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## EDITORIAL RESPONSIBLE SCIENCE

Scientists who are aware of the potential and likely threats to the ecological survival of our world will be aware of the increasing concern about these major threats:

- the population pressure against finite and foreseen limited resources;
- widespread degradation of the environment through careless and inefficient use of technology, resulting in loss of soil fertility, pollution of the atmosphere, acid rain, increasing levels of atmospheric CO<sub>2</sub> and dust, heavy metal poisoning, etc;
- the threat of global extinction due to nuclear war (or use of other mass destruction technology).

In all these areas of concern, debates have arisen as to the reality of the predicted effects, the scale of their impact, the reliability of the data, the models and their predictions. Often a particular interest motivates people or groups to try to dismiss the concern, or to confuse the public with conflicting 'expert' statements and arguments. The result is that hazardous activities continue and grow. In many instances the scientific community has contributed to public confusion because of the way in which theories are put forward and the way in which we engage in objective, sceptical, critical analysis and refinement of the proposed theory or phenomenon. For healthy science this is an essential, creative and progressive activity. Since many scientists themselves are not cognisant of the need for this open, strong debate and take personal, emotive positions in response to the ideas or the criticism, it is not surprising that the public responds as it does with bewilderment and dismissal.

Further difficulty arises because of the extreme complexity of the systems involved in these massive issues, and the tendency of individuals to concentrate on specialist areas, looking only at part of the whole system or phenomenon. A case in point is the current debate about the potential for global climatic change due to the doubling of the atmospheric CO<sub>2</sub> content resulting from the combined effects of burning fossil fuels and the destruction of forests — see the book review by Sherwood B. Idso in this issue for example. Dr Idso has long experience in the area of infrared radiation and is eminently qualified to contribute to the debate on these effects. His recent book "Carbon Dioxide: Friend or Foe?" is well worth reading. He argues strongly, with some justification, that the observed mean hemispheric temperature changes (data which is actually used by the modellers who predict 2 to 4 °C global

mean temperature rises with a doubling of the CO<sub>2</sub> level) indicate far smaller temperature rises. He notes that in the Northern Hemisphere during the recent strong rise in CO<sub>2</sub> levels there has actually been a decrease in the mean temperature. He goes further to assert that there should be positive benefits due to enhanced food production with the rise in CO<sub>2</sub> because of evidence that many plants exhibit greater water-use efficiency and yield with CO<sub>2</sub> enrichment. Thus it is concluded that the increased release of CO<sub>2</sub> could alleviate the world hunger problem.

While in terms of some aspects of plant growth this is reasonable, I suggest that a broader view could well lead to significantly different conclusions. The generation of CO<sub>2</sub> and the destruction of forests is almost entirely the responsibility of people from developed countries (though it takes place around the world) who have shown almost total disregard for the world hunger problem and their contribution to it. It is also evident that systems currently being used to generate CO<sub>2</sub> (cars, power stations, factories, transport vehicles, heating systems, etc) are linked to pollution which has definite harmful effects on the local residents and the local environment. Recent reports (e.g. Nature, 23 August 1984) acknowledge the connection between UK coal-fired power stations and acid rain in Scandinavia. Effects of acid rain are being seen with wide-spread crop, forest and lake damage in many parts of Europe and North America. We are also aware of the non-renewable nature of fossil fuels being used as energy sources when they have a high potential value for other uses. We could well be judged by future generations as being extremely selfish and wasteful of these valuable resources which have taken the ecosystem hundreds of millions of years to produce.

Another product of the combustion of fossil fuels (and other human activities) is hundreds of millions of tonnes of smoke, dust and other particulates which are injected into the atmosphere each year. Although our contribution to the atmospheric aerosol content is estimated at around 28% of the total, natural sources such as volcanos and sea salt contributing large amounts, we can clearly see that human activity has *increased* the atmospheric particulate matter by about 39%. With increasing human activity the amount will rise, increasing the turbidity of the atmosphere and reducing the transmission of solar radiation. Measurable cooling of the surface climate has been observed following major volcanic eruptions. This lends weight to the nuclear winter hypothesis. It also suggests that increasing temperatures due to the 'greenhouse effect' of CO<sub>2</sub> are likely to be mitigated by the effects of increasing the atmospheric dust content. More work is necessary in studying global climate histories to determine whether it is likely that CO<sub>2</sub> is warming the world, or dust is cooling the world, or the fluctuations observed are occurring as part of natural variations in world climate which have been observed to vary by about  $\pm 0.5^{\circ}\text{C}$  over periods of centuries.

As scientists we have valuable skills and insights. Stand up, look around. Look at the complex world, with its many facets, phenomena and processes. We need to do all we can do to critically evaluate the data, synthesise an integrated view and understand and appreciate its implications for the health and survival of life on this planet, and to communicate to people the information we have about those things over which people have some control. This will not come about unless we can relate and debate within disciplines

and between disciplines, placing our work in the broader context of the complex physical, ecological and social global system, AND improve our communication with the public.

There is clear, objective evidence of the reality and the major characteristics of the prime threats to life on earth. Let what we know, and what is becoming clear, not be lost from our own and our communities' sight because of unnecessary confusion brought about either by too narrow a world-view or a misunderstanding about the process of scientific debate and knowledge refinement.

*Neil Cherry*