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# THE BLUE EARTH PROJECT: "IS HUMANITY SETTLING ITS OWN FATE ON ECOLOGICAL SURVIVAL?"

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*This is a report from NoRCEL's Blue Earth Project symposium BEP2022 held online on January 8th, 2022. We are reporting the outcome pertaining to the following question: "Is Humanity Settling its own Fate on Ecological Survival?" A succinct conclusion drawn is that the Earth is facing the sixth mass extinction of flora and fauna; this being different from the previous five extinctions, in that it is entirely due to mankind's activities. Five invited eminent speakers delivered their input, highlighting the fact that there is extensive deterioration of the environment at large, coupled with an unprecedented demise of ecosystems leading to the extinction of species across the globe.*

**Keywords:** global warming; climate change; pollutants; population explosion; biosphere; species extinction; ecosystem demise; water shortage; ozone; carbon-neutral. carbon footprint.

## INTRODUCTION—SETTING THE SCENE

Humankinds' destiny and environmental issues which we face today coupled with the seeming lack of care for our beautiful home planet were brought into focus during the backdrop of the "Space Race" in the 1960's, a fact that has become widely forgotten by now. The Space Race (1955-1975) was generated out of the ambitions of the major Cold War adversaries, the USSR and the USA. On October 4, 1957, the USSR launched Sputnik 1 into space—it was just a bleeping sphere and nothing more. This was the first ever satellite to orbit Earth at an altitude of 577 km. Inadvertently, such actions by the USSR, set the wheels in motion and so, five years later, the U.S. President John F. Kennedy made a speech on September 12, 1962, entitled: "We Choose to go to the Moon". The main message of the speech was: "landing a man on the Moon and returning him safely to the Earth". The Apollo Mission programme began in 1961 and lasted until December, 1972 and although the goal of the Moon landing was achieved on July 20, 1969 by the crew of Apollo 11, a significant step in relation to this BEP2022 report was taken by the crew of Apollo 8, namely

Frank F. Borman II, James A. Lovell Jr., and William A. "Bill" Anders. Their first trip away from Earth in Saturn V blasted off on December 21, 1968 on its way to the Moon, and although their initial mission was to test the rocket and computer technologies of the day and take close-up photographs of the lunar surface, they were in for a surprise. They made a major discovery: the earthrise—no one had ever observed the Earth and earthrise from space before. It was Bill Anders who took the images of the earthrise—two were black and white, and the third was in colour. It was the latter picture which kick-started the focussing of minds to do something about the vulnerability of the Earth, in that when the coloured image was viewed from the perspective of the Earth being suspended like a "blue marble" in the vast darkness of the space, it looks fragile and vulnerable (Figure 1). By the time Neil Armstrong and Buzz Aldrin, had set their feet on the Moon on Monday, July 21, 1969 (an epic moment in the history of humanity), NASA had released the three photos taken by Bill Anders and, at that point, the environmental movement wheels were well and truly set in motion—*take care of our home planet*.

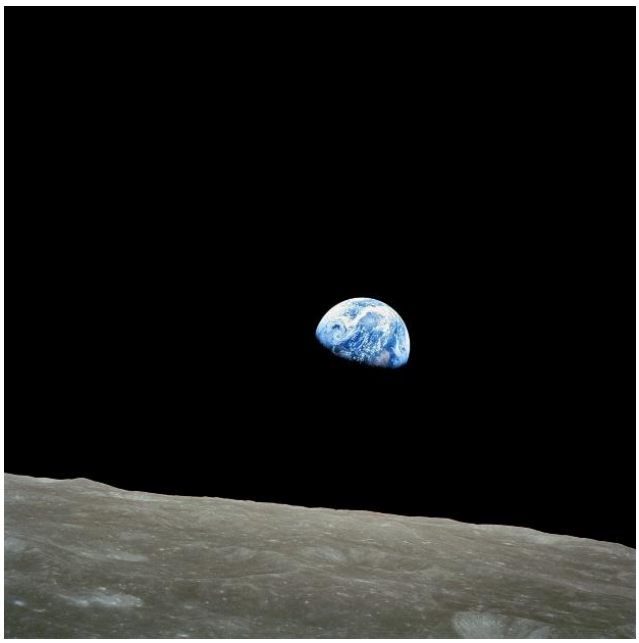

***Figure 1.*** The famous earthrise photograph taken by William "Bill" Anders as the space module came up from behind the Moon for the third time on December 24, 1968. It was this photo which truly set the wheels of eco-environmental movement in motion in 1969. If by some fate or quirk animals could have their say, how would they vote? Would they banish us from the face of the Earth to another Planet B?

Fast track forward to March 1995, the first COP (Conference of the Parties) was held in Berlin, Germany. These COP conferences have been held annually ever since; the latest being COP26 in Glasgow, October 31 – November 13, 2021. During this conference a lot of "buzz words" were bandied about, including green economy, carbon neutrality, zero carbon, decarbonisation and climate change denial and, dare we say it, carbon footprint. However, a specific focus on two elements, namely *human population growth* and the demise of *ecosystems and flora and fauna species* was somewhat in short supply. These topics remained elusive as either no-one mentioned them or considered them to be important enough to make front-page news, or indeed any news, at least in the UK press.

In an attempt to throw a spotlight on these crucial issues, at NoRCEL (Network of Researchers on the Chemical Evolution of Life, www.norcel.net) we inaugurated the Blue Earth Project (BEP) with our first conference on January 8, 2022. The principal aim of this project is to identify and explore the essence of these major factors and find inspiration and potential suggestions for solutions; looking at these major issues from sometimes overlooked approaches. In order to develop this concept, BEP will host a one-day conference each year in the month of January, the next being entitled: "Is it Time for Planet B?" and in addition will run an interactive programme and a BEP website throughout the year so as to maintain momentum. The 2022 inaugural question "Is Humanity Settling its own Fate on Ecological Survival" was addressed by five eminent international speakers. In this report, we summarise their main points commencing by outlining the crisis: the impending "sixth" mass extinction. Subsequently, we briefly review cumulative effects of atmospheric gases, and then summarise what the speakers brought forward. Finally, we look at the impact and reach of our meeting and suggest further steps forward.

## THE CRISIS: THE IMPENDING "SIXTH" MASS EXTINCTION

Throughout the history of our planet, there occurred five major mass extinctions. The worst of these was due to a massive volcanic eruption and is believed to have taken place 251.9 million years ago—the Permian-Triassic extinction event [Jurikova *et al*., 2020]. During this event 81% of marine species and 70% of terrestrial vertebrates perished. The most recent mass extinction, namely the K–Pg event which happened about 65 million years ago, was caused by a cataclysmic impactor that destroyed the dinosaurs as well as over 70% of those species with a body mass of 25 kg or more [Muench *et al*., 2020]. While these past mass extinctions happened well before humans evolved, the impending "sixth" event is distinctive in that it is going to be brought about due to human activity and our pollution of the planet. We will highlight the main way by which pollutants are introduced into the biosphere—namely, toxicants that are attributed to the burning of fossil fuels, industrial and chemical waste emissions.

*Combustion of fossil fuels*: the crisis began with industrialisation and a drive for increased gross domestic product per capita during the early 1800s when the global population was merely around 1 billion people [Roser *et al*., 2019]. This was the time when burning fossil fuels (peat, coal, oil and gas) on a large-scale became ubiquitous, as opposed to the burning of wood which was the norm up until then; this is because pound-for-pound, fossil fuel yielded more energy and burnt longer when compared to wood. Fossil fuels were used by huge industrial plants as well as domestically; the preferred choice for steam ships, early trains and later coal-powered electric generators was coal and subsequently diesel fuels. The levels of smoke and smog generated, even with a much lower population density compared to today, had a profound detrimental effect on both the atmosphere and environment, notably the phenomenon of "smog" (which is a portmanteau of smoke and fog). Further, the advent of mass-produced and petrol-powered automobiles during the earlier part of the 20$^{th}$ century added to the levels of gaseous pollutants in the air. Even in the present day, the most commonplace sources of energy for domestic heating, lighting and cooking all over the world are still either gas, oil, or wood. In the 1960's, mass holidaying abroad became fashionable, which meant that more aeroplanes took to the sky, adding further toxicants, especially within the upper atmosphere. By and large, the fumes generated by fossil fuels are invariably mixtures of soot particles and high levels of carbon dioxide ($CO_2$) and carbon monoxide (CO), as well as toxic/carcinogenic oxides of sulphur ($SO_x$) and nitrogen ($NO_x$). For example, although the dioxides of both nitrogen ($NO_2$) and carbon ($CO_2$) forms less than 0.1% of the air composition, the former is a reddish-brown gas with a distinct pungent and acrid odour and, being heavier than the latter, form a "halo" around cities—*c.f.,* a molecular weight of 46 with that of $CO_2$ at 44. The effect of this halo is twofold: first, it is a regular feature of some large, industrialised cities in developing nations as an indication of highly polluted air; and second, it is bad for human health—also see Table 3 below.

*Humankind's additional action*: with the invention of refrigerators (*circa* 1913) and use of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) came another dimension to the detrimental effect on the Earth's atmosphere. Both CFCs and HCFCs are used on an industrial scale as solvents, refrigerator coolants, degreasing agents, and as a propellant in aerosol cans. Further, leakage from refrigerators and during improper disposal of such appliances adds to the inventory of gases in the atmosphere. Likewise, vinyl chloride—a manmade gas product, which is a colourless, flammable gas used for making polyvinyl chloride (PVC) for pipes, wire/cable coatings, vehicle upholstery, and plastic kitchenware etc., also adds to the pollution of the atmosphere.

*Natural phenomena*: the levels of atmospheric pollutants are further made worse due to natural emissions from wild bushfires (even though sometimes deliberately the work of arsonists), agricultural burning, volcanic eruptions, sandstorms and pollen grain precipitations. An incoming meteor (e.g., Tunguska or the more recent Chelyabinsk event) could explode in mid-air causing huge devastation; for instance, the Tunguska explosion, which occurred on June 30, 1908 over the Siberian Forest flattened trees within an area of 830 square miles (2150 km$^2$). As a result, the soil and peat in the area was enriched with rare-earth elements such as samarium (Sm), europium (Eu) and terbium (Tb) as well as with barium (Ba), mercury (Hg) and copper (Cu), and there was raised radioactivity over the epicentre which lasted until 1945 [Golenetsky, Stepanok, 1980; Dmitriev, Zhuralev, 1984].

*Input from natural sources*: methane ($CH_4$) is a natural gas produced mostly by methanogenic archaea. They inhabit both natural and anthropogenic environments such as wetlands, boglands, marshlands, sediments of water bodies and permafrost as well as ruminants (e.g., domesticated animal cattle, goats, sheep as well as giraffes, bisons, elks), waste waters and landfills etc.

The cumulative net effect of this inventory of atmospheric pollutants is multiple [Jheeta, 2022] and some are briefly discussed in the next section.

## CUMULATIVE EFFECTS OF ATMOSPHERIC GASES

Our invited speakers addressed many of the deleterious effects due to changes in the atmospheric conditions and the biospheres of the Earth. Here we will briefly look at four problematic effects attributed to gaseous pollutants as follows: (1) the rise in global atmospheric temperatures, (2) the deterioration of the environment, (3) the demise of ecosystems and the resulting loss of flora and fauna, and (4) the damaging effects on the health of humans.

*Global temperature*: this is related to the accumulation of greenhouse gases within the atmosphere which include: water vapour, $CO_2$, $CH_4$, ozone ($O_3$), nitrous oxide ($N_2O$), nitrogen trifluoride ($NF_3$), sulphur hexafluoride ($SF_6$), hydrofluorocarbons (HFCs); and perfluorocarbons (PFCs)—the latter four being purely due to industrial activities. These gases prevent the dissipation of heat from the atmosphere by trapping it within the confines of the atmosphere. By the time of the first COP conference in March 1995, it was conspicuously obvious that the atmospheric temperature was rising; according to the NASA Goddard Institute for Space Studies, the average global temperature on Earth has increased by at least 1.1 ℃ since the time of the Industrial Revolution. The accelerated rate of temperature rise began in 1975 [Hansen et al., 2010; NASA online, 2022]. These changing temperature patterns are the cause of disasters, including storms, heatwaves, flash-floods, and droughts. Further, the impact of increasingly high temperatures is also causing the escalation of ice melt at the poles, resulting in rising sea levels and both the disappearance and forging of new coastlines around the globe, with the eventual need for evacuation of some low-lying areas becoming a major fear; the erection of flood barriers and levees are only temporary measures and not a solution. The melting ice also means that polar-dwelling animals (e.g., emperor penguins, polar bears and arctic foxes) are losing their traditional habitats.

*The deterioration of environment*: the seas and oceans are becoming more acidic due to both acid rainfall and gases being directly absorbed by open bodies of water; this is affecting marine flora and fauna—such as the widespread death of coral reefs. Table 1 shows a list of gases produced during natural events such as volcanic eruptions and bushfires, as well as during the burning of fossil fuels; these gases are the acidic causative agents in niche environments such as freshwater habitats, as exemplified by lakes, ponds, lagoons, rivers, streams, wetlands, and swamps, as well as saltwater marine habitats including oceans, seas, intertidal zones, reefs and sea beds [Ramakrishnan et al., 2022].

**Table 1.** List of gases produced by volcanos that go on to make respective acids which are then precipitated on to the surface of the Earth

| | **Gaseous** | **Generic name** | **Aqueous** | $CO_2$, HCl, HF, $SO_2$, $H_2S$ and $NO_2$ are a composition of volcano plumes and coal-fired power stations. Together all these form their respective acids. It is these acids that are the major causative agent of acidification of natural waters.<br><br>It should also be noted that some of these gases (e.g., $NO_2$ and $H_2S$) are also produced by naturally decaying organic material. |
|---|---|---|---|---|
| Carbon dioxide | $CO_2$ | Carbonic acid | $H_2CO_3$ | |
| Hydrogen sulphide | $H_2S$ | Sulfuric acid | $H_2SO_4$ | |
| Sulphur dioxide | $SO_2$ | ditto | ditto | |
| Hydrogen chloride | HCl | Hydrochloric acid | HCl | |
| Hydrogen fluoride | HF | Hydrofluoric acid | HF | |
| Nitrogen dioxide | $NO_2$ | Nitric acid | $HNO_3$ | |

*The demise of ecosystems*: A major cause of the demise of ecosystems is deforestation—for example entire swathes of the Amazon rain forest have been annihilated to make way for mining industries, grazing land for domestic animals, extensive agriculture and not forgetting felling of timber for domestic use. In another setting, Madagascar with its niche tropical dry and rainforests, in addition to its spiny forests has already lost 80% of its primary tropical forest due to human activity; it is estimated that within 40 years Madagascar's forest will be lost entirely. These acts of deforestation "vandalism" are repeated globally, and although clearances of yet more and more areas may be seen as justifiable (i.e., a basic need for shelter, firewood and food etc.), the results are the same: loss of biodiversity and the habitats of many plants, insects, as well as birds and, both small and large animals which depend on such specialised ecosystems [WWF

brochure, 2007]. Another effect on the delicate balance of ecosystems is caused by the poaching of wild animals to the brink of extinction, as exemplified by the hunting of endangered pangolins as an exotic foodstuff and the killing of tigers and rhinoceroses for traditional homeopathic Chinese medicine—the majestic northern white rhinoceros are now virtually extinct apart from the two captive female rhinoceros at the Ol Pejeta Conservancy in Kenya. Since the late 1980's to 2019 at least eighteen iconic species have become extinct—Table 2.

**Table 2.** Extinct species 1980's-2019 [Wikipedia, 2022]

| | | | | |
|---|---|---|---|---|
| Alagoas curassow | Franklinia | Kihansi spray toad | Scimitar oryx | Spix's macaw |
| Beloribitsa | Golden skiffia | Oahu deceptor bush cricket | Socorro dove | Wyoming toad |
| Cachorrito de charco palmal | Guam kingfisher | Panamanian golden frog | Socorro isopod | |
| Escarpment cycad | Hawaiian crow | Père David's deer | South China tiger | |

To add to this, many species of fish are also teetering on the brink of extinction, as their stocks are regularly depleted due to over-fishing—e.g., some shark species, bluefin tuna and monkfish. In contrast, during World War II, when trawlers didn't venture into deeper waters for fear of being attacked by U-Boats, cod and other economically viable North Sea fish stocks were soon repleted.

*Human health issues*: during the early 1950s smog hung over the city of London for five days constantly and as a result it is believed that over 4000 people died [Bell *et al*., 2004]; further, in more than a100,000 cases, respiratory tract complications were attributed to this smog—e.g., chronic obstructive pulmonary disease. In the UK, these issues pertaining to smog were sufficient to bring about the Clean Air Act in 1956. It is now well documented that smog and polluted air have an effect not only on the respiratory tract but also on eyes and skin; the latter includes cancer, atopic dermatitis, eczema, psoriasis or acne, etc. According to the World Health Organisation (WHO), the impact on human health is dire, as nearly 6 million people die prematurely from illnesses attributable to the quality of air worldwide. The biggest killers are as shown in Table 3.

**Table 3:** Global deaths due to the presence of pollutants in the air [WHO online factsheet]

| | **Clinical cause of death** | **Effect of pollutant** |
|---|---|---|
| **27%** | pneumonia | Primarily inhalation of soot ($PM_{2.5}$)* |
| **27%** | ischaemic heart disease | Exposure to $PM_{2.5}$ and $NO_2$ |
| **20%** | chronic obstructive pulmonary disease | $NO_2$ affects respiratory tract |
| **18%** | stroke | CO brings on stroke after inhalation |
| **8%** | lung cancer | Vinyl chloride |
| * $PM_{2.5}$ refers to fine particulate matter, tiny particles or droplets in the air that are $\leq$ 2.5 μm in diameter. When mixed with $NO_2$, these appear as an orange haze/halo. | | |

## THE EVIDENCE: WHAT THE SPEAKERS SAY

Our symposium featured five speakers (see Figure 2). In a succinct summary, Prof Lowell Gustafson (USA) and Dr Mukesh Bhatt (UK) kicked off the programme with a survey of the problems faced by humanity: physical population growth on the one hand, and the legal and moral challenges on the other. Prof Gustafson delivered a presentation entitled: "Human Population Growth: A Set of Unprecedented Questions." He began with highlighting that the human population 300,000 years ago numbered a few thousand globally; fast forward to 1900 and the population had increased to 1.65 billion. Then within only the next 121 years, the growth was exponential and unparalleled reaching 7.9 billion. He further extrapolated that it might rise to 11 billion by the end of this century and stated that this is an "unprecedented situation". He concluded that policy makers across the globe would have to dispense with old practices and values, as well as addressing the security of food supplies and rethinking of farming practices; in short, he declared that "wholesale change is on the horizon". Dr Bhatt gave a talk entitled: "A Quest for Life unchained and unbound." He systematically explored "life" in its entirety, from within historic, religious settings and scientific definitions of life through to anthropogenic human laws, as well as looking at what western

society's ideas of what life is, as opposed to those of other cultures with different and broader definitions of what constitutes life. The issues surrounding life are, indeed, perplexing—for example he tackled the ethical treatment of non-human species and inanimate environments and eco-systems, which are little understood or accepted in the West. He further explored the human destiny of settling in outer space by asking: "are we justified in interfering with what may be future sites for the origin, evolution and development of life?" Dr Bhatt concludes that the issues of life are extremely complex to say the least. Perhaps life needs to be defined and continually redefined, from the molecular or organic entities to various types of xeno-species and civilisations. Following this, Prof. Medina Omo Kadiri (Nigeria) added supporting evidence for the demise of ecosystems which both Prof Gustafson and Dr Bhatt touched upon in their talks; her oral presentation was entitled: "Global Assessment on Biodiversity, Conservation and Environment." She gave a comprehensive review of the loss of diversity across the planet, be it plants or animals. No class of multicellular life is entirely safe from habitat loss, pollution, and climate change. From the onset, Prof Kadiri declared that nature is "deteriorating globally at an accelerated pace", which is reflected in the environment in general along with the disappearance of habitats and biodiversity of species; with the eventual demise of entire ecosystems. She concisely demonstrated with facts and figures that a million species of both flora and fauna are on the verge of extinction, further adding that such a reduction in biodiversity, as well as habitat loss will adversely affect the United Nations' Sustainable Development Goals (SDGs) [UN resolution, 2015; UN online]. These include poverty (SDG 1), hunger (SDG 2), health (SDG 3), water (SDG 6), cities (SDG 11), climate (SDG 13), oceans (SDG 14), and land (SDG 15). In conclusion, to safeguard the "global biosphere", in no uncertain terms she stated: "local efforts as well as international cooperation is vital".

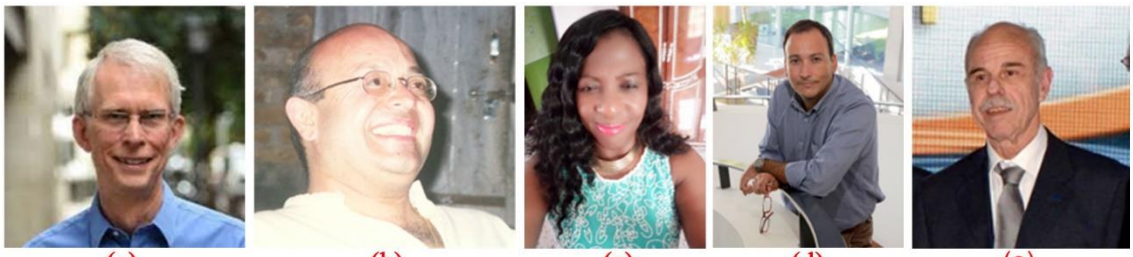


***Figure 2.*** **Symposium speakers:** **(a)** Prof Lowell Gustafson, Department of Political Science, Villanova University College of Liberal Arts and Sciences, Philadelphia, USA. One of his main interests is in "Big History", placing historical developments in the widest context and covering a timeline from the Big Bang to the present. **(b)** Dr Mukesh Bhatt, School of Law, Birkbeck College, University of London, UK. He is particularly interested in outer space, colonisation and cultural recidivism. **(c)** Prof Medina Omo Kadiri, University of Benin, Benin City, Nigeria. Her interests are in environmental management and toxicology as well as global assessment on biodiversity and conservation. **(d)** Dr Alex Godoy-Faúndez, Global Young Academy and CiSGER, Facultad de Ingeniería, Universidad del Desarrollo, Chile. The main areas of Dr Godoy-Faúndez interests are environmental policy, environmental affairs and sustainability science. **(e)** Prof Nathan Nelson, Emeritus in Biochemistry Molecular Biology, The George S. Wise Faculty of Life Sciences, the Tel Aviv University, Israel. Prof Nelson's research interest primarily includes V-ATPase, neurotransmitter transporters, metal-ion transporters and complexes involved in the process of photosynthesis. In addition, he is interested in the effect the population growth is having on the health of the Earth

Finally, Dr Alex Godoy-Faúndez (Chile) and Prof Nathan Nelson (Israel) looked at the resource and energy situation, respectively, stressing the fact that, as encouraged under the current economic model, neither the extensive exploitation of resources nor the free disposal of waste products is sustainable. Dr Godoy-Faúndez's presentation concerned "Economic System and Growth, Engineering, and Ecosystems. How the planet has subsidised well-being?" Effectively, Dr Godoy-Faúndez's presentation outlined how the environmental deterioration, death of flora and fauna, and demise of ecosystems (as pointed out by Prof Kadiri) came about. He explained that humanity today is going through one of the most pronounced periods of increasing wealth and acquisition of commodities in all of human history, as compared to those by-gone eras of meagre hand-to-mouth existence. These excesses come with a price. These being that ecosystems are put at risk of deterioration due to over-extraction of natural resources surpassing Earth's boundary limits as well as increased general wastes, effluent discharges, and gaseous emissions; "these impacts are simply unsustainable", he pointed out. Further, the productivity and consumption—as exemplified by modern agricultural practices—are constructed on economic models that encourage continuous growth beyond Earth's sustainable limits, without consideration of the socio-environmental costs. These models are extrapolated across all other areas of industries—a collective conscious global disaster relating to the biosphere. The net result being that the "plate-tectonics" of the economic models in light of the more-or-less

permanent change in the Earth's climate (global warming), causes the deterioration of the environment, the demise of ecosystems and extinction of species. Dr Godoy-Faúndez reminded us that there is an imminent need to reconstruct the current productivity and consumption models such that the Earth is placed at the heart of such models. Prof Nathan Nelson's input was short, sharp and swift and was related to: "Energy management for sustainability". He stated, in no uncertain terms, that the Earth was overpopulated and that the population should be reduced to 5 billion, matching the levels of 1987 [Erlich, Erlich, 1990], meaning that we would need to be limiting the birth rate to 1.5 children per family. He further advocated that heavy taxes be levied on the use of energy, curtailing overall global overconsumption and consequential waste management in general. These were stark statements from Prof Nelson, which ought not to be ignored.

*These talks can be accessed via NoRCEL's website at https://norcel.net/. Please scroll to the bottom of the page for the links to the videos*.

## IMPACT AND REACH

The meeting was very well-attended with a representation from 42 different countries (Table 4). Of these, 17 were located across the global north, and 23 were in the global south which is a positive outcome, as the Earth's global challenges affect the developing nations the most [Jheeta, 2022; Jheeta, 2018]. In addition, we were intent on achieving as wide a reach throughout the world as possible. Bearing in mind the range of time zones covered, the audience level remained relatively steady throughout.

**Table 4**: Countries with at least one participant at the inaugural BEP conference (January 2022)

| **GLOBAL NORTH** | | | **GLOBAL SOUTH** | | |
|---|---|---|---|---|---|
| Australia | Italy | Slovenia | Botswana | Israel | Philippines |
| Austria | Japan | Spain | Brazil | Jordan | Singapore |
| Canada | Netherlands | Switzerland | Chile | Kenya | South Africa |
| Finland | Poland | UK | Egypt | Mexico | Sudan |
| France | Portugal | USA | India | Malaysia | Taiwan |
| Germany | Russia | | Iran | Morocco | Turkey |
| Greece | Serbia | | Iraq | Oman | Zambia |
| | | | | | Zimbabwe |
| **19** | | | **24** | | |

At NoRCEL, we are mindful of the fact that for any programme to be seen as a success, we would need to somehow determine how effective the campaign is. There are two ways this can be achieved: the operative interlinked words are "impact" and "reach". For example, one can inspire others so that this influences their action and creates "impact". This is different from the "reach" which simply refers to the number of individuals with whom one engages. It is obviously easier to extend reach than to influence, and increased reach must not come at the cost of the quality of engagement leading to impact. So how large a group should be involved? The best way forward may be where the group is neither too small nor too large—i.e., moderately sized. BEP is one of several projects created by NoRCEL whereby we are inspiring a reasonably large number of people (e.g., 150 to 250) to consider the problems facing our Earth and in return make a bigger impact. Please see Supplementary Table 1 which highlights some of the feedback received from this inaugural BEP2022 symposium.

Open discussions followed the oral presentations. These included the prospect of damming of the Red Sea for energy production, or the use of integrated farming. The overall gist of the discussions was a need for a change in current economic operating models as the *status-quo* today represents a *tragedy of the commons*, in that the depletion of resources, including energy, will eventually be destructive to all.

## WHAT'S NEXT?

Scientific research has highlighted the Earth's five previous mass extinctions of larger flora and fauna and predicted the approach of the sixth. What does this mean? When scientists discuss the current themes of such an extinction, it is exclusively from an anthropocentric standpoint. Yes, flora and fauna are being eradicated at an alarming rate, there is absolutely no doubt about that, but humanity's fears are directed largely toward itself… fears that the human race will perish if we do nothing about the Earth's worsening

problems. What if humankind were extinguished due to rising sea levels; intolerable temperatures; pollution; water shortages; disappearance of arable land and other consequences of overpopulation; so, what? If science and history have taught us anything, it is this… after all five previous mass extinctions, life always bounced back; it would not matter one iota to planet Earth if humans no longer existed on it… Other life would still go on.

While no decisions were made at this first meeting, the possibility exists to invite science-based journalists and other interested parties who have championed change in the past to come on board. There is a need for new ideas! The next hybrid Blue Earth Project meeting will be held on Saturday 21st January 2023 to address the question: "Is it time for planet B?" Readers may wish to consult the remit pertaining to this question published in the "COSPAR's information bulletin: Space Research Today" (Dominik et al, 2022).

SUPPLEMENTARY

**Table 1**: The feedback given to the three posed questions

| **Three Feedback Questions posed**<br>1. Q1: Your overall experience from 1 (poor) to 5 (excellent);<br>2. Q2: How likely are you to attend an online symposium in 2023 by scoring 1 (not likely) to 5 (highly likely)?<br>3. Q3 Any additional information | | | |
|---|---|---|---|
| | **Names** | **Scores** | **Additional information provided** |
| 1 | MOK | Q1: 5<br>Q2: 5 | |
| 2 | CK | Q1: 4<br>Q2: 4 | Some of us are new converts to issues related to preservation of Earth and related issues so, if possible, I will like to have all the presentations in copies for proper understanding |
| 3 | DK | Q1: 3<br>Q2: 5 | I score the overall experience with 3. I was expecting more from B.E.P.,<br>having the previous exp. from the NORCEL, maybe more technical or mathematical. |
| 4 | SK | Q1: 4<br>Q2: 4 | |
| 5 | JA | Q1: 5<br>Q2: 4 | |
| 6 | KF | Q1: 4<br>Q2: 5 | |
| 7 | TCK | Q1: 5<br>Q2: 5 | Personally, I also do not want the symposium to be another talk show with no significant contribution to the situation on the ground. So, I would like to suggest that each and every segment of the symposium be led or moderated by a young climate activist who can represent Thunberg's generation. The reason is to give an opportunity for youngsters to hone their leadership skills in managing differences. I think that it is timely that the NoRCEL's future webinars/ symposiums should be led by youngsters. After all, the generation to come is going to manage the planet Earth with all the problems we have created for them. Time to train them to be leaders for climate change mitigation. Maybe they already are as shown by Thunberg's example. Just that they are not given enough opportunity to manage the differences in their own terms/ ways as all spheres including the NoRCEL are still dominated by 'old people' like us |
| 8 | AK | Q1: 5<br>Q2: 5 | Thank you for arranging such a great and significant academic event, as well as providing us with the opportunity to express our views. |
| 9 | SP | Q1: 5<br>Q2: 5 | highly likely to attend 'is it time for planet b' 2023. |
| 10 | PC | No score | I would be happy to participate. |
| 11 | WDC | No score | First of all, congratulations on the success of the symposium, which gave both a varied and interesting perspectives which challenged my previous perspectives with worldwide contributions<br>With regards to the overall experience, it has to be a 5 and likewise a 5 to the follow up symposium.<br>Well done - keep up the good work raising awareness. |
| 12 | BI | Q1: 4<br>Q2: 5 | |

| | Names | Scores | Additional information provided |
|---|---|---|---|
| 13 | RDG | Q1: 5<br>Q2: 5 | |
| 14 | NP | Q1: 5<br>Q2: 5 | |
| 15 | ZB | Q1: 5<br>Q2: 5 | Thank you so much for the e-mail. It was my first time to follow and later join the project. It was very amazing, and the experience was excellent. I have learnt a lot from the symposium. I will attend the next symposium. In a nutshell my scoring for both questions |
| 16 | MC | Q1: 5<br>Q2: 5 | The experience was excellent. |
| 17 | RG | Q1: 4<br>Q2: 5 | there is still a lot to do here. Not time yet to think about leaving. Too much money for too few people |
| 18 | SVS | Q1: 5<br>Q2: 5 | |
| 19 | NeH | Q1: 4<br>Q2: 5 | I would be happy to participate. |
| 20 | PYM | Q1: 5<br>Q2: 5 | I would like to add that the online brainstorming with miro/ wonder.me or any other application prior to the Symposium was a very good idea. |
| 21 | MCB | Q1: 4<br>Q2: 5 | |
| 22 | AM | Q1: 5<br>Q2: 5 | highly likely |
| 23 | JS | Q1: 4<br>Q2: 4 | |
| 24 | EK | Q1: 5<br>Q2: 5 | |
| 25 | ALG | Q1: 5<br>Q2: 5 | I´d rate my experience as 4, the meeting was really interesting and I enjoyed it very much, however it would be better if I just could stay until the end of the meeting (because it lasted longer than expected).<br>I would definitely attend the next meeting and I´m looking forward to it.<br>Another comment I´d like to add is regarding the hour of the symposiums. I don´t know how the timezone is chosen but I guess the most fair is to determine it according to the timezones where most participants and members from NoRCEL live. Thank you |
| 26 | MC | Q1: 5<br>Q2: 4 | |
| 27 | IM | No score | I'll give it one more try as you ask, keep me informed of what is coming up. |
| 28 | MS | Q1: 5<br>Q2: 5 | Yes, I likely to attend an online free symposium in 2023 |
| 29 | MP | Q1: 4<br>Q2: 5 | Add other activities between now and the next symposium 2023 |
| 30 | AS | Q1: 5<br>Q2: 5 | |
| 31 | KV | No score | The directions of research related to the Blue Earth project are indeed very important at the present time. But they are outside my professional competence. Therefore, I must mark my answer to both of your questions as 1. But I confirm my interest in the subject of the chemical evolution of life, on which I have been working for many years, and my desire to participate in the next conference in this direction |
| 32 | AT | Q1: 5<br>Q2: 4 | |
| 33 | IS | Q1: 4<br>Q2: 4 | May the providence give you courage and energy to continue your struggle to uplift the awareness level of some parts of human society. |
| 34 | BS | Q1: 5<br>Q2: 5 | |
| 35 | KR | Q1: 4<br>Q2: 4 | |

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