

Climate change – transitions, tipping points and typhoons

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As I write Hurricane Florence is approaching the east coast of the US. Here is a storm out of the ordinary. It is most uncommon for such a powerful hurricane to reach so far north. The projected rainfall (up to 1.2 meters) is unprecedented. The tidal surge, which may be as high as 5.5 metres, has been experienced only twice since 1851. On no other occasion has a hurricane combined all these features.¹

Florence may turn out to be less severe than forecast. But it is a sign of the new times, an era in which climate change is super-charging familiar threats and delivering novel risks. On the other side of the continent, there are wildfires burning in the northern forests, hotter and wider and more prolonged than previously. The smoke from the fires caused Vancouver authorities to issue air alerts throughout July and August and cancel outdoor events because of health concerns. But it is not just the immediate effects that are important. The extensive fires that now occur in the far north each year might trip a switch. The enormous boreal forests may flip from being a net carbon sink to being a net carbon source. In this setting the greenhouse emissions from combustion exceed the capacity of a disrupted biome to take up carbon, accelerating warming and further promoting fire risk.

This is the theme of what may be the most important scientific paper of the year, by Will Steffen from the Australian National University and colleagues.² Published in July, this paper describes the ways in which human activities now overwhelm the planet's natural systems, and the prospect of "self-reinforcing feedbacks" that drive the Earth onto unexpected and dangerous trajectories. They identify fires in the far north as one possible "tipping cascade". Other examples include the die off of ocean coral, melting of ice sheets in the Antarctic and Greenland, and destabilisation of the El Niño Southern Oscillation. Just when these tipping points will occur is uncertain. Steffen et al refer to climate models, paleo-climate data and recent experience of the impacts of climate variability, and they conclude that a potential planetary threshold could be crossed at around 2 degrees Centigrade of global

average warming above pre-industrial. In this case, the world might move abruptly to a zone that was never experienced before and is profoundly hostile to human well-being.

Here is one more reason to increase our ambition with climate change mitigation, and to take seriously the goal of holding global warming to no more than 1.5 degrees. The small island states, including Pacific nations, were instrumental in the negotiations for the Paris climate accord, when a 1.5 degrees goal was added to the final document. Signatories agreed it was necessary to "keep a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees".³

The 1.5 degrees goal is important for the Pacific because those who live in this region are in many respects highly vulnerable to even moderate shifts in global climate. Small low islands, especially those in the tropical cyclone belt, which rely on local food sources, with limited supplies of fresh water, are amongst the first to be affected by increased storm activity, rising sea levels, changing rainfall patterns and the damaging effects on local ecosystems of warmer, more acid oceans. If the world moves onto a "Hothouse Earth" pathway, as Steffen et al outline, then the impacts on communities across the Pacific could be devastating.

We saw an example of the impacts on health of extreme weather events in last year's hurricane season in the northern hemisphere. Hurricane Maria was a category 5 storm (the most severe category) that caused severe damage to Puerto Rico and the Dominican Republic. Estimates of the excess deaths in Puerto Rico related to the hurricane are in the order of 3000-4500.^{4,5} Most of the deaths were not immediate, but occurred in the weeks and months after the hurricane. They resulted from the breakdown of essential services such as power, transport and health care, and the very slow recovery of normal operating conditions. Most at risk were the elderly and

people with chronic life-threatening conditions such as diabetes and cardiovascular diseases.

Every super-destructive hurricane sends a message to the high consumption countries that bear the heaviest responsibility for climate change. Mitigation, primary prevention in public health terms, is essential, and while the Paris Accord points in the right direction, its goals and time-scale are too modest.

In the Pacific the threat of climate change is a very good reason to invest more heavily in health systems and public health. Disaster preparedness, secure supply chains, safe location of hospitals and health clinics, robust vector control programmes, information systems that are backed up and accessible in all conditions, these are just some of the elements of resilience in the face of natural disasters. But improvements of this nature have an immediate pay off also. Appreciating the new world of climate change, and making changes necessary to limit casualties, will strengthen health care and deliver co-benefits immediately.

REFERENCES

1. Climate change washing away the world we once knew. NZ Herald 14 September 2018
2. Steffen W, Rockstrom J, Richardson K et al. Trajectories of the Earth System in the Anthropocene. PNAS 2018;115:8252-8259
3. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
4. Kishore N, Marques D, Mahmud A et al. Mortality in Puerto Rico after Hurricane Maria. NEJM 2018;379:162-170
5. <https://gwtoday.gwu.edu/gw-researchers-2975-excess-deaths-linked-hurricane-maria>