

Engineers' Solutions to Scientists' Warnings

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*“For a successful technology, reality must take precedence over public relations for nature cannot be fooled” –
Richard Feynman*

Abstract

Two Scientists' Warnings issued twenty-five years apart by the Union of Concerned Scientists in 1992 and a group of 15,372 scientists in 2017 underscore humanity's abject failure to address global ecological challenges. This paper points out the axiomatic flaws in our global industrial civilization that prevent any solutions to these global ecological challenges to emerge by tweaking policy parameters within the same framework. Instead, it issues a clarion call for a civilizational transformation to a VEGAN World by 2026 in order to correct for these axiomatic flaws. Furthermore, it shows that the implementation of the Paris Climate Accord by focusing entirely on fossil fuel elimination will accelerate the warming of the planet. Since quite a few global biogeochemical cycles are on the cusp of nonlinear phase transitions, it is important to implement such planetary scale interventions with engineering integrity in order to minimize the risk of runaway climate change and near-term extinction. The paper shows that humanity must first transition to a vegan economy as quickly as possible so that the loss of cooling gases due to the reduction in fossil fuel usage can be compensated with the gain in carbon sequestration through active rewilding of former grazing lands, possibly augmented with the use of reflective mirrors. It then shows how we can go about implementing the necessary civilizational transformation over the next five years in a systematic fashion using seven strategic actions deployed globally.

1. Introduction

In the original Scientists Warning to Humanity issued by the Union of Concerned Scientists in 1992^[1], the authors noted,

“We, the undersigned, senior members of the world's scientific community, hereby warn all humanity of what lies ahead. A great change in our stewardship of the earth and the life on it is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated.”

Twenty five years after this original warning, a Second Notice was published in Nature magazine in 2017, signed by 15,372 scientists from 184 nations^[2]. This Second Notice looked back at the original warning and evaluated the human response by exploring the available time-series data. It pointed out that with the exception of stabilizing the stratospheric ozone layer, humanity had failed to make sufficient progress in generally solving these foreseen global ecological challenges, and alarmingly, most of them were getting far worse.

In its Living Planet Report of 2014^[3], the World Wildlife Fund reported that between 1970 and 2010, the total biomass of wild vertebrates had **declined by 52%**.

Two years later, in its Living Planet Report of 2016^[4], it reported that between 1970 and 2012, the total biomass of wild vertebrates had **declined by 58%**.

Finally, in its Living Planet Report of 2020^[5], the World Wildlife Fund reported that between 1970 and 2016, the total biomass of wild vertebrates had **declined by 68%**.

If this trend continues, it is clear that the total biomass of wild vertebrates will **decline by nearly 100% in 2026**, which we designate as Year ZERO. This is like a race car driver careening around a hairpin bend in the road and discovering a concrete wall in front of him, just five seconds to impact. Would he continue to press on the accelerator because “he loves to drive his car fast,” or would he apply brakes and take evasive action? Humanity is in exactly the same situation today, counting down to Year ZERO.

In a public letter to governments and people of the earth, leading international scientists and participants at the recent “Delivering the Human Future^[6]” conference declared a global emergency comprised of catastrophic risks, including “resource scarcity, ecological collapse and extinction, global overheating, food insecurity, weapons of mass destruction, global poisoning, pandemic disease, population overgrowth, uncontrolled new technologies and widespread apathy and delusion.” In a recent scientific paper entitled, “Underestimating the Challenges of Avoiding a Ghastly Future^[7],” the authors underscored the pressing need for transformative change^[8]. They pointed out that humanity is causing a rapid loss of biodiversity and with it, the earth’s ability to support complex life. They state,

“The apparent paradox of high and rising average standard of living despite a mounting environmental toll has come at a great cost to the stability of humanity’s medium- and long-term life-support system. In other words, humanity is running an ecological Ponzi scheme in which society robs nature and future generations to pay for boosting incomes in the short term^[9].”

The COVID-19 pandemic can be viewed as a warning shot fired across our bow by nature in response to this ecological Ponzi scheme. In the words of Dr. Anthony Fauci^[10],

“It boggles my mind how when we have so many diseases that emanate out of that unusual human-animal interface, that we don’t just shut it down.”

Three out of every four new and emerging infectious diseases are zoonotic in origin^[11]. Swine flu, mad cow disease, bird flu, Ebola, SARS-1, HIV-Aids, Cholera, Leprosy, Typhoid and Measles all originated from animals^[12]. It is common knowledge that stressed animals spawn diseases^[13] and yet in response to COVID-19,

the U.S. Federal Government issued a Presidential Executive Order declaring slaughterhouses to be critical infrastructure.

In this paper, we make the case that we are in a Galileo moment in human history. When everything is going so spectacularly wrong, it is a safe bet that there are fundamental, axiomatic flaws in our civilizational framework. Therefore, just as 17th century Europeans could not make scientific progress without abandoning their false belief that the sun goes around the earth, we cannot address our global ecological challenges without correcting these axiomatic flaws and relinquishing the perceived advantages that stem from the resulting ecological Ponzi scheme.

James Lovelock, one of the world's most important scientists and inventors, wrote^[14],

"There have been seven disasters since humans came on the earth, very similar to the one that's just about to happen. I think these events keep separating the wheat from the chaff. And eventually we'll have a human on the planet that really does understand it and can live with it properly. That's the source of my optimism."

Engineers are the community of human beings that Lovelock is seeking. We can understand how best to implement solutions to global challenges within the body of scientific knowledge available to humanity since we are professionally trained to do precisely that. It is engineers who designed and created the transportation and life-support systems that safely conveyed humans to space and back. It is Allan McDonald, an engineer, who declined to endorse the launch of the NASA Space Shuttle Challenger and who was overruled by NASA administrators resulting in the disaster of Jan 28, 1986, costing the lives of 7 human beings^[15]. Therefore, in the face of these global ecological challenges, we feel compelled to use our engineering know-how and devise solutions to protect the lives of 8 billion human beings and millions of species, not to mention all of Spaceship Earth's life-support systems.

The organization of this paper is as follows:

In Section 2, we show that humanity's ecological Ponzi scheme arises from two axiomatic flaws in our global industrial civilization and their associated twin engines of planetary destruction:

- 1) the **Burning machine**, and
- 2) the **Killing machine**.

Using data from the United Nations Intergovernmental Panel on Climate Change^[16] and other peer-reviewed sources, we conduct a global sensitivity analysis on the greenhouse gas emissions profile of these two machines and thereby establish a power-down sequence for safely shutting them down. We show that while everything improves when the Killing machine is shut down as soon as possible to create a Vegan world, the Burning machine is best powered down gradually to avoid overheating the planet during the power down process itself.

In Section 3, we propose two foundational axioms for a sustainable civilization in a thriving natural world to replace the false axioms of our global industrial civilization. We propose an ecological role for humanity as the “Thermostat species” of the planet and show that humanity’s conscious assumption of this role would be in resonance with life’s evolutionary processes. Life is increasing in complexity to overcome the environmental challenge of recurring ice ages on earth at the inner edge of the habitable zone around the sun. Therefore, once we reconnect with nature as the “Thermostat species,” we would prove that nature is once again the most amazing system design ever.

In Section 4, we examine the institutions, infrastructure, constitution and currencies necessary for implementing a Vegan world. Specifically, we propose a new currency system, Aquarius, that can govern human free-market economic activities while constraining our global ecological footprint to stay within planetary boundaries ad infinitum.

In Section 5, we show how we can implement the necessary civilizational transformation over the next five years in a systematic fashion using seven strategic actions deployed globally.

2. The Axiomatic Flaws in our Global Industrial Civilization

When the human family migrated out of Africa and settled in different parts of the earth during the previous ice age, they separated and grew into distinct civilizations and distinct cultures, but learned similar environmental lessons. Almost every major human civilization destroyed the environment around it, learned its lessons and adopted a new model to live in harmony with nature in its changed circumstances^[17]. However, those who reach this stable state tend to be nonviolent and become easy to conquer for their human relatives who are still improving their war-making technological capabilities. The victorious colonizers then assert the superiority of their violent worldview over that of the nonviolent indigenous people and the learning cycle for the assimilated community starts all over again. Currently, the global industrial civilization has colonized the whole world but it is proving to be ecocidal on a planetary scale. While diagnosing our ecological predicament, Gus Speth, the founder of the Natural Resources Defense Council (NRDC) said^[18],

“I used to think the top environmental problems were biodiversity loss, ecosystems collapse and climate change. I thought that with thirty years of good science, we could address those problems.

But I was wrong.

The top environmental problems are selfishness, greed and apathy... and to deal with those, we need a spiritual and cultural transformation - and we scientists don't know how to do that.”

As engineers, we have dug deeper and identified two false axioms underlying the ecological Ponzi scheme that is destroying the planet and the selfishness, greed and apathy that this Ponzi scheme engenders:

1) **The false axiom of Consumerism:** The pursuit of happiness is best accomplished through stoking and satisfying a never-ending series of latent desires - the "Greed is Good" rule, and

2) **The false axiom of Supremacism:** Life is a competitive game in which those who have gained an advantage can possess, enslave and exploit animals, nature and the disadvantaged for their pursuit of happiness - the "Might is Right" rule.

The false axiom of Consumerism causes the average citizen in the United States to be bombarded with over 3000 advertisements every day^[19]. The false axiom of Supremacism makes us tolerate rampant deforestation, bottom trawling in the oceans, factory farming of animals and slaughterhouses, and its corollaries, the pervasive racism, ableism, sexism, etc. in our social institutions. Since these foundational axioms are false, it is to be expected that the global industrial civilization built on these axioms is ecocidal and not sustainable. This civilization is ensconced within a capitalist economy which^[20]

1) **Monetizes everything** so that when dead trees have more economic value than live trees, it bulldozes trees; when dead animals have more economic value than live animals, it slaughters animals; and when sick humans have more economic value than healthy humans, it sickens humans;

2) **Endangers life on earth** through climate change, biological annihilation, chemical pollution and pandemics;

3) **Addicts everyone** into compulsive behaviors in order to maximize corporate revenues and profits;

4) **Lies to us** about the basics of nutrition, the root cause of pandemics, the toxicity of industrial processes and products, etc. and

5) **Steals from the poor** (and future generations) in order to enrich the rich. When we buy a pound of organic rice in the supermarket for \$2, it manages to trickle a mere 5¢ of it down to the poor family that grew the rice in South Asia. Through such mechanisms, it currently siphons an estimated \$3 trillion of wealth from the global South to the global North annually.

This ecological Ponzi scheme^[9] is enabled by a global fractional reserve banking system in which central banks require banks under their purview to keep just a small fraction of their deposits as cash on hand and lend out the rest. Increasing the reserve requirement takes money out of the economy, while decreasing it puts money into the economy. Central banks tweak these reserve requirements to grow the economy since such growth is necessary for the Ponzi scheme to sustain. This is why even in the 17 United Nations (UN) Sustainable Development Goals (SDG), there is a redundant goal #8 (Decent Work and Economic Growth)^[21]. SDG #8 is clearly redundant since if all the other goals are met, 1) No Poverty, 2) Zero Hunger, 3) Good Health and Well

Being, 4) Quality Education, etc., it is immaterial whether some measure of our cumulative human activity is endlessly growing or not. Therefore, SDG #8 appears to be a Trojan horse inserted to continue the ecological Ponzi scheme and for no other useful purpose.

Over the past few centuries, diverse social justice movements have realized that the axioms of Consumerism and Supremacism are false. Table 1 shows the timeline of these social justice movements, culminating in the Vegan movement of the 20th century which has taken up the cause of other species who are oppressed within the human economic system.

| False Axioms of Western Civilization | How Overturned? |
|--|---|
| 1. The Sun goes around the Earth | Copernicus, Galileo 16-17 th Century and the Scientific Revolution |
| 2. Black/Brown people were put on Earth for White people to enslave and exploit | Ongoing - Civil War of 19 th Century, Civil Rights Movement of 20 th Century onward |
| 3. Women were put on Earth for Men to possess | Ongoing - Feminist movement of 20 th Century onward |
| 4. Happiness can be attained by fulfilling a never-ending series of latent desires | Ongoing – the Spiritual Movement of the 19 th Century onward - Swami Vivekananda |
| 5. Animals and Nature were put on Earth for humans to possess and exploit | Ongoing – the Vegan Movement of the 20 th Century onward |

Table 1. *False Axioms of Western Civilization and the Social Justice Movements overturning them.*

However, at the Rio Summit in 1992, President George H. W. Bush of the United States stated flat out^[22],

“The American Way of Life is Not Negotiable,”

which seemed to have ended any serious attempt at addressing the false axioms of Consumerism and Supremacism at the base of the global industrial economy. However, we believe that President Bush was referring to the American cultural ideals of equality and the inalienable rights to Life, Liberty and the Pursuit of Happiness as being not negotiable. American civilization has fallen far short of these ideals as Rev. Martin Luther King, Jr., and social justice leaders have tirelessly pointed out^[23]. Far from the ideal of equality, American civilization has become one of the most unequal in human history^[24]. Far from the inalienable right to Life, Americans are all expected to “earn a living,” which implies that they are not entitled to live if they don’t obey “the Master.” Far from the promise of Liberty, America has one of the most incarcerated populations in the world effectively performing slave labor for corporations^[25]. Finally, far from the pursuit of happiness, almost half of American adults are on anti-depressants, anti-anxiety medications or illegal drugs on a regular basis^[26].

We consider cultural ideals to be like a specification, while civilization is its engineering implementation. As with any engineering project, such an implementation would not match its specification when there are fundamental, axiomatic flaws in the design process. Imagine if NASA engineers were to chart a spacecraft trajectory assuming that the sun goes around the earth. The spacecraft would never reach its destination as intended.

The global industrial civilization is operating two main machines of doom:

- 1) the fossil fuel **Burning machine**, primarily associated with the false axiom of Consumerism, and
- 2) the **Killing machine**, primarily associated with the false axiom of Supremacism.

The industrial effluents and biospheric impacts of human activity in general and these two machines in particular, have been estimated to exceed planetary boundaries in terms of biodiversity loss, land conversions, nitrogen and phosphorous loading and climate change. It is unknown whether human impacts have exceeded planetary boundaries on chemical pollution and aerosol loading of the atmosphere because we have simply neglected to measure these impacts. From an engineering perspective, such negligence is no way to run a spacecraft program, let alone our planetary home. Therefore, our global industrial civilization is an engineering shambles.

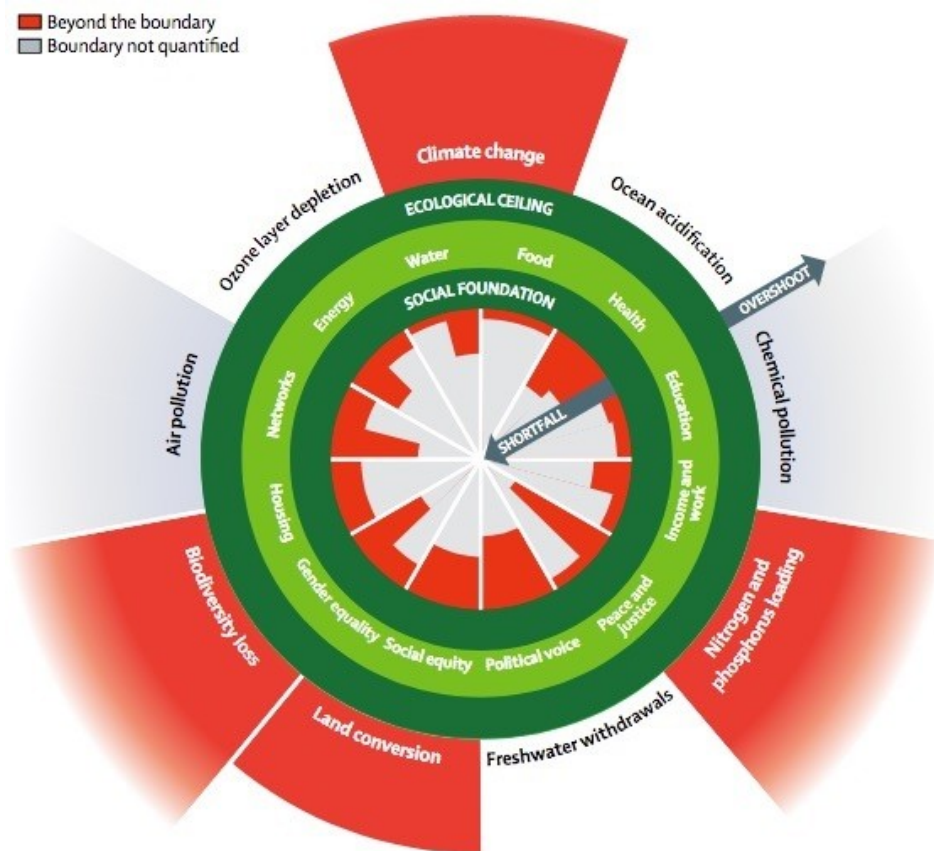


Fig. 1. *Overshoot on Planetary Boundaries and Shortfalls on Social Foundations (from Raworth [2018])^[27].*

Fig. 1. shows that despite exceeding planetary boundaries on all these parameters, the global economy has not met basic social foundations for healthy living for a substantial segment of the human population.

Our global food system, which primarily operates the Killing machine for animal agriculture and fishing, is also an engineering shambles. While humans consume 1.6 Giga tons (Gt) of dry matter biomass as food each year, humanity is procuring 9.05 Gt of plant foods, almost six times as much food as we need from nature. Most of that food, 7.27 Gt, is being fed to our farmed animals who then provide just 12% of the food we eat. In order to produce this 12% of our food intake, we are using more than 40% of the ice-free land area of the planet, while 85% of our food is already plant-based or Vegan and comes from about 6% of the land. Finally, in order to provide just 3% of our food intake in the form of seafood, we are virtually destroying the oceans with government subsidies to the tune of \$35B per year keeping that destructive enterprise afloat.

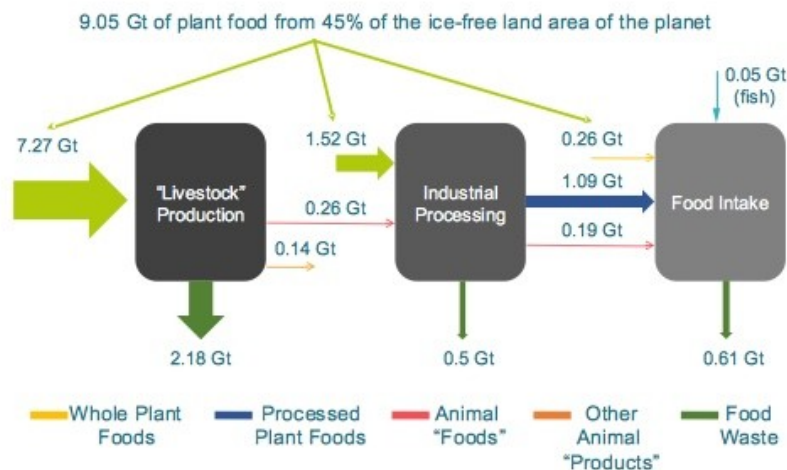


Fig. 2. Block diagram showing biomass flows in the Food System - adapted from IPCC AR5 WG3 Chapter 11, Page 836^[28]

The Food system block diagram in Fig. 2. shows that in addition to 190 million tons of food on our plates, the Killing machine is supplying 140 million tons of “other animal products” such as skin, blood and bones for the industrial production sector. Since corporations are perfectly capable of raising animals just for these “other animal products,” it follows that the entire false axiom of Supremacism must be jettisoned in order make an environmental impact, not just our food intake.

The Killing machine is the leading cause of biodiversity loss^[29], ecosystems collapse^[30] and climate change^[31]. Nevertheless, in mainstream political and environmental circles, there is virtually no discussion on the Killing machine or the false axiom of Supremacism that this machine mainly serves. Instead, the discourse is mainly about how to switch the fuel for the Burning machine to renewable sources without questioning the false axiom of Consumerism either^[32]. The tacit assumption is that both the Killing machine and the Burning machine can be

electrified and sustainably operated with solar panels and wind-mills ad infinitum. However, in this paper, we choose to address the root causes of our ecological challenges and therefore, we shall examine how best to power down these two machines from an engineering perspective. To do so, we conduct a global sensitivity analysis of the greenhouse gas emissions of the Killing machine and the Burning machine below.

The UN Intergovernmental Panel on Climate Change (IPCC) has quantified the radiative forcing of various greenhouse gases in the atmosphere relative to their levels that existed in 1750 as the base year^[33] (see Fig. 3). CO₂ is the main human-made exhaust gas that heats the Earth and it is estimated to provide an additional 1.68 W/m² of heating power relative to its atmospheric concentration in 1750. In other words, the impact of the additional CO₂ in the atmosphere since 1750 is like adding a 1.68 Watt continuous heater on every square meter of the Earth's surface. The Burning machine is the primary source of CO₂ emissions today, though on a cumulative basis over the past 8000 years, the Killing machine has contributed more CO₂ to the atmosphere than the Burning machine^[34].

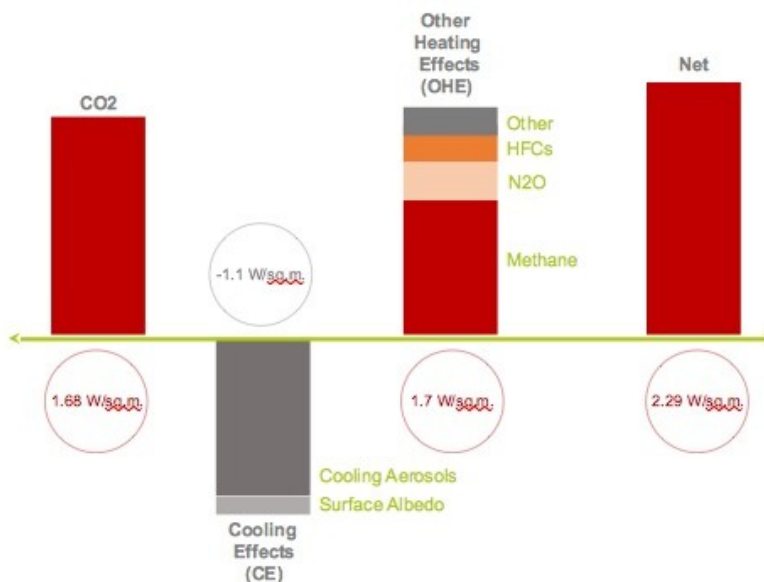


Fig. 3. Radiative Forcings from various greenhouse gases grouped in three segments, 1) CO₂, 2) aerosols and other cooling effects and 3) methane and other greenhouse gases. Values sourced from IPCC AR5 WG1 Ch8^[33].

The next most significant human-made exhaust gas is methane, which has the chemical formula CH₄. Methane is estimated to have a mean radiative forcing of 0.97 W/m² and it lingers in the atmosphere for an average half-life of 8.4 years before it reacts with oxygen free radicals and also converts into CO₂. The Killing machine is the leading cause of methane emissions and it contributes 37% of it on an annual basis^[34]. Even though the radiative forcing of methane (0.97 W/m²) is less than that of CO₂ (1.68 W/m²), the annual emissions of methane has a more significant impact on incremental radiative forcing, and therefore climate change, than the annual emissions of CO₂^[31].

On an annual basis, the fossil-fuel Burning machine is contributing 87% of the CO₂ emissions, 23% of the methane emissions and almost 100% of the sulphate aerosols. The Killing machine is contributing 29% of CO₂ emissions, 37% of the methane emissions and it is using an extra 37% of the ice-free land area of the planet on which the Carbon Opportunity Cost (COC) is an estimated 34.5 Gt CO₂ per year. In other words, if the Killing machine was to be replaced with Vegan alternatives, that would free up 37% of the land area of the planet on which rewilding would yield a net drawdown of 34.5 Gt CO₂ per year.



Fig. 4A – Annual radiative forcing contribution of the Burning machine is -0.901 W/m²



Fig. 4B – Annual radiative forcing contribution of the Killing machine is 0.104 W/m²

As the detailed calculations in Fig 4A show, a total power down of the Burning machine would result in a **net increase** in radiative forcing of 0.901 W/m² annually. In contrast, Fig 4B shows that a total power down of the Killing machine would result in a **net decrease** in radiative forcing of 0.104 W/m² annually. Therefore, the optimum strategy to power down these two machines without increasing the radiative forcing is to first power down the Killing machine as soon as possible and then power down at most 0.104/0.901 = 11.5% of the Burning machine every year over the next 9 years. Perversely, if we don't power down these machines but simply fuel them with solar and wind energy, that would increase the radiative forcing by at least 0.95 W/m².

Since quite a few global biogeochemical cycles are on the cusp of nonlinear phase transitions^[35], it is important to implement these planetary scale interventions with engineering integrity in order to minimize the risk of

runaway climate change and near-term extinction. These calculations show that humanity must first shut down the Killing machine and transition to a Vegan economy as quickly as possible so that the loss of cooling gases due to the reduction in fossil fuel usage as we power down the Burning machine gradually can be compensated with the gain in carbon sequestration through active rewilding of former grazing lands, possibly augmented with the use of reflective mirrors^[36].

3. The Axiomatic Basis for the New Model

Humans are the quintessential engineers among all species on earth. Five hundred thousand years ago, our human ancestors learned to control fire in the first significant transformation in human history^[37]. Before then, humans were a prey species with scarcely competitive sense or motor skills. The transformation from prey to predator species was facilitated by our ability to communicate, our partnership with animals and our ability to cook food. In an environment of abject terror, we survived by attacking the predators before they could attack us as prey. In the following couple of hundred thousand years, we improved communication through speech, art and text, domesticated animals and turned vast swathes of land into monocultures. With the agricultural revolution twelve thousand years ago, we became the dominant species on the planet.

A few thousand years down, we invented the printing press and tapped on fossil fuels for energy. We turned domesticated animals into “food” by factory farming. With the industrial revolution, we developed such technologies and weapons that no other predator may prevail over us. Today, we are capable enough to blow up the planet into flames. This is what we call the *caterpillar culture*, characterized by games and habits that are competitive, and stories and rituals that normalize violence. The resulting *caterpillar civilization* implements institutions and infrastructure that are steeped in violence with global governance structured on a rights-based discourse.

In the current interglacial warm period, we have taken over the climate of the planet^[38]. With the control of energy and resources, we have heated up the planet and successfully delayed the onset of another ice age, acting effectively as a thermostat to the planet. In nature, every species contributes to the well-being of the whole even when it is seemingly destructive. When an Indian elephant breaks branches off trees, that's where sunlight streams to nourish the underbrush. Wherever the elephant tramples on bushes walking through the forest, new pathways are formed for the other animals to use. Even elephant droppings contain jackfruit seeds along with the manure to nourish a jackfruit seedling. Likewise, even during our seemingly destructive caterpillar phase, we humans unknowingly prevented the earth from entering another ice age while creating all the tools and technologies needed to become the *thermostat species* of the planet. Since the nations of the world have acknowledged that human activities are changing the climate of the planet, humanity has *ipso facto* assumed the responsibility to consciously regulate the climate for the benefit of all life on earth.

It is easy to recognize the three major elements of civilizational transformation – communications, energy and food – how we communicate with each other, how we tap energy and how we procure and prepare our food.

Today, we are connected across the world via the Internet; to produce clean energy, we have tapped into solar as a source of energy; and awareness of a health and climate conscious Vegan diet is on the rise. Thus today, we stand at a crossroads of another transformation. Will we continue with this fear-based psychosis, kill everything off and die out ourselves? Or will we choose to switch to a love-based system and transcend into the “butterfly” phase?

James Lovelock wrote that if the earth improves as a result of human presence, then we will flourish. If it does not, then we will perish^[39]. This is the impetus to rethink our models. The question should not be,

"What is the optimum human population on the planet if everyone lived like us?"

Instead, it is much more productive to address the question,

"How should we be living, given that there are 8 billion human beings and 20-100 million other species on the planet today?"

This is an engineering question and a clarion call for whole systems transformation and action. We view the COVID-19 pandemic as the birthing of the “chrysalis” phase for humanity. We could ask,

"Yes! So how do we go about implementing this transformation?"

Alternately, we could ignore the ominous signals, conduct business as usual and make all species on the planet extinct, including ourselves. The choice is entirely ours.

There are really only two possible future scenarios for life on earth:

1. **The Thermostat Setting scenario:** This is the desirable scenario in which humans and residual life forms on earth recover and thrive with humans assuming the responsibility for regulating the climate on planet earth and preventing it from ever going into another ice age.
2. **The Near-term Extinction scenario:** In this scenario, most life on earth and most likely, the apex predator, Homo Sapiens Sapiens, goes extinct as most of the carbon on land and in the ocean dissipates into the atmosphere and the Earth enters runaway global heating. In all the five past major extinction events, the apex predator didn't survive the event and therefore, the odds of human survival are likely low.

Given the poor state of the modeling to date, it is unclear if we even have a narrow time window to implement the Thermostat Setting scenario in which humans thrive. Therefore, time is of the essence and we must do everything we can to rapidly execute on a plan to realize this scenario. This is not a question of promoting a

Vegan agenda, for in the other scenario, Veganism will be a passing fad as humans eat each other into oblivion. However, it is impossible to execute on the Thermostat Setting scenario without diminishing our egos and openly embracing a love-based Vegan ethic.

The advancement of any species thrives on the fear-love dichotomy – fear to protect ourselves from danger and love to nourish our offspring. Both the caterpillar and the butterfly are within us, and what we enhance is a choice we make as well. For a long time, fear has been paramount in driving us. But as we look inward and transcend away from the individualistic approach, the ego diminishes and we understand that we are part of the whole. How do we create a system in which we automatically enhance the butterfly, and not the caterpillar? For this *butterfly culture*, we need stories that normalize nonviolence, games that are collaborative (and infinite), rituals that are compassionate and habits that are outward-looking, asking how we may contribute to a better planet for ALL species. The corresponding *butterfly civilization* would entail redefining our institutions, infrastructure, constitutions and currency systems in ways that are quite the opposite of what we do today.

This would be the greatest cultural and civilizational transformation in human history - from a culture of normalized violence to one of nonviolence, from finite competitive games to collaborative (and infinite) ones, and from a predator species to a caretaker species, “Homo Ahimsa.” A civilizational shift from oppressive, extractive, dominating, disease-ridden, consumeristic and destructive mindset of scarcity, to a mindset of accountability and generosity fueled with harmony and sacred relationships with nature and its beings – a shift from a profit-driven economy to a service-driven economy. This will not, however, happen by tweaking policy as the Paris Climate Accord envisages, but in fact, by creating and implementing a new model. As Buckminster Fuller said^[40],

“You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.”

Academic institutions from around the world have to be at the forefront of creating this model, which must be based on the true axioms:

- 1) **The true axiom of Inner Peace:** The pursuit of happiness is best accomplished by seeking it within ourselves - the “Self-Mastery” rule, and
- 2) **The true axiom of Homo Ahimsa^[41]:** All life is one family in which we each bring our unique skills to give all we can, receive all we need and become all we are - the “Vitality Code” rule^[42].

Rather than calling ourselves “Homo Sapiens Sapiens,” the “wise, wise hominid,” a fundamentally narcissistic and supremacist label, we can call ourselves “Homo Ahimsa,” a term coined by Judy Carman^[41] as a combination of a Latin word and Sanskrit word, signifying our unification across geographies and our character as a nonviolent hominid in service to all life.

4. Engineering a VEGAN World

We define VEGAN as “Vitaly Engaged Guardians of Animals and Nature” and VEGANism as a way of living in which we seek to never intentionally hurt animals but care for them and nature instead. By that definition, most of us are already VEGAN in our hearts. However, we live in a society where what we say and what we do are not always in alignment, because we have been systematically lied to regarding the necessity of consuming animal foods, among other things. This is why human supremacism, the opposite belief system to VEGANism, which conditions us to abuse animals, is so prevalent in the world today. As a result, the birthing of a post pandemic VEGAN world will likely be viewed as the “greatest transformation in human history,” even though it is just a return home to who we really are.

Humans are one of the most adaptive species on the planet. At many times in the past, we have transformed our culture and civilization rapidly as environmental circumstances changed around us. In the Great Migration^[43] some 60,000 years ago, during the previous ice age, we journeyed out of Africa and spread throughout the earth. This required transforming our diets and lifestyles as we settled in different climatic conditions. When the earth emerged out of the ice age into the Holocene interglacial era some 12,000 years ago, we began the Agricultural Revolution^[44] simultaneously almost everywhere, which once again transformed our diets and lifestyles tremendously. Human history is literally a chronicle of such exponential transformations, but at any given point in time, we assume that whatever has been happening to us will continue to happen forever linearly. However, in a self-fulfilling virtuous cycle, those of us who advocate for an ongoing exponential transformation then accelerate it and help bring it to fruition.

In order to realize a VEGAN world, we need to imagine and create its four main components:

- 1) **VEGAN Institutions**
- 2) **VEGAN Infrastructure**
- 3) **A VEGAN Constitution**
- 4) **VEGAN Currency**

VEGAN Institutions manage the rewilding of the planet, the creation of food forests and ensure that resources are equitably allocated and the animal kingdom is protected. Their primary function is to ensure that humanity fulfills its ecosystems role as the Thermostat species of the planet in service to all life.

VEGAN Infrastructure ensures that healthy immune-boosting vegan foods and necessities are easily available to every human being on the planet.

A VEGAN Constitution is the set of basic principles that govern decision making and implementation processes in our VEGAN world. A good starting point for this Constitution could be the International Treaty to Protect and

Restore Mother Earth^[45], signed by hundreds of indigenous communities from around the world, which in Article 15, explicitly calls on the Human family to commit to eliminating the exploitation of our animal relatives.

Finally, a **VEGAN Currency** is a mechanism by which we promote the free exchange of goods and services while ensuring that the total ecological footprint of humanity does not exceed planetary boundaries. The Aquarius currency system axiomatically implements the two core values of our VEGAN culture — equality of all independent of race, age, gender or national origin plus the inalienable right to life, liberty and the pursuit of happiness — while providing an accounting mechanism to ensure that the total footprint of humanity does not exceed prescribed limits. In this system, tokens flow into the heart of every player's account at a constant and equal rate determined by the global ecological footprint allowance divided by the total population of humanity. Each token is a multi-dimensional ecological footprint allowance, representing a certain unit CO2 footprint allowance, land-use footprint allowance, energy footprint allowance, etc., which can be exchanged between players in a free marketplace.

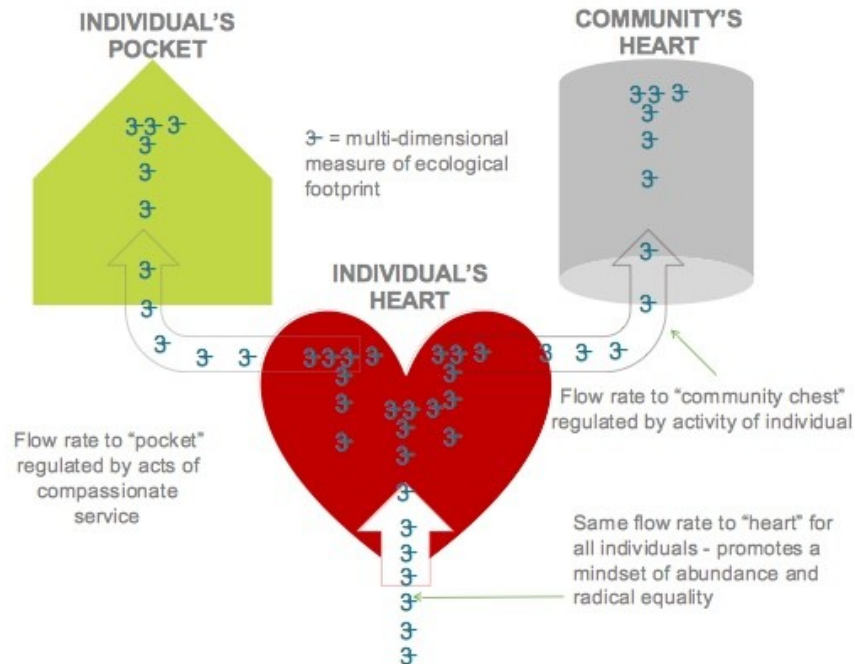


Fig. 5. An overview of the Aquarius currency system which is designed to transform humanity from a “predator” species to a “caretaker” species.

From the heart of the player's account, the flow into the pocket of the account (see Fig. 5) is regulated by acts of compassion. As the Aquarius tokens flow into each player's account, it is easy to ensure that a minimum flow is immediately available for the player's use so that basic necessities of life are automatically met. Likewise, a minimum flow can be directed to the “community chest” so that the player belongs in a community with resources at its disposal. The remainder of the flow constitutes the gap between the “social foundation” and the

“environmental ceiling” in Kate Raworth’s “Doughnut Economics” model^[27] which can be determined by local governance rules.

Unlike the current money game in which all money flows down from a central bank in the form of loans, in Aquarius, all tokens flow up from individual players to the community, which has an Aquarius account with exactly the same architecture as the individual player’s account. The community can then be part of a larger community, say a Watershed Council, which can be part of an Ecosystems Council and so on, until there is an Aquarius account for all of humanity from which global footprint allowances are drawn. When a player consumes a product, the ecological footprint of that product is retired from the pocket of the player’s account. In order for this accounting to be correct, the TRUE cost of the product must be calculated in terms of its CO2 footprint, energy footprint, land use footprint and so on, and stored in the Aquarius database. The purpose of the Aquarius currency system is to monitor our ecological footprint accurately and ensure that it is within bounds as we fulfill our responsibilities as the caretaker species of the planet. Therefore, the Aquarius system can only work in an open source economy and ecology, in which all novel ideas are viewed as contributions to the community.

Clearly, the Aquarius currency system can be implemented in conjunction with the current money game. Players can voluntarily monitor their ecological footprint using the Aquarius system and ensure that they are within their limits. They would still be purchasing products using fiat currencies, but only those VEGAN products with Aquarius entries would be accounted for in the Aquarius system. Over time, as more and more people join the Aquarius system, the current dysfunctional game of money would become increasingly redundant.

Unlike the current money game which generates economic activity from a foundation of fear, the new Aquarius system generates economic activity from a foundation of love. People would do things because they want to contribute to the good of the whole. While we are in the process of modeling whether this new approach would be sufficient to generate economic activities to meet all the needs of humanity and the planet, at a Community Kitchen in Phoenix, AZ, USA^[46] we have run a weekly social experiment for the past few years in which those who consume a pay-as-you-can vegan meal are requested to volunteer to clean the dishes, the kitchen and the dining area. If there are not enough volunteers, the work doesn’t get done. Thus far, we haven’t had a single day in which the work wasn’t done, even though many of the volunteers were well-to-do and would likely have declined to do that cleaning work if we had paid them \$15/hr.

It is through the promotion of such conscious volunteerism, with accurate feedback on our ecological footprint usage using the Aquarius currency system, that we can safely transition to a Kate Raworth style doughnut economy for humanity^[27]. Such an economy is necessary when we assume our ecosystems role as the thermostat or caretaker species of the planet in the *butterfly* phase of our existence.

5. The Seven Strategic Actions

U.S. President George Bush, Sr., said,

“Think of every problem you face. The solution to each is education.”

Without education, we cannot dispel ignorance. Fundamentally, this is the root cause of all our problems. We propose to create an education system and an online Climate Healers Academy that serves the new sustainable global civilization in harmony with a thriving natural world. The primary focus of the pedagogy at Climate Healers Academy will be on art and culture for the pursuit of happiness and science for the purpose of understanding nature's processes including the biogeochemical cycles of the planet and humanity's role in it. It is through this “Climate Healing” lens that the four branches of science - physics, chemistry, biology and mathematics will be taught. High school graduates of the Academy will have a broad understanding of these topics while university graduates specialize in various branches of art, science, medicine and engineering related to this framework. Therefore, the first strategic action is

Strategic Action 1: *Education, education, education*

Secondly, it will be very difficult for us to address our environmental problems if the current economic system continues to “grow the economy” as a pretext for addressing poverty and hunger, while the animal exploitation industries continue to make things worse on the planet. Therefore, the second Strategic Action is to petition the UN to drop Sustainable Development Goal^[21] (SDG) #8, “Economic Growth,” and replace it with Claire Smith's SDG #18 (Zero Animal Exploitation)^[47] which would make it easier for the world to meet all the other SDGs.

Strategic Action 2: *Petition the UN to drop SDG #8 (Economic Growth) and add SDG #18 (Zero Animal Exploitation)*

Thirdly, we seek immediate action on healthy, immune-boosting Vegan food to be made readily available to every human being on the planet. The UN data shows that humanity is extracting plenty of food from the planet and it is a matter of executing a large-scale, yet simple, engineering task of distributing that food to community centers and places of worship to cook the food and make it available to everyone in the world. If we can distribute masks and bleach to everyone, we can certainly distribute food to everyone. Therefore, the third Strategic Action is the Food Healers initiative:

Strategic Action 3: *Food Healers initiative to provide healthy, immune-boosting food to every human being on the planet*

Fourthly, we need to recruit a Citizens council to work on a new Constitution to govern our global actions to heal the planet.

Strategic Action 4: *The New Constitution Initiative*

Next, we need to recruit academic institutions worldwide to work on a new economic model founded on a cooperative, open-source currency system that implements Kate Raworth's Doughnut Economics. As detailed in the previous section, such a system can be designed to operate in parallel with the current money game and thereby transition corporations from their destructive presence to a more constructive presence on the planet.

Strategic Action 5: *The New Open-Source Economy model and Aquarius currency system*

The sixth strategic action is to strengthen the Interfaith VEGAN movement and bring the grassroots organization within religion as a force for unity. This action is synergistic with Strategic Action #3, Food Healers, as that initiative provides the incentive for places of worship to act in service to their congregations.

Strategic Action 6: *The Common Spiritual Initiative*

And last, but certainly not least, is the initiative to clean up the environment and regenerate native Food forests wherever possible in order to restore the water cycles of the planet. We support the World Water Law initiative of Codes for a Healthy Earth^[48] as a mechanism to incentivize this environmental clean up.

Strategic Action 7: *The New Ecology Initiative*

These concrete actions can help humanity get re-oriented and become the enormous force for the well-being of the planet that Pierre Teilhard de Chardin envisioned^[49]:

"Someday, after mastering the winds, the waves, the tides and gravity, we shall harness for God the energies of love, and then, for a second time in the history of the world, man will have discovered fire."

Let's activate that inner fire.

6. Conclusions

Solving the environmental challenges on spaceship Earth requires a large dose of engineering rigor just as solving the challenges of the Apollo Moonshot in the 1960s. As shown in this paper, these challenges are not insurmountable. Though the outcome is not entirely in our hands, we do understand that a desirable outcome requires an 180 degree phase shift in the direction taken by global policymakers at the moment as they are mired administering a global ecological Ponzi scheme founded on the false axioms of Consumerism and Supremacism. We urge grassroots organizations to execute on the Strategic Actions outlined in this paper instead.

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