Greener Colglen

A Colintraive and Glendaruel Development Trust Project

Climate Challenge Fund Final Report CO_2e Calculations For CCF2765

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Record keeping has been on going throughout the project for food harvested, and food and garden waste composted at the polytunnel sites. Feedback surveys have returned with records of extra activity taking place at home, and of travel incurred, which have been added to the totals.

FOOD Growing –

assumptions and emissions are as per CCF Low Carbon Route Map – FOOD.

The total food harvested during the course of the project was 189Kg. This took place from August to March, leaving out 4 very productive months, April to July, so we can assume that production may have been doubled. For the purposes of the calculation, only actual recorded figures have been used.

The average baseline emissions of purchased fruit and veg is 2.09KgCO_2e per Kg.

Fruit and Veg not purchased	X	Average emission factor	=	Baseline Emissions
189Kg	x	2.09 kgCO2e per kg	=	395.01kgCO_2e

Project emissions are calculated to take account of the use of seed, fertiliser, pesticides etc. as per average allotment growing

Fruit and Veg grown	X	Average emission factor for allotment growing	=	Project Emissions
189Kg	x	0.54 kgCO2e per kg	=	102.06kgCO_2e

Project travel emissions

3 households reported making extra journeys by car. Others reported that they had walked or cycled more as a result of the project, and those who reported no change stated they visited the polytunnel whilst driving past on other errands.

Data source ***CCF CO_2e recommended conversion factors jan 2014 update***

Miles	x	Conversion factor for vehicle	=	KgCO_2e from travel
40 [small diesel]	x	0.27579	=	11.0316

30 [large diesel]	x	0.45491	=	13.6473

Therefore travel emissions are 11.0316 + 13.6473 = 24.6789KgCO_2e

Therefore the CO_2 emissions savings would be

Baseline Emissions	-	Project Emissions kgCO2e	=	**Total savings**
395.01kgCO_2e	less	102.06 + 24.68	=	**268.27kgCO_2e**

Therefore the total CO saved is 268.27KgCO_2e = 0.268 tCO_2e

FOOD - Project lifetime savings

It is assumed that food-growing projects will have a 10-year lifetime; therefore we can calculate this with an assumed full uptake of the growing spaces – as we have learned that the Growers will grow communally in 'empty' beds, regardless of the number of people involved. During the project, we increased the growing space by building outside raised beds at both sites. The total growing space available now is at least 257m².

The assumed yield per m² is 3Kg / year, therefore: -

The total food harvested during the lifetime of the project is (257m² x 3Kg x 10 years) = 7710Kg

The average baseline emissions of purchased fruit and veg is 2.09KgCO_2e per Kg.

Fruit and Veg purchased	X	Average emission factor	=	Baseline Emissions
7710Kg	x	2.09 kgCO2e per kg	=	16113.9kgCO_2e

Project emissions are calculated to take account of the use of seed, fertiliser, pesticides etc. as per average allotment growing

Fruit and Veg grown	X	Average emission factor for allotment growing	=	Project Emissions

7710Kg	x	0.54 kgCO2e per kg	=	4163.4kgCO_2e

Therefore the CO_2 emissions savings would be

Baseline Emissions	-	Project Emissions	=	**savings**
16113.9kgCO_2e	less	4163.4kgCO2e	=	**11950.5kgCO_2e**

Therefore the total lifetime CO_2e saving would be 11.95tonnes CO_2e

FOOD WASTE

Resulting from the bin surgery and sustainable cookery demo, ('Scottish risotto' made with oat groats – having an embodied CO_2 of 0.55 KgCO_2e/Kg, instead of rice, which has an embodied CO2 of 5.05 KgCO_2e/Kg. [Data source http://www.keepscotlandbeautiful.org/media/43522/ccf-low-carbon-route-map-food-2011.pdf]) and also people report being encouraged / inspired by using the village hall facility and looking at the record sheets at the polytunnels to see what other people have been doing.

In total we recorded 105.2Kg of **food waste**, which would otherwise have been sent to landfill, has been composted by 7 households and 1 village hall. Emissions factor data from
WRAP
http://www.wrap.org.uk/sites/files/wrap/Household%20food%20and%20drink%20waste%20in%20the%20UK%20-%20report.pdf

Food waste recorded in Kg	x	(Embodied emissions for typical food waste + emissions from landfilling food waste)		Baseline emissions in KgCO_2e
105.2Kg	x	(3.59 kgCO2e + 0.45 kgCO2e)	=	425

Project emissions for composting food waste. Emissions factor data from

http://www.ukconversionfactorscarbonsmart.co.uk/

[DCFCarbonFactors_27_3_2015_134317.xls]
See APPENDIX _ for DEFRA "waste disposal" data sets

Food waste in tonnes	x	emissions factor for composting per tonne $KgCO_2e$	=	Project emissions in $KgCO_2e$
0.1052	x	6	=	0.631

Baseline emissions in $KgCO_2e$	less	Project emissions $KgCO_2e$	=	CO_2e savings
425	-	0.631	=	424.369$KgCO_2e$

So total CO_2e saved from composting food waste is 0.424 tCO_2e

Lifetime savings are assumed – a food waste project would have a 5-year lifetime, therefore we might expect a ***total saving of 2.12tCO_2e***

Annual Saving	X	Lifetime	=	Lifetime saving
0.424tCO_2e	x	5	=	2.12t CO_2e

COMPOSTING

In total 1266.28Kg of **garden waste**, which would otherwise have been left to rot, has been dealt with this way. Additionally around 35Kg of cardboard packaging and shredded paper has been composted. Calculations have not been made for this as paper and card are uplifted locally for recycling and so we assume it would not otherwise be sent to landfill.

Emissions factor data from

http://www.ukconversionfactorscarbonsmart.co.uk/

See APPENDIX _ for DEFRA "waste disposal" data sets [DCFCarbonFactors_27_3_2015_134317.xls]

Weight of garden waste rotting	x	Emission factor from rotting [landfill]	=	Baseline Kg CO_2e

1.2663 tonnes	x	212.5	=	269.089 KgCO_2e

Project emissions

Total weight composted	x	Emission factor from [composting]	=	Project emissions
1.2663 tonnes	x	6	=	7.6 Kg CO_2e

Total CO_2e saved from rotting garden waste is (269.089 – 7.6) = 261.489KgCO_2e

In addition there was garden waste, which would otherwise have been burnt (approximate ratio of rotting: burning = 3:1)

Weight of garden waste burning	x	Emission factor from burning [combustion]	=	Baseline Kg CO_2e
0.375 tonnes	x	21	=	7.875 KgCO_2e

Project emissions

Total weight composted	x	Emission factor from composting	=	Project emissions
0.375 tonnes	x	6	=	2.25 Kg CO_2e

Total CO_2e saved from burning garden waste is (7.875 – 2.25) = 5.625Kg

So we can say that the garden waste project has reduced CO_2e emissions by

(261.489 + 5.625) = 267.114 Kg CO_2e = 0.267 tCO_2e

Lifetime saving is assumed over 8 years, and based on the same ratio of burning to rotting, which would be reasonable to expect, because although the lifespan of the infrastructure would be in the region of 25 years, and we anticipate an increase in households participating, Local Authority services may change and these factors cannot be predicted.

Because garden waste has a peak in the summer months, basically increasing from March and then reducing again in November, and because we did not have a fully-operating facility until August, it would be fair to assume increased up-take, in that each site could easily compost 2 tonnes each year, with full

participation, so 4tonnes a year (assume 3t rotting and 1t burning) for the lifetime of the project, will lead to savings of ….

Weight of garden waste rotting	x	Emission factor from rotting [landfill]	=	Baseline Kg CO_2e
3 tonnes	x	212.5	=	637.5 KgCO_2e

Project emissions

Total weight composted	x	Emission factor from [composting]	=	Project emissions
3 tonnes	x	6	=	18 Kg CO_2e

Total CO_2e saved from rotting garden waste is (637.5 - 18) = 619.5KgCO_2e

In addition….

Weight of garden waste burning	x	Emission factor from burning [combustion]	=	Baseline Kg CO_2e
1 tonnes	x	21	=	21 KgCO_2e

Project emissions

Total weight composted	x	Emission factor from composting	=	Project emissions
1 tonnes	x	6	=	6 Kg CO_2e

Total CO_2e saved from burning garden waste is (21 - 6) = 15KgCO_2e

Therefore it is assumed that the total lifetime saving over 8 years is 8 x (619.5 + 15) = 5.076 tonnes CO_2e

WOODFUEL - Rhododendron

The approximate quantity of rhododendron wood set aside by this project has been 25 tonnes. The yield of the project was fairly impossible to predict beforehand, and has proven to be less than anticipated.

Woodfuel is normally Sitka spruce logs delivered in trailer loads of $2m^3$. The Solid Fuel Association http://www.solidfuel.co.uk/frame/main.html states that the weight of 7 different species of seasoned (min 25% moisture content) logs ranges between 770Kg for hardwood and 410Kg for softwood. On this scale, we assume that Sitka is 410Kg per cubic meter and rhododendron is 695Kg per cubic meter.

1 load of Sitka will therefore be 410 x 2 = 820Kg. 25,000Kg ÷ 820Kg = 30 deliveries of 18 miles, x2 for return miles. Total mileage in a large (over 2 litres vehicle) 1080 miles

Mileage	**x**	**Conversion factor large diesel car over 2 litres**	**=**	**Baseline emissions for delivery of woodfuel**
1080	**x**	**0.45491**	**=**	**491.3Kg CO_2e**

For the project emissions, the average delivery of the local rhododendron, when it is seasoned will be an average of 5 miles from any one source of stored rhododendron, and 1 load of rhododendron will be 695 x 2 = 1390Kg. 25,000Kg ÷ 1390Kg = 18 deliveries of 5 loaded miles, and 18 empty return journeys. 180 miles.

Mileage	**x**	**Conversion factor large diesel car over 2 litres**	**=**	**Baseline emissions for project scenario**
180	**x**	**0.45491**	**=**	**81.88Kg CO_2e**

Therefore total savings will be 491.3 – 81.88 = 409.42Kg or 0.41 tonnes CO_2e.

For the **unexpected outcome**, in terms of carbon reduction, for 1 hectare, as we have learned that the conventional 'cut and burn' technique emits around 160tCO_2e per hectare*Source on page 25 http://www.forestry.gov.uk/pdf/acriticalreviewofrhododendroncontrolAugust2013.pdf/$FILE/acriticalreviewofrhododendroncontrolAugust2013.pdf we can say that **we have avoided 160tCO_2e** for the Demo event.

The lever and mulch technique has no carbon impact.

The activity of chipping will have some emissions and we needed to ascertain how to calculate this. The contractor let us know he used 60litres of red diesel over the 3 days in his chipper, so using the DEFRA data source (for liquid fuels) http://www.ukconversionfactorscarbonsmart.co.uk/Filter.aspx?year=38

The conversion factor is 2.669144KgCO_2e per litre so, x 60, the emissions were = 160.15KgCO_2e (or 0.16015t)

So we can say we saved (160t – 0.16015t) = 159.83tCO_2e

Lifetime savings.

Due to the plans for future development of this community model, it will be difficult to accurately predict what the lifetime savings might be. For the purposes of this report, we will assume a modest repetition of this year's activity – a clearance of 1 hectare per year for 5 years, but with a ratio of 4:1 in favour of clearance that does not avoid the cut and burn technique, but does include firewood production at a rate of 25t per hectare.

So for woodfuel supply, a lifetime saving of 0.41 tonnes CO_2e x 5 years = 2.05 tonnes CO_2e

Plus a further Hectare of cut and burn avoidance, leading to ***(160t – 0.16015t) = 159.83tCO_2e***