

HEATED DEBATE

By BHUWAN PRASAD

Graduate student questions the science of global warming

GLOBAL WARMING HAS NEVER BEEN A HOTTER TOPIC. AND SINCE CANADA HAS BECOME the 99th country in the world to ratify the Kyoto Protocol (aimed at reducing greenhouse gas emissions by up to 30 per cent) the debate has only heated up. But what exactly is global warming? From the beginning, the planet has experienced natural cycles of warming and cooling over geological time scales. Under this background, are we presently undergoing such a cycle of warming? If so, how do we know whether the warming is natural or manmade? Where does our information come from and how reliable is it? And why are there such widely differing views on whether the current warming is fact or myth?

Like glass in a greenhouse, certain gases occurring naturally in the atmosphere tend to trap the heat of the sun. The air that makes up our atmosphere consists primarily of nitrogen and oxygen molecules while a large number of trace gases like carbon dioxide and methane (so-called "greenhouse" gases) make up the rest. These gases absorb a significant portion of the heat radiated by Earth and prevent it from escaping into outer space. This natural greenhouse effect keeps Earth's temperature at a comfortable 15 degrees Celsius. However, in general, global warming is understood as an average increase in Earth's temperature, which in turn causes changes in climate including rainfall patterns, sea level change and a wide range of impacts on plants, wildlife and humans.

Carbon dioxide generated by the burning of fossil fuels is responsible for about half the increase in the greenhouse gases. Other gases (such as CFCs, methane, nitrous oxide, tropospheric ozone, etc.) are responsible for the rest. There seems to be no dispute that increased levels of these gases are due to humankind's explosive population growth over the last century, increased industrial expansion and massive deforestation. Approximately 80 per cent of atmospheric carbon dioxide increases are due to the use of fossil fuels — oil, coal and gas. Since 1945 petroleum consumption has increased dramatically, mostly due to increased automobile use and the substitution of machines for animal power.

However, most of the debate is mainly over two issues: Is global warming taking place at all? And if so, is it due to an increase in greenhouse gas emissions from manmade sources or are other factors responsible?

Whether or not the planet is warming depends largely on the time period considered. As noted above, the planet has experienced numerous warming and cooling trends throughout its history. If we begin measuring from the 16th century, for example, then global temperatures have decreased. If, however, the starting point is the middle of the 19th century at the conclusion of the "little ice age," then the planet has warmed by roughly 1.5 degrees. But there is little evidence that this warming trend has continued appreciably over the past 50 years.

According to climate models used by the United Nations Framework Convention on Climate Change, global mean temperatures were supposed to have risen by 0.3 degrees per decade but no such warming has occurred, forcing modellers to consistently revise their projections downward. In order for a climate model to be credible, it must be able to reliably "predict" current climate. A 1994 article published in *Science* noted that "nearly everybody cheats a little" by manipulating their models to make them agree with today's temperatures. Therefore, the predictions from such climate models are largely flawed.

On the other hand, the American National Center for Atmospheric Research developed a climate model in 1977 with a holistic approach where such "cheating" was apparently avoided. This model projects that doubling of carbon dioxide levels would raise global temperatures by just two degrees, much less than anticipated.

Modest climate variation like this is subject to some debate among climatologists. Certain scientists even argue that Earth is actually cooling off and that we may be on the verge of another ice age.

It is true that at present more scientists believe global warming is occurring, although the

rate of warming is widely debated. Even if this assumption were true, how responsible are the manmade emissions of greenhouse gases (mainly carbon dioxide)? Manmade sources account for only 0.2 per cent of greenhouse gases.

Moreover, it seems the role of carbon dioxide on the climate is not clearly understood, let alone the role of emissions of these gases by human interventions on the climate. Four hundred and forty million years ago, atmospheric concentrations of carbon dioxide were up to 10 times greater than current levels.

Based on climate models of the U.S. Intergovernmental Panel on Climate Change, the temperature during this period should have been between five and eight degrees warmer than today. Yet geologic evidence suggests that the period was in the grip of a major ice age, with temperatures five to 10 degrees colder than today, suggesting carbon dioxide levels are only one of many factors affecting global climate.

History similarly shows little solid connection between human emissions and climate change. Although Earth's temperature has increased by 1.5 degrees since the mid-1800s, two-thirds of this rise occurred before 1940 when carbon dioxide emissions from human activities, such as fossil fuel consumption, were still minimal. Further, according to the Worldwatch Institute, worldwide carbon emissions from fossil fuels reached an all-time

high in 1996 of 6.25 billion tons. If such emissions are responsible for global warming one should expect that the rise in human-generated carbon dioxide emissions would result in a corresponding rise in temperatures — they haven't. Despite a 19 per cent rise in such emissions since 1979, the planet temperature has cooled slightly (by less than one degree) over the past 18 years. Global warming — if it is indeed occurring — appears to be the result of a natural process rather than human activity.

A critical piece of information that is often ignored is that water vapour is responsible for the vast majority of all greenhouse warming in the atmosphere. Water vapour constitutes 98 per cent of the

greenhouse gases and if we know we cannot control it, how much effect can the other gases possibly have? Add to that the fact that the heat content of water in its gaseous state is far greater than the heat content of carbon dioxide in its gaseous state and we really have to wonder how much impact the non-water vapour gases can have. It is clear that the impact of the gases that can be controlled is minuscule — this alone should dispose of the global warming myth.

Moreover, the release of sulfur dioxide and different forms of particulate matter from power plants and other heavy industries produce an opposite effect to warming, thus cancelling the effects of greenhouse gases, particularly in the vicinity of large industrial areas where manmade greenhouse gas emissions are most significant.

There are other groups of scientists who believe that most changes are due to fluctuations in the energy of the sun. Large sunspot activity is thought to be partially responsible for the little ice age from 1450 to 1850. This well-documented climate change had many impacts on civilization in Europe, including famines, but the temperature fluctuation was minimal.

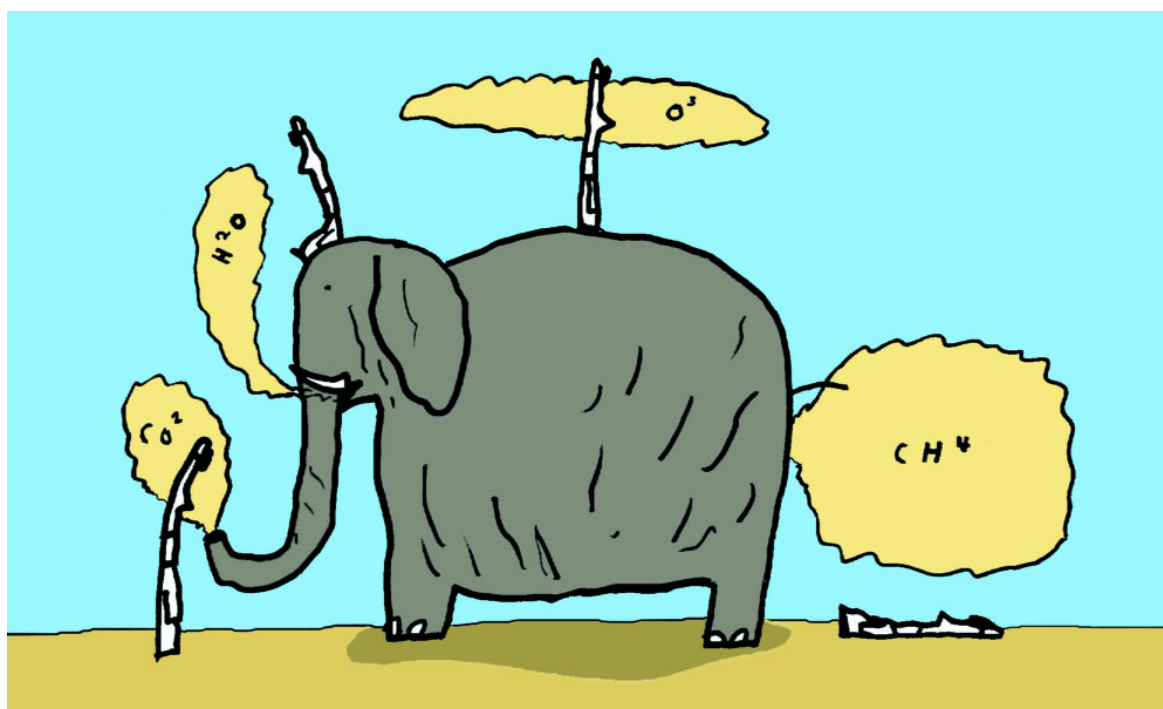
In fact, during the past 3,000 years there have been five extended periods when it was distinctly warmer than it is today.

A petition signed by over 17,000 scientists and circulated by the Oregon Institute of Science and Medicine, declared that there is "no convincing scientific evidence that human release of carbon dioxide, methane or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of Earth's atmosphere and disruption of the Earth's climate."

The issue of global warming reminds us of the famous fable of four blind men and the elephant — each man touching only one part of the elephant and thinking that his

own perception of the elephant was correct, which left everyone with a small piece of the picture but none with a holistic view. Similarly, it seems today's scientists are trying to build an overall perception of global warming based on a partial view of the true scenario — either blinded by preconceived notions or twisting deliberately to suit their hypothesis. Even if global warming is a problem, the role of the different elements in the complex system must first be understood in greater depth before any remedy is suddenly prescribed to solve this highly complicated system.

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HISTORY SHOWS LITTLE SOLID CONNECTION BETWEEN HUMAN EMISSIONS AND CLIMATE CHANGE