it's as high as 90%.²⁷

WHAT WE CAN DO

- Use a lot less fossil fuel-based energy. Use as little plastic as possible. Don't eat endangered or threatened species. Limit your consumption of seafood in general, and learn which species concentrate toxins and thus toxify you.
- International laws are drastically inadequate to address threats like large-scale commercial fishing, which sweeps life out of the seas at unprecedented rates—often only to discard the unusable “bycatch,” an unacceptable waste of life.
- Urge the US Congress to increase government protection of fish stocks. Existing regulations and controls on overfishing must be enforced, primarily targeting those fisheries with the highest rate of bycatch.
- Join a beach clean-up. Since 1986, the Ocean Conservancy organizes shoreline cleanups each fall. To date, 6.2 million volunteers in International Coastal Cleanups have removed 49 million kilograms of debris from nearly 288,000 kilometers of coasts in 127 nations.²⁸

CORAL REEFS

Colorful “Rainforests of the Sea”

Degraded for decades by toxic run-off, bleached coral reefs are now viewed as early indicators of global warming.

Coral reefs are among Earth’s most diverse, exquisite, and fragile ecosystems, essential to the web of life. They have been vanishing at alarming rates for the last 40 years, mainly from run-off of agricultural (including lawn) chemicals and waste. Now the rapid pace of environmental change threatens to overwhelm the reef species’ ability to adapt. Coral reefs appear particularly vulnerable to even the most modest climate-change scenarios, as they are unable to adjust to rapid changes in temperature and ocean acidity, and we may be approaching a tipping point that will wipe out entire bio-regions.

While these changes are likely to exceed the capacities of many species to adapt, elkhorn and staghorn corals gained US federal legal protection in 2006, becoming the first species listed under the Endangered Species Act because of vulnerability to global warming. Coral reefs throughout the Caribbean and along the coast of Florida are vanishing at unprecedented rates.²⁹ Protection under the ESA creates greater opportunities for coral reef conservation.

The 2008 report, released by the Global Coral Reef Monitoring Network, predicts that many of the remaining reefs may disappear within the next 40 years if current emission trends continue; 19% are already dead.³⁰ A third of reef-building corals are threatened.³¹ The demise of coral reefs affects the entire ocean ecosystem—a quarter of all marine fish species reside in the reefs,

according to The Nature Conservancy. The International Union for the Conservation of Nature (IUCN) estimates that 500 million people depend on coral reefs for their livelihoods.³²

The coral reef assessment found that 45% of the world’s reefs are healthy, providing hope that some species may be able to endure the changes expected from global warming. Marine biologists are now attempting to understand how certain coral reef species can better survive warmer, more acidic ocean waters.

In addition to climate change with its warming sea-surface temperatures and acidification, other factors affecting the health of coral reefs are overfishing (including the technique of dynamiting reefs to catch fish), pollution, and invasive species such as crown-of-thorns starfish.

WHAT WE CAN DO

- The area of coral reefs under protection needs to be increased globally from the current level of 15% to 30%. Within these protected regions there need to be clear areas where human uses are significantly limited so that already-stressed marine species can recover.³³
- Don’t touch delicate corals with swim fins. Learn to enjoy snorkeling without touching or breaking the corals, or keep a safe distance.
- Don’t buy coral jewelry, and inform those selling it about the threats to coral.

If nothing is done to substantially cut CO₂ emissions, coral reefs as we know them will no longer exist.



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FRESH WATER

Using Water Wisely

We all know that most life on Earth is impossible without water, so why would we pollute and waste this priceless substance? Water bodies are assumed to have endless capacity to “disappear” toxins, trash, and wastes (industrial, sewage, agricultural, to name a few). But Earth’s rivers, lakes, and oceans have suffered so much dumping that their ability to support life is lost, compromised, or disappearing fast. There isn’t enough anymore, with our increasing population, to waste another drop. With global warming drying out much of the planet, this will only get worse.

Nearly 97% of the world’s water is salty or otherwise undrinkable. Another 2% is locked in ice caps and glaciers. **Only 1% can be used for all agricultural, residential, manufacturing, community and personal needs, and much of that is polluted.**³⁴

About 20% of the world’s fresh water (one-fifth of the 1%) is in the Great Lakes.³⁵ Humans currently consume 50% of the Earth’s available fresh water, leaving what’s left over for all other species.³⁶

“What you people call your natural resources our people call our relatives.”

—Oren Lyons,
faith keeper of the Onondaga

Climate change will exacerbate water shortages. The Intergovernmental Panel on Climate Change (IPCC) predicted that melting alpine glaciers and evaporating snow cover will accelerate during the 21st century, which it has steadily been doing. As a result, many regions will likely experience a decline in freshwater resources and hydropower potential, with redirected seasonal water flows.³⁷ Water security in a warming world will require major improvements in water use efficiency (especially in the agricultural and industrial sectors) and in techniques such as rainwater harvesting and groundwater management and use.

It may be that investing in renewable energy sources enables us to conserve water. According to *Harper’s* magazine, half of all fresh water drawn from US sources each year is used to cool power plants.

According to the *Washington Post* in 2005, just one flush of a toilet in the West uses more water than most Africans have to perform an entire day's washing, cleaning, cooking, and drinking.^a

Water: A Basic Right Not Yet Available to Everyone

Ensuring access to safe water for all people has long been a humanitarian goal, but this has yet to be accomplished. It's already clear that the UN's Millennium Development Goal will not be met in this area: "Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation."

In addition to the existing shortages, strife, and distribution problems around clean drinking water, we are facing an enormous crisis of increasingly degraded water quality and diminishing quantity. The world's population is growing rapidly while freshwater sources are drying up or polluted—from overdrafted aquifers to shrinking glaciers to toxic urban rivers.

More than a billion people today lack access to potable water, and 2.4 billion are without sanitation services.³⁸ That's one out of six people worldwide. The United Nations projects there will be more than four billion people living in nations defined as water-scarce or water-stressed by 2050, up from half a billion in 1995.³⁹ How to ensure that all people will have access to this vital, limited resource? Conservation and wise usage is the only answer.

Transnational corporations are viewing investments in water as potentially lucrative—in fact, water is being called "the oil of the 21st century." *Yet water should not be a profitable industry.* Concerned organizations are working to protect universal access to safe and affordable drinking water by keeping it in public hands.⁴⁰ In short, the sale of public works to private companies can foster corruption and result in higher rates, inadequate customer service, and a loss of local control and accountability, as many privatization efforts have shown.

Historically, governments have been responsible for public water systems, but with the high cost of development and upkeep along with the moral imperative

to extend systems to the billion people worldwide who lack access to clean drinking water and sanitation, the private sector has entered the picture. Institutions like the World Bank and Inter-American Development Bank often require privatization of utilities as a condition of making loans to governments. The idea is that the public sector is failing to deliver; and the private sector, which is presumed to be more efficient and cost-effective, can pick up the slack. However, in countries with heavy debt loads and desirable natural resources, "Privatization World Bank-style becomes a feeding frenzy for foreign multinational corporations, eager to scoop up struggling enterprises at bargain prices."⁴¹

The social and environmental impacts of water privatization have caused fresh waves of protest as communities all over the world have organized, and in some cases shed blood⁴² to regain control of their water resources. This growing social movement stands in firm opposition to the privatization of our most essential natural resource.⁴³ Let's face it: Private-sector companies are organized to make profit, not to fulfill socially responsible objectives.

No Profits from Water!

TRUE THIRST

- 40% of the world's population carries their water from wells.
- 50% of India's morbidity is because of poor water quality.
- In Nigeria, impoverished households spend almost 20% of their income on water.
- By 2050, more than 523 million people in Africa will not have access to clean water, and famine will be even more rampant as the arid landscape increases.
- Forty of the 50 countries on the critical list for water scarcity are located in the Middle East, and in north and sub-Saharan Africa.
- 60% of the world's population lives in Asia, which has only 36% of the Earth's renewable fresh water.
- 90% of wastewater of developing nations is discharged untreated into local waterways.
- Between 1.8 and 3.5 million Americans get sick from tainted water annually.^b

WHAT YOU CAN DO

Support Public Water!

Ensure that a public resource stays in public hands

- If your utility is publicly owned, ask if privatization is being considered. Get involved. Food & Water Watch can help provide information on fighting privatization—email cleanwater@fvwatch.org.
- Advocate for democratic control and protection of public water resources in the face of international corporate strategies to privatize ownership and distribution.
- Public funding for infrastructure improvements is the answer, not privatization!
- World Health Organization's website is a great educational resource to learn more about the water crisis. You can contribute to this cause through organizations like World Water Council; Charity: Water; and End Water Poverty.
- To raise awareness, the US Fund for UNICEF has initiated the **Tap Project** (www.tapproject.org): Various restaurants pledge a certain amount of money and then offer diners the option of paying a nominal fee for their usually free tap water. Funds provide drinking water to children around the world who lack access. As the website tell us, "Just \$1

THE FOLLY OF BOTTLED WATER

Consumers waste billions of dollars a year on billions of gallons of bottled water. With these unnecessary purchases, we are creating trash and financing the corporate takeover of water supplies. Bottled water can cost up to a thousand times more than tap water and funnels the profits from the sale of water, a public resource, to private companies.⁴⁵

As much as 40% of bottled water comes from a municipal tap!⁴⁶

Production, transportation, and disposal of bottled water consume large quantities of water and energy. You can actually conserve water (and spare yourself the carcinogenic leaching of plastic chemicals into the liquid) by switching from the bottle to the tap.

BOTTLED WATER CONSUMPTION IN THE UNITED STATES

- 1978: 415 million gallons.
- 2001: 5.4 billion gallons.
- That's a rise of 1,300%, equaling about 43 billion 16-oz plastic bottles.
- Bottled water is now the fastest growing product among the top 50 supermarket categories.
- *National Geographic* estimates that more than 85 million plastic water bottles are used every three minutes.

can supply a child with safe drinking water for 40 days.”

- Techniques for water retention and improved technology allow simple practices such as solar water heating, rainwater harvest and storage, stormwater management (bioswales, sediment traps, rolling dips), micro-hydro electricity generation, and biofiltration (“living machines”)—all of which help replenish groundwater resources, conserve water, and use it wisely. The Internet offers many options and resources.
- Rainwater harvesting can take place anywhere there is a roof by gathering rainwater in do-it-yourself systems (such as plastic barrels) or commercial systems (for irrigation and livestock). This traditional practice is just as appropriate today, if not more so!⁴⁴
- Water is a public trust. It is time for a water trust fund, a long-term solution to provide all US communities safe and affordable water for the future—not just those that can afford sharp rate increases. Support clean and safe tap water—tell Congress to make clean water a priority and to increase funding for it.
- Download and share the **Smart Water Guide** from Food and Water Watch, filled with facts and helpful tips.
- Host a movie screening of **FLOW**, **Blue Gold**, or **The Water Front**, powerful



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documentaries sure to get the message across.

- **Curb your own water use!** Calculate your water footprint using an online water calculator: www.h2oconserve.org (part of foodandwaterwatch.org).

FORESTS

Forests have long been valued and exploited for timber products, leading to the loss of the great majority of global primary forest ecosystems. According to one estimate, stands of century-old forest now account for only 7% of forest cover in the US.⁴⁷ But lately trees are being looked

at a little differently because of their ability to suck carbon out of the atmosphere and sequester it in their biomass. Climate change might finally be the catalyst to economically value standing forests more than lumber. The global money machine is even beginning to work out a process for giving **carbon credits** to businesses that leave trees standing and storing carbon. This also spares the air the effects of burning the wood that is cut down—a massive contributor to global warming that has put Indonesia and Brazil third and fourth, respectively, on the list of top GHG contributor nations (with the US and China topping everyone).

Home to countless creatures, forests are the lungs of the Earth, arbiters of weather patterns, major storehouses of carbon, and our original cathedrals.

Scientists agree that the world's rainforests are the best natural defense against climate change because they are **carbon sinks**. For example, Indonesian old-growth rainforests store almost 750 tons of carbon dioxide—the equivalent of 620 flights between New York and London—per acre. When cleared, rainforests release that carbon into the atmosphere, furthering global warming rather than curbing it.⁴⁸

Halting new deforestation is as powerful a way to combat warming as closing the world's coal-burning plants.⁴⁹ But until now, there has been no financial reward for keeping the trees standing. That's what may change: A growing number of experts is saying that cash payments are the only way to end tropical forest destruction and "provide a game-changing strategy in efforts to limit global warming."⁵⁰

Carbon Offsets

This emerging (and controversial) trade seeks to enable industrialized nations and wealthy corporations to "offset" their GHG emissions by paying developing nations to protect their forests and/or replant new ones—Reducing Emissions from Deforestation and forest Degradation, aka REDD. Forests were not considered as carbon sinks in the Kyoto Protocol, but later realization that deforestation accounts for roughly 20% of global greenhouse gas emissions has led to their reevaluation. Meanwhile, the buyer of the offset can keep polluting (theoretically until he can afford to make deep changes in his business).

Not all offsets are equal. Poorly designed programs to pay for forest conservation can end up financially rewarding the very people who are destroying them! Verifying the efficacy of an offset is a key issue, and the details have yet to be determined. Already many people are lining up to get "carbon credit" for some dubious activity.



Vinit Allen

For example, California issued rules allowing offset credit for logging that can include clearcutting!⁵¹ A major criterion is that GHGs be removed from the atmosphere in ways that would not have occurred otherwise—such as replanting denuded areas.

The Plight of the Tropical Rainforests

Home to more biodiversity than any ecosystem on Earth, the magnificent rainforests are falling daily, often for rapidly proliferating palm oil and soy plantations. Largely owned by US agribusinesses, these plantations and the rapid expansion of industrial agriculture constitute one of the fastest-growing threats to the world's great tropical forests: in the Amazon and Indonesia, Malaysia, and Papua New Guinea. Spurred in part by the growing demand for biofuels, US agribusiness giants Archer Daniels Midland, Bunge, and Cargill are establishing soy and palm oil operations in some of the planet's most biodiverse and virginal forests.

**WARNING: MAY CONTAIN
RAINFOREST DESTRUCTION**

Tropical rainforests are disappearing at a rate of 100,000 acres per day. That's an area larger than the state of West Virginia.⁵²

Meat consumption is one of several factors driving soybean demand and production. Brazilian beef is surging in global popularity, and soybean prices are on the rise due to global meat consumption and biofuels production. However, biofuels made from recycled waste products differ greatly from "first-generation" agrifuels—agribusinesses' industrial alternative. Agrifuels are not low-carbon. Because of their impacts on climate change, direct and indirect land use impacts, fossil fuel inputs, and the investments they may draw away from real solutions, agrifuels will not solve the twin crises of climate change and our dependence on oil.⁵³

*Every blade of grass has its angel
that bends over and whispers,
"Grow! Grow!"*

—*The Talmud*

The Palm Oil Takeover

Palm oil, found in food products, soaps, and cosmetics, could well be the most widely traded vegetable oil in the world today, seemingly a part of everything tasty. It is the controversial link that connects your cookies, climate change, and disappearing rainforests. Demand for palm oil has more than doubled in the last decade as worldwide food consumption soars. And now that palm oil is being used for biofuel, the problems are magnified.⁵⁴ Farmers are expanding existing palm oil plantations and burning primary forests to plant more. Nearly all palm oil imported to the US originates in Indonesia.

Rainforests shouldn't be open for agribusiness.

"Biofuels began with a great dream: making fuel from oil or plant waste. But when agribusinesses got involved, the dream went bad."

—*Rainforest Action Network*

WHAT WE CAN DO

- Don't destroy pristine ecosystems to make way for plantation farming.
- Consumer power can be directed to seek out responsible sources of palm oil and to avoid products derived from recently cleared land and other unsustainable agribusiness practices. Companies providing palm oil need to improve techniques and sourcing to be part of the solution.
- Instead of cutting and burning forests to make way for palm plantations, farmers should be encouraged to grow the crop on already cleared land. "Global production could be doubled by planting palm trees on degraded areas of Borneo. The advantage is that not a tree would have to be cut."⁵⁵
- Go vegetarian, or at the very least, source your meat responsibly. Beef production is ruining the planet.
- Rather than continuing to pursue agrifuels policies and increasing the global marketplace for agrifuels, decision-makers in the corporate and political arenas should prioritize proven, true solutions that halt the expansion of carbon-intensive industries. Policies and investments that support mass transit, bike transit, and plug-in vehicles recharged by a green grid

are far more efficient and cost-effective means to reduce our dependence on oil. Agrofuels are not low carbon, and we can't afford to lose any more time pursuing false solutions. It's time for a real transportation revolution.⁵⁶

■ Wood and paper buyers should endeavor to understand the origin of the products they buy.⁵⁷ Look for the Forest Stewardship Council (FSC) logo as a tool to promote environmentally, socially, and economically responsible management of the world's forests. Beware of imitations such as the Sustainable Forestry Initiative (SFI), designed to evade higher standards and mislead consumers. Learn more about certification standards at these links: www.credibleforestcertification.org and www.buygoodwood.com. The trees thank you!

BIODIVERSITY

Every Species Matters

"This we know. All things are connected like the blood that unites one family. Whatever befalls the Earth befalls the sons and daughters of the Earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself."

—attributed to Chief Seattle

This is the sixth great extinction documented on Earth, and the largest since the dinosaur exodus 65 million years ago. A 2008 study in the *Proceedings of the National Academies of Science* said the current extinction period, known as the Holocene extinction event, may be the greatest event in the Earth's history and the first due to human actions.

Our impacts are undeniable in regard to the current extinction crisis, including our relentless pressure to accommodate the exploding human population, obtain essential forest and ocean resources, and convert native ecosystems to arable land (in large part to raise soybeans to feed cattle to make burgers). Land use changes such as deforestation and conversion to cropland contribute to global warming emissions as well as species loss.

Extinction is accelerating all around

us, in myriad large and small ways. Although extinction is a natural phenomenon, its "background" rate is about one to five species per year. Scientists estimate that presently dozens are going extinct every day.⁵⁸ According to biologist E.O. Wilson, we are experiencing this catastrophic extinction "at 100 times the normal rate of extinctions, and this rate is expected to rise to 1,000 or higher. In each of the prior extinction spasms, it took about 10 million years for evolution to regain the amount of biodiversity lost."⁵⁹ If present trends of human consumption continue, half of all species of life on Earth could be extinct in less than a century "as a result of habitat destruction, pollution, invasive species, and climate change."⁶⁰

Species loss weakens the web of biodiversity. Given our interrelatedness here on spaceship Earth, the extinction numbers are likely to snowball in coming decades if ecosystems continue to unravel. We don't know what the major tipping points will be.

Every 10 or 20 minutes—the time it may take you to read a few pages—the last individual of a unique species has taken its last breath and has gone extinct forever.⁶¹

Major Causes of Extinction

Habitat Loss

Habitat alteration and loss is the main force driving species extinction. As human populations increase exponentially, more land is deforested or otherwise altered for housing,

farming, livestock, fuel, roads, and other uses. Species previously living on that land either move and adapt or die. Worldwide deforestation is occurring at record rates.⁶² Efforts to reestablish habitat seldom work and are less stable than the natural systems that evolve over time.

The extinction of species has reached crisis proportions with the collapse of the diversity of life that sustains both ecosystems and human cultures
Extinction is forever.

Invasive Species

The second leading cause of extinction is the presence of invasive species, brought to a new habitat by humans. Not all transplanted species adapt well, but some can take over habitat of indigenous species, often driving them to extinction. Humans can be viewed as the number-one invasive species, since we use 40% of net primary productivity—all organic matter produced by photosynthesis on Earth—leaving what's left over for other species.⁶³

Pesticides and Toxic Pollution

After World War II, the use of new synthetic chemicals as pesticides and herbicides became widespread and began to bioaccumulate in plants and animals, including humans. Rachel Carson's ground-breaking book *Silent Spring* (1962) brought our attention to negative effects on wildlife.⁶⁴ Additional sources of potentially lethal pollution include lawn chemicals, human medications, and other synthetic chemicals flushed into surface water. Mercury from coal-fired power plants is found in fish throughout the US.⁶⁵

Global Warming

The warming climate is undermining biodiversity by accelerating habitat loss, altering the timing of animal migrations and plant flowerings, and forcing some species toward the poles and to higher altitudes. Major alterations to the complex and delicately balanced food chain will have significant and often unpredictable impacts, including the domino effect. Scientists warn that just ten more years of our current GHG pollution trajectory may commit the planet to devastating warming trends,

CRIES OF THE WILD

- 50% of all primates and 100% of great apes are threatened with extinction.
- Three of the world's eight tiger subspecies became extinct in the past 60 years; the remaining five are endangered.
- Humans have already driven 20% of all birds to extinction.
- 12% of mammals, 12% of remaining birds, 31% of reptiles, 30% of amphibians, and 37% of fish are threatened with extinction.^c



Vicki Walker

sea-level rise, and species extinction. Many species such as polar bears and penguins are already suffering and severely threatened by the effects of climate change.⁶⁶

Overexploitation and Poaching

Overhunting by humans has caused many species to go extinct. “Sport” hunting of tigers and other large mammals has contributed to the demise of many of the planet’s most majestic creatures. Poaching, such as the elephant deaths that the illegal ivory trade propagates, undermines global conservation efforts and must be opposed with all legal means.

Solutions

Many concerned nonprofit organizations assist countries with purchasing and managing refuges for endangered wildlife while simultaneously educating people about the importance of biodiversity, rainforests, and sustainability. See the *Resources* section for a complete list, and give these groups your support!

In recent years innovative debt-for-nature swaps give poorer nations a chance to wipe out some of their international financial burden by protecting vital habitat from degradation or loss. Even more recently, intact forest ecosystems are being accorded a different value on the world market—that of **carbon credits**—in recognition of their important natural functions, which include carbon storage and climate moderation. This trade-off has yet to be refined to avoid corruption, but it holds some potential for

protecting valuable wildlife habitat.

Tourism is a vital component of many national economies, bringing in foreign exchange and ideally creating minimal negative impacts on a protected area. If enough travelers pay to visit botanically interesting and/or wildlife-rich areas, this is a strong incentive for local communities to value and protect habitat. Obviously, the local people must be direct economic beneficiaries of tourism to be inspired to maintain natural qualities for long-term motives rather than short-term gain.

Ecuador has recently taken a mighty step by passing an amendment to its constitution stating that nature has the right to exist, persist, maintain, and regenerate its vital cycles, structure, functions, and its processes in evolution.⁶⁷

Finally, only a concerted international effort to slow greenhouse gas emissions and maintain as much biodiversity as possible will give any of Earth’s wild species a hope of surviving the coming decades, much less centuries.

WHAT YOU CAN DO

- Never buy products made of endangered species’ parts, e.g., ivory, turtle shells, coral, etc.
- Travel with responsible eco-tour groups, and carbon-offset your travel.
- Grow a wildlife garden, not a lawn.
- Eat less meat and fish, and if you wish, go vegetarian or vegan.
- Support animal rehabilitation centers.

- Support conservation groups locally and worldwide.
- Educate your friends and family about these issues.
- Don’t buy wood unless it is certified “green.” Purchasing power can stop the destructive logging of endangered forests around the world.⁶⁸ Read and follow the guidelines in *Green America’s Guide to Woodwise Purchasing*. Urge government representatives to enter into and support treaties to protect wildlife and preserve ecological “hot spots.” Encourage creation of jobs that will help achieve these goals.
- Demand elimination of subsidies that promote destruction of habitats (forests, wetlands, oceans, etc.).
- Eat lower on the food chain: a plant-based diet respects the lives of animals as well as the sustainability of the planet.
- Work for a strong climate bill. Become an advocate for legislation to cap and rapidly reduce GHG emissions. Encourage the enforcement of existing laws like the Clean Air Act that already address GHG pollution.
- Write to companies that have an obvious negative impact on species, e.g., those that promote operations that cut down rainforests or pollute.
- Continue to educate yourself. Documentary videos, in particular, are a powerful experiential way to stay informed.
- See The Center for Biological Diversity’s “toolboxes” for more ideas for action, including advice on writing letters and speaking out: www.biologicaldiversity.org.

“Pollution not only is destroying the global commons worldwide but also is ‘trespassing’ onto the local commons and private property. I say trespassing advisedly because loud noises, the unwanted glare of lights at night...the stench from a nearby factory, and industrial chemicals fouling water in a private well are all examples of pollution caused by someone else, somewhere else—pollution that crossed the boundary into such commons as the seven seas, national parks, city parks, as well as private property, all without the owner’s permission.”

—Chris Maser,
author, *Earth in Our Care*

WASTE, POLLUTION, AND TOXICS

Fouling Our Own Nest

As a species we've created a lot of pollution on Earth, far more than anyone wants to really know. That fact is not news if you have read about or even experienced poisoned produce, toxic tuna, birth defects, or asthma induced from particulates in the dirty air. Yet the work of reducing waste and pollution at its source remains to be tackled with resolve. Excess consumption, wasteful practices, and the ongoing manufacture of deadly toxins are at the core of many of our environmental problems. They need to be comprehensively addressed at the industrial level as well as the personal. Fouling one's own nest is a sign of a sick animal.

While we can lobby our political representatives to enact or enforce laws reining in industrial-scale pollution, most people feel powerless to alleviate these serious problems. Yet there are multiple personal actions that we can each take to reduce not only climate pollution (those darn greenhouse gases) but plastic and paper trash, cumulative effects from "mildly toxic" home and yard products, and many other pernicious forms of pollution. More importantly, you might finally be inspired to tackle the consumption disease—*affluenza*—at its core and create a simpler life, thereby inspiring others around you to do the same. Just stop buying and using most of this stuff! That alone will help curtail its production. See "Getting Personal" for details on how to clean up your own act.

The Plastic Vortices

With all the plastic we produce, use, and toss, it was inevitable that the oceans would eventually teem with windblown and drifting debris. Durable and lightweight, buoyant and persistent, plastic travels over vast distances. The majority of marine debris is plastic. A plastic "vortex" north of Hawaii has been the subject of recent study and news reports, but as it turns out, this North Pacific Gyre is not the only one in our oceans. And while the main known part of this particular gyre is stated to be twice the size of Texas, this particular vast eddy of plastic refuse is now known to be a sub-gyre

of a much larger area (approx. 10 million sq. miles!) stretching from the equator to about 54 degrees N latitude.⁶⁹

Plastic debris doesn't just look bad—it behaves abominably.

A plastic vortex, or *gyre*, gets its name from the dynamics of its formation: ocean currents and winds create pools or eddies where things can gather. And gather they have—about threefold since the 1960s. The North Pacific Gyre (also known as the Great Pacific Garbage Patch) contains at least 4 million tons of plastic litter, including bits of packaging, plastic bags, cigarette lighters, and diapers. Broken, degraded plastic pieces outweigh surface zooplankton here by a factor of 6 to 1. That means six pounds of plastic for every single pound of zooplankton.⁷⁰ The UN Environment Programme estimates that 46,000 pieces of plastic litter are floating on every square mile of the oceans.⁷¹ The gyre continues to increase due to poor waste management practices on land and sea. Estimates for the total quantity of plastic at sea exceed 100 million tons, with only 20% from ocean sources (like lost or tossed fishing gear) and 80% from land-based sources. Much of the plastic is single-use disposable consumer items like bottle caps, wrappers, and plastic bags.

The tragedy of plastic is that it doesn't biodegrade—no naturally occurring organisms can break it down. But it does photodegrade (breaks down from the effects of sunlight) into ever tinier bits, each of which remains a plastic polymer for centuries that can resemble seaweed or plankton. Most

PLASTIC STATS

Californians use about 19 billion plastic bags each year, or 600 bags a second.

Only 6.8% of municipal waste plastic in the US gets recycled.

The average American throws away 184 lbs of plastic annually.^d

plastic floats near the sea surface where it is mistaken for food by birds, fish, and other marine life. Marine conservation groups estimate that more than a million seabirds and 100,000 mammals and sea turtles die globally each year by getting tangled in or ingesting plastics.⁷²

Although plastic products are of great convenience, plastic dust never fully degrades, even the process of photodegradation can take a long time: Estimates include 500 years for a disposable diaper and 450 for a plastic bottle. The more we produce, the more we have to live with forever! Just say no to plastics!

Project Kaisei, which is surveying the area and gathering data, is attempting to find ways to clean up and recycle plastic into useful commodities, such as clothing, construction materials, and diesel fuel.⁷³

"Instead of having sand made out of coral and lava rocks and other rocks and shells, now we are having beaches made out of broken-down plastics."

—Captain Charles Moore, scientific researcher



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Mushrooms as Planetary Healer

“War against nature is war against our own biology...It’s time for environmentalists to come to the forefront of business.”

—Paul Stamets, mycologist

Nature’s solutions to pollution, evolution, and other daunting processes surpass our conception of what’s possible. This is primarily why preserving biodiversity (especially in highly diverse areas such as complex old-growth forest ecosystems) is a matter of human survival and future security. There is too much to lose that we don’t even understand yet.



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Mycologist and author Paul Stamets is an advocate of *bioremediation*, or cleaning up contaminated areas with natural processes such as mycelium breakdown of stubborn toxins. To be exposed to his research and insights is to have hope again that our mess may yet get cleaned up properly. Stamets is utilizing mushroom mycelia to break down hydrocarbon-based contaminants such as gasoline, diesel, and PAHs (polycyclic aromatic hydrocarbons); to clean up dioxin at lumber mill sites; to degrade and disappear PCBs, PCPs, pesticides, herbicides, and other toxins; to work as an antimicrobial and anti-viral agent; and even to be active against insects such as the carpenter ants destroying his Washington-state home. Different fungi strains overcome

- Raise the price of what harms the environment. This will help reduce consumption of unnecessary items as well as trigger efficiency improvements in businesses.
- Agencies at all levels of government need to mandate and enforce emissions reduction targets and pollution limits for cars and trucks, industry and agriculture. Penalties must be stiff.
- Eliminate subsidies that go to polluting businesses.
- Institute an environmental tariff: an import or export tax placed on products imported from or being sent to countries with substandard pollution controls. This helps avoid “environmental races to the bottom” and eco-dumping.
- Ideally governments would reward or subsidize low consumption through tax deductions and credits.
- Legislatively require recycled content in containers. Post-consumer material reduces the amount of virgin material consumed.
- Let’s move on to a new paradigm that “liberates us from this rat race of cheap replacements for cheap products that pollute and don’t work for very long.”⁷⁶
- Unfortunately, much “recycling” of electronic waste (old equipment) translates

POLLUTION—WHAT WE CAN DO

- into dumping overseas. It is currently unlikely that you will be able to responsibly recycle your e-waste without paying for the service. For information on recycling electronic waste, go the US Environmental Protection Agency’s website at www.epa.gov/osw/conserves/materials/ecycling/index.htm or www.ban.org.
- Products must be easy to recycle, the least toxic, and the most cradle-to-cradle in terms of raw materials. Our calculus must take into account the lifecycle of the product and its true value; we must reject cheap products that don’t last.
- Get plastic manufacturers directly involved with plastic disposal and closing the material loop. Container and resin makers can help develop the reprocessing infrastructure by taking back plastic from consumers.
- Standardize labeling and inform consumers: The “chasing arrows” symbol is ambiguous and misleading. We need significantly different labels for “recycled,” “recyclable,” and “made of plastic type X.”
- Reduce, Reduce, Reduce—then offset and reduce some more!
- We need to take the slogan “Yes, we can” seriously and develop alternative strategies—the tepid solutions often proposed are not going to work in the long term.

different contaminants or pests, and Stamets has received many patents, including a ground-breaking one for a strain that can work against more than 200,000 different insects and which has the potential to revolutionize the entire pesticide industry.

Mycelium (*plural* mycelia) is the vegetative part of a fungus, vital in terrestrial and aquatic ecosystems for its role in the decomposition of plant material. It contributes to the organic fraction of soil and can also confer resistance to some plant pathogens. The sciences of mycofiltration, mycoremediation, mycoforestry, etc., are part of an emerging field of study with great potential for repairing many forms of environmental damage.⁷⁴

Various forms of *living machines* can create soils, purify water, and break down contaminants utilizing carefully selected grasses, plants, bacteria, etc.⁷⁵



Jim Embry