

## Pollution and Other Environmental Harms

Climate change through excessive greenhouse gas releases is a huge, important problem, but that's far from the only harm we're doing to natural environments that support life and health. We're harming almost everything, poisoning ourselves, our environments and probably most living beings on Earth.

"Pollution is more deadly than smoking, kills nearly 15 times more people than all the world's wars and violence combined, and is three times as deadly as AIDS, malaria and tuberculosis all put together."<sup>63</sup> That radically understates the problems. Pollution is the greatest health risk to the world population.<sup>64</sup>

### Air Pollution

In addition to pumping greenhouse gasses into our atmosphere at unprecedented rates, altering the climate of the planet and microclimates where we live, we're also releasing all kinds of other chemicals, toxins and poisons into the air we breathe. These things are harming us and most life on the planet.

Try this experiment! Put your face by the exhaust of a diesel bus and breathe! What does your body tell you about that air? Is it healthy or unhealthy? You're breathing that air all the time, just usually not as close to the source of the problem. Just because we can't see it doesn't mean it isn't doing great harm. We breathe to live, and so do many other forms of life. Air circulates throughout the atmosphere.

95% of the world's population breathes unsafe air.<sup>65</sup> Air pollution is the 3<sup>rd</sup>-largest human health threat, behind high blood pressure and dietary risks, about tied with tobacco deaths, which are getting lower.<sup>66</sup> The number of deaths due to ambient air pollution is on track to increase by more than 50% by 2050.<sup>67</sup> 6.5 million deaths worldwide were from air pollution-related diseases in 2012, 12% of all global deaths, more than numbers of people killed by HIV/AIDS, tuberculosis and road injuries combined.<sup>68</sup>

Human health problems created and exacerbated by air pollution include: asthma, allergies, impaired cognition, lung problems, cardiovascular problems, gene mutations, endocrine pathway disruptions, cancers, declines in male and female fertility, and chronic diseases associated with aging, like dementia, Type 2 diabetes, chronic obstructive pulmonary disease (COPD), metabolic syndrome, Parkinson's,<sup>69</sup> and autism spectrum disorder (ASD).<sup>70</sup> In 2018, air pollution was the #7 biggest fear of people in the U.S., and 5 of the biggest top 10 fears were environmental.<sup>71</sup> From space, it looks like the Earth is on fire with all the pollution.<sup>72</sup> We are making ourselves and other life sick with the bad air we produce.

We are harmed through both outdoor and indoor air pollution. Outdoor air pollution comes from:

- *mobile sources* – like cars, buses, planes, ships, trucks, and trains, which account for more than half of all air pollution in the U.S., the main source being the automobile,
- *stationary or single point sources* – like power plants, oil refineries, industrial facilities and factories (especially chemical and mining), that emit large amounts of pollution from single locations,
- *area sources* – like agriculture, cities, waste treatment and management, fireplaces and dirty heating systems, which describe aggregations of smaller sources that add up to big deals, and
- *natural sources* – like wind-blown dust, wildfires and volcanoes that are sometimes significant but don't usually create ongoing air pollution problems like the other source types can.<sup>73</sup>

*“Sometimes you can’t even see it, but air pollution is everywhere... with every breath, you are sucking in tiny particles that attack your lungs, heart and brain. For millions of people across the globe, this is causing a host of problems – illness, lower IQs and death chief among them... sources spew out a range of substances including carbon monoxide, carbon dioxide, nitrogen dioxide, nitrogen oxide, ground level ozone, particulate matter, sulphur dioxide, hydrocarbons and lead – all of which are harmful to human health.*

*Deaths and illnesses from air pollution are largely down to tiny, invisible airborne particles, known as particulate matter, which can be as small as a molecule. These particles are clumps of poison, containing anything from black carbon (soot), to sulphates to lead. The smallest particles are the deadliest: PM2.5 particles, which are 2.5 microns or less in diameter, and PM10, which are 10 microns or less in diameter. These tiny killers bypass your body’s defences and lodge in your lungs, bloodstream and brain... Air pollution has been called a major global health epidemic, causing one in nine of all deaths. It also has massive negative impacts on climate change and economies... In 2016, PM2.5 exposure reduced average global life expectancy at birth by approximately one year.*

*Around seven million people die each year from exposure to polluted air, both indoor and outdoor. The three biggest killers attributable to air pollution are stroke (2.2 million deaths), heart disease (2.0 million) and lung disease and cancer (1.7 million deaths)... Air pollution doesn’t just kill, however. It also contributes to other illnesses, hampers development and causes mental health problems... One study found that ambient PM2.5 contributed to 3.2 million cases of diabetes in 2016...*

*Research from the United Nations Children’s Fund (UNICEF) shows that breathing in particulate air pollution can damage brain tissue and undermine cognitive development in young children – with lifelong implications... Other studies have linked air pollution to lower intelligence levels, with the average impact equivalent to one lost year of education, and to an increased risk of dementia, with those living closest to major traffic arteries up to 12 per cent more likely to be diagnosed with the condition...*

*If you are lucky enough to not suffer the negative health impacts of air pollution, it can still hit you in the pocket. Air pollution creates a burden on healthcare systems, which costs taxpayers money...*

*Air pollution from energy production in the U.S. caused at least US\$131 billion [11% of FADS] in damage to its economy, including increased healthcare costs, in 2011... Without action, the costs will rise. A study by the [OECD] showed... annual global welfare costs of premature deaths from outdoor air pollution are projected to be US\$18-25 trillion in 2060 [1,556%-2,161% of FADS]. In addition, the costs of pain and suffering from illness are estimated at around US\$2.2 trillion by 2060. [190% of FADS]<sup>74</sup>*

We are poisoning the air outside, and it is harming us, and most life and environments, but we are also poisoning the air inside the homes and buildings we spend most of our time in, through things like:

- Exposures to outdoor air pollution that get in through doorways, windows and cracks,
- Volatile organic compounds (VOCs) – gases from many household products that cause problems, like headaches, nausea, and irritated eyes and throat, especially for kids and babies who breathe air faster and closer to the ground where heavy contaminants are more concentrated,
- VOCs, mites and dust particulates from carpets, which trigger things like allergies and asthma,
- VOCs and other harmful chemical exposures from paints, varnishes and other finishes,
- Toxic fumes released from (Teflon) nonstick cookware and markers, glues and other art supplies,
- Toxic chemicals in household cleaners, paints and polishes, like phenols, ammonia and chlorine,
- Toxic chemicals like perchloroethylene from dry cleaning, which are known to cause cancer,

- Harmful particulate and poison exposures from cigarette smoking, and wood and coal fires,
- Carbon monoxide, nitrogen dioxide and other gases released in cooking and heating,
- Radon exposure from improper home seals, 2<sup>nd</sup> only to smoking as a cause of lung cancer,
- Toxic chemicals in air fresheners and scented candles,
- Formaldehyde and other chemicals in pressed-wood and other furniture,
- VOCs and other toxins from aerosols, personal care products, polishes, fertilizers and pesticides,
- Phthalate endocrine disruptors in shampoos and plastics,
- Furniture flame retardants, fragrances and perfluoro-alkyl sulphonates in synthetic materials,
- Chlorine, fluoride and other toxins released into the air from drinking water, and
- Suspended plastics and other petroleum chemical dusts from fabrics and other products <sup>75 76</sup>

We buy, store and use toxic and harmful chemicals in all kinds of products and materials we have in our homes, schools, barns and workplaces. Not only are many of these dangerous and harmful themselves, many react in dangerous and harmful ways with each other, often in ways that aren't studied or tested, which most of us don't understand, and are about as pleasant to read as being kicked in the face.<sup>77</sup>

Much of this stuff harms us, to varying degrees, as we're exposed to it, repeatedly, as fetuses, children, teenagers, adults and elderlies, and much of it also escapes from our indoors environments into outdoor air, water and land environments, creating exposures and harms there also.

As a human being, independent of politics, using common sense, this is all not very, very smart, right? We can change this. We don't have to wait for others. We can each do things right now, like: boycott polluters, convert to green energy; walk, bike or use public transportation; ditch combustion engines; compost, reuse and recycle; don't buy or use products with plastics, petroleum, toxins and other unnatural chemicals; ditch synthetics; use natural fertilizers and cleaning supplies; and advocate for social and political changes. We have the power to change this in our lives now. Change!

This stuff is hard to take. Take a break if you need one, but please stick with it! It's important to know.

### Land Pollution

Land pollution is the destruction and contamination of the land through the direct and indirect actions of humans, "a serious problem that impacts humans, animals, and the Earth. Without taking measures now to reduce pollution levels, permanent changes to the land can occur. The adverse changes to the environment due to land pollution are subtle, but the problem is much bigger than it appears."<sup>78</sup>

### Deforestation

Forests are major participants in the life support systems of planet Earth. They capture carbon from the atmosphere, sequester it in the lands and produce oxygen for humans and other animals to breathe. They affect water distribution and weather patterns. They partner with millions of organisms to create healthy soils and prevent erosion. They provide habitat and serve as cradles of life, for much of our life.

Human destruction and degradation of lands starts with deforestation, which changes forested lands to non-forested arable, pasture, urban or waste lands. Half of illegally taken forest trees are used as fuel. We cut down forests to make land available for housing and urbanization, for agriculture and ranching, and to harvest timber for lumber, paper and other products, like palm tree oil. Deforestation often happens by burning, horrendously polluting, or clearcutting, mowing forests down and leaving nothing.

There are about 3 trillion trees on Earth today. That sounds like a lot, but it's just 45% of what existed before the rise of humans.<sup>79</sup> Forests now cover about 30% of the world's landmass. We've destroyed 55% of the trees on Earth. 90% of continental U.S.' indigenous forests have been removed since 1600. In 2016, Earth had a record loss of 73.4 million acres of forests globally. Each second, humans destroy 1.5 acres of forest. Some 1.6 billion people in the world rely on forest products for their livelihoods.

"Deforestation occurs around the world, though tropical rainforests are now particularly targeted. About half the world's tropical forests have been cleared." 2017 was the 2<sup>nd</sup>-Worst Year on Record for Tropical Tree Cover Loss. "Tropical rainforests which cover 6-7% of the Earth's surface, contain over half of all the plant and animal species in the world!" They produce 20% of our oxygen, and could be gone in 40 years, taking nearly "half of the world's species of plants, animals and microorganisms" with them. 90% of West Africa's tropical forest was destroyed in the last century. They provide huge services.

Deforestation creates ecological and environmental imbalances and habitat and biodiversity declines. "Forests are complex ecosystems that affect almost every species on the planet. When they are degraded, it can set off a devastating chain of events both locally and around the world."

Deforestation has big effects on climate: 300 billion tons of carbon is now stored in trees. Deforestation reduces the amount of stored carbon, but it also releases CO<sub>2</sub> into the air, nearly a billion tons of carbon a year, the 2<sup>nd</sup> largest human-caused source of CO<sub>2</sub> in the atmosphere after fossil fuel combustion, up to 17% of all the carbon humans release into the air. Deforestation eliminates powerful and important natural ecoservices that remove carbon and pollution from the air and store it in woods, plants and soil, produce oxygen for humans and animals to breathe, and maintain the delicate balance that keeps our climates in ranges that support life as we know it. Knowing that, does it make common sense to do it?

Carbon isn't the only greenhouse gas affected by deforestation. Water vapor is a greenhouse gas. Deforestation has decreased global water vapor flows from land by 4%. Even this slight change in vapor flows can disrupt natural weather patterns and change current climate models", affecting water cycles. Trees absorb groundwater and release it into the atmosphere in transpiration. With deforestation, the climate becomes drier, and water table stores are reduced. Trees reduce pollution in water by slowing polluted runoff. In the Amazon, more than half the water in the ecosystem is held in the plants.

Some 70% of the world's plants and animals live in forests and are losing their habitats to deforestation. That can lead to species extinctions and have negative consequences for medicinal research and local populations that rely on the animals and plants in the forests for hunting and medicine. "Up to 28,000 species are expected to become extinct by the next quarter of the century due to deforestation."

Tree roots anchor soil. Without trees, soil often washes or blows away, so plants can't grow there. Scientists estimate 1/3 of the world's arable land has been lost to deforestation since 1960. Soil erosion silts lakes, streams and other water sources, harming water quality and contributing to health problems.

Some think we just need to plant more trees to fix the system. That would definitely help over time, allowing forest ecosystem services like carbon storage, water cycling, wildlife habitats and reducing buildup of CO<sub>2</sub> in the atmosphere. However, reforestation won't be able to catch up to the rate humans are releasing carbon into the atmosphere through fossil fuel burning. Nor will it help with extinctions caused by destructions of contiguous old-growth habitats. We must also stop destroying those.

Almost half of world's timber and up to 70% of paper is consumed by Europe, the U.S. and Japan. Industrialized countries consume 12 times more wood per person than non-industrialized countries. With less than 5% of the world's population, the U.S. consumes more than 30% of the world's paper, including 41 pounds of junk mail per adult per year, 44% of which is never opened.<sup>80 81 82</sup>

It does not make sense to keep cutting down forests. We've cut down 96% of the original old-growth redwoods in California, the tallest trees on Earth.<sup>83</sup> It takes 2,000 years to replace 2,000 year-old trees. We have to change by no longer cutting down old-growth forests, sustainably raising trees as agriculture for wood needs, replanting and supporting new forests, and no longer ignorantly, greedily, recklessly and wastefully consuming forest products that create demand for clearing forests. Change!

### *Soil Loss and Degradation*

When forests are cleared for development, and to meet forest product demands, the soil is loosened. Without the protection of the trees and their ecological services in capturing and distributing water, supporting organisms in the soil that produce biomatter that becomes soils, the lands become barren over time and are eroded by winds and rains. That erosion silts waters and affects their flows. That erosion also means that there is no longer productive soil on those lands to support future plant growth.

We mismanage lands converted for agriculture use. Irrigation techniques create erosion that washes away soils. Agricultural practices, like artificial fertilizers, insecticides and bioengineering, overgrazing, antibiotics and other chemicals given to farm animals, destroy soil productivity and pollute waters. Persistent organic pollutants, like aldrin and DDT, can remain in soils and environments for years.

The chemical pollution and toxins we release into the atmosphere precipitate down on the lands and poison the soils, destroying their productivity, and the pollution and poisons we release into our waters and groundwaters flow through the lands, destroying their productivity. We dump our poisonous wastes in the lands, destroying their productivity. Our mining projects and techniques destroy and erode lands and release toxic and radioactive chemicals that end up in soils and waters, poisoning life. We pave or otherwise cover our soils with development, which destroys soil.

95% of our food comes from soil, and it takes 1,000 years to generate 1.2 inches of it naturally. A third of global soil has already been degraded. If soil degradation rates continue, all the world's topsoil could be gone in 60 years. Unless new approaches are adopted, global amounts of arable and productive land per person in 2050 will be only a quarter of 1960 levels. We're losing 30 soccer fields of soil a minute.<sup>84</sup> Land pollution causes us to lose 24 billion tons of topsoil per year, and decreasing productivity is observed on 20% of the world's cropland, 16% of forest land, 19% of grassland and 27% of rangeland.<sup>85</sup>

Exposure to contaminated soil can make us sick with things like birth defects, breathing disorders, skin diseases, cancer and cognitive and other developmental problems in children."<sup>86</sup> Same for other life.

As a human being using common sense, it seems dumb to be destroying soils supporting life that supports us, especially with our population growing rapidly, so we'll need more good soil in the future, rather than less. That logically may result in our demise. Change! We're empowered now to change our impact on that by composting, removing pavement, only consuming foods and products made with natural and sustainable inputs and practices. Those with land are empowered now to go to work restoring soils and taking actions to prevent their erosion and degradation. We can all help by establishing and caring for trees and plants that help maintain soils and clean our air and environments.

## *Hazardous Waste*

Hazardous, toxic or harmful waste is an absolute, sickening disaster, no matter how we try to look at it: its definition, what it includes, how do we know, who makes it, what happens to it, who knows about it, who's responsible for it, how it's dealt with, how much of it there is, what it harms, what to do about it...

Many define hazardous waste as waste that's harmful to humans, but that doesn't reflect harm to other life, or environments. Some define it as waste that's harmful to humans or other animals, but that does not reflect harm to other life - plants, insects, bacteria, algae, protozoans, spirochetes, molds, yeasts... Some define it as waste that's harmful to life, but that doesn't reflect impacts to environments, like the global greenhouse ecosystem, the quality of water and water ecosystems, soil ecosystems, minerals... No matter how we define it, we do not adequately understand how most hazardous materials interact with most things and whether or how they do harm to many things. That said, here's a definition:

*Waste that poses substantial or potential threats to public health or the environment, determined by four factors: ignitability (i.e., flammable), reactivity, corrosivity and toxicity. In addition, "hazardous waste" has potential to cause, or significantly contribute to an increase in mortality (death) or an increase in serious irreversible, or incapacitating reversible illness; or pose a substantial (present or potential) hazard to health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.<sup>87</sup>*

In a generation, global man-made hazardous waste has increased 40,000%, from 1 to 400 million tons annually,<sup>88</sup> almost 132 pounds (60 kg) per person in the world annually, 13 tons a second, and amounts are growing fast. 400 million tons would fill roughly 10 million 40-ton 18-wheeler trucks, which placed end to end would circle the equator 5.6 times. In 2015, the last reported year, the EPA collected data from 26,800 organizations producing 34 million tons of hazardous waste in the U.S.<sup>89</sup> That's over 200 pounds (94 kg), a toxic football player, for each man, woman and child in the U.S.

That underestimates volumes of hazardous waste produced and released into our environments, because that's only data reported by those required to report it, and not all are required to report it. It doesn't include toxic or hazardous end products in use, hazardous waste released into air and water as pollution, or hazardous waste consumers dump. On average, each person in the U.S. dumps 4 pounds (1.8 Kg) of household hazardous waste yearly, things like aerosol cans, antifreeze, batteries, fire extinguishers, motor oil, paint, pesticides, pool chemicals, cleaning chemicals, pharmaceuticals, propane tanks and gasoline. That's another 530,000 tons per year.<sup>90</sup>

Weight of hazardous materials also does not reflect the danger of hazardous materials. A single drop of VX on human skin can be fatal. (VX was marketed as a pesticide.) One spoonful of Botulinum can kill millions of people. Mercury is one of the deadliest poisons known to humanity. Strychnine can kill a human in half an hour. Cyanide can kill a human in minutes.<sup>91</sup>

Hazardous wastes are involved in all kinds of things, like just about anything produced by or used in production by petroleum, chemical, fertilizer, paint, biomedical or pharmaceutical industries. Hazardous waste includes at least 4 broad categories: radioactive, chemical, biological and other.

## *Radioactive waste*

Approximately 5 million cubic feet (141,500 cubic meters) of radioactive waste were "disposed of" in the U.S. in 2017, 30.5 million cubic feet (864K cubic meters) of radioactive waste between 2005 and 2017.<sup>92</sup> (That's 12,700 40-foot cargo containers of radioactive waste from 2005 to 2017.)

“Disposed of” means it went to 4 storage facilities (in Texas, South Carolina, Utah and Washington), where it waits for someplace to go, or (mostly in drums) to the only U.S “permanent” nuclear-waste storage site, the Waste Isolation Pilot Plant (WIPP) salt caverns 2,000 feet under New Mexico’s desert. (That site was closed for years when the wrong kind of cat litter was used to soak up radioactive waste, and it reacted and exploded, above and below ground on Valentine’s Day 2014.) A U.S. long-term plan is to bury nuclear waste underground at Yucca Mountain, Nevada, but people there don’t want it and have delayed it, so there is no permanent place for high-level radioactive waste in the U.S.<sup>93</sup>

Among the worst ever created or known to man, radioactive pollution kills quickly and slowly, alters DNA in living beings, produces intense suffering, and lasts 250,000 years.<sup>94</sup> What’s the cost of safely storing and protecting nuclear waste 250,000 years? That’s not counted in nuclear energy business plans, or nuclear energy would be unaffordable. Those costs and future disasters have been pushed out to the future public and our environments. Even if it is underground, there is no guarantee it will not be released into our groundwater, lands and atmosphere over hundreds of thousands of years.

*“Since the first nuclear test explosion on July 16, 1945, at least eight nations have detonated 2,056 nuclear test explosions at dozens of test sites... Most of the test sites are in the lands of indigenous peoples and far from the capitals of the testing governments. A large number of the early tests—528—were detonated in the atmosphere, which spread radioactive materials through the atmosphere. Many underground nuclear blasts have also vented radioactive material into the atmosphere and left radioactive contamination in the soil.”<sup>95</sup>*

Radioactive waste has been dumped on and in our lands, air and waters for more than 70 years. Without question, it has done harm, it continues to do harm, and it will do harm for a long time.

Does it make sense to create extremely dangerous poisons that last for thousands of years? Change! Refuse to do any business with any company making any use of nuclear technologies! We don’t need it.

### Chemical Waste

Humans use more than 70,000 chemicals, some that occur naturally in the Earth or atmosphere, and others that are synthetic, or human-made.<sup>96</sup> Even when used properly, many can still harm human health and the environment. When they’re thrown away, they become hazardous waste. They’re in many products, including foods, batteries, electronics, cleaning supplies, bug sprays, garden products, cosmetics, and paints. Chemical wastes are dangerous and cause harm, because they are:

- **Corrosive** - They wear away or eat up substances, like acids that can burn through metal or skin, and emit vapors that burn eyes and other soft tissues.
- **Ignitable or Explosive** - They catch on fire easily, blow up, can irritate skin, eyes and lungs, and may release harmful vapors. Gasoline, paint and furniture polish are ignitable.
- **Reactive** - They can explode or create poisonous gases or other problems when combined with other chemicals. Combining chlorine bleach and ammonia creates a poisonous gas, for example.
- **Toxic or Poisonous** - They can poison people and/or other life, causing illness and death if consumed or absorbed. Pesticides, weed killers and many household cleaners are toxic.<sup>97</sup>
- **Carcinogenic** – They can cause or increase risks of cancer, such as: asbestos, benzene, beryllium, cadmium, coal tars, dyes metabolized to benzidine, mineral oils and nickel compounds.<sup>98</sup>

- **Mutagenic** – They cause damage to chromosomes, for example: acridines, nitrosamines, mustards, epoxides and alkyl sulphonates.<sup>99</sup>
- **Tetratogenic** – They cause birth defects, like quaternary ammonium compounds or "quats," often used as disinfectants and preservatives in household and personal products such as cleaners, laundry detergents, fabric softeners, shampoos, conditioners and eye drops.<sup>100</sup>
- **Bioaccumulative** – They concentrate at the higher ends of food chains, where humans are, like dioxins, lead, mercury and Polycyclic Aromatic Compounds (PACs).<sup>101</sup>

Crikey, it feels like we can get sick just trying to understand this yuck. Really, we don't understand it. We create this stuff in labs, release it into our lives and environments by the millions of tons, haven't had time to adapt to it, and it makes us and other life sick in ways we haven't grasped. Enough said.

### Biological Waste

Biological hazardous waste is human-created biological materials that harm or create risk of harm to life, including: stuff from medical facilities, like pharmaceuticals, human or animal tissues and materials infected with blood, diseases, bacteria and viruses, stuff from biotech or academic biology lab research, agriculture waste, like feces and plant or animal parts that foster growth or mutations of harmful things.

Biohazardous waste items may contain or be contaminated with: human, animal, or plant pathogens; recombinant nucleic acids (rDNA); human, primate or other animal blood; blood products; tissues; cultures; cells; or other potentially infectious material (OPIM) and sharp objects that can cut and infect. They can include bioengineered live or dead animals, plants, microbes, bacteria and other life forms. They can include foods or stuff used in preparation of foods infected with pathogens, like salmonella.

We produce tons and tons of that stuff in hospitals, clinics, doctors' offices, academic labs, corporate labs, pharmaceuticals, biotech, agricultural labs, farms, food suppliers, etc. It's in our food and drink. Much of that ends up in our lands. That's bad news, and it does harm. Ooh, yuck, it's making life sick.

### Other Hazardous Waste

We produce other kinds of hazardous wastes. Nanotechnology, for example, is a new field of science, engineering and technology that produces things at nanoscales, 1 to 100 nanometers. A nanometer is a billionth of a meter. There are 25,400,000 nanometers in an inch. Nano-science and -technology work at the level of individual atoms and molecules. It's clever, but we can produce and release uncountable numbers of nanoscale stuff, and who knows what harm or impact they'll have on life and environments?

Hazardous wastes can create harm if: a large amount is released at one time, a small amount is released many times at the same place, the substance doesn't decay or become diluted quickly enough, it's very toxic (like arsenic), it replicates or grows, it causes harmful reactions in other things, anyone's exposed to it, through lungs, mouth or skin, or anything else is affected by it, like ecological systems or beings.

This stuff goes everywhere. We put some of it underground, where it can still get out over time. We burn some, and it gets out into the atmosphere. We transport it around, and spill it. In 2014, there were over 20,000 hazardous waste spills in the US.<sup>102</sup> We sell it to people as finished products, and use it in our lives. We dispose of it in all kinds of inadequate ways. We kind of try to regulate it.

Businesses and our current government try to deregulate it. We send it to other countries with less protections and make them sick (1 of 2 countries in the world not agreeing not to)<sup>103</sup>. It burns up in increasing wildfires, and floods our neighborhoods in storms, reacting and poisoning us in new ways. It gets into every part of our water systems. We used to let children run behind trucks spraying DDT to kill mosquitos, before we realized it was killing the children and other beings also. We knew lead was a poison, but we used it in paint and let everybody burn it in gasoline until the 1980s.

It's an ugly and dangerous mess. "The U.S. Geological Survey places cleanup costs for existing environmental contamination in the U.S. between several hundred million and more than one trillion dollars (86% of FADS)." <sup>104</sup> The world's largest polluter is the U.S. Department of Defense, producing more hazardous waste than the five largest U.S. chemical companies combined.<sup>105</sup>

### U.S. Government Response

*18,000 sites and an associated 22 million acres of land are related to the primary hazardous waste programs that comprise much of the nation's hazardous waste infrastructure, and more than half of the U.S. population lives within three miles of a hazardous waste site... Three primary programs have shaped the nation's hazardous waste infrastructure: Superfund, RCRA, and Brownfields...*

**Superfund... (CERCLA)** – *federal government's program to cleanup uncontrolled hazardous waste sites... September 2016... 1,180 non-Federal sites, and 157 Federal Sites... (...numbers exclude sites proposed... but not yet final)... Contamination from more than 160,000 abandoned mines in the West poses costly and complex environmental and public health challenges... Impacts of more intense storms, increased flooding, and rising sea levels may jeopardize a large number of... Superfund sites.*

*EPA's inventory of Superfund sites shows... over 500 Superfund sites are within a 100-year floodplain or... less than 6 feet above... sea level, and... vulnerable... Over the past several years, EPA's workforce has declined by over 2,000... EPA Superfund project managers, scientists, and engineers has significantly declined, as has the Agency's staff of procurement professionals. As a result, EPA's ability to keep pace with program needs has been substantially impacted...*

**Resource Conservation and Recovery Act (RCRA)** – *1976 law... gives EPA... authority to control hazardous waste from... cradle-to-grave including... generation, transportation, treatment, storage, and disposal... 6,600 facilities, with over 20,000 process units... between... 350,000 and 550,000 facilities that generate hazardous waste... 2.5 billion tons of solid, industrial, and hazardous waste... of which 30 to 40 million tons are classified as hazardous waste annually. RCRA corrective actions are addressing more than 3,700 existing contaminated facilities needing cleanup... 87% of RCRA facilities have controls in place that prevent human exposure to toxic chemicals, and 77% of RCRA facilities are effectively preventing the migration of contaminated groundwater... Maybe.*

**Brownfields** – *Real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant... funding levels are less than what is needed... impacting both pre-construction and construction activities. While some projects are deferred altogether due to lack of available funds, other projects progress in series of small phases, adding time and cost for achieving cleanup... 30% of grant proposals... for brownfields cleanup are funded. Many deserving projects that could significantly benefit communities aren't getting funded...*

42% of U.S. greenhouse gas emissions are attributable to materials management activities, and approximately 16% are related to land management choices. An ongoing effort is needed to continue to reduce waste generation, develop treatment technologies that require less energy and chemicals and use less water, and make our hazardous waste infrastructure more resilient to extreme weather.<sup>106</sup>

Using common sense, hazardous waste is a giant problem, and we change to deal with it, or we get sick, make other beings sick, and harm our life support systems. We each have the power to stop buying stuff involving hazardous waste, do what we can to do no harm, and advocate ending this. Change!

### Garbage

In 2016, globally, humans produced 2 billion metric tons of municipal solid waste (household and commercial garbage) that is dumped on or in our lands, 1lb 6 ounces (740 grams) a day for every man, woman and child on Earth. That's expected to increase 70% to 3.4 billion metric tons by 2050.<sup>107</sup>

In the U.S. in 2015, there were 262 million U.S. short tons of municipal solid waste, about 4.5 pounds per person per day, 3.3 times the world average. That would fill 6.5 million 40-ton 18-wheeler trucks, which placed end to end would circle the equator 3.7 times. Its composition looked like this:<sup>108</sup>

Material	Recycled	Composted	Combustion with Energy Recovery	Landfilled	Total	Total Percent	Landfill Percent	GHG Benefits (MMTCO <sub>2</sub> E)	Passenger Vehicle Emissions/Year (millions of cars)
Paper and paperboard**	45.32	-	4.45	18.27	68.04	27%	27%	-152.55	-32.67
Food, Other <sup>^</sup>	-	2.1	7.38	30.25	39.73	16%	76%	-6.56	-1.4
Yard trimmings	-	21.29	2.63	10.8	34.72	14%	31%	0.73	0.16
Plastics	3.14	-	5.35	26.01	34.5	14%	75%	3.14	0.67
Steel	6.06	-	2.14	9.97	18.17	7%	55%	-14.51	-3.11
Wood	2.66	-	2.58	11.06	16.3	6%	68%	-2.81	-0.6
Textiles	2.45	-	3.05	10.53	16.03	6%	66%	5.29	1.13
Glass	3.03	-	1.47	6.97	11.47	5%	61%	-0.89	-0.19
Miscellaneous Inorganic Wastes	-	-	0.78	3.21	3.99	2%	80%	-0.32	-0.07
Rubber and Leather <sup>‡</sup>	1.51	-	1.78	0.46	3.75	1%	12%	-0.38	-0.08
Aluminum	0.67	-	0.5	2.44	3.61	1%	68%	-6.11	-1.31
Other nonferrous metals <sup>†</sup>	1.5	-	0.06	0.66	2.22	1%	30%	-6.6	-1.41
<b>Totals</b>	<b>66.34</b>	<b>23.39</b>	<b>32.17</b>	<b>130.63</b>	<b>252.5</b>	<b>100%</b>	<b>52%</b>	<b>-181.58</b>	<b>-38.81</b>
	<b>26%</b>	<b>9%</b>	<b>13%</b>	<b>52%</b>	<b>100%</b>				

\*Includes material from residential, commercial and institutional sources. \*\*Does not include 10,000 tons of paper from durable goods.  
<sup>^</sup>Includes lead-acid batteries. Other nonferrous metals are calculated in WARM as mixed metals. <sup>‡</sup>Only includes rubber from tires.  
<sup>†</sup>Includes collection of other MSW organics for composting.  
 These calculations do not include an additional 1.43 million tons of MSW that could not be addressed in the WARM model. MMTCO<sub>2</sub>E is a million metric tons of carbon dioxide equivalent. Numbers in parentheses indicate a reduction in either GHGs or vehicles, and therefore represent environmental benefits.

These numbers are 10 million short tons short, but they're in the ballpark.

- It's wasteful we dump 68 million tons of paper and paperboard a year, much of which we've cut down forests to produce, especially when so much is packaging, paper bags, junk mail and ads, but it's encouraging we only dump 27% of it, recycling or burning the rest, largely for electricity. Paper isn't going to harm the land too much, except many inks and dyes in them are toxic.
- It's embarrassing that we dump 40 million tons of food when there are so many hungry people, and that ¾ of it goes to dumps when it could be composted to replenish soils, but it's not inherently bad for the land that food waste goes into the dumps and lands, maybe.
- We're actually making decent progress with our 35 million tons of yard waste, recycling or burning it for energy and only sending 31% to dumps. Really, it belongs in composts for soil.

- The 35 million tons of plastics we waste every year, with  $\frac{3}{4}$  going into landfills - that can't go on. That is essentially criminal at this point. More on that below.
- The 24 million tons of metals we discard every year is wasteful, especially the 54% that's not recycled and goes into dumps, making us dig up more, but much of that will degrade over time.
- 47.5 million tons of wood, textiles, glass, rubber and leather are wasteful, but they will degrade.
- 4 million tons of inorganic wastes with 80% being dumped in our lands is a big source of harm. Much of that is poisoning us, our environments and other species.
- The good news is we're better at recycling, with 26% of garbage being recycled, 9% composted and 13% burned for energy. We still dump 55% on the lands, 130.6 million tons of it. Yuck, but, together, those efforts prevent 182 million metric tons of CO<sub>2</sub> equivalent of greenhouse gas emissions from entering the atmosphere, and that's like taking 40 million cars off of the road!

That proves each of us has power to make a difference. Each of us who recycles makes a difference. More powerfully, we can choose not to purchase what we will waste. If we are not going to use it, a lot, just don't get it, save the money, and don't end up throwing it away! That has the greatest impact of all. A great falsity in most of our thinking is that we can throw things away. There is no such thing as away. It continues to exist in our environments, and often it comes back to haunt us, by doing harm. Change!

#### E-Waste

E-Waste is a term describing electronic devices we dispose of. In 2016, we produced 45 million metric tons of it globally, an amount that would fill 1.2 million 40-ton 18-wheeler trucks, which placed nose to tail would form a line from New York to Bangkok and back. That's an average of 14 pounds (6 kilograms) per person in the world, 3.3 times less than average E-Waste produced by people in the U.S.

By 2021, E-waste is expected to grow 17%, to 52 million metric tons, making it the fastest growing part of the world's domestic waste stream. It's considered hazardous waste, because it often contains toxic heavy metals, like lead and mercury. International E-Waste exports are banned in the Basel Convention, but the U.S. is 1 of 2 nations that did not sign it.<sup>109</sup> We waste at least \$55 billion (4.8% of FADS) in recoverable materials by failing to recycle much of it.<sup>110</sup> It poisons our lands. Change! Recycle E-Waste!

#### Litter

We bury most of our garbage in the ground, but we also throw 52 billion pieces of litter on our roadways in the U.S. alone. During the 2009 Great American Cleanup, 64 million pounds of litter were collected. Littering costs the U.S. \$12 billion every year (1% of FADS). (Not included are indirect costs of littering, like decreases in property values, commerce and tourism, as well as the health effects.)

Cigarette butts comprise 38% of all items littered on the highways, streets, parks and playgrounds, and 53% of all litter is attributable to motorists, 81% of observed littering is committed "with intent" and is mainly attributable to lack of individual awareness or sense of obligation.<sup>111</sup>

Common sense? Babies and animals choke on cigarette butts. The rest of it causes other harms. Change now! It's not that hard. Just don't litter! If you see litter, pick it up and dispose of it properly! Put out trash cans in public spaces so people have an alternative to littering! Don't be a pig!

It's not that hard to just not be a pig, right? Avoid polluting stuff, and/or dispose of any of it properly!

## Plastics

Plastics deserve special mention. We've made lots of good use of them. We've created loads of them. They're out of control, though, and they're doing us, all life and all of our environments great harm.

Plastic as an adjective means made of plastic, or easily shaped or molded. Plastics as nouns are mostly synthetic or human-made materials made from polymers, long molecules built around chains of carbon atoms (monomers) that can be molded into shape while soft and then set into rigid or elastic forms. Most come from petroleum. There are lots of varieties, with different characteristics, including:

- **Acetal (Polyoxymethylene, POM)** - very high tensile strength, almost like metals, very resistant to heat, abrasion, water and chemicals, with a low friction coefficient, good for things like gears
- **Acrylic (PMMA)** - transparent, scratch resistant, and not likely to damage tissue if it fails, so it's best known for use in optical devices
- **Acrylonitrile Butadiene Styrene (ABS)** - resists corrosive chemicals and physical impacts, molds in low heat and is easy to machine, so it's used in injection molding, 3D printing and Lego toys
- **HDPE** - stiff stuff used for things like trashcans
- **LDPE** - the plastic shopping bags in grocery stores, with high ductility but low tensile strength
- **Nylon (PA)** - used for a variety of things, like clothing, rope and injection molded parts
- **Polycarbonate (PC)** - clear stuff with high impact strength in greenhouses and police riot gear
- **Polyethylene (PE)** - harder plastic used for plastic detergent bottles and other containers
- **Polyethylene terephthalate (PETE or PET)** - the most widely produced plastic in the world, used for polyester fibers in clothing and for bottling and packaging, like pervasive drink bottles
- **Polypropylene (PP)** - used in a bunch of stuff, like product packaging, car parts and textiles
- **Polystyrene (PS)** - is used to make Styrofoam for cups, packing peanuts and soft drink lids
- **Polyvinyl Chloride (PVC)** - in things like plumbing pipe, electrical wire insulation and vinyl siding
- **UHMW** - stuff about as strong as steel used for things like medical devices (artificial hips)
- **Polylactic Acid (PLA)** – from biomass, not petroleum, so it degrades; used for utensils

Plastic wasn't invented until the late 19<sup>th</sup> century, and production really started taking off around 1950. Since then, we've made 9.2 billion tons of it. Of that, 7 billion tons have become waste, almost a ton for every man, woman and child on the planet today, 6.3 billion tons never recycled.<sup>112</sup>

That never recycled amount of plastic would roughly fill 157 million 40-ton 18-wheeler trucks, which placed end to end would circle the equator 89 times. We use:

- 500 million plastic straws every day in the U.S., enough to circle Earth twice at the equator,<sup>113</sup> 183 billion a year, enough to circle the Earth 730 times,
- A million plastic bottles a minute globally,<sup>114</sup> 526 billion a year,
- 100 billion plastic bags in the U.S. every year, enough to reach around the Earth's equator 773 times if tied together,<sup>115</sup> almost one plastic bag per resident per day,<sup>116</sup>
- Nearly 2 million single-use plastic bags worldwide every minute,<sup>117</sup> up to 5 trillion single-use plastic bags worldwide every year,<sup>118</sup> enough to circle the equator 38,650 times, and
- 8% of world oil production to make plastic, projected to rise to 20% by 2050.<sup>119</sup>

Truly, it is mind-boggling how much of this stuff we produce and discard. The problem is that it's unclear how long it will take for that plastic to completely biodegrade into its constituent molecules. Estimates range from 450 years to never.<sup>120</sup> Aw, snap.

That's the thing. Only the last plastic on the list above, PLA from biomass, degrades into harmless stuff. Only about 1% of plastic we make now is that.<sup>121</sup> The rest basically doesn't biodegrade, or takes a really, really long time to biodegrade or break down into harmless natural stuff. It's estimated monofilament fishing line takes 600 years to degrade, 6-pack rings and plastic bags 450 years, disposable diapers 500, tires 2,000,<sup>122 123</sup> Styrofoam never?<sup>124</sup> It may be here when the Giza pyramids have eroded away. Nobody knows, because it hasn't been around long enough to know what it will do over the long run. Plastic is as big a problem to the environment and climate change as the other oil and gas industries.<sup>125</sup>

Basically, nature doesn't make stuff like plastic, so it hasn't developed ways to break it down. Bacteria and fungi and most things that eat and process most things can't break up those long-chain polymers. Supposedly, some plastics photodegrade, break down in sunlight, but they don't really go away; they just break down into smaller and smaller pieces, called microplastics, and that just make them easier to get into ever smaller living things. So, they do. Stuff buried in landfills isn't exposed to sunlight, so it just stays there. Maybe we'll find some bacteria or solution to degrade plastics, but we haven't yet.<sup>126</sup>

Of plastic waste between 1950 and 2015, a ton for every person alive today, only 9% was recycled. Most isn't recyclable. PET and HDPE are. PVC, PP, Polystyrene, LDPE and others are generally not. In practice, most recycled plastics are only recycled once or twice before being dumped or incinerated.<sup>127</sup> In 2015, 55% of global plastic waste was discarded, 25% incinerated, and 20% recycled. The U.S. recycles just 9% of its plastic trash.<sup>128</sup> 40% of all plastic is used only once before being thrown away.<sup>129</sup>

Many rich countries have been shipping waste to other countries, rather than deal with it themselves, and many of those countries just bury or burn it unsafely.<sup>130</sup> China took 45% of the world's plastic waste since 1992, not anymore, which will leave 111 million metric tons of plastic waste stranded by 2030.<sup>131</sup> 180 nations agreed to ban plastics trafficking; the U.S. is one of two nations in the world that did not.<sup>132</sup>

It's everywhere. It's in our lands, sitting there, breaking into ever smaller pieces, if at all, and getting into everything. It infests our waters, from oceans to aquifers. When we burn it, it releases horrible stuff into the air we breathe. When PVC burns, in wildfires for example, it turns into dioxins, the same stuff used in Agent Orange. It's utterly infested oceans:

- 18 billion pounds of plastic flows into the oceans every year from coastal regions, equivalent to 5 grocery bags of plastic trash sitting on every foot of coastline around the world.<sup>133</sup>
- It kills more than a million seabirds every year through entanglement and ingestion.
- There will be more plastic than fish in oceans by 2050.
- Plastic causes \$13 billion of damage to marine environments each year.
- 80% of plastic waste in oceans originates on land.<sup>134</sup>
- Nearly 700 species, including endangered ones, are known to be affected by ocean plastic.<sup>135</sup>
- Shellfish lovers are eating up to 11,000 plastic fragments in their seafood each year.<sup>136</sup>
- There are 80,000 tons of plastic in the "Great Pacific Garbage Patch," a soup of plastic in the middle of the Pacific Ocean about twice the size of Texas, humanity's most disgusting legacy?<sup>137</sup>
- Plastic is in every tested example of life at the very bottom of the deepest part of the ocean<sup>138</sup>

Now, microplastics are in our drinking water, beer, 90% of sea salt, fish and shellfish,<sup>139</sup> and our poop.<sup>140</sup> Humans are consuming tens of thousands of pieces of microplastics every year, harming our health.<sup>141</sup>

Use a little common sense! This stuff doesn't go away. We're drowning in it. It's getting in most parts of our food chains. We are consuming humungous amounts of energy producing it. It's making us sick. It may be harming all life. We don't even know the long-term effects, but they can't be good, right?

It's not hard to change and make a difference. If there is a choice, buy the version that's not plastic! Only buy plastic stuff if you plan to really make very good and long-term use of it! Carry a shopping bag with you and use that instead of using yet another plastic shopping bag! Just say no to plastic! Change!

## Water Pollution

Scientists believe there are 8 planets and 181 natural moons in our solar system, estimate there are 10 to 40 billion planets in our galaxy, and estimate there are some 100 billion galaxies in the universe. However, there is only one place in the universe we have ever identified standing surface water: Earth. Ours is the only planet we know of with those stunningly gorgeous blue colors from space. We believe life began in our oceans, 3 billion years ago, and almost every living being we know of requires water. We exist because Earth is a healthy water planet. Water is our source of life.

Oceans generate most of the oxygen we breathe, and they play a major role in regulating our climate. 97% of Earth's water is in oceans, oceans are the habitat of at least 230,000 known species, 50-80% of all Earth life, and two-thirds of all marine life remains unidentified. We're largely ignorant of our waters.

The human body is 50-65% water. Water is the major component of most body parts. It allows cells to grow and reproduce, flushes waste out of the body, lubricates joints, helps deliver oxygen all over the body, forms saliva and aids digestion, lubricates joints, and is involved in so much more we do to live. Without controversy, clean and healthy water and natural water systems are extremely important. Humans can live without love? Human beings cannot without clean and healthy water. We are water.

Yet, humans dump 80% of world wastewater (> 95% in some countries) back into the environment without being treated or reused, polluting rivers, lakes and oceans. Water pollution caused 1.8 million deaths in 2015, more than war and all other forms of violence combined. Every day, we spend millions of hours carrying water, 750 million people don't have access to an improved source of drinking water, and up to 2.5 billion people don't use an improved water sanitation facility.

Unclean water sickens a billion (1 in 7) people a year, globally. Low-income communities are often at higher risk, because they're closest to polluting sources. Waterborne illnesses come from pathogens, disease-causing bacteria and viruses from human and animal waste, like cholera, giardia and typhoid. Thousands of people across the U.S. are sickened every year by Legionnaires' disease, a severe form of pneumonia caught from piped water. Unregulated chemicals in water are sickening us everywhere.<sup>142</sup>

Flint, Michigan residents suffer lead contamination from cost-cutting measures and bad water systems, but they're not alone, and contaminated water includes more than lead: a wide range of chemical pollutants, from heavy metals, like arsenic and mercury, to pesticides and nitrate fertilizers. Ingested, these toxins can cause many health issues, like cancer, hormone disruption and altered brain function. Children and pregnant women are especially at risk. Harmful contaminants have been found in the tap water of every U.S. State, and water in the U.S. is considered safer than in many countries in the world.

Swimming can be risky. Every year, 3.5 million people in the U.S. get health problems like skin rashes, pinkeye, respiratory infections and hepatitis from chemical and sewage filled waters.

Water pollution happens when harmful substances, chemicals or microorganisms contaminate a stream, river, lake, ocean, aquifer, other body of water or water source, degrading its quality, making it harmful to human, other life or environments. Water is especially vulnerable to pollution. A “universal solvent,” it can dissolve more substances than any other liquid. Toxic stuff from farms, towns and factories easily mix with it and dissolve into it, causing water pollution, easily passing to us and other water bearing life.

When rain falls and seeps through cracks and porous materials into an aquifer, or underground water storehouse, it becomes groundwater, one of our least visible but most important natural resources. We reduce groundwater buildup if we pave land with asphalt, concrete and other impermeable surfaces. 40% of people in the U.S. rely on pumped groundwater for drinking water. In rural areas, it’s often the only freshwater source, besides rain. Groundwater is polluted when contaminants, like pesticides, fertilizers and waste leaching from landfills and septic systems, make their way into an aquifer.

Eliminating groundwater contamination is hard to impossible, and definitely costly. Once it is polluted, an aquifer may be unusable for decades, even thousands of years. Groundwater can also spread contamination far from original pollution sources, as it seeps into streams, lakes, and oceans. That’s the concern that caused native-led protests of oil pipelines over the Oglala aquifer, the largest in the U.S.

Covering about 70% of the Earth, surface water fills our oceans, lakes, rivers, streams and ponds. Surface water from freshwater sources (not oceans) provides more than 60% of water in U.S. homes. Big portions of that water are threatened. Nearly half of U.S. rivers and streams and more than a third of our lakes are polluted and unfit for swimming, fishing and drinking. The main source of that pollution is farm waste and fertilizer nutrient runoff, including nitrates and phosphates, but municipal and industrial waste discharges also contribute to the problem.

Some water contamination comes from single sources, wastewater discharged legally or illegally by a manufacturer, oil refinery or wastewater treatment facility, leaking septic systems and illegal dumping. That’s supposed to be regulated. Some comes from diffuse sources, like agricultural or stormwater runoff, or debris blown into water from land. That nonpoint source pollution is the leading cause of water pollution in U.S. waters, but it’s hard to regulate, since there’s no single, identifiable source. Water pollution, like air pollution, can’t be contained by lines on a map. Polluted water flows all over.

80% of ocean pollution comes from the land. Contaminants like chemicals, nutrients and heavy metals are carried from farms, factories and cities by streams and rivers into bays and estuaries and out to sea. Marine debris, particularly plastic, is blown in by the wind or washed in via storm drains and sewers. Seas are also contaminated by oil spills and leaks and constantly soak up carbon pollution from the air. The ocean absorbs as much as a quarter of man-made carbon emissions.

Agriculture uses most freshwater. Farming and livestock use 70% of Earth’s surface water, and Ag’s the leading cause of water degradation around the world. In the U.S., agriculture is the top source of contamination in rivers and streams, the 2nd-biggest source in wetlands, the 3<sup>rd</sup> biggest in lakes, and a major contributor to estuary and groundwater contamination. When it rains, fertilizer, pesticide and animal waste nutrients, bacteria and virus yuck from farm and livestock operations get into waterways.

Nutrient pollution, from excess nitrogen and phosphorus, is the #1 threat to water quality worldwide. Healthy ecosystems rely on a complex web of animals, plants, bacteria and fungi interacting directly or indirectly with each other. Harm to any can create chain effects, harming entire ecosystems. Nutrient pollution can stimulate plant and algae growth, reducing oxygen levels in water, which can suffocate plants and animals and create toxic and harmful “dead zones,” where waters are basically devoid of life. Sometimes, harmful algae blooms produce neurotoxins that harm life.

Wastewater is used water, from sinks, showers and toilets, and from commercial, industrial and agricultural activities (metals, solvents and toxic sludge). It’s also stormwater runoff, when rain washes oil, grease, chemicals, road salts and debris from impermeable surfaces into our waterways

In the U.S., wastewater treatment facilities process about 34 billion gallons of wastewater a day, reducing amounts of pollutants, like pathogens, phosphorus, nitrogen and human waste in sewage, and heavy metals and toxic chemicals in industrial waste, and releasing treated waters back to waterways, but the country’s aging and easily overcome sewage treatment systems also release more than 850 billion gallons of untreated wastewater annually.

Nearly half of the estimated 1 million tons of petroleum oil that gets into marine environments each year comes from land-based sources, like factories, farms and cities, 10% from tanker spills, and a third from regular shipping industry operations, through both legal and illegal discharges.

Radioactive waste from nuclear power plants, uranium mines, military weapon production and testing, and universities and hospitals using radioactive materials for research and medicine get dumped into waters and can persist in the environment for thousands of years. The cleanup of 56 million gallons of radioactive waste at the Hanford nuclear weapons production site in Washington will cost more than \$100 billion (9% of FADS), and last through 2060. Fukushima has leaked radioactive waste since 2011.<sup>143</sup>

Industrial and municipal wastewater chemicals and heavy metals contaminate waterways and are toxic to aquatic life, reducing life spans and abilities to reproduce, and work their way up food chains as predators eat prey. That’s how tuna and other big fish accumulate high levels of toxins, like mercury. Marine debris can strangle, suffocate and starve animals. It gets swept into sewers and storm drains and out to sea, turning oceans into trash soups and collecting as gigantic floating garbage patches. Discarded fishing gear and other debris harm more than 200 different species of marine life.

Oceans absorb 1/4 of the carbon pollution from burning fossil fuels, and they’re becoming more acidic, making it hard for shellfish and corals to build shells, and impacting nervous systems of other life.<sup>144</sup>

Less than 1% of Earth’s freshwater is accessible to us. By 2050, global freshwater demand will be 1/3 greater. Global water demand for manufacturing is expected to increase 400% from 2000 to 2050.

Some facts about water:

- It takes 15,000 liters (almost 4,000 gallons) of water to produce two steaks.
- Worldwide hydropower produces 16% of electricity, but those dams disrupt entire ecosystems.
- A U.S. person uses an average 7,500 liters (almost 2,000 gallons) of water a day, mostly for food.
- One liter (about a quart) of water is needed to irrigate one calorie of food.
- Irrigation takes up to 90% of water withdrawn in some developing countries.
- Producing one kilo of rice requires 3,500 liters of water, one kilo of beef some 15,000 liters.

- 10 liters/quarts of water go into making a sheet of paper, 91 into a pound (500 grams) of plastic.
- U.S. bottled water uses 17 million barrels of oil, enough to fuel 1.3 million cars annually.
- About 95% of the water entering our homes goes down the drain.
- More than a quarter of drinkable water used in your home is used to flush toilets.
- One dollar can provide clean water for a child in the developing world for an entire year.<sup>145</sup>
- If all the world's ice melted, the oceans would rise 66 meters (217 feet).
- Three times as much garbage is dumped into oceans as the weight of fish caught every year.
- The Great Barrier Reef is the largest living structure on Earth.
- 39% of U.S. citizens live in shoreline counties.<sup>146</sup>
- Around 45% of the world's population lives within 90 miles (145 kilometers) of the ocean.
- Roughly 43% of humans depend on seafood as the primary protein source in their diet.
- 40% of China's water bodies are polluted; 700 million Chinese drink polluted water regularly.
- 1.3 million gallons of oil is spilled into the ocean every year.
- 85% of Bangladesh's groundwater is contaminated with arsenic.
- 80% of urban sewage discharged into the Mediterranean Sea is untreated.
- Earth has now around 500 marine "dead zones," equivalent to the territory of the U.K.
- 46% of plastics produced on the planet float.
- 80% of all trash floating in the oceans is made of plastic, around 46,000 pieces per square mile.
- 10% of the plastic we use in daily lives, equivalent to 700 billion plastic bottles, ends in oceans.
- 40,000 tons of plastics are currently floating on the oceans' surface.
- The Great Pacific Garbage Patch, a floating continent of plastic trash, is twice the size of Texas.
- There are now at least 6 of these gyres – in the Indian Ocean, North Atlantic Ocean, South Atlantic Ocean, North Pacific Ocean and South Pacific Ocean, and now the Mediterranean.<sup>147</sup>
- Los Angeles dumps 22,000 pounds of plastic bottles, bags and straws in the Pacific daily.
- In North America's Lake Erie, 85% of the plastic particles are smaller than two-tenths of an inch.
- 50% of sea turtles, 44% of seabirds, 22% of cetaceans and many fish species have eaten plastics.
- Plastics and water pollution kill a million seabirds and 100,000 marine mammals annually.<sup>148</sup>

Water is essential to life. In the U.S., and in much of the world, we put poisonous chemicals in it to “make it safe to drink.” Chlorine in water was used to gas soldiers on the frontlines of World War I.<sup>149</sup> We put fluoride poison in our water to “prevent cavities”? Huh? There’s no way to regulate that dose. An athlete on a hot day may drink gallons, and others none. That doesn’t pass a common-sense test. There are better ways now to treat water than poisoning it and us, such as filtering and ultraviolet light. In 2018, pollution of oceans, rivers and lakes was the #2 and pollution of drinking water was the #3 biggest fear of people in the U.S., and 5 of the top 10 fears were environmental.<sup>150</sup>

Water’s really important. We are bags of water with appendages. It makes no sense to mistreat it so. Our government is currently weakening clean water protections, suspending Clean Water Rules and attacking the Clean Water Act, lifting federal protection for sources of drinking water for 1 in 3 people in the lower 48 states.<sup>151</sup> Change! Get a stainless-steel water bottle, filter tap water and drink from that! Just say no to plastics, if possible! Get low-volume toilets, pee in the woods or use composting toilets! Properly dispose of all chemicals, oils and non-biodegradable items! Stop using combustion engines! Protect waters, essential for life! Stop buying things using chemical pesticides, herbicides or fertilizers! Reduce impermeable surfaces in your environments! Be awake, aware and conscious! Respect water!

## Light Pollution

For billions of years, life on Earth existed in a rhythm of light and dark created solely by the light of the Sun, Moon and stars. For millions of years, stars and fires were humans' TV. That's what we watched and were inspired by at night. Mythologies and stories were based on constellations and stellar events. Ancient civilizations had stunning knowledge of the heavens, including using stars to be able to predict the changes of seasons, and knowing about the 26,000-year cycle of the procession of the equinoxes, just from just carefully observing the sky at night. Sailors were able to navigate the seas using stars.

100 years ago, most people on Earth could look up and see spectacular starry night skies. By 1866, dim stars were no longer visible in cities like London and Paris. Smoke from gas lights were creating haze. City sky watchers and astronomers there had to find new ways or places to observe the skies by 1909, because they could no longer see most stars from the cities.

Light pollution is a global concern. In an urban or suburban area all you have to do to see this pollution is go outside at night and look up at the sky. The sky over cities is often more than 500 times brighter than over non-urban areas. City lights can obscure almost all stars on even a clear, cloudless night. Light pollution harms faraway locations also, because it spreads hundreds of miles from its sources.

80% of the world's population lives under skyglow. In the U.S. and Europe, 99% of people can't experience a natural night. More than a third of people on Earth can't see the Milky Way from their location because it is obscured by light. In North America, 80% of humans cannot see it, in Europe 60%, in the United Arab Emirates 99%, in Israel 98%, and in Egypt 97%. Singapore is the most light-polluted country, where people live under "skies so bright that the eye cannot fully dark-adapt to night vision." During a 1994 blackout, residents of L.A. called 911 because they saw the Milky Way for the first time.<sup>152</sup>

For people in or near Paris, the closest large area without light pollution is over 500 miles away in Corsica, Central Scotland, or Cuenca province, Spain. From Neuchâtel, Switzerland you'd have to go 850 miles to northwestern Scotland, Algeria, or the Ukraine to find unspoiled night skies.

Light pollution is a curse of industrial civilization. Its sources include building exterior and interior lighting, advertising, commercial properties, offices, factories, streetlights, refineries and sports venues. Gas flares and machinery created by oil and gas production facilities pollute many rural areas.

Light pollution components include:

- Clutter – bright, confusing and excessive groupings of light sources
- Glare – excessive brightness that can create visual discomfort
- Light trespass – light going where it's not intended or needed
- Skyglow – brightening of the night sky over inhabited areas

Much outdoor lighting at night is unnecessarily bright, poorly targeted, inefficient, poorly shielded and totally unnecessary. It's wasted by shining it into the sky, rather than focusing it on objects and areas we want lit, so the electricity used to create it is also wasted. In the U.S., 13% of electricity in homes is used for outdoor lighting; half a kilowatt-hour of energy per house is wasted each night by bad lighting; 120 terawatt-hours of energy are used annually, just to light streets, parking lots and stuff outdoors; 30% of outdoor light is wasted; and it costs \$3.3 billion a year (.3% of FADS), equivalent to 21 million tons of CO2 released in the air. 875 million trees would have to be planted annually to offset that.

Now, artificial lights override darkness, and our cities glow at night, disrupting natural day-night patterns and messing with the delicate balance of our environments. Negative effects of the loss of natural night patterns and lights, inspirational natural resources, might seem intangible, but growing evidence links light pollution to measurable negative impacts, including: increased energy consumption, disrupted ecosystems and wildlife, and harm to the health of human and other beings.

Inappropriate or excessive use of artificial light, light pollution, has serious environmental consequences for humans, wildlife and climate. It impairs views of the universe. In most organisms the circadian clock affects brain wave patterns, cell regulation and hormone production, among other things. Light pollution disturbs that, creating health problems, like obesity, early-onset diabetes and cancers. Darkness stimulates melatonin production. Light pollution disrupts that, which can mess with sleep patterns and lead to sleep disorders, headaches, stress, depression, fatigue and cardiovascular disease.

Artificial lighting can harm plant life by disrupting natural rhythms based on natural day/night cycles and signals for when to drop leaves and become dormant in the Fall, or start growing again in the spring. Similarly, it creates all kinds of problems for animals and other forms of life. For example, it messes up female sea turtles, because they return to lay eggs on beaches, sometimes decades later, and new lights prevent them from nesting, or lights so disorient them, that they end up on roads getting hit by vehicles. Hatchlings typically find the ocean by moving away from the dark land. With artificial lights over land, they often crawl away from the sea instead of toward it.

Light pollution stresses the migration patterns of birds. In North America, 200 species migrate at night, but bright lights can disorient them, especially with low cloud cover. In addition to fertilizers, pesticides and habitat losses, light pollution is thought to be a cause for firefly population declines. They're not often seen where light is bright, even from a full moon. Lights produced by the insects are used to signal each another, find mates, communicate, claim territory and deter predators. Exterior lights, like those in yards and gardens, seem to harm them.

Light pollution is changeable. We just change habits. Turn 'em off! Shield lights for outdoor fixtures; direct lights down, instead of up; lower bulb powers; close drapes and blinds at night! Get out in nature and appreciate natural night skies!<sup>153 154 155 156</sup> Change! Pepsi plans to invade the night sky with an orbiting billboard advertisement.<sup>157</sup> Resist! Most of us don't know we're harmed by this. We are.

## Noise Pollution

For most of Earth's and humanity's existences, the sounds were mostly the pure sounds of nature. Mostly, except special events, those were balanced, harmonious, not overly loud and richly beautiful. Today, most of us are surrounded by loud and unwholesome noise that does us and nature harm.

The decibel system measuring loudness is logarithmic, like the earthquake Richter scale. The smallest audible sound (almost total silence) is 0 dB. A sound 10 times louder is 10 dB. A sound 10 times louder than that is 20dB, which is 100 times louder than 0 dB near silence. 30 dB is 10 times louder than that, 1,000 times louder than 0 dB... Distance affects loudness. These ratings are for near the sound.

Noise	Source	Noise	Source	Noise	Source
0 dB	Near total silence	80 dB	Shouting	110 dB	Car Horn
15 dB	Whisper	85 dB	8 hrs/day => hearing loss	120 dB	Rock Concert/Jet Engine
60 dB	Normal Talk	90 dB	Lawnmower	140 dB	Gunshot

That's sorta tricky, but most of us get that very loud noises can hurt us. An explosion can make us deaf. That's maybe 150 decibels (dB). Exposure to 140 dB sound causes immediate damage and actual pain. A really big sound might kill us, like 185-200 dB. Not all understand that length of exposure to sound also affects the damage it does. Noise over 85-90 dB can cause hearing loss over time, a factor of loudness and exposure length.<sup>158</sup> If you have to raise your voice to be heard, that is about 85 dB. Many are not aware that exposure to noise pollution is harming us. Over time, exposure to enough noise can damage hearing, which is called Noise Induced Hearing Loss (NIHL). What did you say?

Of 4 million people in the U.S. with hearing loss, 25%, a million, have NIHL. About 30 million people in the U.S. are exposed to hazardous sound levels at work every day. Mining is the industry with the loudest work environment, then manufacturing and construction. 1 in 8 workers in these and similar industries have hearing loss from their workplaces. The #1 cause of hearing loss isn't age, it's noise. Elderly are at higher risks of hearing damage, because they've been exposed longer. Modern life exposes us to loud and lots of noise, and we suffer hearing and other health damages from that.

Noise pollution health harms are physiological (like hearing loss, hypertension and sleep disturbances) and psychological problems (like annoyance, aggression and stress). Noise pollution, AKA environmental noise, is displeasing sound from humans, animals or machines that disrupts environmental balance. *"Calling noise a nuisance is like calling smog an inconvenience. Noise must be considered a hazard to the health of people everywhere."* — William H. Stewart (former U.S. Surgeon General)

30% of people exposed to noise pollution have frequent heart rate, blood pressure and stress changes. Two types of headaches come from noise pollution: chronic headaches and episodic tension headaches. Chronic headaches occur over 15 times a month and have throbbing pain in the top or side of the head. Episodic Tension Headaches happen less than 15 times a month and can last many days at a time. Emotional problems can be intensified by noise. Noise can make people tired, anxious and aggressive.<sup>159</sup>

Children may be particularly affected, with things like long term memory loss, reading impairment and development of metabolic problems, like obesity and diabetes. Children's stress hormones are boosted by constant noise pollution, which affects their psychological well-being. Babies' natural abilities to understand sounds can be greatly interrupted by unnecessary sounds in the home, like TV or radio. These noises affect the baby's brain and make it hard for them to naturally learn language.

There are laws to curb environmental noise. In some places, making noise is prohibited. In other places, it's prohibited for specific times (like 10 PM to 6 AM), or limited to certain levels. In the U.S., noise emission measures and noise emission standards are monitored under the Noise Control Act (1972).<sup>160</sup> For some reason, we seem to like it loud, and we are increasingly designing our common restaurant, bar and entertainment spaces to be loud, like 70-90dB, because it's more profitable to do so.<sup>161</sup>

According to the World Health Organization, 1 in 5 Europeans is regularly exposed to noise levels that could significantly damage their health. Excessive noise can affect blood pressure, hypertension and heart disease. Its recommendations are to reduce average noise levels of day road traffic below 53 dB, the equivalent of hearing a dishwasher in the next room, and 45 dB at night. 40% of European Union residents are exposed to traffic noise levels above 55 dB. For railway, aircraft and wind turbine noise, average less than 54 dB during the day, less than 40dB at night, to avoid adverse effects on sleeping. The most frequent impacts from noise pollution are annoyance and sleep disturbance.<sup>162</sup>

Noise pollution harms other life also. It disrupts animals' abilities to communicate. Female frogs have trouble locating males from their calls. Nocturnal species, like owls and bats, have trouble locating prey. In oceans, underwater noise from commercial shipping, boats, off-shore drilling and U.S. navy sounds affects marine species, like dolphins and whales, leading to things like whales beaching themselves. Noise pollution drives us nuts, and it drives other kinds of life nuts also.

Much less understood intellectually, but widely known experientially, are the effects of sound on mood and emotion. Living beings react to different sounds differently, because they make us feel different. Think of music. Most everyone is moved by it, because we feel things as we listen to it. A minor chord tends to make us feel sad, and a major chord happy. We love music, because it is emotionally moving. It affects how we feel. Sound can be described as a function of frequency, amplitude and phase in ranges we hear. In music, different frequencies, amplitudes, phases, rhythms, melodies and harmonies are used to affect emotions and feelings. Tones and relationships between sounds have effects in us.<sup>163</sup>

Many, many of the human-made sounds we surround ourselves with have negative effects in us. Appliance noises, traffic, aircraft, machinery and many other noises we produce trigger bad moods and emotions in us. We feel bad, because of the sounds we are exposed to. Most of that is unconscious. When we walk into a new house, for example, we hear the appliances running, abrasive whining sounds that trigger bad feelings. A few minutes later, our brains squelch that out, as not useful. We don't hear it consciously, but we're still hearing it unconsciously, and it's still affecting how we feel. We're making ourselves feel bad with the qualities of the sounds we surround ourselves with.

It doesn't make sense to harm ourselves, our children and other life with excessive bad noise we make. That's in our power to change. Just turn it down! Change the tones! Respect quiet! Shhhh! Change!

## Population Growth

In the 1970s, human population growth was widely accepted as the world's greatest ecological problem, because it enormously increases the negative impacts of almost everything we do that causes harm, and because there must be a limit to how many people the Earth can support, at least in any kind of healthy way we want to live. People talked about it regularly and with deep concern back then. The global human population then was about 4 billion; today, almost nobody talks about human population growth as a problem, and the global human population is about 7.5 billion, almost twice as many.<sup>164</sup>

The world population reached 1 billion in 1804. It took 123 years to reach 2 billion in 1927, 33 years to reach 3 billion in 1960, 14 years to reach 4 billion in 1974, 13 years to reach 5 billion in 1987, 12 years to reach 6 billion in 1999, and another 12 years to reach 7 billion 2011.<sup>165</sup>

According to current projections, the global population will reach 8 billion by 2024, about 13 years, and will likely reach 9 billion by 2037, another 13 years.<sup>166</sup> Population growth seems to be slowing to about a billion people every 13 years. That's some progress, but those are still big increases, and there's still a limit to how many people the Earth can support. It looks like we may learn what that limit is. It's possible people alive today will experience catastrophic effects of approaching or reaching that limit.

Half the people in the world lived in cities in 2010.<sup>167</sup> By 2050, it is estimated that 70% of people will.<sup>168</sup> 70% of 10 billion people is 7 billion living in cities in 2050, almost the entire human population today. The greater Los Angeles area has over 18 million people.<sup>169</sup> It already imports almost 90% of its water.<sup>170</sup> The mighty Colorado River no longer flows to the sea, because we use the water before it can get there.

How will L.A. get enough water for maybe 25 million people by 2050, especially if global warming disrupts or reduces water supply in the broad region, which is already mostly desert?

Almost half the world's population, 3 billion people, live on less than \$2.50 a day; 80% on <\$10 a day, What happens to Earth's resources if, as much of the power elite in the U.S. want, these people currently living simple, low impact lives start producing and consuming like people in the U.S.? It's estimated we'd already need more than 4 Earths to support Earth's population if all lived like us.<sup>171</sup>

It doesn't take much imagination to envision many problems that will arise and get worse as the human population continues its unsustainable growth. That's scary, and depressing, and it doesn't make sense to knowingly do that to ourselves, or to others, or to the planet, or to other species. Limit family sizes! Focus on quality of life, rather than length of life! Share information about this! Change!

### Harm to Other Beings

We are doing harm to our environments with all this stuff, but we are also harming other Earth beings. We're creating illness and suffering in billions of other beings on Earth with these polluting behaviors. We are killing billions of individuals, and we are killing hundreds of thousands of entire species. Change!

### Extinctions

Humanity is only one species in the vast and awe-inspiring expression of life on Earth. Some estimate there may be between 100 billion and a trillion species of microbes alone, most unknown to us.<sup>172</sup> About 1.5 million species have been formally described in scientific literature, most of them insects.<sup>173</sup> A study billed as the most accurate yet claims Earth has 8.7 million forms of life, but 86% of all plants and animals on land and 91% of those in the seas have yet to be named and catalogued.<sup>174</sup> Honestly, the truth is that we don't know how many species of life are on Earth. We aren't even close to knowing. Each species of life is unique, and we can learn from it. Each unit of life is unique and deserves respect.

We do know that humanity's actions are harming other species, driving many to extinction, and that is accelerating with global warming and the sickening levels of pollution we release all over the planet.

- Scientists say Earth is undergoing a "mass extinction event", the first since the dinosaurs disappeared some 65 million years ago, and only the 6<sup>th</sup> in the last half-a-billion years.
- 2 species of vertebrate have gone extinct every year, on average, for the past century.
- 41% of amphibian and more than 1/4 of mammal species are threatened with extinction.
- Half of all coral reefs have died in the last 30 years.
- African elephant numbers dropped to 415,000 in 2016, down about 111,000 over 10 years.
- Annual economic losses as a result of deforestation and forest degradation alone may be as high as \$4.5 trillion (3.6 trillion euros – 389% of FADS).
- We now expect human caused global climate change to make 1 million species extinct.<sup>175</sup>

Global populations of 3,706 monitored vertebrate species declined roughly 60%, from 1970 until 2012. In 2017, 26,000 of 92,000 species assessed were classified "threatened." Of these, 5,600 were "critically endangered," 8,500 "endangered," and 12,000 "vulnerable." Of the plant and animal species we know, 1,204 mammal, 1,469 bird, 1,215 reptile, 2,386 fish, 2,100 amphibian, 1,414 insect, 2,187 mollusk, 732 crustacean, 237 coral, 12,505 plant, 33 mushroom, and 6 brown algae species are threatened.<sup>176</sup>

Global wildlife populations since 1970 have declined by 58%. Among vertebrates, the loss could reach 2/3 by 2020. Pollution, climate change and human activity like habitat destruction have contributed, with the biggest impact on animals in rivers, lakes and wetlands.<sup>177</sup> Reindeer and caribou populations have declined 56% in the past two decades, from 4.7 million to 2.1 million.<sup>178</sup>

In the U.S., scientists recently found monarch butterfly populations fell by 90% in the last 20 years, a loss of 900 million individuals; the rusty-patched bumblebee, which once lived in 28 U.S. States, dropped by 87% over the same period; and, measured by weight, flying insects in German nature reserves fell by 75% over 27 years. If you looked at midsummer population peaks, the drop was 82%. Half of farmland birds in Europe disappeared in three decades. More than 97% of bluefin tuna are gone. If you look at the world's mammals by weight, 96% of that biomass is humans and livestock; just 4% is wild animals.<sup>179</sup> 1 in 5 plant species faces extinction threat. Plants' biggest threats are habitat destruction for farming (31%), deforestation (21%), building and infrastructure construction (13%) and climate change (4%).<sup>180</sup>

Extinction rates have accelerated to 1,000 times the rate before the existence of modern Homo sapiens. 10,000 species could become extinct every year? Due to climate change, one fourth of Earth's species could be on their way to extinction by 2050. Inextricably tied to extinction, food chains are likely to become permanently unbalanced as apex predators and their prey begin to disappear.

“Considered a crucial barometer of environmental health, ocean acidity is already wiping out entire marine ecosystems. The planet's oceans are constantly absorbing excess CO<sub>2</sub>, causing their pH to decrease, literally acidifying the water. And as water temperatures rise, vast expanses of life sustaining coral, such as Australia's Great Barrier Reef, are also bleaching and dying.”<sup>181</sup> Average freshwater vertebrate species, like freshwater fish and frogs, have seen an 86% drop,<sup>182</sup> and average vertebrate (birds, fish, mammals, amphibians) populations have declined 60% since 1970.<sup>183</sup>

Bee colony collapse disorder is killing honeybees. From 1947 to 2005, the number of honeybees in the U.S. declined by over 40%, from 5.9 to 2.4 million. 2016, honeybee keepers lost 44% of their colonies, after losing 42% in 2015, and 39% in 2014. The Western honeybee is the world's premier managed pollinator species. Demand for its services has soared from fruit, nut, and vegetable growers. Bee pollination is worth \$15 billion to the U.S. farming industry. Over the last 6 years, the bee industry spent \$2 billion to replace 10 million hives, for an industry that earns \$500 million a year.<sup>184</sup>

Coral reefs cover less than 0.1% of the world's oceans and yet house a third of all marine biodiversity. Oceans cover 70% of our planet, and house a huge amount of the biodiversity of our planet. So, anyone who cares about extinction, or about biodiversity, needs to worry about the future of coral reefs.<sup>185</sup> Corals house between 1 to 9 million species, most of them undiscovered, as well as fish an estimated one billion people rely on.<sup>186</sup> “At least one-seventh of the world's population benefits from reefs”<sup>187</sup>

Coral bleaching has gone from once every 25-30 years in the early 1980s to once every six years now.<sup>188</sup> Half of Hawaii's coral reefs bleached in 1 year.<sup>189</sup> Half of Australia's Great Barrier Reef died in a year.<sup>190</sup> Florida Keys coral cover is now at 3%.<sup>191</sup> Mass coral bleaching events now hit 5 times more often than in the 1980s.<sup>192</sup> Global warming is expected to wipe out 90% of remaining corals by 2050.<sup>193</sup>

We do not know what impacts the losses of these species will have on environments, ecosystems, other species, climates, local weather patterns or humans. We are selfishly and ignorantly doing them harm.

The impacts could be enormous. "The Living Planet Report pegs the value of ecosystem services at \$125 trillion, just a few trillion shy of the world's total GDP."<sup>194</sup>

Using common sense, as an aware and thinking human being, this is ignorant, uncontroversially stupid. Stop doing this! In 2018, extinction of plant and animal species was the #8 biggest fear of people in the U.S., and 5 of the top 10 fears were environmental.<sup>195</sup> Change! Respect, protect and support other life!

### Harm to Humans

These harms we are going to our environments, ecosystems, life support systems and other species are bad news, but we are doing the same thing to human beings. We are making ourselves sick and unhealthy and threatening our future viability as a species, which creates suffering for human beings.

### Makeup

Let's look at just one little area among many where we are poisoning ourselves: women's cosmetics. Women buy and put poisons on and in our bodies, believing that it will make us appear more beautiful; those poisons then slowly and insidiously destroy our beauty, and often our health, which bothers us; and we respond by buying and putting more of those poisons on and in our bodies, to mask our losses and make us appear better, or at least feel better, in some "make up" way. That is truly tragic addiction.

Of almost 13,000 chemicals used in cosmetics, only 10% have been evaluated for safety. The U.S. Food and Drug Administration (FDA) is authorized to regulate harmful cosmetic and personal care product ingredients, but they generally don't. No approval is required for cosmetics to be sold. The FDA only takes regulatory action after others determine a product to be harmful, adulterated or misbranded.

According to the FDA: "FDA's legal authority over cosmetics is different from our authority over other products we regulate, such as drugs, biologics, and medical devices. Under the law, cosmetic products and ingredients do not need FDA premarket approval, with the exception of color additives."

The FDA says companies that manufacture and sell cosmetics are responsible for ensuring their safety (any conflict of interest?). "Neither the law nor FDA regulations require specific tests to demonstrate the safety of individual products or ingredients." "The law also does not require cosmetic companies to share their safety information with FDA." So, cosmetics companies are responsible for assuring the safety of their own cosmetics, but there are no required tests for that, and they don't have to share any data about that. The FDA is also not authorized to order recalls of hazardous chemicals in cosmetics.

Average U.S. women use 12 cosmetic/personal-care products a day, containing 168 different chemicals. Average men use less products, and are only exposed to about 85 such chemicals daily. Average teens report using 1 personal care product a day, but tests of their bodies show 16 different personal care hormone-altering chemicals in their bodies, including parabens and phthalates. 37 nail polishes from 22 companies contain dibutyl phthalate (DBP), that causes lifelong reproductive impairments in male rats, and damages the testes, prostate gland, epididymus, penis and seminal vesicles in animals.

One test of different cosmetics, including foundations, concealers, powders, blushes, mascaras, eye liners, eye shadows, lipsticks and lip glosses, found serious heavy metal contamination in virtually all: 96% contained lead, 90% beryllium, 61% thallium, 51% cadmium and 20% arsenic. A study of 31,000 U.S. women checked blood and urine levels for 111 mostly man-made chemicals in plastics, beauty products and household items, or commonly contaminating air, water and soil, found:

- Dioxins/furans (industrial combustion byproducts),
- Phthalates (found in plastics, common household items, pharmaceuticals and personal care products, including lotions, perfumes, makeup, nail polish, liquid soap and hair spray),
- Phytoestrogens (plant-derived estrogens),
- Polychlorinated biphenyls (PCBs and coolants),
- Phenolic derivatives (phenols, industrial pollutants),
- Organophosphate pesticides and Surfactants, and
- Polycyclic aromatic hydrocarbons (combustion products).

Women with higher levels of these chemicals in their bodies went into menopause 2-4 years sooner, with early ovary function decline, leading to heart disease and osteoporosis. Many of these chemicals have been linked to health risks, including cancer, metabolic syndrome and early puberty. Some of the more hazardous chemicals found in many cosmetics and personal care products are:

- **Paraben** - in deodorants, lotions, hair products and cosmetics, mimics the female estrogen hormone, linked with breast cancer, which often appears in upper and side breast quadrants, near where antiperspirants are applied.
- **Sodium Lauryl Sulfate (SLES/SLS)** - a detergent, surfactant and emulsifier used in thousands of cosmetic products and industrial cleaners, including almost all shampoos, scalp treatments, hair color and bleaching agents, toothpastes, body washes and cleansers, make-up foundations, liquid hand soaps, laundry detergents and bath oils/salts, which is often contaminated with the 1,4 dioxane carcinogenic by-product in its ethoxylation manufacturing process.
- **Methylisothiazolinone (MIT)** - a chemical in shampoo to prevent bacteria from developing, suspected of harmful nervous system effects.
- **Phthalates** - plasticizing ingredients often called "fragrance" linked to birth defects in the reproductive system of boys and lower sperm-motility in adult men, among other problems.
- **Toluene** - from petroleum/coal tar, in most synthetic fragrances and nail polishes. Exposure is linked to anemia, liver or kidney damage and possible effects on developing fetuses.

So, of 13,000 chemicals in U.S. women's beauty products, 10% have been tested, an average woman uses 12 cosmetic products daily, exposing her to 168 different chemicals. Skin is our largest organ, and it's permeable, so what we put on it gets in our bloodstream, gets distributed throughout our bodies, and accumulates over time.<sup>196</sup> We put this stuff on our skin. The E.U. banned 1,300 makeup chemicals; the U.S. has banned 11.<sup>197</sup> Using common sense, does it make sense we're doing this to ourselves?

We aren't just doing this to ourselves with cosmetics and personal care products. We're doing it with the poisoned air, water and land we live with; thousands of other synthetic and toxic products we buy and use; wastes we produce; plastics we eat and drink from; and chemicals, genetic manipulations, radiation and packaging we use in our food and drink. And we spend large amounts of our lives working to earn the money to buy stuff that poisons us. We're making ourselves and our loved ones sick, killing people and other life, and making healthcare unaffordable. Of 80,000 chemicals sold in the U.S., the EPA has banned 9, and hasn't banned one in 3 decades.<sup>198</sup> What does common sense say about that?

Fortunately, we can change! Stop doing it! Quit buying or using things with artificial chemicals in them! Be in environments that are less saturated with them! Help others understand! Be natural! Change!

## Disconnection from Nature and Spirit

How did we get to this point? How is it that we are willing to go along with this level of environmental destruction and harm we are doing to ourselves, other life on Earth and our very life support systems?

Well, for one thing, most people simply do not know any better. Half of people on Earth live in cities, more than 63% of people in the U.S. live in cities,<sup>199</sup> and a large percentage of those have never experienced undisturbed nature, so we don't know what that is or how it feels. In 2016:

- 40.5 million U.S. people, 13.7% of the population over age 6, went camping at least once.
- 3% of the population over 6 went backpacking.
- 5% went RV camping, and 9% went car camping.
- 11% of those who went camping had never been before.
- 39% of those who went camping were under age 17, and only 24% were 25 or over.
- 77% of those camped in tents, 35% in cabins/yurts and 25% in RVs at least once in the year.
- More than half of all the U.S. camping trips lasted only 1-2 nights.
- The favorite camping activity of participants was card and board games, at 49%.
- 74% of adults used a Smartphone while camping.
- Only 19% use no electronic technology while camping.
- 53% used texting, 39% personal email 39%, 29% news, 28% gaming, and 26% work email.
- 72% stay within 150 miles of home.
- only 4% went alone, 68% with a spouse or significant other.<sup>200</sup>

A small percentage of people in the U.S. get out in any kind of nature, and when we do most of us are in managed nature, developed campgrounds near home, focused more on each other, our technical gadgets and interactions with each other than with nature. Only 5% of total U.S. land is protected wilderness, only 2% of the land in the lower 48 states,<sup>201</sup> and the vast majority of people in the U.S. have no experience with that land, its nature or how it feels to be part of it. Most don't know what it's like:

- To lie back at night, gaze up at the heavens and be absolutely overwhelmed by the volume and stunning beauty of the stars, to see the Milky Way in crystal clarity spanning the heavens like a great river, as the Incas referred to it, make wishes on dozens of falling stars, and be transported outside of ourselves in mystical experiences of our smallness and insignificance, or the stunning grandeur of the universe, and how we are one with it somehow, deep inside and outside.
- To sit quietly with ancient trees in an old-growth forest and directly and personally feel their great strength, silence and palpable life energy.
- To have the absolute adrenaline producing ecstatic thrill of seeing vast herds, schools or flocks of wild animals, fish or birds in coordinated movement.
- To taste pure, clean water from a wilderness snowmelt stream, tumbled into virtuous energy structures down natural streams and waterfalls, and realize that is what real fresh water really tastes and feels like, or the incomparable satisfaction and refreshment it produces.
- To consume wild and healthy foods, moments after harvest, right there, and experienced the rich flavors and unrivaled burst and sustained flow of good energy they produce in our bodies.
- To hear the rich, balanced and harmonious sounds of wild nature in concert, or experience just how loud, profound and spirit provoking real and total silence can be.

- To breathe truly clean air, or smell and be moved by fresh diverse smells of nature, things that mystically trigger deep and moving memories, perhaps from deep in our DNA.
- To challenge ourselves to do something difficult and demanding in a great wilderness, like climbing a high mountain peak, with all of the great stamina, willpower and perseverance needed, with all the little challenges of stream crossings and obstacles to overcome, and internal battles with doubt, fatigue and motivation, and to finally reach the peak, see out over vast expanses and share that glory and satisfaction with others.

We do not personally know nature, so we do not know what we are destroying, and we don't care. There is no direct and personal relationship. We're harming things and beings that we don't know, and we don't experience the act of doing the harms, or seeing the harms done. Generation to generation, our baseline shifts; what we know from youth to compare nature to has already been deeply degraded.

Ever notice how people can nearly lose their minds and beings emotionally over a health problem in a close relative, but be almost utterly unmoved by a massive genocide, that kills, maims, injures and destroys the well-being of millions of equally real and important people somewhere else in the world?

That's how it is for most of us with nature and other forms of life. We'll want to kill someone and risk life in prison because our technical app doesn't work for a second, we get cut off in traffic, or our sports team loses, but we don't even look up to acknowledge being complicit in murdering billions of individuals and committing genocide on a million entire species of other forms of life, glorious and beautiful species that we could learn and benefit much from. That's ignorance and apathy.

We don't have personal relationships with nature, and we don't know this stuff's going on. Change! Get outdoors in nature! Spend time in nature! Watch other forms of life and imagine being them! Challenge yourself to do something you've never done before in nature! Get educated about nature! Live more naturally! Cultivate more nature in your immediate surroundings! Grow plants!

### Need for Change in Pollution and Environmental Harms

The U.S. is one of the world's biggest consumers of fossil fuels and all energy. It's also one of the world's greatest foot draggers in terms of changing that. At the same time, we're among the world's greatest polluters and biggest consumers and wasters of everything. We also actively model and promote the rest of the world being like us. Earth can't support everyone living like us. We'd need 4 Earths for that.

It does not compute. It must change; will change, and is already changing. We must find other ways of living now, or all life on Earth will suffer, as environmental and social systems collapse. At that point, then, we'll be forced to find other ways of living, or die. Some are now predicting a "high likelihood of human civilisation coming to an end" within 30 years.<sup>202</sup> Holy smoke! Why wait for that? Change now!

We're changing the climate of the planet with all of the carbon pollution we're emitting, combined with our destruction of forests and ecosystems that regulate climate, making it warmer, with devastating and cataclysmic likely predicted effects that are accelerating, arriving and will hit within our kids' lifetimes.

We're poisoning our air in other ways, harming ourselves and most life, wiping out our forest systems, reducing their virtuous effects on climates, the air we breathe and ecosystems, wiping out hundreds of thousands of wildlife species. We're ruining our soils, allowing them to erode away and poisoning them.

We're producing crazy amounts of poisons we dump on our lands, including DNA-changing radioactive waste that lasts millennia, with no real plan for what to do with it, insane volumes and varieties of chemicals nature has not developed ways to deal with, biological wastes that affect entire food chains, and other stuff like nano-materials, without enough concern for long-term impacts. We consume toxins in our cities, homes, products, food and drinks; and we waste and dump huge amounts of poisons.

We're polluting our waters, at every level: what we put in our bodies, what's in our oceans and rains, and what's in our rivers, streams and aquifers. We are wasting our energy polluting the night skies, so we can't see and be inspired by the universe. We harm ourselves and other life with disturbing noise. We're causing mass extinctions, often without even knowing or caring. We're multiplying rapidly, ignorantly pretending our out of control population somehow, miraculously, won't collapse catastrophically when the planet's life support systems can no longer support us in those numbers.

Land, water, air, noise and light pollution are harming the health of humans and other species, killing us, making us sick, and harming the quality of our lives. That drives up healthcare system costs enormously, making them unaffordable. Combustion engines cough poisons into our airs and drip them on our lands. Chemical poisons are ignorantly or uncaringly used in consumer goods, without regard to how they harm us and our environments. We put toxins on and in our bodies to make them better? Nonsense.

Drinking water is poisoned to clean it (really?), and poisons are used throughout our food supply chains, in fertilizers, pesticides, processing, preservatives and packaging. Schools and daycare facilities, where children play outdoors, are next to unhealthy exhaust spewing roadways. Refinery, manufacturing and chemical processing facilities release tremendous volumes of poisons into the air, water and lands.

Roads carve up natural landscapes, making it hard, dangerous and sometimes impossible for people not in cars and other animals to cross safely, destroying wandering and migration routes and spreading air, land, noise and light pollution across the nation. Plastics are pervasive, most of which don't go away, but just get ever smaller, so they get into even the smallest life forms and poison entire food webs, and pollute our land, air, water and bodies. Almost anywhere humans are there is vehicle traffic, belching pollution into the environment, frustrating and creating stress for drivers, pedestrians and bicyclists.

Cities are designed for the convenience of cars, not living beings. Impermeable concrete and asphalt cover as much as half the ground, killing soils and making water run off rather than enter aquifers. Closed buildings constructed with toxic materials choke out natural air, because that's polluted, so we breathe manipulated air and consume huge energy, isolated from each other and polluting the milieu.

Advertisements battle to steal our attentions. There is a cacophony of selling noise almost everywhere. Environmental stresses cause us to interact poorly with and withdraw from each other, suffering various "nature deficit disorders," problems arising from disconnection from balanced, pure and healthy natural systems and beings.<sup>203</sup> Vast military operations destroy and damage land, environment and lives.

Industrial agriculture wipes out natural ecosystems and diversity and uses polluting oil technologies for fertilizers, machinery and transport. Short-term genetic and other bio-manipulation plays experiment with real world life webs, not knowing what harms they will produce. Pesticides and poisons pollute our waters and bodies, and destroy insects, like bees that pollenate plants we depend on to support lives. Poisons used to process, preserve, irradiate and package foods make us sick. Farmers spray crops with poisons just before harvest to increase money yields, assuring they are in foods we take into our bodies.

Some know of these problems and try to do something about them, but little money is made protecting the environment, and these obstacles are small to entrenched, wealthy and powerful polluter and poisoner interests, who vastly outspend and defeat poorly financed, grass roots environmental activists. The current administration's overseeing the biggest reduction in public protected lands in U.S. history.<sup>204</sup> Polluter interests and lobbyists vastly overwhelm environmental groups to influence government rules. The current administration is cutting environmental protections and organizations charged with that.

Most of us kind of shrug and turn our attentions away and just let it happen. We do that, in part, because we often can't see most pollution, so it isn't top of mind; we're ignorant of it, because we're too busy trying to get ours; because we're lost in technology, substance and entertainment escapes; because we depend financially on what creates harms; because we falsely think we're powerless to do anything about it; or for whatever other reasons. It doesn't matter the reasons. We're doing harm.

This isn't about politics, religion or any other group belief. Seriously, you're a thinking, feeling being. Use common sense! Does this make sense? If not, we have to change, and we have to do it real fast. We have about 10 years to stop irreversible climate change. Change! Please change! Pretty please!

We can try to change big governments, corporations and other institutions. Let's do that! Write to government representatives and employees expressing yourself, even if you think it doesn't help! Vote! Support environmental activists! Write news agencies and polluting corporations asking for change!

However, there is no way this will get better without big change at the individual human being level. We can change because the walls are falling down on us and we're threatened for our lives in fear later. Or we can decide to wake up and change proactively, making it better, reducing the harms we do now.

The good news is we do not have to wait for anyone or anything to make big, positive changes now! Quit using gas engines! Install green energy where you are, using a loan, keeping payments the same as you pay now, so it costs you nothing to use green electrons now! Or convince your landlord to do it! Only buy what you truly need for the long-term from those whose values and practices you respect; and communicate your consumer behaviors so companies understand them! Stop wasting things!

Don't buy or use anything with any chemical ingredient name you don't instantly recognize as natural! Refuse and reuse as much as possible, and recycle the rest! Eat natural plants from sustainable farms! Get a stainless-steel bottle, filter water and drink that! Reduce needs! Use no or natural cosmetics! Turn off or down outside lights, and close shades at night! Try to reduce or avoid noise around you!

Get out in nature and develop a personal relationship with it, so you can be aware of it, appreciate it and understand why to support it! Produce fewer children and don't try to artificially extend your life! Cultivate good soils with composting! Don't use chemicals, inside or out! Cultivate trees and plants!

How does this make you feel? What emotions do you experience? What do you feel in your body?

Where do those feelings come from? Are there values inside you that are affected? What are they?

How can you exercise your own power to create positive change now, so you will feel better about this? Do that, and share what you are doing, and why! You are a powerful influence on those who know you. The more you behave with integrity to shared life values, the more others will respect you. Fortunately, you can make a big difference! You don't have to wait for anyone to start doing that. We can change!

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