Radical carbon dioxide removal projects could be a risky business

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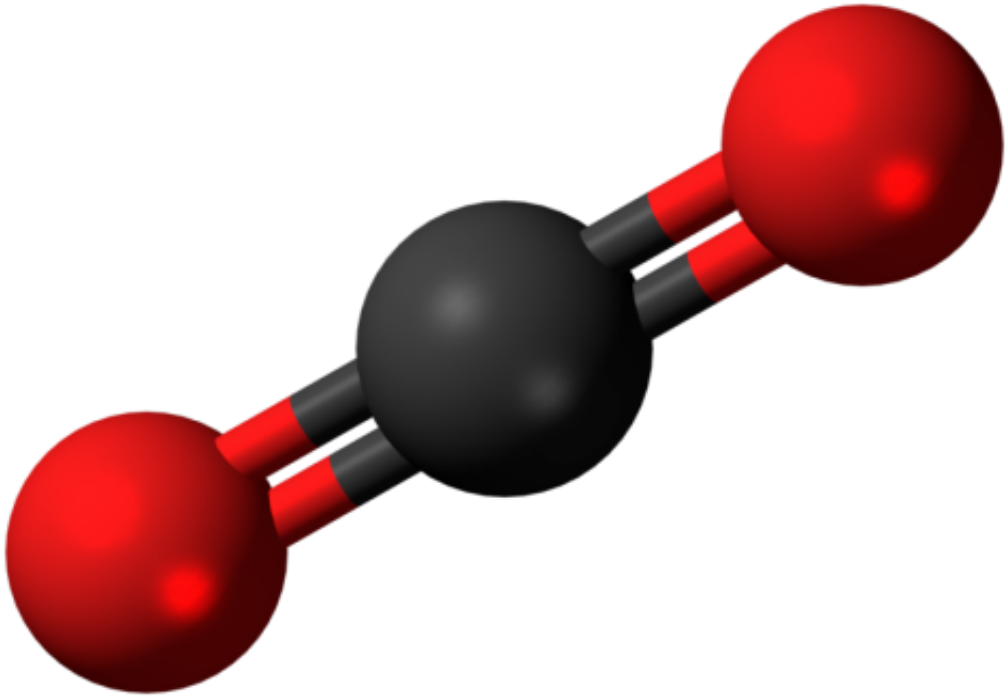

Ball-and-stick model of carbon dioxide. Credit: Wikipedia

Radical new ways of removing CO2 from the atmosphere could prove to be a risky business—according to an environmental scientist at the University of East Anglia.

Techniques put forward include growing crops to be burned in power

stations, large-scale tree plantations, adding biochar to soil, adding nutrients to sea water to boost plankton and seaweed, and using chemicals to extract CO2 from the atmosphere—to be buried deep underground.

But a comment piece published today in *Nature* shows that most, if not all, of these methods pose environmental risks—and that much more research is needed before the wheels are set in motion on global-scale 'climate geoengineering' schemes.

The paper's author, Dr Phil Williamson, employed by the Natural Environment Research Council at UEA's School of Environmental Sciences, said: "In Paris, world leaders agreed to limit the increase in global average temperature above pre-industrial levels to well below 2°C—and preferably below 1.5°C.

"But unless a lot more effort is made to cut carbon emissions, by the UK and other countries, we will have to work out how to safely remove very large amounts of CO2 from the atmosphere.

"The aim is to have a balanced global carbon budget. For that to work, from now on we have to think of matching the addition of greenhouse gases to the atmosphere with their subsequent removal.

"Climate modellers estimate that as much as 600,000 million tonnes of CO2 may need to be extracted from the atmosphere by 2100 to deliver the main goal of the Paris agreement.

"If rapid cuts are not made, then significant CO2 removal will need to begin in less than four years—with up to 20,000 million tonnes removed each year by 2100 to keep the global temperature increase well below 2°C.

"But removal will be expensive, and is currently unproven at the scale needed—so it would be much better to reduce emissions as rapidly as possible."

A variety of schemes have been proposed to remove carbon from the atmosphere, including:

- Growing bioenergy crops to be burnt in power stations, with the resultant CO2 captured for secure long-term storage underground.
- Large-scale tree plantations to increase the natural storage of carbon in biomass and forest soil.
- Restoring saltmarsh and mangrove habitats which have high potential for carbon storage.
- Adding biochar (carbon from partly-burnt biomass) to millions of hectares of soil.
- Fertilizing the oceans to increase the growth of plankton and seaweed—capturing CO2 from the atmosphere by their increased photosynthesis.
- Adding crushed silicate rocks to the Earth's land surface to chemically absorb CO2.
- Using chemicals to extract CO2 from the air, and storing it deep underground in a liquid state.
- Treating clouds to produce alkaline rain which would react with and remove atmospheric CO2.
- A massive increase in the use of straw and timber as building materials to remove carbon from the atmosphere for centuries.Dr Williamson said: "Many CO2 removal techniques have been proposed. But whether any of them could work at the scale needed to deliver the goal of the Paris agreement remains to be seen.

"Crucially, large-scale CO2 removal, by whichever means, will have knock-on effects for ecosystems and biodiversity. There could be benefits, but damage seems more likely.

"For example, the amount of bioenergy crops we would need to grow could use up to 580 million hectares of land—or half of the land area of the US. This would in turn accelerate the loss of forests and natural grassland with impacts for wildlife, whilst also having implications for food security.

"As well as this, very little is known about the effect of future climatic conditions on the yields of bioenergy crops. For example, we don't know what the water requirements of these crops might be in a warmer world.

"It's also important to think about the financial costs of these ideas. For example, adding enough crushed silicate rocks to the soil, over almost half of the Earth's land surface, could cost up to $600 trillion.

"The crucial thing now is that governments and other funding agencies need to invest in new research to investigate the viability and safety of the 'emit now, remove later' approach. Some of the proposed CO2 removal schemes might provide a win-win for climate and the environment; others might be lose-lose. Present climate policy assumes that one or more of them will work at the scale required, yet we just don't know if that is the case."

'Scrutinize CO2 removal methods' is published in *Nature* on Feb. 10, 2016.

Provided by University of East Anglia