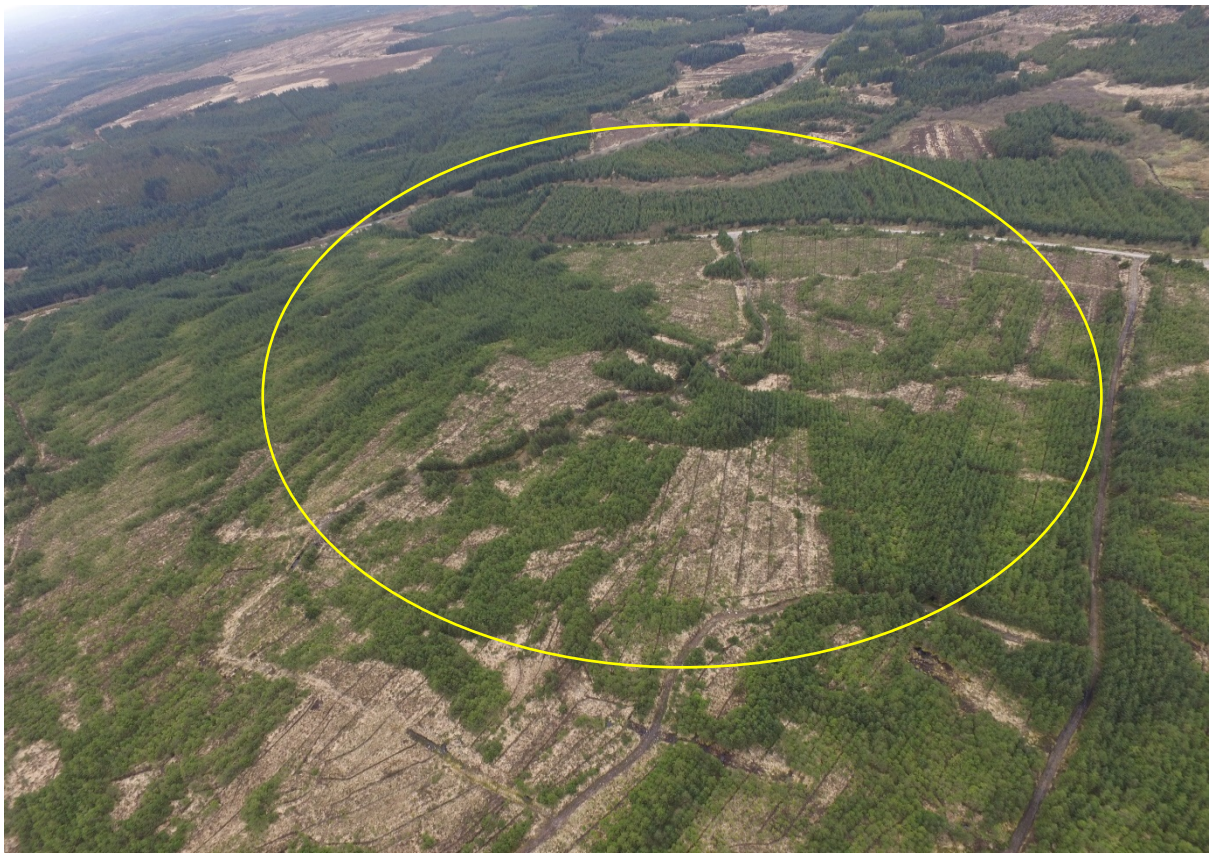
CARBON POSITIVE FORESTRY REPLANTING

Area identified for fertilisation in 2017



The impact of fertilisation in 2019 on the same area (yellow circle)

Biocharged ™ fertiliser will provide a significantly more efficient delivery of the necessary nutrients to the crop. It will be a one-time only delivery due to the nature of biochar, thus minimising costs and interventions into the forest with machines.

To explain how this is possible, it is important to understand **the nature of Biochar**. Biochar is a solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment. Biochar can be used as a product itself or as an ingredient within a blended product, to improve soil properties and/or resource use efficiency, to remediate and/or protect against environmental pollution, and as an avenue for GHG mitigation (IBI 2013). Biochar also offers the possibility of large-scale carbon sequestration which may lead to increased revenues for farmers of all types as carbon marketplaces begin to embrace biochar as a carbon removal product.[1]

Plant biomass consists of approximately 50% carbon, which the plant removes during its lifecycle from the atmosphere in the form of CO2. With the energy from sunlight, the plant separates the carbon (C) from the up taken CO2 and builds it into organic molecules such as glucose, cellulose, or lignin. When plant biomass is burnt or decomposed, the assimilated carbon is released again as CO2. However, if the plant biomass is pyrolyzed, only about half of the plant carbon becomes volatile and escapes as combustible gas. The other half is transformed into a very persistent, solid form of carbon (biochar) that degrades extremely slowly under natural conditions. Provided that the biochar is not burned, a comparably large portion of its carbon remains in the terrestrial system for several centuries and thus represents a terrestrial carbon sink (C sink).

Green Belt Proposal:

Low yield class forests require fertilisation to improve yield. Closing canopy early will eradicate competition and allow the tree to capture the available nutrients and thus develop into a viable crop. The frequent application of chemical-based fertilisers is harmful to the environment as well as financially expensive.

The use of biochar as a catalyst to deliver fertiliser to the trees, in a dedicated, hand application means the efficiency of uptake is 90% (versus 10% on traditional fertilisers application). It reduces leaching; thus, **water courses are further protected** and it delivers nutrients through cation exchange capacity.

There are approximately 2.8 tonnes of carbon sequestered in 1 ton of biochar and the application rate of Biocharged ™ biochar is 2m3 per hectare. **The biochar can be a net carbon sink if buried, increasing crop yields and adding fertility back to the soil.** Woolf et al. (2010) point to biochar's potential to improve agricultural productivity (particularly in low-fertility and degraded soils) through **reducing nutrient loss and through its water-holding capacity**.

Pyrolysis has been recognized by the **Intergovernmental Panel on Climate Change** (IPCC) as one of only a handful of **negative emission technologies** (NETs). In addition, biochar used in soils has recently been added to the IPCC's list of mechanisms for countries to reach their Nationally Determined Contributions (NDC), or reduction commitments. The goal is to **permanently lock carbon underground** instead of letting CO2 re-enter the atmosphere, so such long-term sequestration requires high biochar stability, which will depend on the type of feedstock and process. Wood is more stable than grasses and manure and Green Belt Biochar is created using sustainable, certified Irish timber residues.

Biochar is a stable form of carbon, and additions of biochar to soil are considered a means of carbon sequestration (Laird, 2008). Each ton of biochar at 80% Carbon content, removes 2.8 tonnes of Carbon from the atmosphere and captures it in the soil for over 1,000 years. Green Belt Biochar is produced using sustainable, FSC certified timber residues.

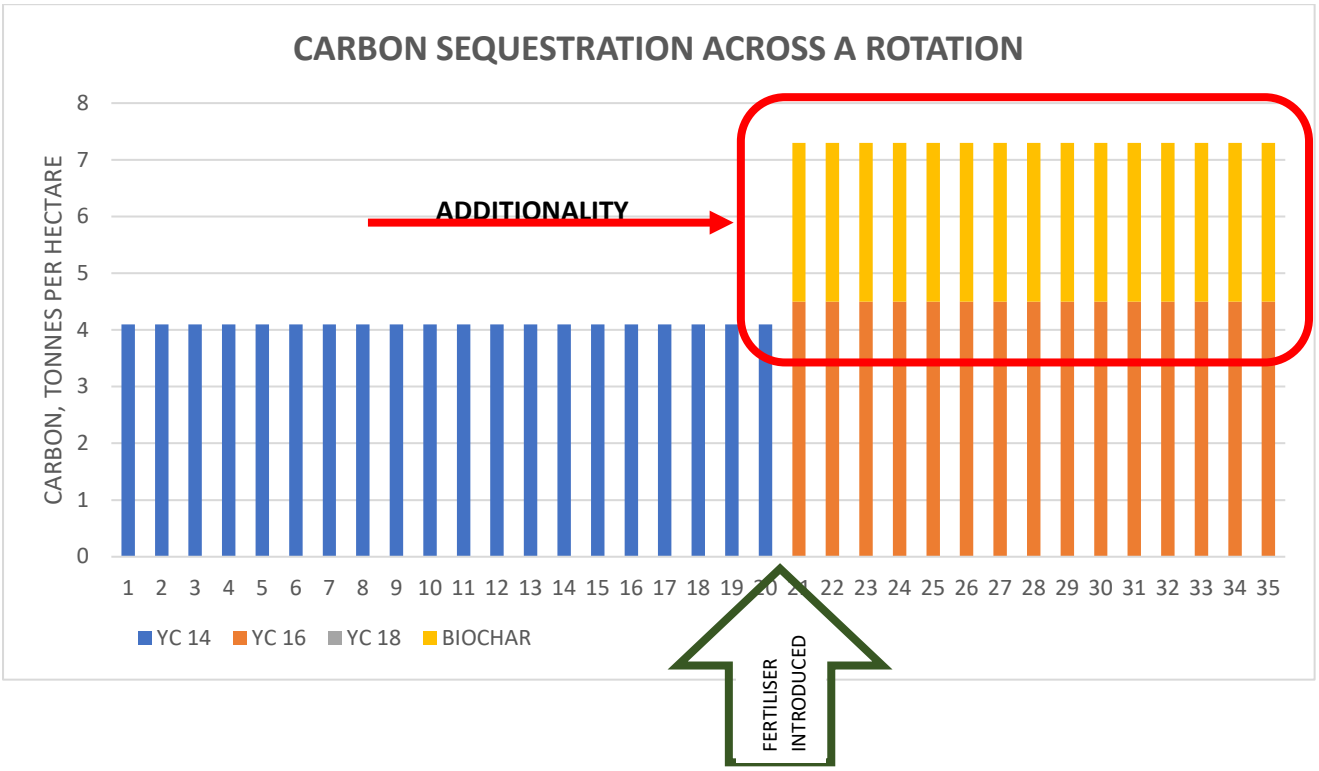
Green Belt is recommending the application of organic farm fertilisers to low yield class, previously under fertilised forests using biochar as a catalyst. This catalyst will deliver 9 times the efficiency of the fertiliser to the crop and expect to see an increase of at least one Yield Class (YC) bracket through its application.

[1] The Potential for Biochar to Enhance Sustainability in the Dairy Industry; Draper et al, 2020

Species	Yield Class (m^3 ha^{-1} $year^{-1}$)	Rate of storage[1] (Mg C ha^{-1} $year^{-1}$)	Equilibrium carbon storage[2] (Mg C ha^{-1})				
			Trees	Wood products[3]	Litter	Soil	Total
P. sitchensis[4] (unthinned)	24	5.6	90	42	34	89	254
	22	5.3	88	41	32	90	251
	20	5.1	86	40	30	92	249
	18	4.7	83	39	28	87	237
	16	4.5	79	37	26	87	229
	14	4.1	74	34	24	83	215
	12	3.7	68	32	21	77	198
	10	3.4	62	30	18	79	189
	8	2.9	54	27	15	72	169
	6	2.5	45	22	12	72	152

2

By increasing the YC of a Sitka Spruce plantation measured at YC 14 from year 20 through the introduction of biochar and fertiliser you will increase the Carbon Capture per hectare from 4.1 tonnes of Carbon/ Hectare/ Year to 4.5 tonnes of Carbon/ Hectare/ year – with just 1 yield class increase. This does not factor in the 2.8 tonnes of carbon per hectare captured by the biochar, additionally.



The rate of application is 2m3 of Biocharged © per hectare – which results in a cumulative 3.2 tonnes of **additional** Carbon Sequestered in the soil on an annual basis. This does not factor in the Carbon stored annually by the trees, the offsetting of the Carbon in the use of chemical fertiliser nor the impact of frequent machinery used to access the plantations.

The management regime employed on this forest can include **CCF – Continuous Cover Forestry –** which provides for the forestry to remain over a longer term without being cleared entirely. This reduces Carbon losses through harvesting, through the conversion to other products and also keeps the costs of the replanting significantly lower for the forest owner.

To the forest owner, the benefits are tangible – the rotation of the marketable timber is now reduced by 2- 4 years per YC increase, thus increasing the IRR on the forestry from 2% to 3%.

[2] Carbon Sequestration in the trees, products & soils of forest plantations: An analysis using UK examples. 1992