



The Ebola virus

# THE END IS NIGH?

Several self-created threats are coming together to create an existential threat to human dominance on Earth, argues **Stephen Mortlock**.

**T**he Cold War was at a high point in 1953, with the US and USSR testing thermonuclear devices, bringing Earth closer to global annihilation. The Doomsday clock reached two minutes to midnight, the closest it had come since its inception in 1947 (today it stands at two-and-a-half minutes). As a civilisation, we've reached the point where a single person has the power to destroy the Earth and all humanity. A number of these people are dotted around the world. And as technology asymptotically accelerates upward on its merry way, those capabilities will grow and become even more available. The probability of a black swan event (a metaphor for an event that comes as a surprise, has a major effect,

and is often inappropriately rationalised after the fact with the benefit of hindsight), gets larger as access to powerful technology becomes easier.

But it should be remembered that life on Earth has been nearly wiped out five times before by climate change, ice ages, volcanic eruptions, and of course the meteorite that plummeted into the Gulf of Mexico 65 million years ago, wiping out the dinosaurs. These events are known as the big five mass extinctions, and all signs suggest we are now on the precipice of a sixth. Except this time, we have nothing but ourselves to blame. Humankind is facing the greatest test of its million-year ascent. But it isn't a single challenge, like a famine or disease outbreak. It is instead a constellation of many human-made threats that are now coming together to imperil our existence.

## Snowball effect

Society often regards certain risks as separate issues – such as ecological collapse, resource depletion, weapons of mass destruction, climate change, global poisoning, food insecurity, population and urban expansion, and pandemic disease. However, they are in reality deeply intertwined, each one affecting the others. This means they cannot be dealt with one at a time, but must be solved in conjunction – and at species level. Joseph Miller, co-author of the textbook *Biology* (2010), believes that the snowball effect of multiple events occurring is becoming more likely. Climate change seems to be the trigger for many of the other scenarios, certainly some data seem to suggest that the Earth has already exceeded several irrevocable and non-linear milestones (permafrost melt,



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methane hydrates, and arctic sea ice) that make average temperature increases of 4°C, 6°C, and even 16°C possible. Earth would become uninhabitable if the average temperature increased by 4°C to 6°C. While we are used to the temperature changing 15°C overnight, a 2°C to 3°C daytime average increase would give us temperatures that regularly surpass 40°C (104°F) in North America and Europe, and soar even higher near the equator. The human body starts to break down after six hours at a wet-bulb (100% humidity) temperature of 35°C (95°F). Temperatures like this would make swathes of Africa and Asia uninhabitable and the 70,000 deaths in the 2003 European heat wave would pale into insignificance.

One of the other effects of climate change could be an increase in the prevalence of pathogens and possible outbreaks. Already new pathogens seem to crop up every year. Recent pandemics have included outbreaks of SARS (severe acute respiratory syndrome), bird flu, and, most recently, the coronavirus MERS that originated in Saudi Arabia. We have also seen large outbreaks of Ebola virus in Sierra Leone and plague in Madagascar (2,267 confirmed, probable and suspected cases, including 195 deaths, were reported to WHO by the Ministry of Health of Madagascar). And because of our highly interconnected global economy, a deadly disease could spread like wildfire.

Coupled with emerging and re-emerging diseases is antimicrobial resistance (AMR) and the possibility of a pandemic. It used to be that if you got an infection, the prescribed antibiotic would fight it off and you were sent home. Now you go to the hospital, they prescribe antibiotics and maybe they succeed or maybe they don't. AMR is a worldwide problem and resistant bacterial strains have emerged and spread partly because of the remarkable genetic plasticity of the microorganisms, but also because of heavy selective use and the mobility of the world population. Over the years the synthesis



(Far left) Bleached coral reef  
(Left) Shrinking Brazilian rainforest



of new antibiotics may have caused some complacency about the threat of AMR: new drugs always seemed to appear in the nick of time. But it is doubtful that this will keep pace with a growing threat while bacteria continue to evolve and become resistant to the weapons in our medical armoury. We are in an arms race with an opponent who will not sign any treaties and who we might not be able to defeat. The scenario is that when people get sick, we just have to let them die.

### Overpopulation

The fear of an overpopulated globe has been around since the 18th century, when Thomas Malthus published *An Essay on the Principle of Population as it Affects the Future Improvement of Society* where he predicted population growth would overtax the planet and cause mass starvation. Since then technological and medical advances have reduced infant mortality and raised life expectancy. With the global population now at 7.6 billion and rising, many conservationists again think population growth is one of the key threats to the planet. Not everyone agrees and many believe that growth will stabilise in the next 50 years, and that humanity will innovate its way out of the negative effects of the overcrowding. But, already Cape Town is set to become the first major city to run out of water. Lower than average rainfall and



an increasing population have drained the reservoirs and the aquifer. Rationing is in place to prevent a breakdown of the city's infrastructure. As overdevelopment, population growth and climate change upset the balance between water supply and use, urban centres across the world face threats of severe water shortages. Population and economic growth will also drive a doubling in food demand by the 2060s but we are running out of everything needed to grow food by traditional methods: topsoil, freshwater, wild fish, oil and fertiliser.

During our lifetimes we each use on average 100,000 tonnes of fresh water, 750 tonnes of soil, 720 tonnes of metals and five billion energy units, and emit 300 tonnes of greenhouse gas. So it is unsurprising that resources are becoming scarce and landscapes are being ruined to obtain them. The self-evident answer is to re-use everything, and then re-use it again. Thanks to technology the "circular economy" is already feasible and becoming cost-effective, while green energy is rapidly replacing fossil fuels.

However, resistance from vested interests continues to block the development of ways to produce food in cities using recycled water and nutrients, to convert the planet to low-carbon eco-agriculture, and to gradually replace mining with mineral recycling, ending the release of toxins into the ecosystem.

### Eco-collapse

Dozens of species are believed to become extinct every day due to human activity. A study published in *Science Advances* says the current extinction rate could be more than 100 times higher than normal, and that's only taking into account the animals we know about. Earth's oceans and forests host an untold number of species, many of which will disappear before they are even discovered. In 2003, 23% of mammals and 12% of birds' species were already considered threatened. In the next 30 years, as much as one-fifth of all species alive today will become extinct.

The planet's natural ecosystems and regenerating bio-capacity are being severely degraded, compromising its ability to sustain life. Forests, fisheries, oceans, rangeland, freshwater systems and other natural ecosystems are all threatened or on the verge of collapse. Water, land and air are increasingly polluted, water tables are falling, and soil erosion is leading to desertification. About 92,664 acres of forests are lost every day. Brazil lost 91.4 million acres of its tropical forest between 1980 and 1990. At the current rates, 5% to 10% of tropical forest species will become extinct every decade.

The oceans are not faring any better: 75% of all fish stocks are either exploited, over-exploited or recovering, and 70% of coral reefs will cease to exist within the next 40 years. Half of all coastal wetlands, including mangrove swamps and salt marshes, have been lost. More recently Greenpeace and the European Food Safety Authority have showed that large pieces

of plastic entangle and choke turtles and seabirds, while tiny pieces clog the stomachs of creatures from zooplankton to whales, who mistake it for food. Plastic micro particles are entering every level of the ocean food chain and even end up in the seafood on our plates. The long-term effect on the human population is yet to be determined. Finally, Captain Charles Moore, founder of the Algalita Research Foundation, recently discovered a floating plastic rubbish patch in the South Pacific that is estimated to cover an area of around a million square miles.

### Artificial intelligence

Will we be destroyed by the machines that we create to make our lives easier? We are close to having machines that can move far better than we can. They will be impervious to toxins, able to eat non-living materials, capable of producing copies of themselves. Eric Drexler, author of *Engines of Creation*, imagined a world where universal assemblers, tiny machines that can build objects atom by atom, would do everything from clearing capillaries to scrubbing the environment. But he also proposed a "gray goo" scenario: what might happen if nanotechnology was used to build uncontrollable self-replicating machines with artificial intelligence (AI) that focused on the practical and rational rather than the artistic? The question of whether AI will demonstrate consciousness, sentience and sapience is controversial and still vexes researchers as the definitions for these terms are not yet universally or formally defined.

Some scientists are worried that the development of AI is too rapid and that it may gain some motivation that only supremely intelligent beings can understand. It certainly wouldn't take much for it to decide that perhaps humanity is in its way. Just as worrying is the issue of whether AIs might start to show human-like mental disability.

### This is the end

These examples illustrate the compound challenges humanity faces during the 21st century, and the need for cross-cutting solutions. The evidence is overwhelming and cannot be denied by rational people. Resources are finite, and the global increases in population, consumption, and gross domestic product is causing concerns about the sustainability of the current and future use of the planet.

All life on Earth is mired in a toxic swamp of 250 billion tonnes of annual chemical emissions from human activity. It is in our food, our water, the air, in wildlife, the oceans, our bodies and all around us. In 2013 Professor Stephen Hawking said that "humanity would likely not survive another 1,000 years without escaping beyond our fragile planet".

There is an answer, but not an easy one. Most people are so preoccupied with economic status, social rank and cultural identity that they ignore the planet and the systems of nature that sustain us all. We need to understand that we are a living part of nature, and that to cleanse our poisoned planet we need to co-operate and share knowledge on a global scale. Many groups are starting to promote a new human right: not to be poisoned. In 1969 Zagger and Evans' hit song *In the Year 2525* reflected the concern: "Now it's been 10,000 years, Man has cried a billion tears, For what, he never knew, Now man's reign is through." Hopefully this will not be the epitaph for humanity. **BMS**

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