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World at a tipping point

Human activities – largely resulting from our reliance on fossil fuels and industrialised forms of agriculture – have now reached a magnitude that may trigger irreversible environmental change to the planet. It has become critically important to define what levels of human-caused change are 'safe' and which are 'unsafe', and to stay within these boundaries to ensure continued social and economic development.

In a paper published this month in the prestigious journal *Nature*, 28 of the world's leading environmental scientists conclude that humanity needs to act now to avoid threats to human well-being caused by irreversible damage to the Earth, its climate, natural resources and life-supporting systems.[1]

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The scientists propose a safe upper limit of 350 parts per million (ppm) of CO_2 in the atmosphere – a level already exceeded since 1987. The researchers also propose that safe boundaries be set for other critical planetary systems. As a starting point they propose ten boundaries which should not be exceeded to avoid crossing dangerous tipping points. These include the rate of species extinction, the amount of nitrogen and phosphorus in fertilisers, use of fresh water, the clearing of land, ozone depletion, aerosol pollution of the atmosphere and chemical contamination.

They caution that transgressing a safe boundary of 350 ppm for atmospheric CO_2 for too long will increase the risk of dangerous climate change, including the loss of major ice sheets, accelerated sea level rise and abrupt shifts in coral reef, forest and agricultural systems.

The increasing level of CO_2 in the atmosphere and ocean has already caused major damage to coral reefs worldwide over the past 25 years. Allowing it to increase to 450 ppm or higher would be hugely irresponsible and detrimental to millions of people in developing countries who depend on coral reefs for food security and their livelihood.

Man-made climate change is now beyond dispute, and in the run-up to the UNFCCC climate negotiations in Copenhagen in December 2009, international discussions on targets for climate mitigation have intensified. A consensus is building on trying to contain the rise in global mean temperature to no more than 2 °C above the pre-industrial level, on top of the 0.7 °C rise that has already occurred. Business as usual, leading to a doubling of atmospheric CO_2 compared to pre-industrial levels, is likely to cause a catastrophic increase of 6 °C. According to the latest IPCC data on climate change so far, we are now tracking closely along this worst-case scenario.

In a second paper, a Policy Forum published in *Science* this month, an international team of economists and scientists argue that coping with global changes requires new institutions and a global governance system that is currently missing.[2] Energy, food and water crises, climate change, declining world fisheries, emerging diseases and antibiotic resistance are all examples of intertwined global challenges that are outpacing the capacity of existing institutions.

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While there are signs of emerging global action on issues such as climate change, there is widespread inaction on others, such as the destruction of the world's forests to grow biofuels or the emergence of pandemic flu through lack of appropriate animal husbandry protocols where people, pigs and birds co-mingle.

The threat of climate change to coral reefs, for example, has to be tackled at a global scale. Commonwealth and State efforts to save Australia's Great Barrier Reef will inevitably fail unless there is a global solution to global warming and ocean acidification. We need to choose between cheap and dirty energy versus more expensive greener alternatives that won't destroy the world's coral reefs.

The *Science* paper acknowledges that the main challenge is getting countries to agree to take part in global institutions that are designed to prevent destructive human practices.

This would involve all countries drawing up standards designed to protect the earth's resources and systems, to which they would then feel obligated to adhere. They conclude that to address common threats and harness common opportunities, we need greater interaction amongst existing institutions, and new institutions, to help construct and maintain a global-scale social contract.

The institution of the nation-state has undoubtedly helped to improve the average well-being of people, but at the cost of reduced global resilience caused by the demands and activities of more and more people who are increasingly affluent. Better designed, global-scale institutions are urgently needed such that countries are better off participating than not participating. The major powers must be willing to enforce agreements – but legitimacy will depend on acceptance by numerous and diverse countries, and non-governmental actors such as civil society and business.

[1] *Rockström, J., et al. (2009) Planetary Boundaries: A Safe Operating Space for Humanity. Nature 461, 472-475.*
[2] *Walker, B., et al. (2009) Looming global-scale failures and missing institutions. Science 325: 1345-1346.*