Making soils work for a changing climate

Biochar carbon removal 1 Mt/yr in Scotland by 2045 – profitably?

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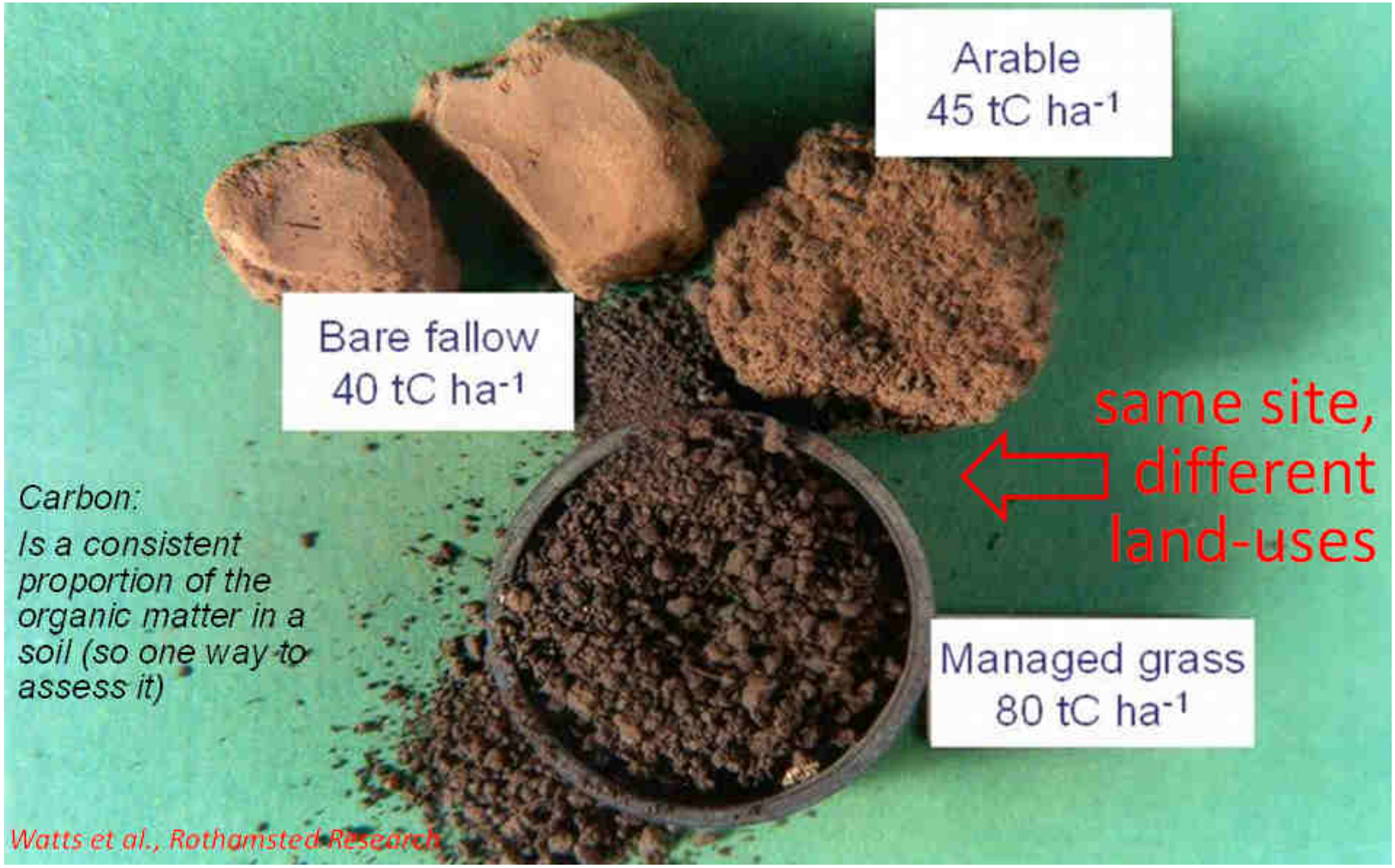
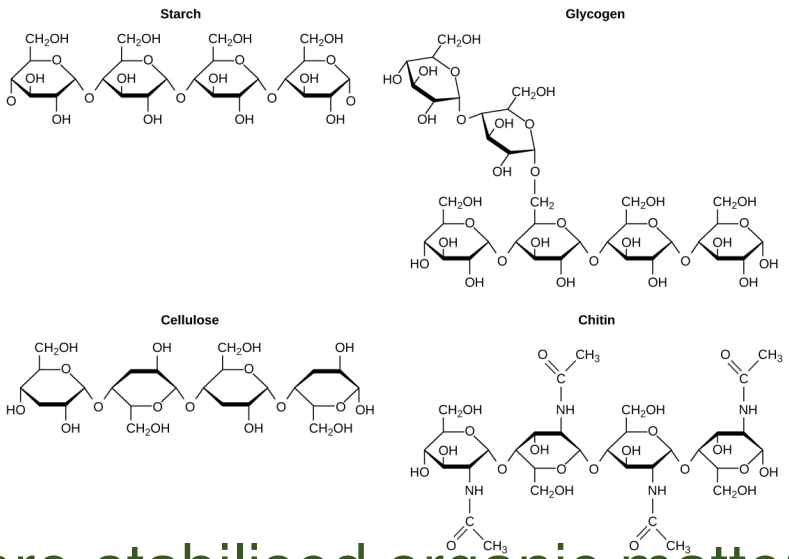
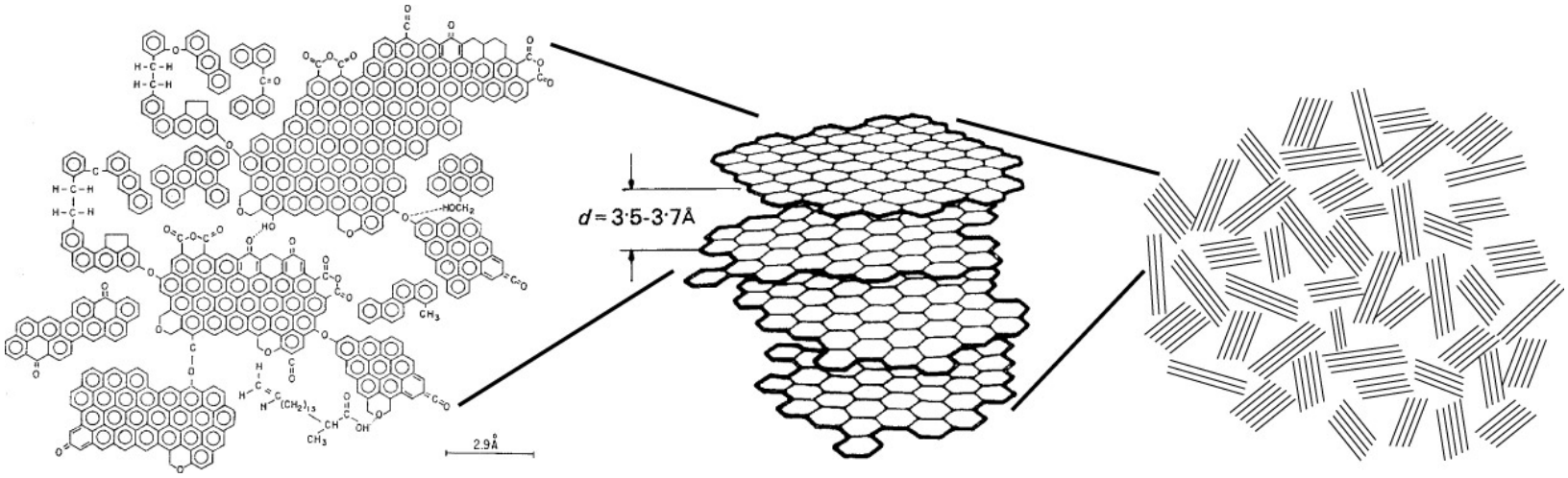
What three things does this picture actually say?





Biochar is pre-stabilised organic matter that offers enduring physical and chemical changes in soil



Oberlin (1984), Carbon, 22: 521–541

Charcoal in Australian soils

Charcoal is sometimes the “forgotten” part of the soil carbon cycle
… because it is so stable. But on geological time, a key control on climate

GLACIAL ATLANTIC OCEAN
Southern waters moving north

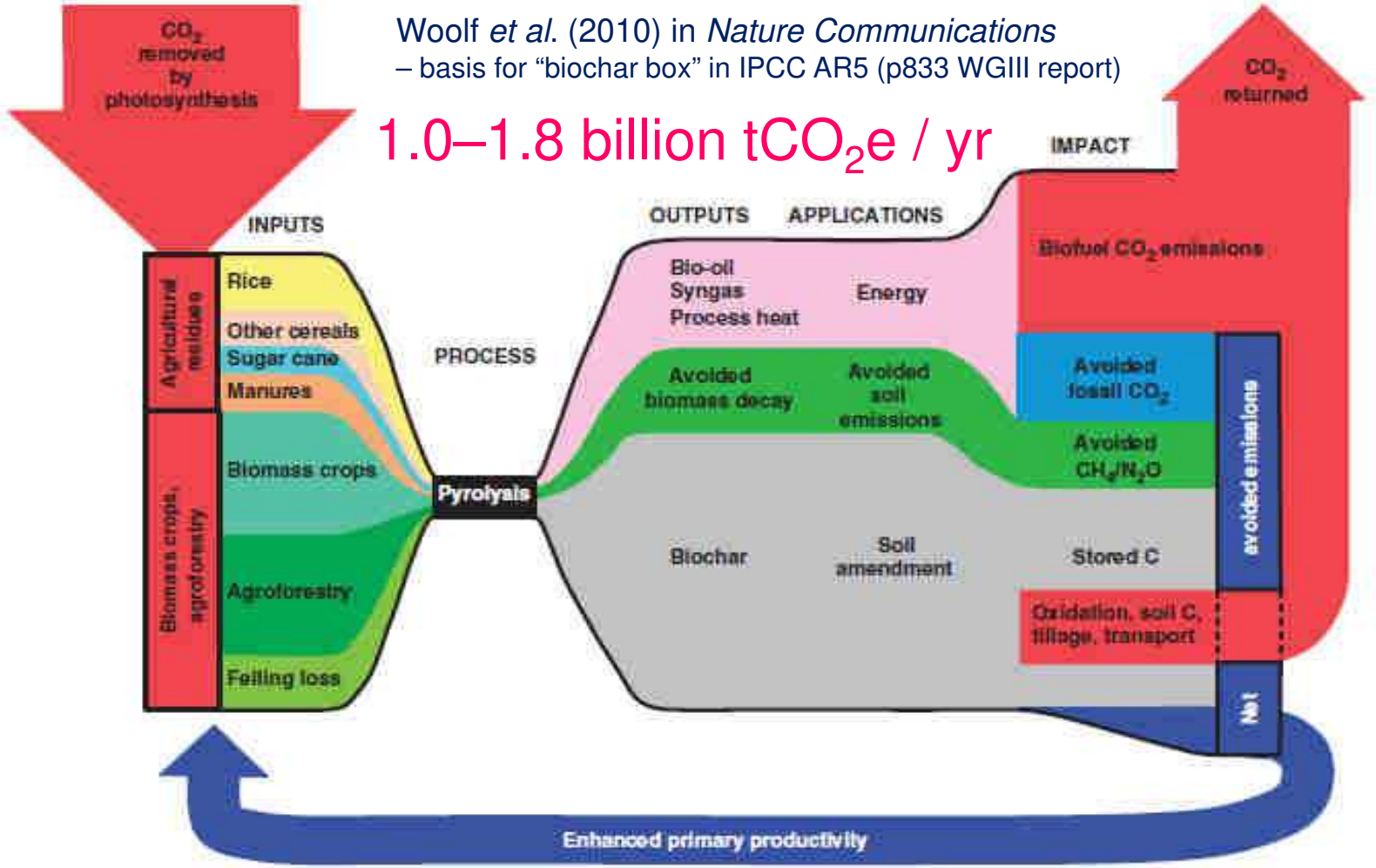
EAST ANTARCTIC ICE FLOW
Fast-tracked by a subglacial flood

Lehmann *et al.* (2005), Nature Geoscience,1: 832-835

Removing CO_2 from the air by making bicohar

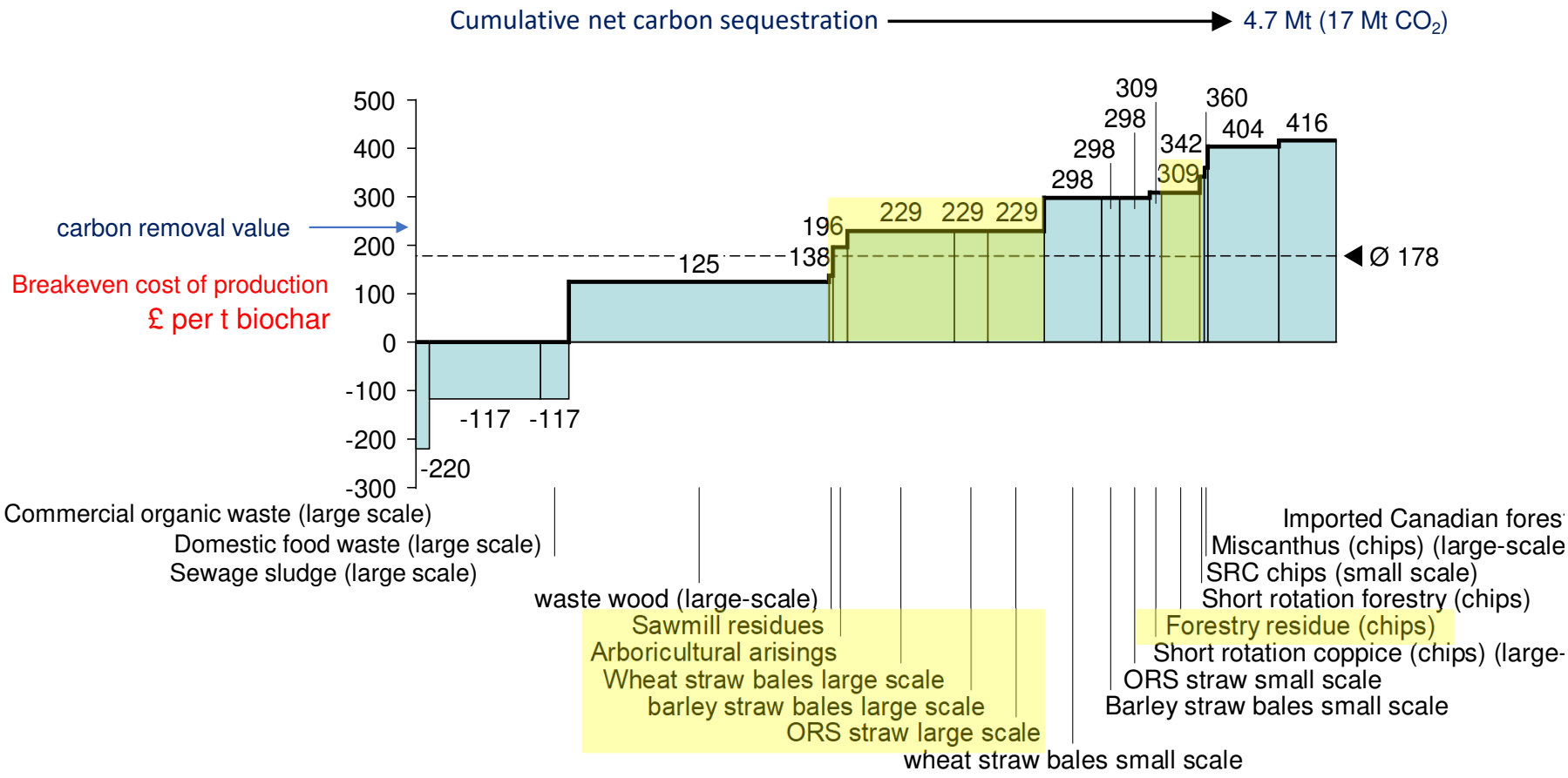
Woolf *et al*. (2010) in *Nature Communications*
– basis for "biochar box" in IPCC AR5 (p833 WGIII report)

1.0–1.8 billion tCO_2e / yr



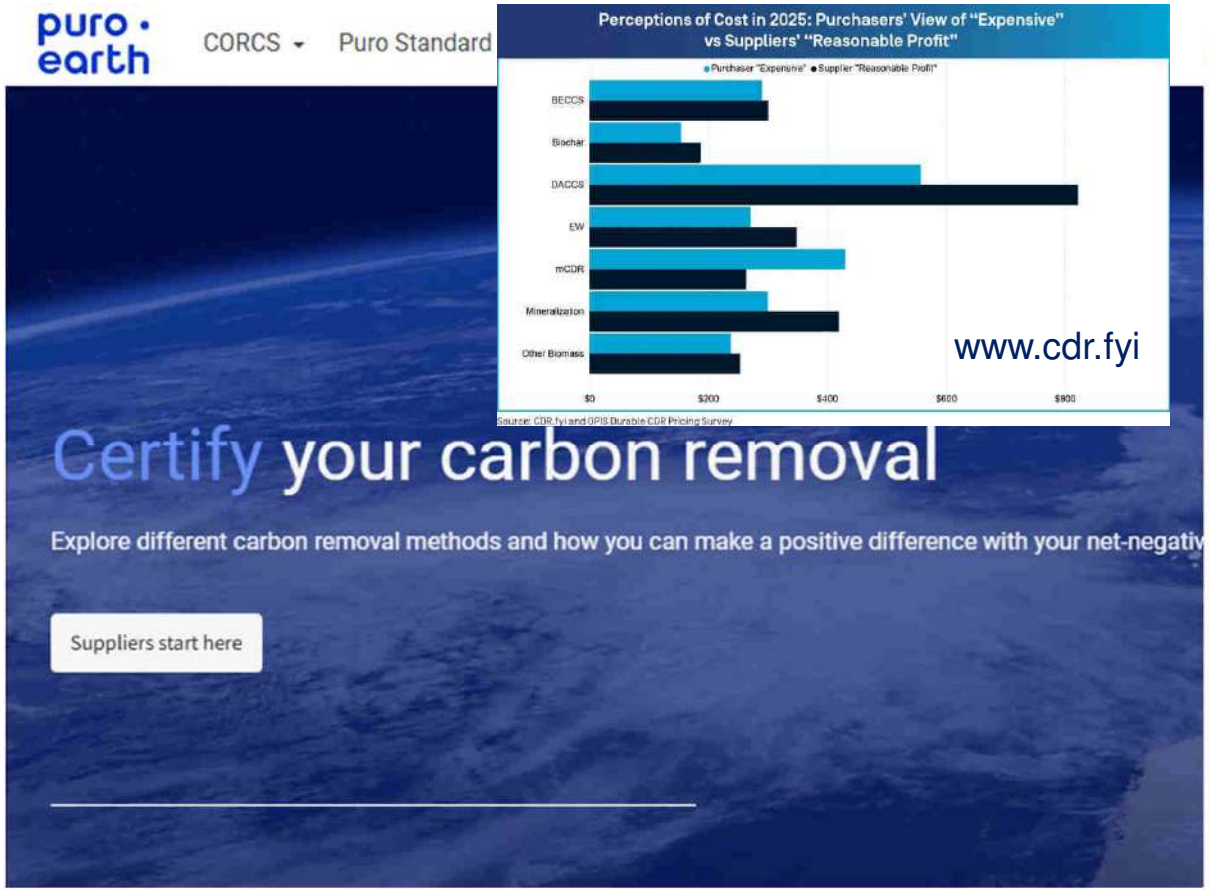
Biochar has a production cost

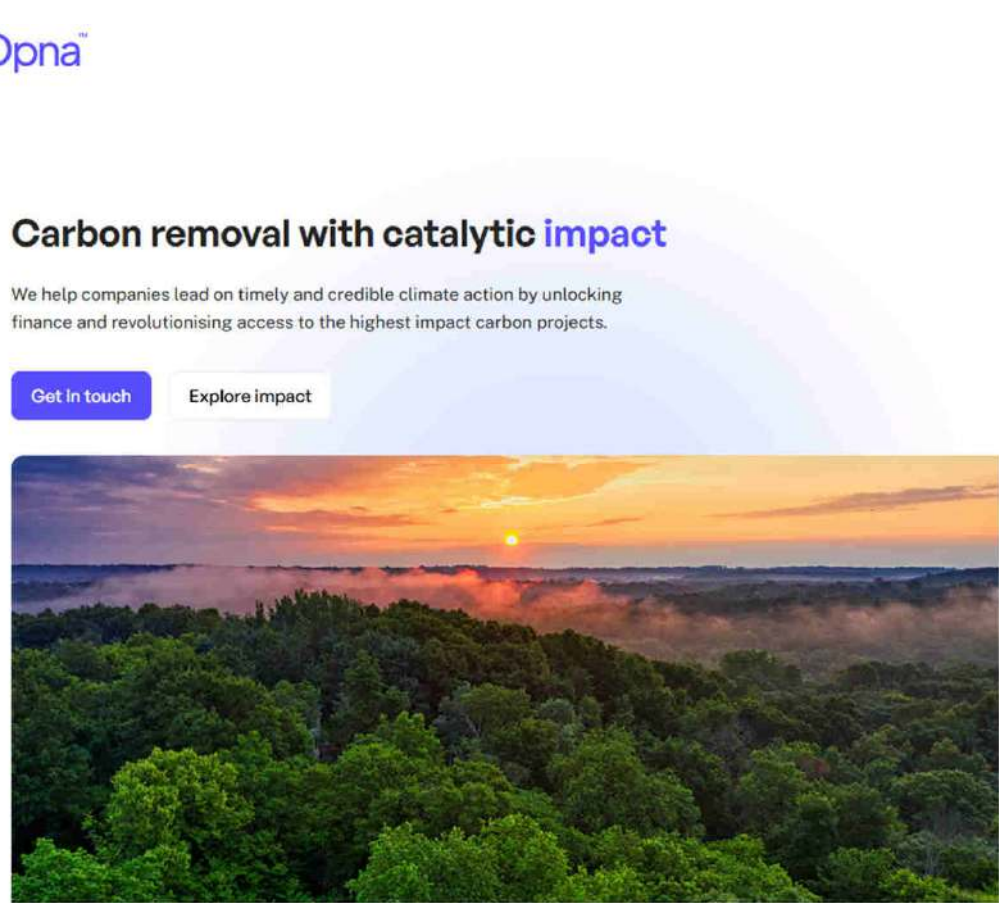
(original UK assessment)



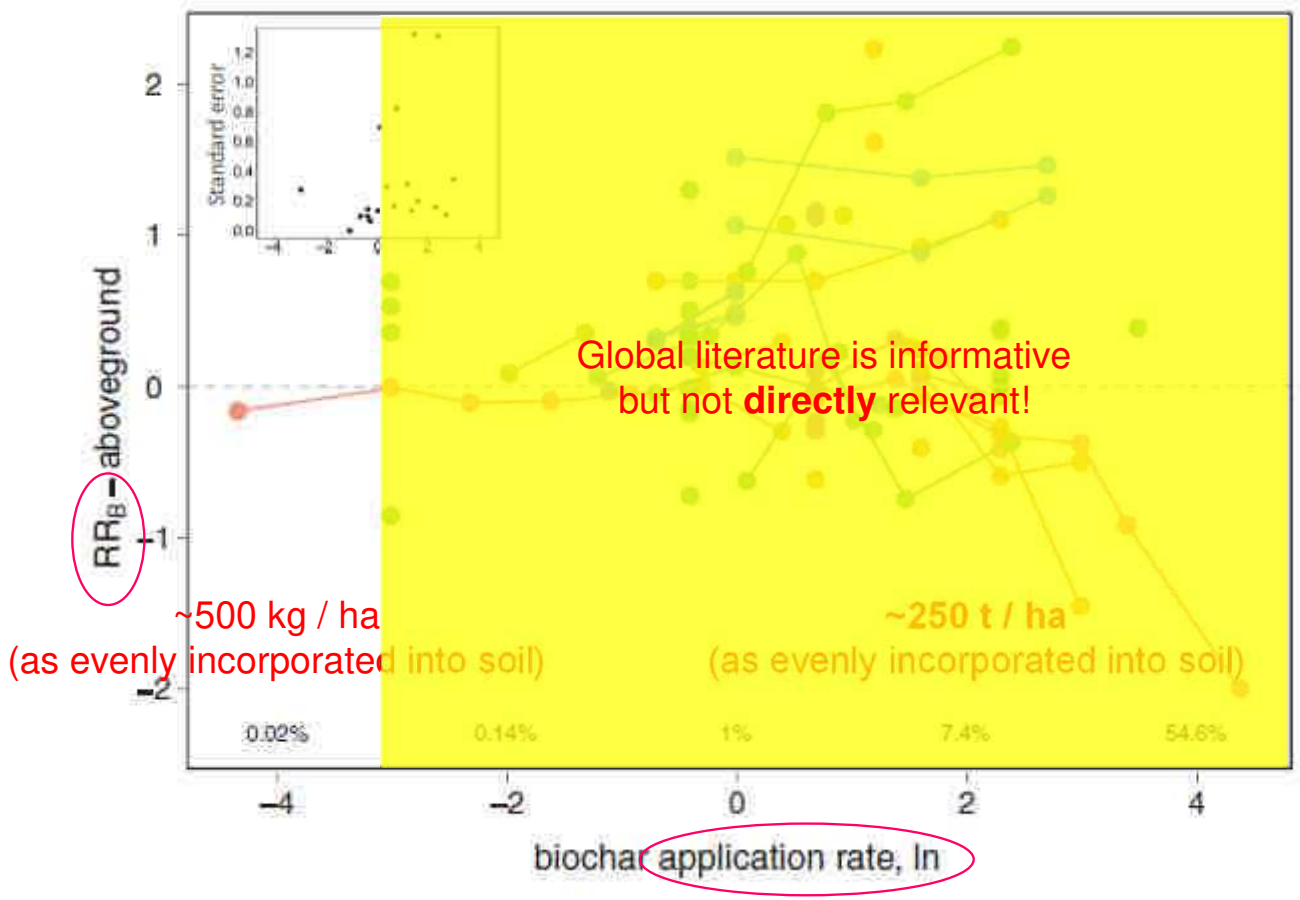
Shackley et al. 2011. Carbon Management, 3:335–356

Systems for certifying and trading carbon removal have emerged
– reduces breakeven cost of production



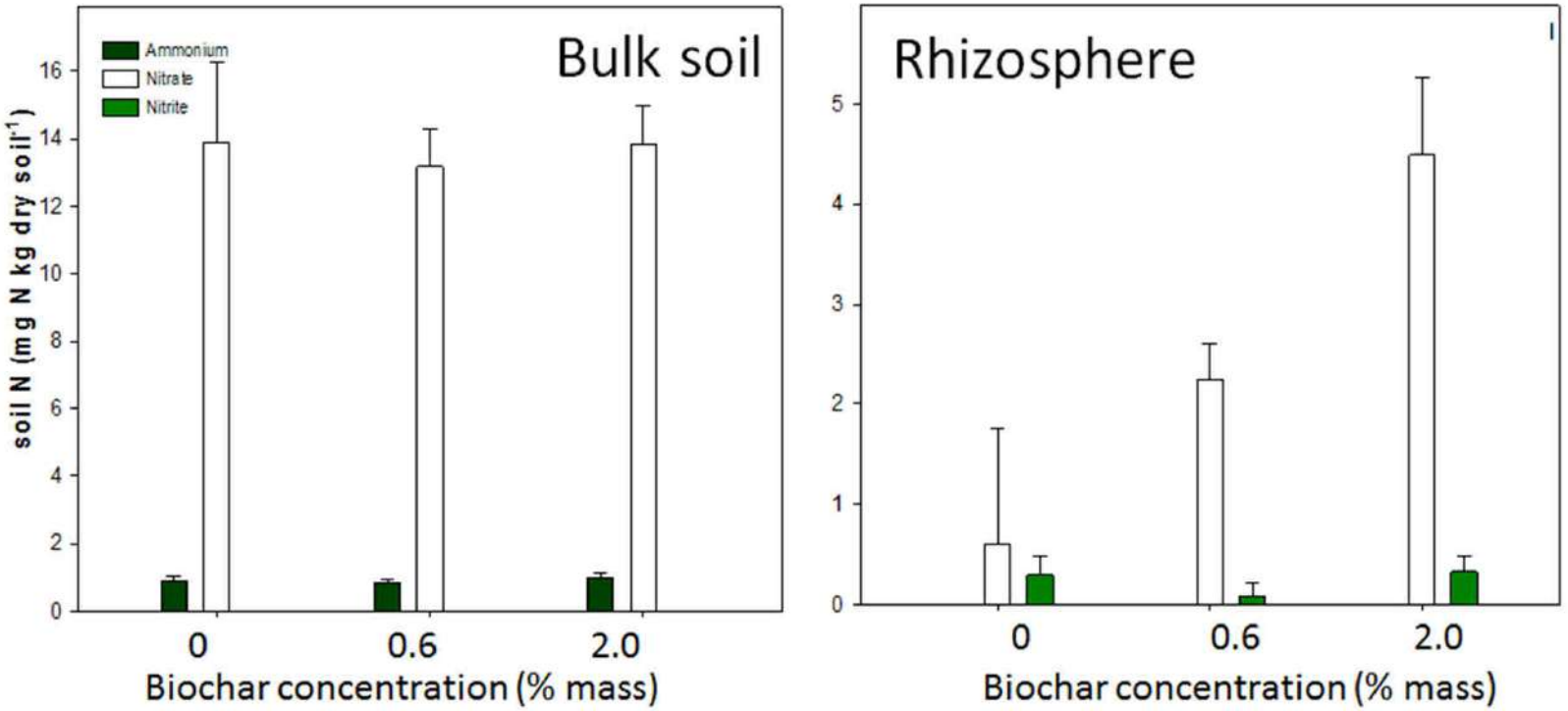


Biochar has often been assessed as a soil amendment (high rates)



Biederman & Harpole 2012, GCB Bioenergy

But biochar has particular value around roots…



Bulk soil – nitrate (NO_3^-) not affected by biochar, low ammonium

Rhizosphere - around roots nitrate (NO_3^-) elevated up to x7

Prendergast-Miller et al 2011, Soil Biol. Biochem 43:2243-2246

Some crops have roots in the ground all the time…

- Grassland
- Forestry

Biochar on dairy farm

Photo: Black Bull Biochar

Ahlstrom Radcliffe: Scalable and modular pyrolysis co-located with industry

Image: Black Bull Biochar (BBB)

Newton Rigg: Medium-scale biochar production linked with district heat

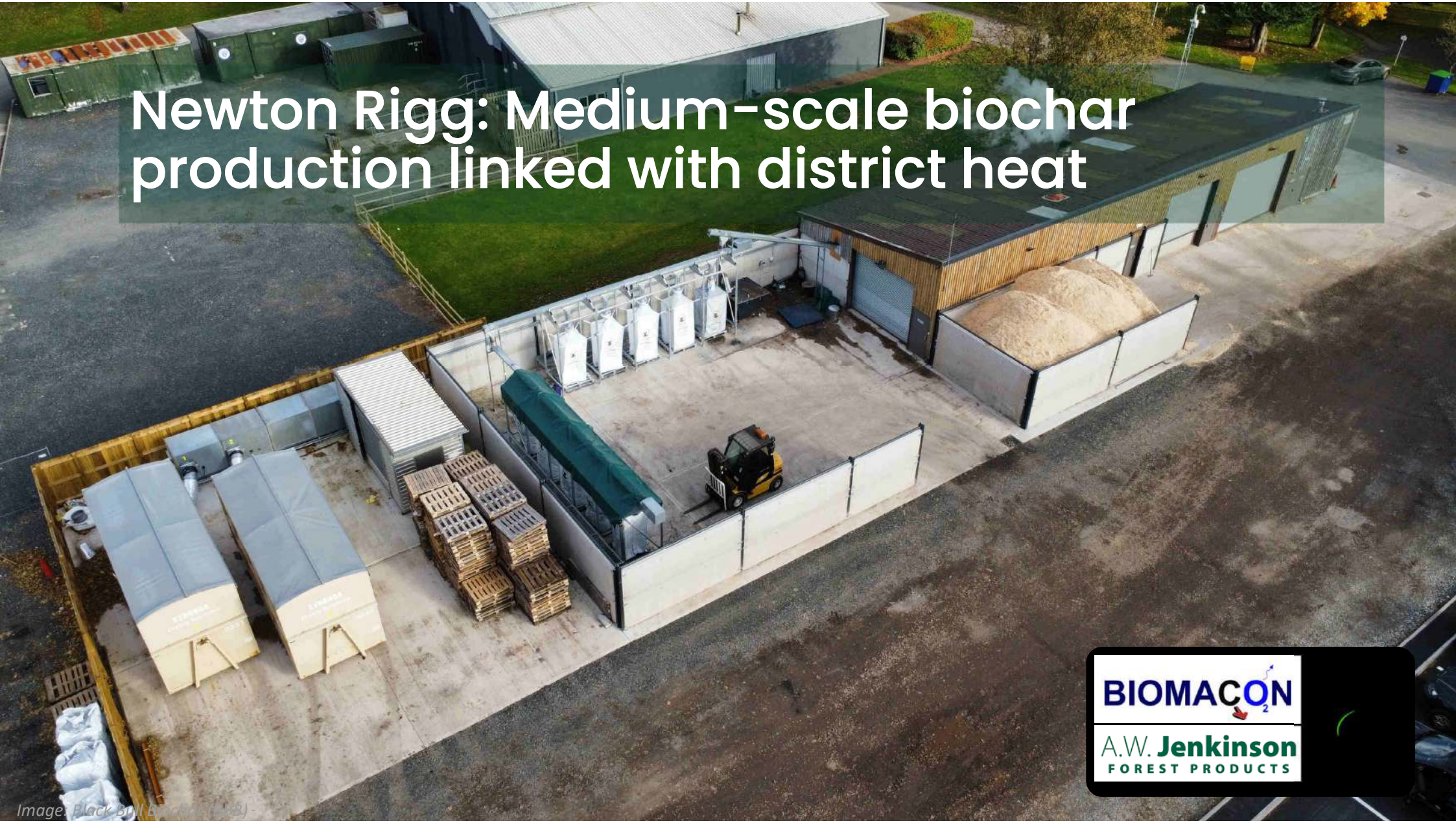


Image: Black Bull Biochar (UK)

Formulation adds value as crop input (must exceed added cost)

With increasing sophistication:

1. Shape and colour – compatibility
2. Blending – routine co-application with nutrients (slurry, etc.)
3. Integration – with chemical nutrients
4. Precision placement – drilling

- adding value to valuable inputs...

UKBRC

What it is likely to look like – on an arable farm

Concluding thoughts

Improving production efficiencies in managed land has many benefits and integration of biochar probably offers the lowest cost option for carbon removal.

1. Clear and open route to Mt carbon removal and further scaling – which could be accelerated through agronomic integration
2. Creating a specific market through fertiliser supply chains or national schemes (c.f. Denmark) would prompt large investment into production, and innovation (industry, employment, skills)
3. Forestry and agricultural offer promising entry points.