

Review of Dr. Rao's position paper on Animal Agriculture as the leading cause of climate change.

Abraham H. Oort, July 20, 2023.

There is the question when to start the Anthropocene epoch, the epoch that men has been drastically affecting the Earth's geology and ecosystems, including climate change. Did it start ten thousand years ago or only centuries ago? This is an important issue since the choice may determine not only the causes of the changes but also what may be the solution for the near future of humanity.

In his thorough studies* of the earth's biosphere, Sailesh Rao, an electrical engineer from Stanford University, has made a clear case that we should start the Anthropocene epoch many thousands of years ago and not centuries. Looking at Rao's recent diagram of the human impact on the biosphere and ecosphere, we see that since the last glaciation, twelve thousand years ago, humans have had a significant impact on the ecosphere and on the production of radiative gases in the atmosphere.

It may be painful to look at the two principal impact factors since they are 1) the "killing" phase and 2) the "burning" phase. We can see these two factors clearly in North America when it was first populated by the immigrants crossing the land bridge between Eurasia and North America. The immigrants found wild animals that easily could be killed for food. With time, people were able to domesticate many wild animals, and to breed cows, horses, and sheep for labor and food. To create enough space, trees had to be cut and/or burned to provide housing for the people and grazing of the domesticated animals and, of course, for growing food for people and animals.

More recently during the industrial revolution since about 1750, another factor became more significant, the exploitation of oil and gas—the fossil fuels that had to be removed from deep under the Earth's surface. Finally, there was the development of nuclear and fission energy, attempting to harness the energy of the sun.

But what has happened with the energy and greenhouse gases created by humans during the thousands of years? During the early years, there was a close balance with only a tiny residue of net heating of the Earth's system—almost negligible but not completely. It is known that the earth has gone through regular cycles of

glaciation and interglacial periods. It is speculated (in the *Gaia* hypothesis) that the tiny residue of heating has been used to prevent another glaciation during the Anthropocene. Later the small residue was used to cause slow melting of the continental glaciers and gradual heating of the oceans.

The balance worked out reasonably well until the industrial revolution, when huge amounts of heat were added in a very short time (decades rather than millennia) to the system. So now in the 21st century we are presented with the “bill”-- the alarming rate of not only melting of the arctic sea ice and the Antarctic ice cap, the heating of the oceans, but also the global warming of the atmosphere itself, where we humans live. It is clear that things are now deeply out of hand.

Is there a solution? It much depends on our perspective. If we only look at the last two hundred years, we would say stop taking oil and gas out of the Earth and the problem would disappear. It would stop this source of pollution of the atmosphere, removing the CO₂ input due to the burning of oil and gas. This is the approach given in the UN IPCC panel reports and is promoted by the various world governments, 350.org, and Vice President Al Gore. But the biosphere would still be out of balance and, unfortunately, not much would change. The global warming of the atmosphere would continue unlimited. After studying Rao’s position paper and accepting his long-term approach, I agree with Rao that animal agriculture is the most important factor in the generation of greenhouse gases in the atmosphere.

From my perspective as a physicist, it is clear that there is a potential solution but only when we stop the burning and killing phase. The burning can be stopped when we convert the large areas of the globe (more than 40% of the habitable land) used for grazing animals and providing animal food, and instead start planting many, many trees and rewilding the land. The killing of animals used to create food for humans is not necessary. If we look at human health, a plant-based diet will create better health both physically and mentally.**

Becoming largely vegan and planting trees will be the only feasible solution to save our civilization.

* Sailesh Rao, *Carbon Dharma: The Occupation of Butterflies, and Carbon Yoga: The Vegan Metamorphosis*.

** , Campbell, T. Colin, 2020: *The Future of Nutrition*, BenBella Books, Inc., Dallas, TX.