

Editorial

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The fact that our mother Earth faces an environmental crisis is indisputable. We can debate till we are blue in the face about how much of this is man-made and how much is natural, but we cannot run away from the fact that our usage of natural resources is not sustainable. Earth just cannot support 6.5 billion (and counting) human beings. It is no wonder that all our resources, from water to petrochemicals, are being depleted at an alarming rate. Water tables, laid down over thousands (if not millions) of years, are fast disappearing. Mountain glaciers, the source of many rivers and storehouses of fresh water, are receding within the lifetime of a sherpa. Traditional fisheries are disappearing so fast that fishermen have to venture farther and farther out for ever-smaller catches. Many staple fish species have become extinct in their catchment areas. Our current method of agriculture is able to feed an ever-growing population because of its unsustainable use of petrochemical-based fertilizers. Once petrol supplies disappear, we are certain to face mass starvation. Coral reefs, built slowly over millions of years and which act as natural barriers against coastal erosion, are dying because global warming has caused sea temperatures to rise. The vast ecosystem of plant and animal life supported by the reefs is dying with them. Global warming is also causing the polar ice-caps to melt and further raising the sea level. This spells doom for many island nations (e.g., Maldives) and coastal countries such as Bangladesh which are almost entirely below sea level.



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A recent study has shown that the next big mass extinction is already upon us, and it is almost certainly caused by human action. Mass extinctions have occurred several times in Earth's history, with the most significant one occurring about 250 million years ago (Permian–Triassic boundary) when about 96% of all marine species and about 70% of land species (including insects) became extinct. But all of the previous ones have been caused by natural events (e.g., meteor impact, basaltic lava outflows); the current one will be the first time that a species that is part of the same ecosystem has caused it. Most mammalian species have a lifespan of a million years before they go extinct, but several have gone extinct in recorded human history lasting only a few thousand years. And, since modern humans are less than 100,000 years old, we will be the first mammalian species to become extinct in such a short time!

The amazing thing is that our mother Earth has recovered quite spectacularly from these past extinctions, so there is no reason to doubt that she will not recover from the present human-



caused one. Unfortunately, it is quite likely that we will not be around to see this recovery. Unfortunate because humans are the first species to have received from evolution the gift of *consciousness* – the mental awareness of our own existence and the ability to foresee the dire consequences of our actions. Earth is being constantly churned by volcanic eruptions that bring molten rock from the mantle to the crust. In some sense, this is “new” Earth because it wipes out completely what was there before. Such new Earth (e.g., on the side of a volcanic mountain) teems with life within a couple of years. It is thus likely that we cannot do anything to harm the Earth on its timescale of millions of years, but we can certainly do damage on human timescales of a hundred years, and kill ourselves in the process.

Our current non-sustainable lifestyle is almost completely driven by petrol and fossil fuels. From our energy needs to automobiles to agriculture, we cannot live without them. That is the underlying cause for all our modern wars, driven by the need to control the oil fields and thus the economy of the world. In less than a hundred years, countries in the middle east have become rich because they are sitting on vast reserves of oil. But once the oil wells dry up, nobody will care about Iraq or Kuwait, or whether they are ruled by dictators or democratically elected leaders. In fact, it is almost certain that future wars will be fought over *water*. Humans can and will learn to survive without fossil fuels, but we cannot survive without water.

If there is a silver lining to a war effort, it is that the needs of war often bring out the best in human ingenuity. A prime example is the Radiation Laboratory (aka Radlab) at the Massachusetts Institute of Technology set up to help with wartime communication. Out of its portals came the father of information theory, Claude Shannon. Many other luminaries worked there, including Robert Dicke, the scientist featured in this issue. Dicke worked on the development of radar and designed the Dicke radiometer, a microwave receiver that was instrumental in the discovery of the cosmic microwave background radiation. He was an accomplished experimentalist, exemplified by his development of the lock-in amplifier, an indispensable tool for research in science and engineering. At the same time, he was a great theorist, formulating the Brans–Dicke theory of gravitation as an alternative to general relativity. He was also a great believer in Mach’s principle for the origin of inertia, as seen in the Classics article reproduced from the *American Journal of Physics*. Prof. Jayant Narlikar, himself a Machian and renowned science communicator, has also written a pedagogic account of Mach’s principle in this issue. Dicke could write a book on how to miss a Nobel Prize – he deserved but missed it on several occasions as shown in the Article-in-a-Box. His seminal contributions to atomic physics appear in a separate article. Dicke was a physicist par excellence of the last century. Let us hope we don’t need another war to produce one like him!

