Dear Indy

A Father's Plea For Climate Action

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Planetary Boundaries Presentation

The majority of our focus is on climate change, but our changing climate is just one of nine planetary boundaries that scientists are telling us cannot be crossed if we are to continue with the human experiment. Here are the nine boundaries: climate change, biodiversity loss, ocean acidification, ozone depletion, atmospheric aerosol pollution, freshwater use, biogeochemical flows of nitrogen and phosphorus, land-system change, and chemical pollution.

In 2009, when scientists first established the boundaries, it was found that we had already passed three of the nine boundaries – climate change, biodiversity loss, and excess nitrogen and phosphorus. Let's start with climate change as this is by far the most understood of the boundaries. In simple terms, humans have increased the level of greenhouse gases in the atmosphere through burning fossil fuels, burning forests, and industrial agriculture. While greenhouse gases are responsible for keeping our planet warm, too little of them can result in ice ages, and too much of them results in hot house Earth scenarios. This is because greenhouse gases like carbon dioxide, methane, and nitrous oxide act as a blanket that traps the Sun's radiation in our atmosphere, and this warms the air. If we were to remove them completely, our planet would be frozen solid. So, they are a good thing - in moderation. Unfortunately, since the industrial revolution, we have increased CO_2 levels from 283 to 420 ppm, methane from 751 to 1,892 ppb, and nitrous oxide from 273 to 335 ppb. This has increased the global average temperature by 1.2C since 1750. Since 1990, concentrations in our atmosphere have doubled.

With our current policies, we are on course to increase the temperature by as much as 3.6°C by the end of the century. Without urgent action to reduce emissions, we are forecast to reach 1.5°C by 2032, and then 2°C by 2043. Increased temperature leads to heatwaves like the one that killed 1,032 people in Japan in 2018, and 53,000 people in Europe this Summer. It leads to more severe storms, increased flooding like we saw in Nigeria and Pakistan this year, and longer and more frequent droughts like those in the U.S. Midwest, and large parts of sub-Saharan Africa. The increased heat is also leading to the rapid melting of Greenland and Antarctica, and it has been forecast that we could see several meters of sea-level rise as soon as 2066. This will all affect food production and wheat crops are expected to decrease by 37% at 2°C of warming, corn harvests are projected to decrease by up to 18%, and soybeans by 12%. These are the most common crops grown on our planet. Some prominent climate scientists predict that at 4°C of warming, the planet will be able to support less than 1 billion people. As food production decreases, our human population is expected to reach 10 billion by 2050. We can all see why this issue is so important for our future.

How do you think Japan will be affected by climate change?

Many Japanese think this is a global problem, and not a problem they need to worry about. A study found 23.8% of Japanese respondents thought the environment was the world's biggest problem, but only 2.5% of those considered it to be Japan's biggest issue. That is not the case. In 2018, Japan scored first globally on the overall Global Climate Risk Index, and a year later it was fourth overall. This is due to deadly heat waves, super-typhoons like Hagibus, and Jebi, flooding and landslides. Since 1990, typhoons which have hit East and Southeast Asia have intensified by 12–15%. The number of the larger category 4 and 5 storms has also doubled in that period, and in some places tripled. Their destructive power has also increased by 50%. Metropolises across Asia can expect to see super-strength typhoons barrel through, raising infrastructure losses from $3 trillion in 2005 to $35 trillion in 2070. Rainfall is also increasing the likelihood of landslides like those that hit Hiroshima in 2014 and my family's former village of Tenno in 2018. Nationally, between 2010-2020, the number of landslides jumped 50%, with over 1,500 occurring every year. Asia will also experience between 10-20% higher sea-level rise than other regions, with Tokyo possibly facing annual flooding by 2050. Kumamoto risks being submerged every year, Hiroshima could be completely inundated,

and Nagoya's citizens may face a very difficult future. Most Japanese live on the crowded 30,000 km coastline, and this coastline is about to be redrawn. In the figure you can see Osaka today and Osaka at 3℃ of warming. At a sea level rise of just 1 m, Japan could lose 90.3% of its beaches. Sea levels are expected to rise by 2-3 m by 2100 and 46% of Japanese will be impacted.

The increased heat, stronger typhoons, sea-level rise, and 17-19% increased summer rainfall will threaten Japan's already vulnerable food self-sufficiency. In 2022 it was just 38%; which means we are reliant on other countries for 62% of the food we eat. Rice yields in Central and Southern Japan are expected to drop by 40%, according to the World Wildlife Fund. And the rice that does grow is expected to be lower quality. So, as we can see – Japan will be greatly affected by climate change. In fact, we are the forefront.

Through changing our climate, and industrial farming, we have also begun the sixth extinction event with as many as 273 species becoming extinct every single day. This is the second boundary we have crossed: biodiversity. Since 1970, human activities have led to a 69% drop in wildlife populations. Freshwater fish populations have declined by 76%, with oceanic fish declining by half since 1970. Each and every species has a vital role to play in a healthy ecosystem, and when you remove one species, this has knock on effects. To give you one example, when you remove sharks from an ecosystem, sea turtles wipe out sea grass and this provides habitat for species like fish, shellfish and birds. Seagrass is also a huge carbon sink. Shark populations have declined by 71% since 1970. Everything on our planet is interlinked and our ecosystems have taken 4.5 billion years to evolve into their current state. By 2100, it is predicted there will be no more insects on our planet. We are losing 2.5% each year. You might dislike insects, but 75% of our food is partially reliant on pollinators. They also provide food for birds, and other species. A quarter of all species on Earth are now threatened with extinction.

What do you think I the largest cause of biodiversity loss?

Without question, the biggest cause of biodiversity loss is our love of eating other animals. Overall, it is estimated that 60% of species loss is due to animal agriculture. In simple terms, meat-based diets use 75% more land than plant-based diets, and as the population grows and becomes wealthier, we are expected to see a huge rise in meat consumption by 2050 as China and India wish to join Japan in copying the American meat heavy diets. Today, humans and the animals we keep for food account for 96% of all mammals. Wild mammals make up just 4%. Only 30% of birds are free to fly, with 70% of birds kept in factory farms. Additionally, there are considered to be 362 megafauna species – including gorillas, elephants, rhinos, giraffes and salamanders. Of these, 70% are decreasing in numbers with 59% threatened with extinction. 98% of these animals are threatened by hunting for their meat.

The second biggest cause of species loss is industrial farming which relies on massive amounts of chemicals like pesticides. These chemicals which are called medicine (kusuri) in Japan are the leading cause of insect deaths. These chemicals also kill birds and destroy fish populations.

The third boundary crossed by 2009 was excess nitrogen and phosphorous. While these are essential for growing food, since the 1970s we have been growing our food using synthetic nitrogen and phosphates, and this has created an imbalance in our systems. As we just saw, we have also massively increased the number of farm animals and their waste, along with synthetic nitrogen and phosphorous - has led to eutrophication in our rivers where algae grows and this sucks oxygen out of the water and starves fish. This has knock on effects for all species in the ecosystem. These rivers then discharge into the oceans, and they create dead zones where nothing lives.

When the scientists released an update to the boundaries in 2015, they discovered that another had been crossed; this was land-system change. As our population increases, we need more land for growing food.

Additionally, as people become more affluent, they increase their meat and dairy consumption. Animal based foods require more land than plant-based foods. In fact 65% of land use change was caused by animal agriculture between 1961-2011. 70% of the deforested parts of the Amazon rainforest are now being used to graze cows while the remaining 30% is mostly used for growing soy beans which are fed to factory farmed animals.

How, if at all, will Japan be affected by land system change?

As we saw Japan has outsourced the production of the majority of its food to other countries. It has also outsourced the destruction of rainforests to the Philippines, Indonesia, Malaysia, Papua New Guinea, and Australia. This has enabled Japan to have the largest forested area of the G20 countries. Currently, 68% of Japan is forested. This is amazing! It is, however, not sustainable. If Japan were to use its own resources for logging and producing meat, Japan would need to deforest large areas. To give you a snapshot of the damage Japan inflicts on forests around the world, after WW2, Japan started importing logs from the Philippines. Imports peaked in the 1960s and ended in 1986 when the Philippines banned exports and became a net importer. Japan then moved its attention to Indonesia, but they too banned exports in 1985. Malaysia was the next to supply forests to Japan, and by the late 1980s, 90% of Japan's trees came from Sabah and Sarawak. By 1999, Japan accounted for 25% of all log exports.

Another way Japan is affecting land system change elsewhere is through their diets. Since Commodore Perry arrived, Japanese have switched from eating predominantly plant rich diets to predominantly meat-based diets. Japan has especially fallen in love with eating beef, not Japanese beef though, Aussie beef. Today, Japan is the largest importer of Aussie beef. 98% of cows in Australia are grass fed and this is definitely better for the cows, but not so good for Australian forests - and the animals that used to live in them. The largest cause of deforestation in Australia is animal agriculture. Japanese also love koalas, but due to deforestation, there are as few as 32,065 left in the wild. As deforestation has increased, their population has declined 30% in just the past three years,. They are projected to go extinct by 2050 in New South Wales. By continuing to eat Aussie beef, Japanese are helping to push the 'kawaii' koalas to the brink of extinction.

This gives you an idea of the amount of natural resources Japan imports. If this was to end, Japan would have to destroy its own forests. This would result in huge CO2 emissions within Japan, even more landslides due to less stable soils, increased flooding, and less biodiversity.

In an interview for the Globalizations journal in 2021, Will Steffen – co-author of the planetary boundaries framework – declared that it was possible we had passed the safe boundaries for ocean acidification. The oceans are absorbing around a quarter of all our CO2 emissions and when CO2 dissolves in water it raises the level of the water's PH. This leads to the acidification of our oceans. You might wonder how this will affect us, so as an example, pure water has a pH of 7, but due to acidification, the pH of our oceans has increased from 8.2 to 8.06. This may not sound much, but pH levels are logarithmic which means they have increased by around 30%. More alarmingly, reef development is believed to stop at pH 7.8. Reefs are breeding grounds for many types of fish, and they support around 500 million people worldwide. Coral reefs only account for 0.2% of seafloors, but they sustain around 25% of marine life.

Research in January 2022 found that the chemical pollution boundary had now been crossed. One of the main chemicals added to our planetary system was plastic which is now double the weight of all the planet's marine and land-based animals combined. Less than 10% of plastic has been recycled, and it is estimated that there will be more plastic in the ocean than fish by 2050.

What are the largest causes of plastic pollution in our oceans?

We have all seen photos of turtles with a plastic straw in their nostril, but the real cause of oceanic plastic pollution is not drinking straws; it is the industrial fishing industry. In what is called the Great Pacific Garbage Patch, between 75 and 86% of plastic is abandoned fishing gear. Much of this waste floats at the surface, but a lot floats below the waves and dolphins, whales, turtles and sea birds get tangled in the web of plastic and either drown or starve to death. This ghost gear amounts to 3,000 km^2 of gill nets, 740,000 km of long lines, and 25 million pots and traps. Around 2% of fishing gear is lost each year and at current pace, the amount of stray fishing nets will be able to cover the surface of Earth within 65 years.

Japan is one of six countries singled out for blame due to massive overfishing in the area. The other countries are China, Taiwan, South Korea and the United States. When it comes to non-fishing related items that could be identified in the Great Pacific Garbage Patch, 34% of items had Chinese writing, 33% had Japanese, 17% English, and 10% Korean.

Further research in April 2022 said the planetary boundary for green freshwater had been passed. Green water is the water that makes its way into the soil. Water is one of the most common molecules found on Earth, but while almost 70% of the planet is covered by water, only 2.5% is fresh, with the remainder containing salt. Of that small percentage, only 1% is easy to access with most frozen in glaciers and snow. Only 0.007% of Earth's water is easily available for the 7.97 billion humans, and all other animals on the planet. Currently, one in every three people lack access to freshwater, either because it is unsafe, unavailable, or unaffordable. Most of these people live in developing nations, but with the climate crisis, people in some developed nations may find out first-hand, just how lucky they have been. By 2025, water researchers warn that 3.5 billion will either be running out of water or be unable to afford it. If our global population hits the projected ten billion mark by mid-century, then our demand for water is expected to grow by as much as 55%. By 2030, our demand for water is expected to outstrip supply by 40% and half of humans will face severe water stress.

Japan has a very humid climate. Do we need to worry about water conservation?

Surprisingly, Tokyo is one of eleven cities most likely to run out of water. The capital is home to around 30 million people and relies on rivers and lakes for 70% of its water. Most of Japan's rainfall comes in just a few months. If rainfall in the rainy season is reduced, as it was this Summer with the shortest season on record, Tokyo and many other cities could face problems which will be exacerbated by extreme heatwaves which are certain to become worse if we don't reduce our emissions very quickly.

If the ocean acidification boundary has been crossed, then we have now crossed seven of the nine boundaries. The final boundaries are atmospheric aerosol pollution and the ozone layer. Aerosols are tiny airborne particles that occur naturally due to volcanoes or dust storms from deserts. They also occur due to smoke and pollution. Depending on the aerosol and the location: they either reflect or trap heat which either cools the planet or causes warming. If we were to remove all aerosols today, it is possible the Earth could warm between 0.5C – 1.1C as the aerosols in the atmosphere have been reflecting the Sun's energy. They can also affect rainfall patterns. Since the industrial revolution, we have doubled the amount of aerosols in the atmosphere. For every 1,000 people on Earth, 973 are regularly inhaling toxins. Today, they are responsible for around 10 million deaths every year. It is possible we have already crossed this boundary, but it has yet to be quantified.

The final boundary is the ozone layer which has been recovering since the 1980s when a hole was identified. Unfortunately, one of the solutions to the climate crisis being given serious consideration is spraying Sulphur dioxide into the atmosphere to mimic volcanic eruptions which cool the planet in the short term. Research suggests that this will lead to the destruction of the ozone layer if/when it is

attempted. In this scenario, we will have crossed every single one of the nine planetary boundaries that scientists state we cannot cross.

So, we can all see the problems we are facing. Climate change is a massive problem, but simply moving to renewable sources of energy - while essential, is not sufficient. The secretary general of the World Meteorological Organization recently said *"We need to transform our industrial, energy and transport systems and whole way of life."* He added that *"the needed changes are economically affordable and technically possible,"* but that *"time is running out."* In a 2018 report by the Planetary Boundaries scientists, they declared that *"Widespread, rapid, and fundamental transformations will likely be required to reduce the risk of crossing the threshold and locking in the Hothouse Earth pathway; these include changes in behavior, technology and innovation, governance, and values."* You might now be wondering what will happen if we continue to push past the nine boundaries? A United Nations report this year found that if we continue to push past these boundaries then total societal collapse is a possibility. A study in 2014 found that if we continue business as usual then *"a relatively rapid fall in economic conditions and the population could be imminent."* A report in 2020 stated that based on current deforestation levels - humanity has less than a 10% chance of avoiding 'catastrophic collapse.' Deforestation is directly or indirectly linked to six of the nine boundaries. What each of these reports makes clear is that we cannot continue to treat the planet as a never-ending resource. They are simply warnings. We still have the power to change the way we live, but we are fast running out of time.

Now, some of you might be wondering why you are hearing about this for the first time? I know I would be. The fact is, countries, (including Japan) pressured the Intergovernmental Panel on Climate Change (IPCC) to remove mention of the urgency for a rapid transition to non-fossil fuel energy, and instead rely on unproven Carbon Capture and Storage technology being viable at some future point. Argentina and Brazil also requested the IPCC to remove the benefits of adopting plant-based diets so they could continue to burn rainforests to the ground to graze cows and grow soybeans for the planet's factory farmed animals. Unfortunately, the IPCC reports are watered down by governments and industry. As an example, the 2022 IPCC report mentions Systemic Change 44 times in 2193 pages, but all but one mention was removed in the summary for policy makers.

In groups, make a list of 5 solutions to the problems discussed today

So, we've got this far, and I agree, it is very very depressing. There is however – light at the end of the tunnel. There are individual changes we can make very easily in our lives that can reduce our emissions significantly. For example, adopting plant-based diets can reduce your individual emissions by up to 27%, and with 60% of species extinction being caused by animal agriculture, according to research from Oxford University, this is the most effective individual change we can make. As an added bonus, it also reduces freshwater use by a quarter, reduces acidification, and eutrophication, and requires 76% less farmland. This land could then be reverted to forest and suck in hundreds of gigatonnes of CO_2 and provide habitat for wildlife. We can also change our home energy provider to a renewable energy company; this can reduce our emissions by another 20%. Together these changes can get our emissions down by the required 45% by 2030. Further cuts can be made by not driving, not flying, buying second hand, and generally consuming less. We can even grow our own food. These are all powerful changes, and they make a statement to your friends and family that the situation is serious.

This, however, really isn't going to be enough. We need systemic changes to the way we feed ourselves, to the way we feed our economy, to the way we travel, ultimately to the way we see the world. We have been told we are simply consumers, but we are not. We are global citizens; we are human beings. Unfortunately, our governments are unlikely to make these changes when they are funded by the very industries profiting from our current system.

We are going to need to pressure them to act. This is happening already with the Fridays for Future movement inspired by Greta Thunberg where students strike from school on Fridays. Sadly, in Japan, the students don't actually miss school which rather misses the point. Other groups like Extinction Rebellion, and Just Stop Oil are taking more radical measures like blockading traffic, closing major city centers, blockading factory farms, and more recently throwing soup at paintings - which are protected by glass. Many people oppose these measures, but in the context of what we have heard today, I think we will all agree that they are justified. The cultural anthropologist Margaret Mead once said *"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."* History suggests she was right.

Civil disobedience got women the vote. The suffragettes weren't popular. They chained themselves to gates, they blew things up, they obstructed horse races, but they got women the vote. It got the British out of India. Gandhi wasn't popular with the British, but they never gave up. In the civil rights movement, Malcolm X and Dr. King complimented each other. King was the moderate and Malcolm X the radical. Malcolm X was successful in driving Lyndon Johnson to the bargaining table, and they were successful. it also ended the poll tax in the UK in 1989. In fact research from Harvard University suggests that when 3.5% of the population take action, then it is always successful. Climate scientists themselves are now beginning to protest peacefully because their warnings have been ignored for 30 years. The head of the U.N. has also defended climate activists in their attempts to pressure governments to leave fossil fuels in the ground. He has called governments continuing to increase fossil fuel development the true radicals.

Recent research suggests civil disobedience is working again. Following Extinction Rebellion protests in 2018, the UK government declared a climate emergency. They also formed a citizens' assembly. These were two of the demands. Research published in 2022 found that two-thirds of the British public now support peaceful protest to protect nature. If you need any further evidence that civil disobedience works, here it is. In 2022, the British government passed a law that criminalizes these acts of peaceful protest. The government knows they are effective, and therefore wants to make them illegal. The tide is turning.

We have to reach this social tipping point before we reach the planetary tipping points. Failure to do that will likely result in the loss of organized human civilization: conflict and suffering on a scale none of us can imagine.

If we can get this right, we could live on a planet with clean air and rivers, thriving oceans, and forests teeming with life. We could have more time to spend with family and friends and spend less time working. And our health would improve. Our challenge is huge, but we cannot shy away from it. I will finish with a quote from Nelson Mandela, a man who knew a thing or two about adversity. *"It always seems impossible until it's done."* So, let's get going!!!