TREE PLANTATIONS AND BIOENERGY WITH CARBON CAPTURE: FAR FROM "SAFE" GEOENGINEERING

June 11, 2013

Eucalyptus plantations in Bahia, Brazil

Amongst geoengineering methods, 'afforestation', Bioenergy with Carbon Capture and Storage (BECCS) and biochar are commonly promoted as 'safe', benign' or 'soft' options – unlike, say, shooting sulphur particles into the stratosphere.

According to a 2011 report by the International Panel on Climate Change, "*combining biomass conversion with developing carbon capture and storage (CCS) could lead to long-term substantial removal of GHGs from the atmosphere (also referred to as negative emissions).*" And the UK's Royal Society report on geoengineering in 2009 concluded that 'afforestation, BECCS and biochar all scored high on safety – though not on effectiveness, timeliness and (except for 'afforestation') affordability.

All of those methods would require land conversions on a vast scale. The experience with biofuels has shown that there are no mechanisms to prevent the development of a big new market for biomass from leading to large-scale deforestation, land-grabbing, human rights abuses and hunger (as land previously used to grow food is turned over to biofuel crops and trees). Yet despite their massive impacts, biofuels still only supply 3% of global transport fuel. Any attempt at removing substantial amounts of carbon dioxide from the atmosphere through charring and/or burying biomass – or burning it and capturing some of the carbon – would have to involve land-conversions on a far bigger scale than has happened for biofuels so far. Concluding that such a mega-project would be 'safe' requires a strange definition of 'safety'. It requires us to ignore the fundamental role of land and how it is used.

Last month, a scientific review was published which asks many of the important questions about 'terrestrial biological carbon dioxide removal'. The article specifically looks at BECCS and 'tropical afforestation' although the findings are clearly also relevant for biochar and other proposals for using biomass to sequester carbon. The authors, Lydia Smith and Margaret Torn look at a scenario where either BECCS or 'tropical afforestation' is scaled up to remove 1 billion tonnes of carbon from the atmosphere every year – one eighth of annual global carbon emissions. Note that sequestering one billion tonnes of carbon is far less ambitious than what many proponents of such geoengineering approaches are speaking about. Stanford University's Global Climate and Energy Project for example claims: *"BECCS could sequester 10 billion tonnes of industrial CO2 billion from the atmosphere every year*", i.e. 2.73 billion tonnes of carbon The authors define afforestation as

"*planting trees in historically treeless areas such as grasslands or shrublands*" and point out: "*Afforestation and commercial reforestation projects often use monocultures of fast-growing species such as pine and eucalyptus.*" This is the result of the UN Food and Agriculture Organisation and Convention on Climate Change falsely classing industrial tree plantations as 'forests', something the authors do not comment on.

Here is a summary of what the authors calculate would result from a 1 billion-tonne "tropical afforestation" or BECCS project if 'afforestation' meant eucalyptus plantations and BECCS relied on switchgrass for biomass:

Sequestering this much carbon in eucalyptus plantations would require

+ between 6.6 and 15 million hectares of grassland and shrubland to be converted every year – that is 300 – 750 million hectares over 50 years;

+ 10-15 million tonnes of phosphorous and 4.5-15 million tonnes of nitrogen fertilisers a year for those 300-750 million hectares (presuming plantation expansion would stop after 50 years);

+ 1.2 – 2.7 trillion cubic metres more water than the original grasslands, which would significantly reduce streamflow, lower water tables and decrease rainfall over much larger areas, thus affecting other ecosystems (and farmlands, though the authors do not mention those).

Sequestering 1 billion tonnes of carbon through BECCS using switchgrass would require:

+ 218-990 million hectares of land to be converted to switchgrass (which is 14-65 times as much land as the US uses to grow corn for ethanol);

+ 17-79 million tonnes of fertiliser a year – which would be 75% of all global nitrogen fertiliser used at present;

+ 1.6-7.4 trillion cubic metres of water a year.

And even if such a eucalyptus or BECCS-project was to actually sequester a billion tonnes of carbon a year, the authors point out that the nitrous oxide emissions from the extra fertiliser use alone would, over the course of a century 'offset' 75-310% of that sequestered CO_2. In other words: Increased fertiliser use alone would likely mean that either of those projects would increase greenhouse gas emissions overall and thus make climate change even worse. And that's without considering the vast carbon emissions from clearing trees, shrubs and grass from hundreds of millions of hectares of land, destroying large reservoirs of soil carbon, or the emissions from all the fossil fuels burned to transport and process switchgrass and from producing the synthetic fertilisers.

The authors have not questioned whether either approach would be guaranteed to sequester carbon. Yet, in the case of BECCS, it is far from proven that Carbon Capture and Storage (CCS) can safely lock up CO2 long-term, i.e. that CO2 will not

leak back into the atmosphere. Nor have they considered the form of CCS most likely to ever become financially viable: Enhanced Oil Recovery, (using CO2 to inject into depleted oil wells to force remaining oil out) which results in far more oil becoming accessible – and thus burned.

In relation to 'tropical afforestation'– or rather eucalyptus plantation expansion – the authors note that all 'afforested areas' – i.e. plantations – would need be protected long-term. Presumably this would require the trees not being cut down so as not to release the carbon back into the atmosphere. This would effectively require fencing off hundreds of millions of hectares of land and ensuring that such plantation expansion would be additional to the ongoing expansion for pulp and paper, bioenergy and other purposes – not a likely prospect.

And presumably the plantations would not be allowed to burn either, though in reality large-scale plantation fires would be virtually guaranteed. Monoculture tree plantations worldwide are highly susceptible to fire, none more so than eucalyptus which is particularly flammable and depletes freshwater faster than most other plants.

It would be nice to think that, based on the many peer-reviewed studies cited by Torn & Smith[1], next year's new International Panel on Climate Change (IPCC) report on mitigating climate change will admit that predictions made for BECCS and 'tropical afforestation' were wrong and that both approaches could (indeed are likely to) make climate change even worse (as well as the biodiversity, food, freshwater and other crises). Yet we are not hopeful. After all, many of the studies cited by Torn & Smith were published well before the IPCC endorsed BECCS in its 2005 report on renewable energy. The illusion of BECCS, large-scale afforestation and other techno-fixes to 'capture carbon dioxide' allows governments and corporations to claim that the worst impacts of climate change can be prevented through techno-fixes and without deep and systemic changes, including major reductions in energy use in rich countries. Acknowledging that those are no more than dangerous illusions may again prove too politically contentious for the IPCC, too.

Article by Almuth Ernsting, Biofuelwatch

---

[1] While the article by Torn & Smith was published too late to itself be included in the 2014 IPCC report, it is a scientific review of previously published studies – and those were published in time to be included.