Cawthron Annual Lecture

Taking it back: Removing CO_2 from the atmosphere to limit climate change

Prof. Gideon Henderson, University of Oxford

Most future energy/climate scenarios that meet the 2°C warming target agreed at Paris, and all of those consistent with 1.5°C warming, required humans to remove greenhouse gases from the atmosphere as well as making stringent cuts to emissions. Greenhouse gas removal (GGR) at the scale of hundreds of billions of tonnes of CO_2 will be challenging, but we must learn how to achieve this quickly if we are to avoid dangerous climate change.

The UK government asked the Royal Society to assess the various methods by which large scale GGR might be achieved. I chaired the resulting report, published in 2018. In this lecture I will summarize the findings of the report, update them with scientific and political changes since publication, and discuss some of my own thoughts and research in this subject.

A broad range of methods for GGR have been suggested. To be successful, these need to both remove CO_2 from the atmosphere, and then store is securely. The removal can be achieved by accelerating biological processes (e.g. growth of plants), by accelerating natural inorganic reactions, or by directly engineering removal by chemical processes. I will describe all three approaches, including those that accelerate inorganic reactions such as enhanced weathering of silicates on land, and addition of alkalinity to the oceans. How do these approaches work in theory? Will they still work at large scale to consume significant amounts of CO_2? What are the environmental consequences if we pursue them at such scale? And what are the social, political and economic limitations on their pursuit?

There is a clear need for GGR to control climate. This need will only become greater as emissions and climate change continues. Researchers with diverse expertise must mobilize to assess how best to achieve this removal, including Earth and environmental scientists who understand the complex network of processes that operate on our planet's surface.

Professor Henderson