

Jules Pretty ponders both the past and the future of the Earth's atmosphere

Man's history of fuelling changes

Pause before you eat that sandwich or pop to the pub for a pint of best. You just changed the climate. Particularly if you care to drive rather than walk, or leave the heating on at home. But before this industrialised age of excess fossil fuel burning, the effect of agriculture on the climate appears to have been more significant than previously supposed. For most of human history, we had only a benign effect on the climate. With the advent of agriculture some 10,000 years ago, however, forests were chopped down for fields (releasing carbon dioxide) and irrigated rice increasingly cultivated (releasing methane). Both were enough, it appears, to have prevented an ice age that should have happened, and set the scene for our more recent and extreme folly of massive carbon releases to the atmosphere. This is the subject of William Ruddiman's intriguing and provocative new book. Intriguing as the evidence seems to fit his hypothesis first proposed in 2003; and provocative as both contrarians and environmentalists have used his arguments to support their current positions.

We have become increasingly aware in recent years that organisms and their environments are tightly coupled and evolve as single systems. It was James Lovelock in the 1970s who first proposed that organisms are not independent of the evolution of their material environment, and who showed that life on this planet changed the chemical composition of the earth.

Known as the Gaia Hypothesis, it was given a wide berth by many for its apparent anthropogenic framing, though Lovelock himself never suggested there was an invisible hand directing the planet's evolution. What has since become accepted is that without life, this planet would be more like

Venus or Mars, with atmospheres rich in carbon dioxide, low in nitrogen and oxygen, with no methane, and extreme surface temperatures (either very hot or very cold). All forms of life have, however, modified their physical and chemical environments, making them in turn more amenable to life. The earth has evolved with life, and lately with humans.

Ruddiman's many layered book builds on this idea of shaping and self-shaping with his hypothesis of early human effects on the climate. For several million years, our Stone Age predecessors left no permanent footprint on the landscape. Culture began to develop from about 50-100,000 years ago, with the advent of tools, ritual burials, art and jewellery, and with these we began to spread across the globe. Many large animals disappeared, including the woolly mammoth, ground sloth, giant beaver and mastodon. Then domestication of plants and animals gave a boost to civilisations worldwide, and caused the retreat of forest frontier with its locked-up carbon. Later, rice and irrigation

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By William F. Ruddiman

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spread across Asia, boosting methane emissions. As a result, a glaciation was delayed, and may forever be so with our additional modern effects on the climate. It all seems so straightforward, and Ruddiman himself notes that scientists themselves said "damn, why didn't I see that?" when they first saw the evidence and its fit with human history. But here lies the problem.

The evidence for changes in atmospheric composition of greenhouse gases has to fit in the right places with significant changes in human history. And too often, it looks like the history is being squeezed to fit the hypothesis. Take the disappearance of those large animals in the Americas about 12,000 years ago. Some 33 genera did indeed die out over a period of about 1,000 years, and this Pleistocene extinction episode may have been caused by humans arriving on the continent. But not if humans actually arrived tens of thousands of years earlier, for which there is growing evidence. What of the spread of irrigated agriculture? Did it really start at the right time, and then spread suffi-

ciently quickly to boost methane levels in the atmosphere? What of the role of ruminant livestock, which get little mention in this book?

There are other problems. Ruddiman sprinkles the text with many loose references to the "primitives" of the Stone Age, with little feel for how hunter-gatherers generally manage their resources with care and longevity. The use of anthropocentric language grates at times, with statements like "nature in control of climate", rather than expressions of climate as an emergent property of whole systems. The discussion on global change science and politics is also disturbingly revealing. For statements like "I do not rank the oncoming global warming as the greatest environmental problem of our time", Ruddiman has been adopted by the contrarian movement, yet there should be little here to support their extreme positions. Indeed, he makes clear his opposition to their one-sided propaganda, yet also condemns all green groups as environmental extremists. Ruddiman naïvely hopes that "both the environmental and (especially) the industry extremists should leave the scientific process alone". If it is a topic relevant to the future of humankind, and at the same time threatens the self-interest of the powerful, you cannot expect a quiet life.

None of this, though, should distract us from one basic truth. Future climate change is already likely to be large, and if everyone in the world aspires to consume at the same levels as those of us in industrialised countries, and particularly in the US where consumption is already a fine art, then we are all in trouble.

Jules Pretty is professor of environment and society, Essex University.