



**Messenger:** Robert May, president of Britain's Royal Society, continues to highlight the need for actions to curb greenhouse gas emissions.

atmosphere to avoid dangerous climate change. It suggested that the action plan agreed in Scotland in July "fell far short of a strategy to stop the rise in greenhouse gases in the atmosphere."

Frustration at the lack of action on climate change was expressed by John Lawton, head of Britain's Royal Commission on Environmental Pollution who, in the wake of hurricane Katrina, criticised US policymakers and told journalists he believed the hurricane was a sign of potential climate change.

May's letter also raises similar concerns. His letter says: "Although it is not possible to say that the destructive potentials of hurricanes Katrina, Rita and Wilma were greater because of global warming, a connection is likely and certainly cannot be ruled out.

"As long as greenhouse gas concentrations continue to rise, there is the very real prospect that the increase in aid agreed at Gleneagles will be entirely consumed by the mounting cost of dealing with the added burden of adverse effects of climate change in Africa. In effect, the Gleneagles communique gave hope to Africa with one hand, through a promise of more aid, but took that hope away with the other hand through its failure to

address adequately the threat of climate change."

It adds: "Therefore, if the increase in aid and other measures outlined in the Gleneagles action plan on Africa are to create maximum benefit, they must be accompanied by effective action on climate change by stopping the inexorable rise of greenhouse gas levels in the atmosphere."

The letter draws attention to a collection of 17 scientific papers, also published last month, which examine the impact of climate change on crops. It highlights a paper that concludes that rising sea surface temperatures in the Indian Ocean are responsible for a drop in rainfall in Ethiopia since 1996.

The letter points out that that the \$200 billion estimated cost of dealing with the impacts of hurricane Katrina is equivalent to 1.7 per cent of the gross domestic product of the United States, compared with estimates that it would cost no more than one per cent of GDP for the country to meet its target under the Kyoto protocol. It concludes: "Clearly dealing with even some of the consequences of climate change, such as more destructive hurricanes, looks more costly than taking measures to reduce greenhouse gas emissions."

## Biologists' alarm bells ring louder

A new study suggests that food security may be under greater pressure from climate change. **Nigel Williams** reports.

Much research on climate change suggests a negative impact on many current natural and agricultural ecosystems. But one possibly positive impact has been that excess carbon dioxide and moderate rises in temperature in the atmosphere may boost some crop yields.

Evidence has largely derived from greenhouse experiments or other studies under enclosed conditions and predictions of yield for the globe's major grain and legume arable crops suggest that production may increase somewhat in the temperate zone, but decline in the tropics. In total, global food supply may show little change. This prediction comes from inclusion of the direct effect of rising carbon dioxide concentration, which significantly stimulates yield by decreasing photorespiration in C3 crops and transpiration in all crops.

Evidence for a large response to carbon dioxide has largely been based on studies made within closed environments and on small scales, which would, however, be considered unacceptable for standard agronomic trials of new cultivars or agrochemicals. Yet many predictions of the globe's future food security are based on such information.

But a new report by Stephen Long and colleagues from the University of Illinois and the United States Department of Agriculture Research Service at Urbana, published in the *Philosophical Transactions of the Royal Society B*, describes a study of plants growing in the open but subject to varying concentrations of greenhouse gases.

The apparatus used by the team comprises a circular or octagonal series of pipes that release the treatment gas, or air

enriched with the treatment gas, just above the top of the crop canopy, and for tall canopies greater than one metre, at one or two additional heights below the canopy. Wind direction, wind velocity and carbon dioxide and ozone concentrations are measured at the centre of each plot and this information is used by a computer-controlled system to adjust gas flow rate to maintain the target elevated carbon dioxide and ozone levels.

Although elevated tropospheric ozone concentrations have been recognised as a factor lowering the yields of the major food crops since the 1970s and 1980s, the major current projections of global food production under atmospheric change scenarios do not account for the damaging effect of rising ozone levels, the authors believe. In industrialised countries of the Northern Hemisphere, tropospheric ozone has risen 1-2 per cent per year, over recent years. Although the risks of acute ozone exposure

around large cities are well known, "it is often not appreciated that background ozone has been rising in rural areas, distant from centres of industrialisation," they say. Tropospheric ozone forms as a result of the action of sunlight on polluted air masses containing nitrogen oxides, hydrocarbons and carbon monoxide and such polluted air can travel for great distances away from its source.

Experiments with rice, wheat, maize and soybean show smaller increases in yield than anticipated from studies in enclosed conditions, the team found. Experiments with increased ozone show large yield losses (20 per cent), which are not accounted for in projections of food security. "These findings suggest that current projections of global food security are overoptimistic", the authors report.

"The fertilisation effect of carbon dioxide is less than that used in many models, while rising ozone will cause large yield



**Signed up:** Paul Martin, the prime minister of Canada, will head new talks on greenhouse gases. (Picture: EMPICS.)

losses in the Northern Hemisphere." But the interactive effects of carbon dioxide, ozone and temperature have yet to be studied. "Without more extensive study of the effects of these changes at an agronomic scale in the open atmosphere, our ever-more sophisticated models will continue to have feet of clay," they believe.



**Enclosure:** Experiments inside looking at the effect of changes in greenhouse gas concentrations that suggest possible increases in productivity may have failed to reveal what might be the case outdoors. (Picture: Maximilian Stock Ltd/Science Photo Library.)