Towards Responsible Sourcing and Manufacture of Growing Media

Guidance Notes

Working Document

June 2023

These guidance notes will continue to be updated; this is a working document. Please ensure you are using the latest available version.

Introduction

Use of any materials, in any industry, will have an impact on the environment we live in, and the people involved in their manufacture.

The UK horticultural industry actively seeks to improve its sustainability wherever possible. As part of this, the industry has examined its sourcing of growing media and drafted the following scheme to enable manufacturers and users of growing media to understand and measure how their choice of growing media materials impacts on seven criteria (energy use, water use, social compliance, habitat and biodiversity, pollution, renewability and resource use efficiency). Sourcing materials responsibly is about making deliberate, educated choices to minimise those impacts, but there is also a need to constantly revisit and challenge thresholds in order to maintain “best practice”. The criteria have been defined as being able to differentiate more responsibly sourced from less responsibly sourced material. It will enable users of the scheme to source materials more responsibly, which we hope will help to improve the sustainability of this part of their businesses.

Some of the decision criteria may appear arbitrary but they have been chosen to account for complicated and variable situations which can include global supply chains. The criteria have been developed through careful deliberation and have evolved through numerous iterations into their current form. The intention has been to make the scheme globally relevant, with reference to documents, standards etc. applicable to all countries.

The scheme will be independently audited, and users will need to provide evidence to support the scores they claim. Evidence will need to be gathered from across the supply chain, as described under each criterion.

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Part 1: The basis of a scheme towards the responsible sourcing and manufacture of growing media

Core requirements

All responsibly sourced and manufactured growing media and soil improvers must meet these requirements:

- ✓ **Fitness for purpose:** They must be capable of growing plants (growing media) or improving the physical, chemical or biological condition of soils (soil improvers). The assessment of this is out of scope of this scheme. A performance standard is available at: https://www.responsiblesourcing.org.uk/media/leshn2xs/p7-protocol_nov22-version.pdf
- ✓ **Environmental accountability:** They must have minimal impact on the environment. This assessment is in-scope for this scheme.
- ✓ **Social accountability:** The supply chain must have transparent social compliance programmes in place. This assessment is in-scope for this scheme.
- ✓ **Product safety:** They must be safe to use. The assessment of this is out of scope of this scheme.
- ✓ **Legality:** They must comply with all legal requirements. The assessment of this is out of scope of this scheme.

The promise

All growing media (and soil improvers) are made from materials that are sourced and manufactured in a way that is both socially and environmentally responsible.

	In scope	Out of scope
Life cycle stages (Stage in process)	✓ Extraction/growing and harvest ✓ Transport to manufacturer ✓ Processing and Production ✓ Up to the point of being mixed	× Bagging (including packaging) × Transport from manufacturer to consumer × Use/disposal by consumer
Ingredients	✓ Bulk ingredients that contribute to the final volume and provide physical structure (>5% by volume) ✓ Organic and inorganic	× Additives (e.g. fertilisers, wetting agents, lime)
Climate change impacts	✓ Energy use ✓ Carbon turnover and cycling with the atmosphere ✓ Land use change	× Direct calculation of greenhouse gas emissions × Carbon sinks
Sustainability pillars	✓ Environmental ✓ Social	× Economic

The promise is a pragmatic compromise, balancing the need for detail relating to the detrimental environmental and social effects of sourcing and manufacturing growing media and soil improving materials with the need to design a relatively simple and workable scheme.

Criteria

Seven criteria have been selected to assess growing media and soil improvers:

- Energy use (in extraction, transport and production)
- Water use (in extraction and production)
- Social compliance
- Habitat and biodiversity
  - The assessment for this varies by class of material. Materials which do not fit one of the existing methods of assessment will need to be referred to the technical committee.
- Pollution
- Renewability
- Resource use efficiency

Out of scope: Carbon emissions and climate change are not listed as a separate criterion although some elements are covered by the other criteria. For example, the renewability criterion has a dual role of capturing both the long term sustainability of the substrate through its replacement time on site; the impact of the substrate on atmospheric carbon dioxide levels and carbon cycling through the period over which emitted carbon dioxide is recaptured through the regrowth of the raw material on the same site.

Materials, starting and end points

Table 1: Materials

Material [a]	Category	Starting point	End point [f]
anaerobic digestate (from energy crops) [b], bark, Biochar (from forestry products), Bracken, coir pith, Cork, grit, Oilseed rape straw, peat, wood fibre, Wool, perlite, sand, Sphagnum (farmed), vermiculite	Virgin material [c]	Extraction or equivalent process [d]	• If produced in country of sale (not imported) = start of mixing system • If finished product imported into country of sale = start of mixing system + transport to point of entry (excludes packaging etc.)
anaerobic digestate (from waste materials) [b], Biochar (from waste materials), Cork (recycled), green compost, topsoil, spent mushroom substrate	Recycled material	Volume where commercial transport becomes viable [e]	

Notes:

[a] Bulk ingredients of growing media and soil improvers that contribute to the final volume and provide physical structure (and make up >5% by volume of the mix). Example materials presented.

[b] Anaerobic digestate and biochar should be treated as a virgin material or a recycled material depending on the source material. Where the digestate or biochar is a blend of sources the scores for the material should be the weighted average for the proportion of each source in the blend on an annual basis. The weighting should be applied after the individual score is generated for each source even though they are in a blend for parts of the production process.

[c] Virgin by-products are not treated separately as they form part of the business model for the material. However, they are allocated responsibility for only a proportion of the impact of the material at different production stages (Table 2 and Table 3).

[d] The starting point for virgin materials (including by-products) is extraction (peat, loam, topsoil, minerals) or equivalent (e.g. raising of a tree seedling or transplant for wood based material including Biochar (from forestry products), harvesting of Bracken, sowing or establishment for Sphagnum (farmed)). For coir pith and wood based materials (including Biochar (from forestry products) and Cork) it is extremely challenging to obtain data from this starting point for all criteria. For anaerobic digestate (from energy crops), Oilseed rape straw and Wool (sheep only) the additional effort of collecting specific data from this starting point is not always justified due to low apportionment of impact (Table 2 and Table 3). Modified starting points have been identified for these materials for certain criteria (Table 4).

[e] The starting point for recycled materials is the volume where commercial transport becomes viable. For recycled materials such as green compost and anaerobic digestate (from waste materials) this would be the transfer station (or composting site/anaerobic digestion facility if material is delivered direct to the site without the use of a transfer station).

[f] In general the end point for measuring impact is set at the end of the processing system or mixing system, when the ingredients are to be combined and before they are packaged. Supply chain models after the processing system or mixing system are too variable and complex to be measured in a consistent way.

Table 2: Allocated responsibility [a] for virgin by-products by production stage - wood based products

By-product		Forest [c,h]	Sawmill [b,h]	Processing [d]	Pyrolysis Plant [e]
Bark	Final	7%	7%	100%	-
	Biochar from	2.5%	2.5%	35%	35%
Sawdust, shavings and fines	Final	10%	10%	100%	-
	Biochar from	3.5%	3.5%	35%	35%
Wood chips	Final	33%	33%	100%	-
	Biochar from	11.6%	11.6%	35%	35%

Notes:

[a] By-products share the impacts going back up the supply chain with the main product and other by-products and are allocated responsibility for an appropriate proportion of these impacts at different stages in production. The proportion will be dependent on the supply chain.

Source or detail:

[b] UNECE/FAO Timber Section (2010). Forest product conversion factors for the UNECE Region. Geneva Timber and Forest Discussion Paper 49. ECE/TIM/DP/49

[c] Harvested roundwood is assumed to be responsible for all of the impact at the forest operations (UNECE/FAO Timber Section (2010)).

[d] The impact for the source material for biochar is modified by the percentage impact that biochar has at the pyrolysis plant, i.e. 35%.

[e] Pyrolysis of biomass produces three products 1) bio-oil, 2) synthetic gas, and 3) biochar. All three products have a value as a fuel substitute, but the value can vary depending on the fuel that is substituted. Biochar also has a range of other uses and economic values associated with them. Therefore, it is not possible to assign impact based on market value of the product. Instead impact is split based on mass of product. This can vary based on the type of conversion process that is used (i.e. fast and slow pyrolysis and gasification). Slow pyrolysis maximises production of biochar. A ratio of 30:35:35 is proposed for oil, gas and char from slow pyrolysis in Tomczyk, A.,

Sokołowska, Z. & Boguta, P. Biochar physicochemical properties: pyrolysis temperature and feedstock kind effects. Rev Environ Sci Biotechnol 19, 191–215 (2020). https://doi.org/10.1007/s11157-020-09523-3 . Therefore an impact of 35% is assigned to biochar at the pyrolysis plant.

Table 3: Allocated responsibility for virgin by-products by production stage – other materials

By-product	Production stage	Responsible for % of impacts [a]
Coir pith	Coconut production	5% [b]
	Coir fibre production	50% [b]
	Coir pith processing	100%
Anaerobic digestate (from energy crops)	Farm	6% [c]
	Anaerobic digestion facility	6% [c]
	Separation of liquid from fibre	67% [c]
Wool	Farm	3% [d]
	From farm gate	100%
Oilseed rape straw	Farm	10% [e]
Cork	Forest/Farm	30% [f]
	Natural cork stopper production	30% [f]
	Grinding processing	100%

Notes:
[a] By-products share the impacts going back up the supply chain with the main product and other by-products and are allocated responsibility for an appropriate proportion of these impacts at different stages in production. The proportion will be dependent on the supply chain.

Source or detail:
[b] Newleaf (2012): Coir: a sustainability assessment. Final report for Defra project SP1214.
[c] Responsibility for impacts is assigned based on the economic value of the products from anaerobic digestion. Using the example of an on-farm digester with an annual feedstock volume of 10,000 tonnes FW, producing 3,000 tonnes FW separated fibre. Value of energy to the business is £300,000 per annum, value of the fibre based on its fertiliser replacement value (price on 4 November 2020) is £19,500, value of liquid digestate based on its fertiliser replacement value is assumed to be half that of the fibre. Giving a value ratio of 91:6:3 at the farm (respectively) and 0:67:33 at the separation process.
[d] Responsibility for impacts is assigned based on the economic value of the products from sheep production. The economic value of a sheep in the UK is around 97% for the carcass and 3% for the wool.
[e] Value of oilseed to straw ratio is 9:1 based on current market value in October 2022.
[f] Natural wine corks, despite accounting for less than 30 per cent of actual weight of cork production, account consistently for approximately 70 per cent of the value of all cork products and exports. (Goncalves, E. (2000) The Cork Report: A study on the economics of cork. Report to RSPB.) Therefore, the remaining cork products from the ground-up leftovers of the wine cork making process have 30% impact at these earlier stages in the supply chain.

Table 4: Modifications to starting points for materials for which assessment at the extraction or equivalent production stage has been judged too challenging (coir pith, Cork and wood based products) [a] or where additional effort is not justified (having <10% impact) (anaerobic digestate (from energy crops), Oilseed rape straw and Wool) [b]

Modification	Material	Criteria modification applies to		
		Social compliance	Pollution	Resource use efficiency
Move starting point	Anaerobic digestate (from energy crops)	Farm [e]	AD facility	AD facility
	Coir pith	Fibre mill	Fibre mill	Fibre mill
	Cork	Processor [f]	Processor [f]	Processor [f]
	Oilseed rape straw	Farm [e]	Farm [e]	Growing media manufacturer
	Wood based [d]	Sawmill	Sawmill	Sawmill
	Wool	Farm [e]	Growing media manufacturer	Growing media manufacturer
		Energy use	Water use	
Use generic data for uncertain supply chain tiers [c]	Anaerobic digestate (from energy crops)	Farm and transport to the AD facility		
	Coir pith	Coconut small holding/plantation and transport to the fibre mill		
	Cork	Forest/Farm and transport to the cork processor		
	Oilseed rape straw	Farm		
	Wood based [d]	forest and transport to the sawmill		
	Wool	Farm and transport to a collection hub (where utilised)		
		Habitat and biodiversity	Renewability	
Approach	Anaerobic digestate (from energy crops)	Weighted average farm approach	No change	
	Coir pith	Regional approach		
	Cork	Scores 20 [g]		
	Oilseed rape straw	Weighted average farm approach		
	Wood based [d]	Proxy approach		
	Wool	Weighted average farm approach		

Notes:

[a] It is not always possible to collect relevant data for the proposed starting point for coir pith and wood based materials (including Biochar (from forestry products) and Cork) for all of the criteria. Modifications to the starting point apply; which in some cases move the starting point to a more pragmatic and accurately assessable production stage. Modifications to the starting point are set by the scheme not the user. These will be reassessed periodically.

[b] As anaerobic digestate (from energy crops) is only judged to be responsible for 6% of the impact at the farm, the additional effort of collecting data from this starting point (multiple fields) is not worth the additional cost or impact on the total score to be justified. The same is true of Oilseed rape straw and Wool (sheep only) which are only judged to be responsible for 10% and 3% of the impact at the farm respectively. Modifications to the starting point apply; which in some cases move the starting point to a more pragmatic production stage. Modifications to the starting point are set by the scheme not the user. These will be reassessed periodically.

[c] If a company has real data which can be used in place of generic data this is encouraged, as long as it is fully auditable.

[d] Wood based products include Biochar (from forestry products), but excludes Cork as the tree is not felled.

[e] Starting point is the farm and not individual fields (will cover more than just fields being used to produce the material).

[f] Starting point is the cork processor.

[g] There is agreement in the literature that the harvesting of cork is beneficial for habitat and biodiversity at the site level and that the economic value of harvested cork is beneficial in conserving and retaining these valuable habitats at a landscape or national level.

Scoring

Scores out of 20 have been separated into categories, illustrated using a traffic light system (Figure 1).

(green)	18-20	Current good practice
(yellow)	12-17.99	Watch
(orange)	6-11.99	Poor
(red)	0-5.99	Critical

Notes:
20 = highest score for all criteria
0 = lowest score for three criteria – habitat, social, pollution
1 = lowest score for the remaining criteria

Figure 1: Boundary scores

Scores are allocated using scoring decision trees (Part 2: The criteria in detail). Not all of the scores 0-20 are available on each tree.

For every product each bulk ingredient will be assessed and awarded a score for each criterion. All criteria have equal weighting. The product score will be the sum of the ingredient scores weighted by % volume (Figure 2 and Part 3: Worked examples).

There is no threshold score at which a product is deemed to be responsible. Instead a rating system (A to E) has been developed to indicate the degree of responsibility (responsibility index – Figure 3).

	Peat	Coir	Woodfibre	Composted Bark Fines	Bark Fines	Green Compost	
Energy Use	14	14	14	10	10	10	
Water Use	20	8	18	20	20	20	
Social Compliance	9	9	5	4	4	5	
Habitat & Biodiversity	1	12	3	15	15	20	
Pollution	12	12	12	12	12	12	
Renewability	1	20	17	17	17	20	
Resource Use Efficiency	8	15	15	15	15	17	
Substrate Calculator Score	**65**	**90**	**84**	**93**	**93**	**104**	
Mix 1	80%					20%	72.8
Mix 2	50%			30%		20%	81.2
Mix 3		20%	30%	30%		20%	91.9
Mix 4		50%		25%		25%	94.25

Figure 2: Example of scored criteria for a range of products

A	>101
B	93-100.9
C	85-92.9
D	77-84.9
E	<77

Figure 3: Responsibility index

Part 2: The criteria in detail

Each of the 7 criteria is described here in detail (followed by consideration of carbon and climate change) with a decision tree to follow to derive a score for that criterion.

Only scores set out in the decision trees can be awarded, unless the methodology calls for an average score to be generated. The colour scheme and boundary values for the categories (current good practice, watch, poor and critical) are a visual representation (see Scoring).

The criteria require consideration of the total impact/resource use through each step in the supply chain from the material start point to end point.

Therefore, in order to use the decision trees an understanding of the supply chain for each material is required.

Supply chain mapping

The supply chain for each material and product must be mapped out. Supply chain maps should include details of each company in the chain (Figure 4).

Evidence should be collected from each company in the supply chain for inspection by the auditor.

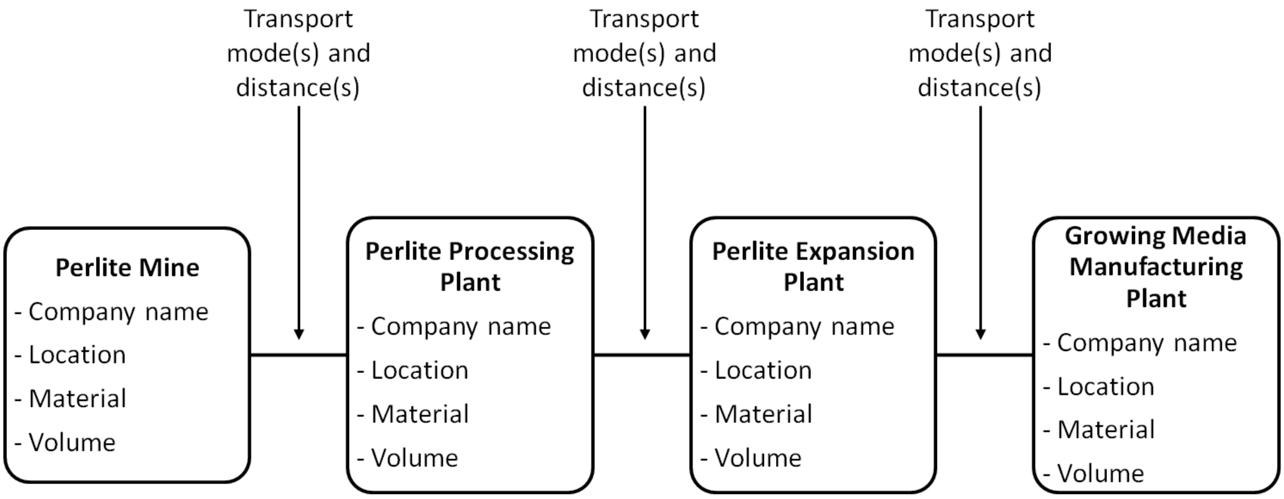


Figure 4: Example supply chain map

More complicated supply chain maps are included in the worked examples (see Part 3: Worked examples).

Energy use (in extraction, transport and production)

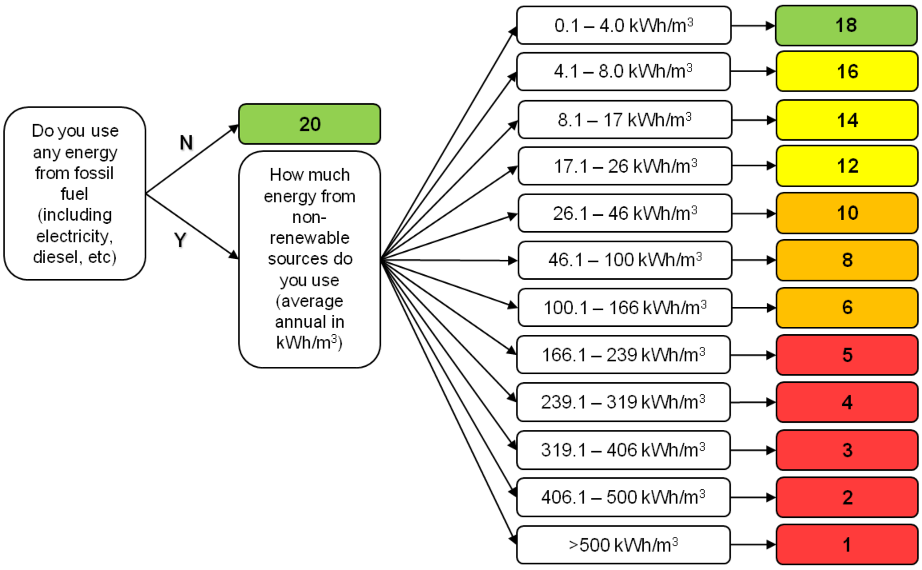
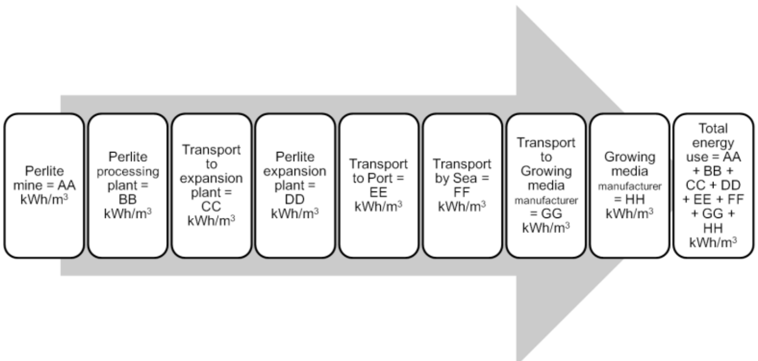


Figure 5: Energy use (in extraction, transport and production) scoring decision tree

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest ✓ Transport to manufacturer ✓ Processing and Production ✓ Up to the start of the mixing system ✓ Waste disposal by manufacturer	× Construction of infrastructure × Mixing system × Bagging (including packaging) × Office × Transport from manufacturer to consumer × Use/disposal by consumer
Imported finished products	✓ Transport from manufacturer to point of entry into country	× Bagging (including packaging)
Return journeys for empty vehicles	✓ Road based transport ✓ Specialist vehicles which are unlikely to have a return or onward load, e.g. timber transport	× Third party haulage (except where specialist vehicles are used) × Transport by air and rail
Energy	✓ Fossil fuel ○ Electricity ○ Diesel ○ Fuel oil ○ etc.	× Renewable energy generated by company used in processing or manufacture of material × Electricity provided through a green tariff certificated by an accepted certification scheme, e.g. the Green Energy Supply Certification Scheme

Figure 6: Example energy calculation



Fossil fuel energy use at each stage of production and transport is calculated (from starting point to end point Table 1) and with consideration of percentage allocated impact at each stage of production for virgin by-products (Table 2 and Table 3)) and added together. Documentary evidence is required. Standard data is provided in Table 5-

Table 7. Generic data for the first production stages of coir pith, wood based materials and anaerobic digestate (from energy crops) (Table 4) are given in Table 8. Where data is missing from one or more sites or companies in a supply chain, an average of the other suppliers or sites at that tier of the supply chain can be used as long as the this does not apply to more than 10% of the volume of the material in that tier. See also Part 3: Worked examples.

Table 5: Fuel conversion factors

Petroleum Products	Litres per Tonne	kWh per Litre
Liquefied Petroleum Gas (LPG)	1914	7.1
Ethane	2730	5.2
Aviation turbine fuel (jet kerosene)	1247	10.3
Motor Spirit (petrol)	1360	9.6
Gas/Diesel oil (including DERV)	1156	10.9
Fuel Oil	1015	11.9

(Source: 2012 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting, and Digest of UK Energy Statistics 2011 (DUKES))

Table 6: Diesel freight fuel use factors

Type of lorry	% weight laden	Litres fuel per km
Rigid	0%	0.236
	25%	0.262
	50%	0.288
	75%	0.314
	100%	0.340
Articulated	0%	0.311
	25%	0.345
	50%	0.379
	75%	0.414
	100%	0.448

The % weight laden refers to the extent to which the vehicle is loaded to their maximum carrying capacity. A 0% weight laden means the vehicle is travelling carrying no loads. 100% weight laden means the vehicle is travelling with loads bringing the vehicle to its maximum carrying capacity.

(Source: Defra (2005) Guidelines for Company Reporting on Greenhouse Gas Emissions)

Table 7: Standard port to port transport distances

Transport distances (km)		Bristol	Hull	Liverpool	Southampton	Belfast	Rotterdam	Felixstowe
Sri Lanka	Colombo	13646	14351	13899	13683	13892	14210	14040
Northern Ireland	Belfast	670	1298	357	1069	-	1613	1443
Eire	Dublin	402	1439	328	765	309	1308	1139
Netherlands	Rotterdam	1346	570	1600	543	1613	-	248
Estonia	Tallinn	3785	2600	3417	2982	3060	2556	2683
Latvia	Riga	3643	2459	3274	2841	2917	2415	2547
Lithuania	Klaipeda	3256	2072	2887	2454	2530	2028	2159
India	Tuticorin	13512	14218	13766	13549	13759	14077	13907
Germany	Bremerhaven	1800	615	2054	996	2067	572	702

		Sri Lanka Colombo
India	Tuticorin	365

Conversion factor - 1 nautical mile = 1.8520km.

(Source: Ports.com (2014). [Online] Available at: http://ports.com/sea-route [Accessed 25.02.15])

Table 8: Generic data for uncertain supply chain tiers or where effort to collect specific data is not justified (Table 4) (energy)

Production tier	Generic data	Source
Coconut small holding/plantation	Energy use assumed to be negligible per m^3 at a 5% impact	Part 3: Worked examples
Transport of coconut husks to fibre mill	As for coir pith transport to pith factory (1m^3 of coir pith is produced from 4m^3 of coconut husks)	
Coir pith transport to pith factory	Generally coir pith is collected from fibre mills within a 20km radius of the pith processing unit. Medium commercial vehicles in India (and Sri Lanka) travel 4.3 km per litre of diesel.	Newleaf (2012): Coir: a sustainability assessment. Final report for Defra project SP1214. http://randd.defra.gov.uk/ ICRA Management Consulting Services Limited (IMaCS)(2013): Market Survey leading to Fuel Consumption norms for Diesel (Engine Driven) Trucks & Buses in India. Final Report for the Petroleum Conservation Research Association
Forest site preparation and establishment	19525.26 MJ/ha (5423.68 kWh/ha or 6.8 kWh/m^3 of wood assuming 796m^3 of standing volume per hectare)	Whittaker CL, Mortimer ND, Matthews RW. (2010) Understanding the Carbon Footprint of Timber Transport in the United Kingdom. Sheffield, UK: North Energy Associates LTD. http://www.timbertransportforum.org.uk/Upload/Documents/22_TimberTransportFootprintReport.pdf
Forest harvest	Diesel fuel consumption for felling is estimated at 1.2 litres/m^3 of biomass and for forwarding at 0.9 litres/m^3 of biomass	Whittaker, C., Mortimer, N., Murphy, R. and Matthews, R. (2011) Energy and greenhouse gas balance of the use of forest residues for bioenergy production in the UK. Biomass and Bioenergy, 35 (11). pp. 29-45. ISSN 0961-9534 http://opus.bath.ac.uk/26708/1/Whittaker_BiomassBioenergy_2011.pdf
Transport of wood to sawmill	The average timber haulage distance is 51 miles (82 km) (or 102 mile/164 km round trip). 20% of the journey is on forest roads. Fuel use is 0.459 l/km for forest roads and 0.342 l/km for public roads.	Whittaker CL, Mortimer ND, Matthews RW. (2010) Understanding the Carbon Footprint of Timber Transport in the United Kingdom. Sheffield, UK: North Energy Associates LTD. http://www.timbertransportforum.org.uk/Upload/Documents/22_TimberTransportFootprintReport.pdf
Transport of wood to sawmill	Timber haulage vehicle typical load is 50m^3.	Part 3: Worked examples
Cultivation and harvesting of energy crops and on-farm transport to anaerobic digestion (AD) facility	Crop specific energy – litres of diesel for a typical yield for that crop in the UK - scaled for the field size and converted to kWh using Table 5. Assumption of 10% recoverable fibre by weight of input material. Assumption that 1 tonne of fibre has a volume of 2.7 m^3. Apply 6% impact factor.	Typical energy use for farm practices associated with energy crops are available from a range of sources. One example is the AD tool produced by the Bioenergy and Organic Resources Research Group at the University of Southampton available at: http://www.bioenergy.soton.ac.uk/resources.htm

Production tier	Generic data	Source
Transport of crops to AD facility	Generally energy crops are only transported within a 10 mile radius of the AD facility.	
Sheep farm	The average energy use by grazing livestock system per hectare is 444.44 kWh for Least Favoured Area Livestock Grazing and 1088.33 kWh for Lowland Grazing Livestock. Apply 3% impact factor. Volume of wool will need to be converted to number of fleeces and then an area using stocking density data.	Statistics on farm energy use in England was published in 2013 using the results of the 2011/2012 Farm Business Survey. Data is taken from Table 8 and converted to kWh. https://www.gov.uk/government/statistics/farm-energy-use Typical stocking densities on productive grass can be approximately 6 to 10 sheep per acre. But optimal stocking densities for some habitats will be considerably lower: https://www.fas.scot/downloads/tn686-conservation-grazing-semi-natural-habitats/
Transport of wool fleeces to collection hub	90% of British Wool members are within 1 hour of a British Wool distribution hub. Average speed on rural A roads in England in 2021 was 34.3 miles per hour. Assuming majority of distance wool travels from farm to British Wool distribution hub is by A roads, the wool travels a maximum distance of 30 miles.	Distance to distribution hubs: https://www.britishwool.org.uk/ksupload/userfiles/About/British%20Wool%20Report%20&%20Accounts%202022%20spreads.pdf Average speeds on rural A roads in England are compiled annually by the Department of Transport. Travel time measures for local 'A' roads: January to December 2021 report - GOV.UK (www.gov.uk)
Cultivation and harvesting of oilseed rape	National average yields of OSR (seed) were 3.4 t/ha in 2022. At harvest 35% of the biomass is stored in each of the seed and the stem and 30% is stored in the seed pod walls. Therefore, average yields of OSR straw (stem plus empty seed pod) would be 7.2 t/ha. Energy use for the sowing, maintenance and harvesting of OSR is 115 litres of fuel per hectare.	Data on yields are compiled by the AHDB: Oilseeds market outlook | AHDB Data on growth stages of OSR come from the AHDB: Senescence and harvest of oilseed rape (GS9) | AHDB Data on energy use for OSR comes from table 7 of Richards, I. R. (2000) Energy balances in the growth of oilseed rape for biodiesel and of wheat for bioethanol. Report to the British Association for Bio Fuels and Oils. http://www.homepages.ed.ac.uk/jwp/research/sustainable/levington/levington.pdf
Cork harvest	Cork is harvested manually. The extracted cork was traditionally stacked in the field and transported to the factory after 21 days. Nowadays, more producers (54% in 2019) choose the direct transport of cork to the factory on the day of extraction or the following days, avoiding the costs associated with the construction of the pile (labour, insurance, guard, etc.).	https://repository.incredibleforest.net/oppla-factsheet/20519

Production tier	Generic data	Source
Transport of cork to processor	160 - 600 km depending on the grade of cork for round trip journeys.	Demertzi M, Paulo JA, Arroja L, Dias AC (2016) A carbon footprint simulation model for the cork oak sector. Science of the Total Environment 566: 499–511 https://doi.org/10.1016/j.scitotenv.2016.05.135.

Documentary evidence required
• Supply chain map with distances and methods of transport • Production/manufacturing fossil fuel energy use records (diesel, electricity etc.) and calculations • Transport energy use calculations covering the whole supply chain, using standard distances and conversion factors where necessary. • For renewable energy generated by company and used in processing or manufacture of material, documented evidence of energy generation and consumption. • For energy obtained through green tariff, documented evidence of certification of the tariff through the Green Energy Supply Certification Scheme or equivalent.
Improvement process
• Increasing use of renewable energy. • Increase energy efficiency of production.

Water use (in extraction and production)

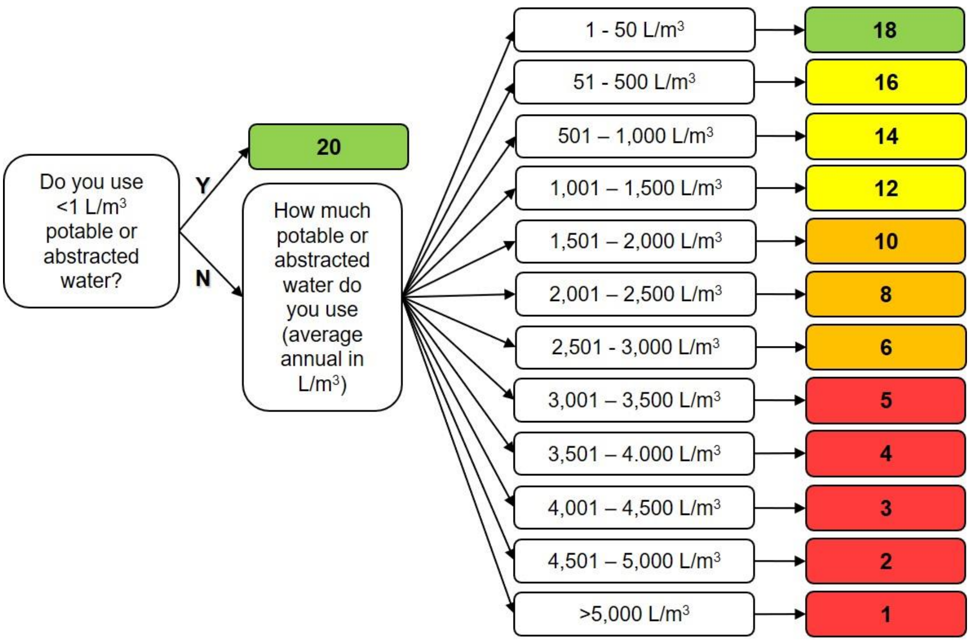
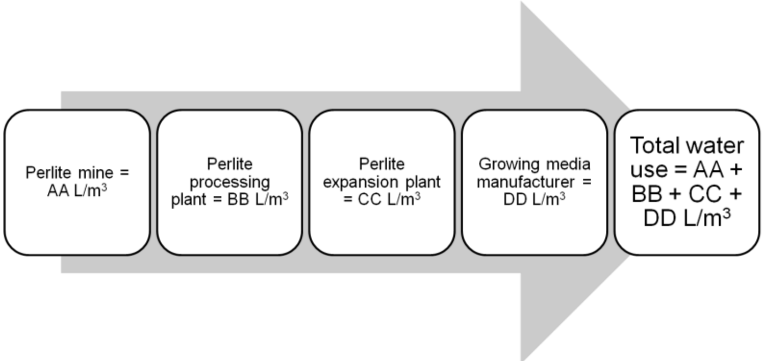


Figure 7: Water use (in extraction and production) scoring decision tree

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest ✓ Transport to manufacturer (water use assumed to be negligible) ✓ Processing and Production ✓ Start of mixing system	× Mixing system × Bagging (including packaging) × Office × Transport from manufacturer to consumer × Use/disposal by consumer
Imported finished		× Bagging (including packaging)

products		× Transport from manufacturer to point of entry into country (water use assumed to be negligible)
Water	✓ Potable or abstracted water used for, e.g.: ○ Irrigation ○ Washing ○ Industrial processes	× Rain (direct) × Harvested rainwater × Reused water

Figure 8: Example water calculation



Potable water use at each stage of production is calculated (from starting point to end point (Table 1) and with consideration of percentage allocated impact at each stage of production for virgin by-products (Table 2 and Table 3) and excluding out of scope water sources) and added together. Documentary evidence is required. Generic data for the first production stages of coir pith, wood based materials and anaerobic digestate (from energy crops) (Table 4) are given in Table 9. Where data is missing from one or more sites or companies in a supply chain, an average of the other suppliers or sites at that tier of the supply chain can be used as long as the this does not apply to more than 10% of the volume of the material in that tier. See also Part 3: Worked examples.

Table 9: Generic data for uncertain supply chain tiers or where effort to collect specific data is not justified (see Table 4) (water)

Production tier	Generic data	Source
Coconut small holding / plantation	Global average water footprint/embedded water for coconuts = 2669 m^3 of water per ton. (1 ton of coconuts produce 1.9m^3 of coir pith.) Regional assessments of the proportion supplied via irrigation need to be applied.	Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. http://www.waterfootprint.org/?page=files/WaterStat-ProductWaterFootprints For selected regional data from the same source see Table 10.
Forest	• Forests in temperate regions such as the UK are un-irrigated. • Water is not used in harvesting operations. • Nurseries which irrigate to produce softwood trees use around 3.39 litres of water per m^3 of standing wood.	Pers. comm. Forestry Commission 2015.
Farm	Energy crops used to supply AD facilities and oilseed rape are typically un-irrigated in the UK.	
Sheep Farm	The average water use by grazing livestock system is 13,200 litres per	Statistics on farm water use in England was published in 2011 using the results of the

Production tier	Generic data	Source
	livestock unit per year (13,000 litres for drinking water and 200 litres for washdown of buildings and equipment). Apply 3% impact factor. Volume of wool will need to be converted to number of fleeces and then livestock units (one ewe is 0.15 LU).	2009/2010 Farm Business Survey. Data is taken from Table 2 and converted to litres. 31% of sheep farms had access to watercourses for drinking water (Table 3). Defra (2011): Water Usage in Agriculture and Horticulture, Results from the Farm Business Survey 2009/10 and the Irrigation Survey 2010 Livestock unit data is taken from Table 1 of: https://www.fas.scot/downloads/tn686-conservation-grazing-semi-natural-habitats/
Cork forest/Farm	Traditionally cork forests are unirrigated. The use of drip irrigation during the first 10 years post planting is being explored to shorten the first harvest date.	

Table 10: Selected regional water footprints for coconuts

Sri Lanka		India					
Region	m³/t	Region	m³/t	Region	m³/t	Region	m³/t
Central	2942	Andhra Pradesh	2275	Haryana	1790	Orissa	2238
North Central	2741	Arunachal Pradesh	1398	Himachal Pradesh	1823	Pondicherry	2580
North Eastern	2556	Assam	1709	Jammu & Kashmir	1846	Punjab	1868
North Western	2851	Bihar	2092	Jharkhand	2039	Rajasthan	2310
Sabaragamuwa	3113	Chandigarh	-	Karnataka	2399	Sikkim	1920
Southern	3044	Chhattisgarh	2151	Madhya Pradesh	2372	Tamil Nadu	2449
Uva	2955	Dadra & Nagar Haveli	2784	Maharashtra	2416	Tripura	2120
Western	3060	Daman & Diu	2886	Manipur	1912	Uttar Pradesh	2179
Average	2914	Delhi		Meghalaya	1971	Uttaranchal	2186
		Goa	2648	Mizoram	2060	West Bengal	2080
		Gujarat	2495	Nagaland	1791	Average	2461

Documentary evidence required
• Supply chain map • Excavation/production/manufacturing water use records for all production and manufacturing processes. • Records of any rainwater harvesting or water recycling used.
Improvement process
• Increase water use efficiency (volume per m^3 of product) • Increase use of non-potable or non-abstracted water, e.g. by harvesting rainwater • Recycle/reuse water throughout the production process/supply chain

Social compliance

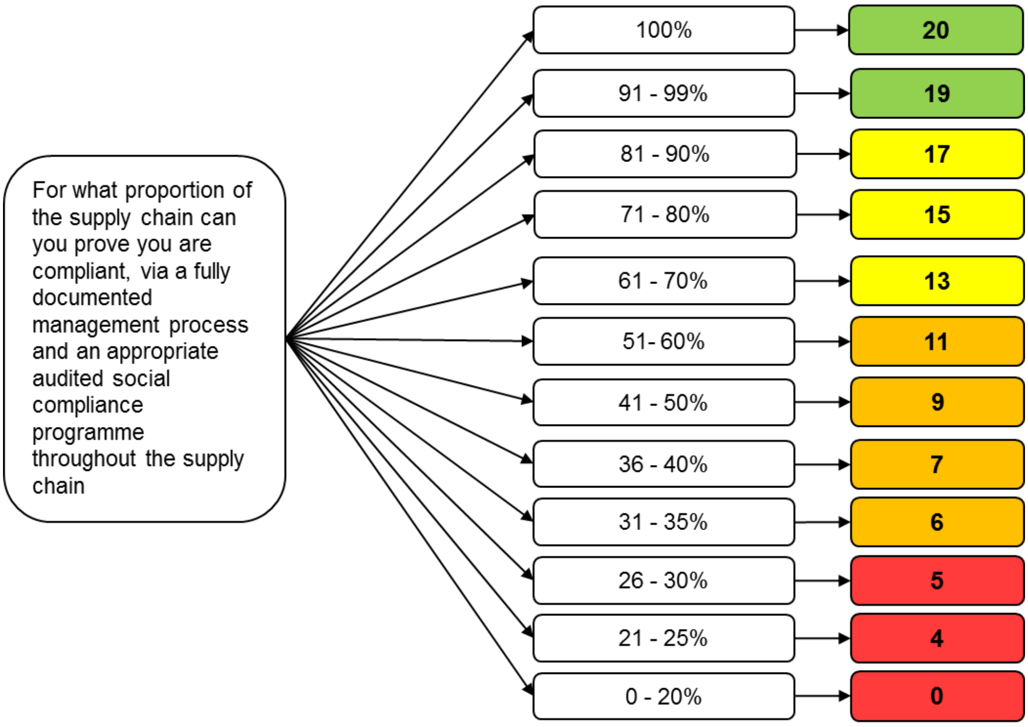
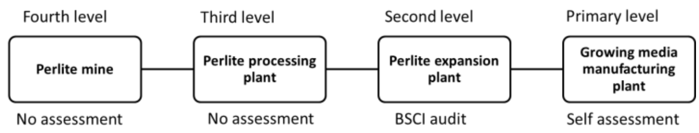


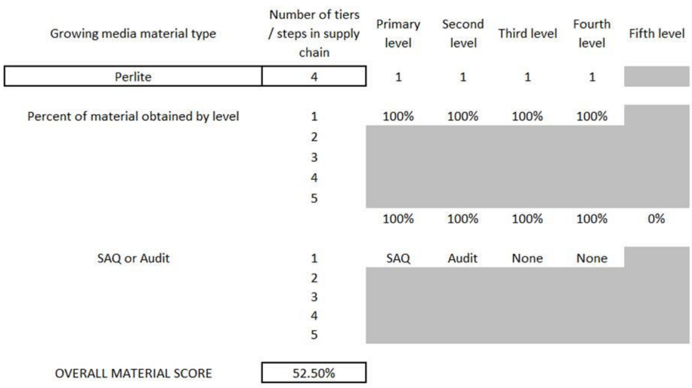
Figure 9: Social compliance scoring decision tree

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest ✓ Transport to manufacturer ✓ Processing and Production ✓ Start of mixing system	× Bagging (including packaging) × Transport from manufacturer to consumer × Use/disposal by consumer
Coir pith	Starting point is Fibre Mill (Table 4)	× Coconut small holding/plantation × Husk traders
Cork	Starting point is the processor (Table 4)	× Forest/Farm
Wood based materials	Starting point is Sawmill (Table 4)	× Forest operations
Anaerobic digestate (from energy crops) and Oilseed rape straw	Starting point is the Farm (Table 4)	× Separating out the proportion of a farm that is not involved in energy crop production
All other materials	✓ Starting point is as set out in Table 1	

Figure 10: Example social compliance calculation



The methodology used to prove social compliance for each company in each of the in-scope tiers of the supply chain (Table 1 and Table 4) needs to be determined. Self-assessment questionnaires (which meet the minimum requirements set out in Annex 2) are valued at half of the value of third party audits (Table 11). Where no assessment has been carried out there is no proof of social compliance; assumptions cannot be made on the basis of country of manufacture and compliance with local law.



The total level of proof is assessed across the supply chain with different weighting applied to each tier according to the length of the supply chain (Table 12); the further back along the supply chain the smaller contribution each tier makes to the score. The percentage allocated impact at each stage of production for virgin by-products (Table 2 and Table 3) is not currently applied. The level of proof at each tier is weighted by the volume of material supplied by each supplier in that tier. A tool has been developed which can be used to undertake this calculation. Documentary evidence is required.

Table 11: Relative value of different forms of proof of social compliance

Form of proof	Relative value
Third party audit	1
Self-assessment questionnaire	0.5
No assessment	0

Table 12: Contribution of each tier of the supply chain to the overall level of social compliance

Number of tiers	Primary level (manufacturer)	Second level	Third level	Fourth level	Fifth level
1	100%				
2	60%	40%			
3	50%	30%	20%		
4	45%	30%	20%	5%	
5	44%	30%	20%	5%	1%

Documentary evidence required

• Supply chain map including sources of all materials
• Details of the social compliance process, including any internal checks of suppliers.
  ○ Transparency is obtained through the use of either an internal management system or an external management system such as Sedex or BSCI.
  ○ Self-assessment questionnaires may be used as proof (see Annex 2: Social compliance self-assessment questionnaire minimum requirements), but they are scored at a lower value than independent audits (Table 11).
  ○ Neither ISO14001 nor ISO9001 are acceptable proof. OHSAS18001 only offers partial proof as it does not cover the labour standards elements required but does cover the

health and safety requirements. • Risk assessments • Certification to confirm successful independent audits throughout the supply chain   ○ Independent audits of suppliers need to be conducted using recognised approaches such as SMETA, BSCI, SA8000 or similar.
Improvement process
• Increase the proportion of the supply chain included in your social compliance programme

Habitat and biodiversity

The habitat and biodiversity issues associated with land management and land use change for each of the most common bulk ingredients of growing media and soil improvers are too diverse to use a single scoring decision tree.

Nine different categories of bulk ingredient are considered in separate scoring decision trees or assessments:

- Peat
- Wood based material (including biochar from forestry products)
- Coir pith
- Minerals (other than peat)
- Recycled materials
- Agricultural crops (energy crops for AD, oil seed rape straw, farmed Sphagnum)
- Bracken
- Wool (sheep only)
- Cork

The same life cycle stage is in-scope throughout, i.e., extraction/growing and harvest.

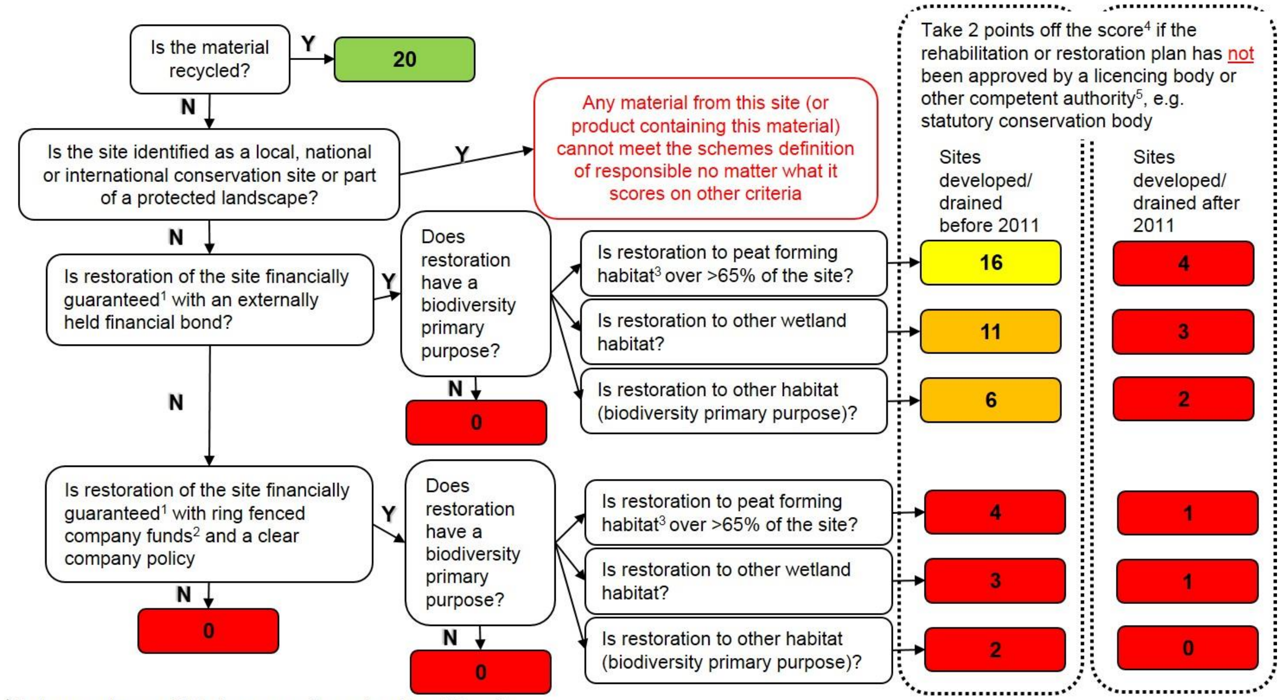
Land used to develop the office and production plant is out of scope.

The impact allocated to virgin by-products at the extraction/growing and harvest production stage (Table 2 and Table 3) have already been built into the scoring decision trees (Figure 11 to Figure 17). The less complex scoring decision trees for wood based materials (including biochar) (Figure 12), coir pith (Figure 13), agricultural crops (energy crops used to produce anaerobic digestate, oil seed rape straw) (Figure 15) and wool (Figure 17) reflect their lower allocated impacts (2.5-33%, 5%, 6-10% and 3% respectively).

At this early stage of development Sphagnum (farmed) uses the same decision tree as other agricultural crops despite having 100% of the allocated impact at the farm. This will be kept under review.

Any materials for which there is not an appropriate decision tree will need to be referred to the technical committee.

Peat



[1] that guarantees sufficient resource for restoration of the site
[2] published in company's public accounts NB: Company track record of restoration is not sufficient
[3] appropriate to the country of the site (as demonstrated by restoring hydrological conditions)
[4] Negative scores are rounded to zero
[5] Where there is no Competent Authority an alternative external reviewer must be agreed with the Technical Committee

Figure 11: Habitat and biodiversity peat decision tree (100% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste
Recycled peat	✓ Waste peat removed from development sites; where removal of peat is not the purpose of development, i.e. the purpose is not peat extraction (for fuel or horticulture) and where it is demonstrated that excavation and removal is unavoidable.	× Peat gathered from run-off from degraded habitats

Peat extracted from sites identified as a local, national or international conservation site or part of a protected landscape are excluded from this scheme. Any material from these sites (or product containing this material) cannot meet the scheme definition of responsible no matter what it scores on other criteria. Sites that are local, national and international conservation sites or protected landscapes will be those identified by statutory conservation bodies or regulating authorities and where formal notification has been given or is underway.

Figure 11 provides two sets of scores depending on when sites were developed or drained; if this occurred after 2011 the loss of biodiversity from site development is taken into account in the scoring. The score is then modified (reduced by 2) at the end of the tree if the site's rehabilitation or restoration plan has not been approved by a licencing body or other competent authority, e.g. statutory conservation body. Where there is no competent authority an alternative external reviewer must be agreed with the Technical Committee. Negative scores should be rounded to zero.

The guaranteed funding for the restoration/rehabilitation of the site after extraction ceases must be sufficient for the restoration of the site. Where this is achieved via ring fenced company funds, this must be published in company's public accounts and there needs to be a clearly stated and published company policy. A track record of restoration on other sites is not accepted as a guarantee. Biodiversity offsetting cannot be used in place of guaranteed funding for restoration of the extraction site.

A replacement peat forming habitat is scored most highly. However, the type of peat forming habitat is not specified; it should be appropriate to the country of the site. If the planned peat forming habitat will not cover more than 65% of the site, the score for other wetland habitat should be used. If the planned restoration for the site is not for a biodiversity primary purpose this does not achieve a score above zero for habitat and biodiversity.

Documentary evidence required (each site)
• Supply chain map including sources of peat • Evidence that the site has not been identified as a local, national or international conservation site or part of a protected landscape • Proof of development/drainage start date • Restoration/rehabilitation plan – including proof that this has been approved by a licencing body or other competent authority, e.g. statutory conservation body • Proof of provision to guarantee the financing of restoration – including documentation of the method of guarantee (and associated policy where relevant) and that the funds will be sufficient to deliver the restoration plan • Proof of source of recycled peat and that excavation and removal of peat at that site is unavoidable
Improvement process
• Ensure that there is financial provision to fund restoration and increase the level of guarantee of this funding • Target restoration to habitats which have higher scores • Gain approval of restoration plans

Wood based material

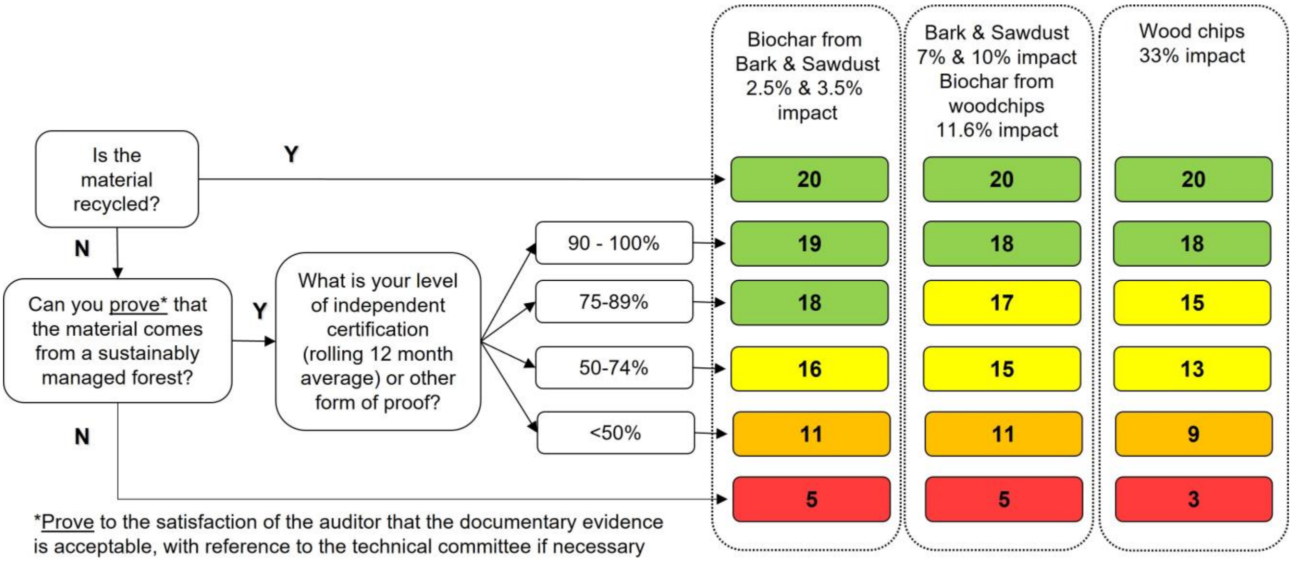


Figure 12: Habitat and biodiversity wood based material decision tree (2.5, 3.5, 7, 10, 11.6 and 33% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste
Wood	✓ Softwood (virgin or recycled) ✓ Hardwood (virgin or recycled)	

As per Table 4, it is not always possible to go back to the proposed starting point for wood based materials. However, the starting point for wood based materials is not modified for the habitat and biodiversity criterion as a proxy approach is applied.

Various scheme and methodologies exist for the assessment of whether wood and wood products are sourced from sustainably managed forests. Whilst many of them do not formally assess the impact on habitat and biodiversity, for the purposes of this assessment they are assumed to act as a suitable proxy, i.e. sustainably managed forests are assumed to have lower detrimental impacts on habitat and biodiversity than those which are not.

As per Table 2 wood based virgin by-products are allocated different levels of impact for different production stages. For the in-scope life cycle stage (the forest) the allocated levels of impact are 7% for bark, 10% for sawdust (and shavings and wood fines) and 33% for woodchips. When wood based products undergo pyrolysis to produce biochar there are additional products produced (bio-oil and gas), which further reduces the impact at the forest for these materials. Therefore, for Biochar (from forestry products) the allocated impacts are 2.5% for biochar from bark, 3.5% for biochar from sawdust and 11.6% for biochar from woodchips.

Figure 12 provides 2 choices of score at each of the scoring points; these take into account the different allocated levels of impacts. Biochar from bark and sawdust should use the first column of scores (left), Bark and sawdust based products and biochar from woodchips should use the second column of scores (middle) and wood chip based products should use the third column (right).

Documentary evidence required

• Supply chain map including sources of wood based materials
• The source of material (virgin by-products and recycled material)
• That material comes from a sustainably managed forest. Could include:
  ○ Independent third party certification
  ○ Recognised national/retailer schemes
  ○ Recognised country of origin risk assessment (low risk)(e.g. FSC Controlled Wood National Risk Assessment) (material relying on this proof alone should not be included in % calculation)
• Membership/certification to appropriate scheme
• Total amount of material handled, detailing level of certification or other qualifying proof (i.e. not country of origin risk assessment).

Improvement process
• Increase the level of qualifying proof (i.e. excluding country of origin risk assessment).

Coir pith

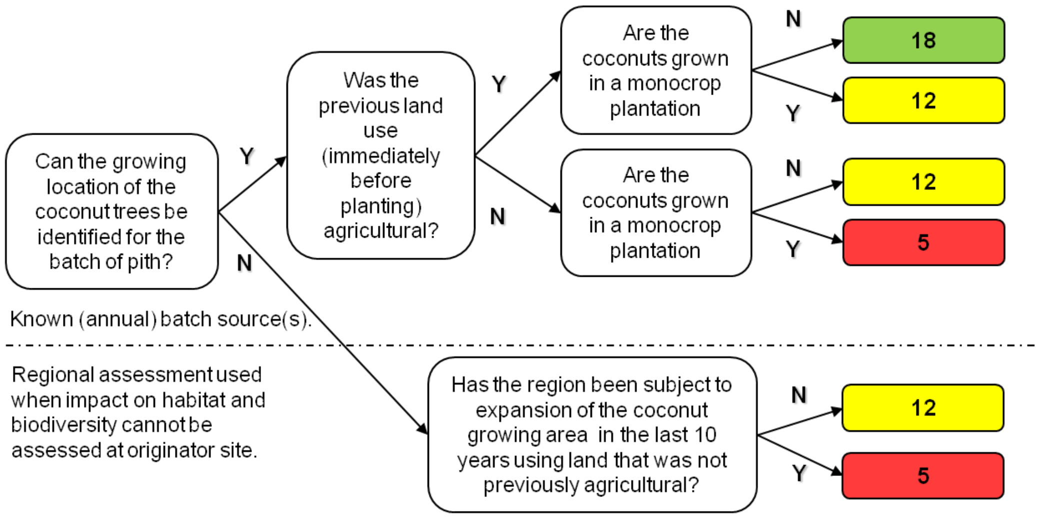


Figure 13: Habitat and biodiversity coir pith decision tree (5% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste

As per Table 4, it is not always possible to go back to the proposed starting point for coir pith. However, the starting point for coir pith is not modified for the habitat and biodiversity criterion as an alternative regional assessment approach is available for use where the specific growing location of the material cannot be traced due to the complexity of the supply chain.

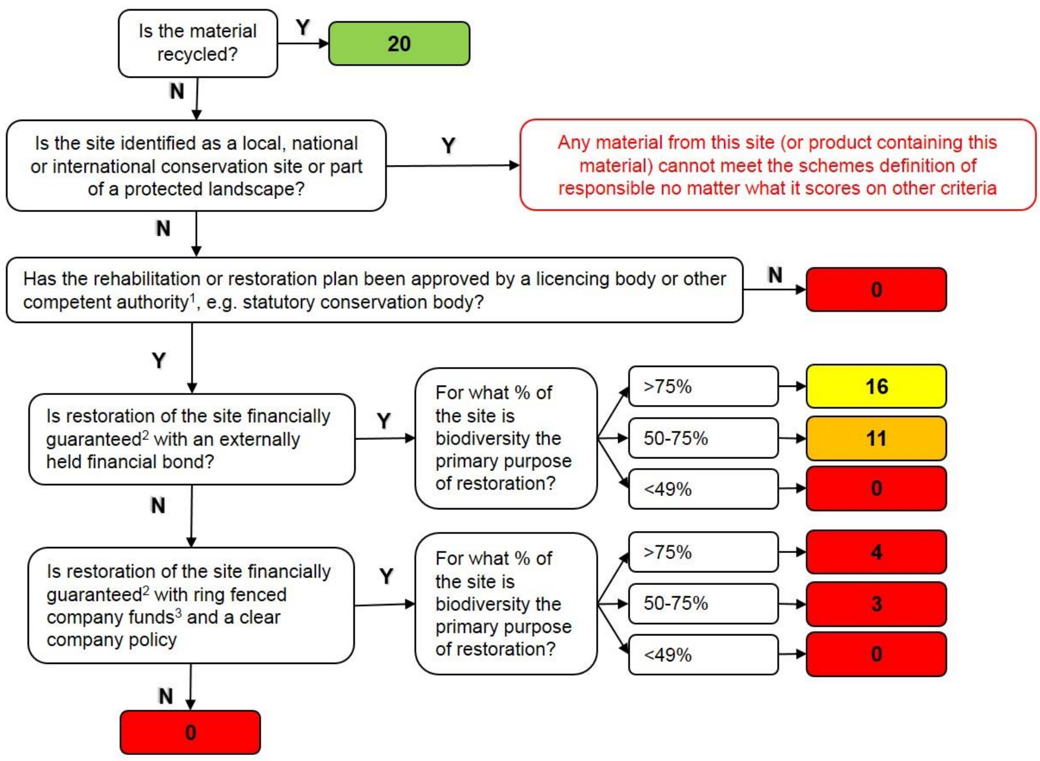
As per Table 3 virgin by-products (including coir pith) are allocated different levels of impact for different production stages. For the in-scope life cycle stage (coconut production) the allocated level of impact is 5%. Figure 13 takes the 5% level of impact into account.

Documentary evidence required

• Supply chain map including sources of coir pith/coconuts
• Documentary evidence of the source of material
• For known specific location sourced materials:
  o Evidence of previous land use
  o Evidence of first cultivation date for coconuts
  o Evidence of cultivation system (monocrop, etc.)
• For regional assessment:
  o Evidence of regional land use change to deliver any expansion of coconut production

Improvement process
• Source from known small holdings / plantations • Source from areas which have not expanded coconut production into non-agricultural areas in the last 10 years

Minerals



[1] Where there is no Competent Authority an alternative external reviewer must be agreed with the Technical Committee
[2] that guarantees sufficient resource for restoration of the site
[3] published in company's public accounts NB: Company track record of restoration is not sufficient

Figure 14: Habitat and biodiversity mineral based material decision tree (100% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste

Minerals extracted from sites identified as a local, national or international conservation site or part of a protected landscape are excluded from this scheme. Any material from these site (or product containing this material) cannot meet the scheme definition of responsible no matter what it scores on other criteria. Sites that are local, national and international conservation sites or protected landscapes will be those identified by statutory conservation bodies or regulating authorities and where formal notification has been given or is underway.

The guaranteed funding for the restoration/rehabilitation of the site after extraction ceases must be sufficient for the restoration of the site. Where this is achieved via ring fenced company funds, this must be published in company's public accounts and there needs to be a clearly stated and published company policy. A track record of restoration on other sites is not accepted as a guarantee. Biodiversity offsetting cannot be used in place of guaranteed funding for restoration of the extraction site.

If the planned restoration for the site is not for a biodiversity primary purpose across at least 50% of the site it does not achieve a score above zero for habitat and biodiversity.

Documentary evidence required (each site)
• Supply chain map including sources of minerals • Evidence that the site has not been identified as a local, national or international conservation site or part of a protected landscape • Restoration/rehabilitation plan – including proof that this has been approved by a licencing body or other competent authority, e.g. statutory conservation body • Proof of provision to guarantee the financing of restoration – including documentation of the method of guarantee (and associated policy where relevant) and that the funds will be sufficient to deliver the restoration plan • Proof of source of recycled minerals
Improvement process
• Ensure that there is financial provision to fund restoration and increase the level of guarantee of this funding • Increase the area of the site which has biodiversity as the primary purpose of restoration • Gain approval of restoration plans

Recycled materials

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste

As per Table 1 the starting point for recycled materials is the point at which the volume becomes commercially viable to transport (and not from the point of extraction/growing and harvest – the in-scope life cycle stage). Therefore, recycled materials are assumed to have no direct impact on habitat and biodiversity and score 20.

Agricultural crops (energy crops for AD, oilseed rape straw, farmed Sphagnum)

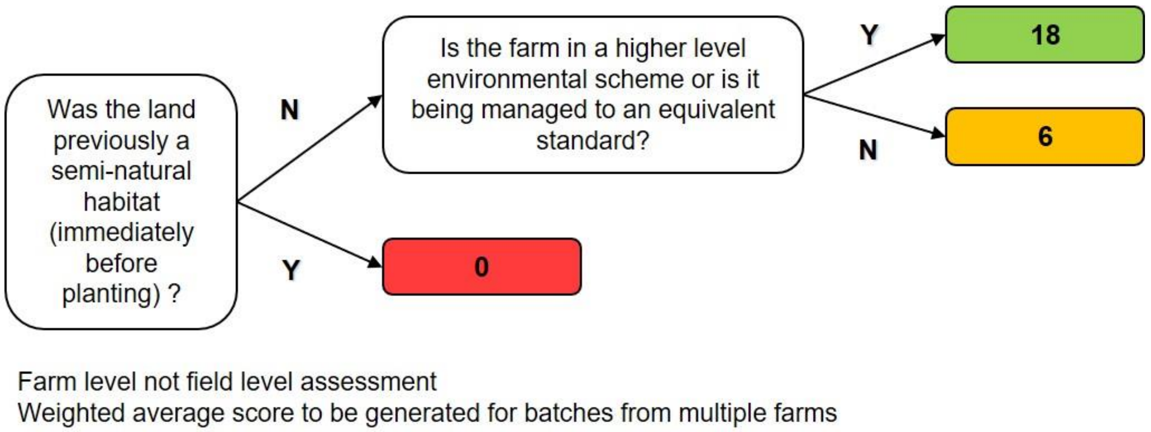


Figure 15: Habitat and biodiversity agricultural crops decision tree (6-10% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste
Sphagnum	✓ Sphagnum (farmed) ✓ Source material for Sphagnum (farmed) is from micropropagation, use of a bioreactor or other method that utilises small amounts of starting material for upscaling	× Wild harvested Sphagnum (both as a bulk material for growing media and as a source material for Sphagnum farming)

As per Table 4, the effort to collect specific data from the proposed starting point is not always justified for anaerobic digestate (from energy crops) and Oilseed rape straw. However, the starting point for anaerobic digestate (from energy crops) and Oilseed rape straw is not modified for the habitat and biodiversity criterion and a weighted average farm approach is applied for both energy crops and oil seed rape straw.

As per Table 3 virgin by-products (including anaerobic digestate (from energy crops) and Oilseed rape straw) are allocated different levels of impact for different production stages. For the in-scope life cycle stage (farm) the allocated level of impact is 6% and 10% respectively. Figure 15 takes the 6-10% level of impact into account.

At this early stage of development Sphagnum (farmed) uses the same decision tree as other agricultural crops despite having 100% of the allocated impact at the farm. This will be kept under review.

Where energy crops, oilseed rape straw or farmed Sphagnum are sourced from multiple farms an individual score should be generated for each farm. The annual volume of materials supplied by each farm should be used to generate a weighted average score for the anaerobic digestate (from energy crops), Oilseed rape straw or Sphagnum (farmed).

Documentary evidence required

• Supply chain map including sources of agricultural crops.
• Documentary evidence of the source of material
    ○ Evidence of previous land use
    ○ Evidence of first cultivation date for agricultural crops
• Documentary evidence that the farm is in a higher level environmental scheme (applicable scheme to the country of origin) or is being managed to an equivalent standard.

Improvement process
• Source from farms where land use change from semi-natural habitat has not occurred immediately prior to the commencement of agricultural crop production. • Source from farms which are able to demonstrate high levels of environmental management.

Bracken

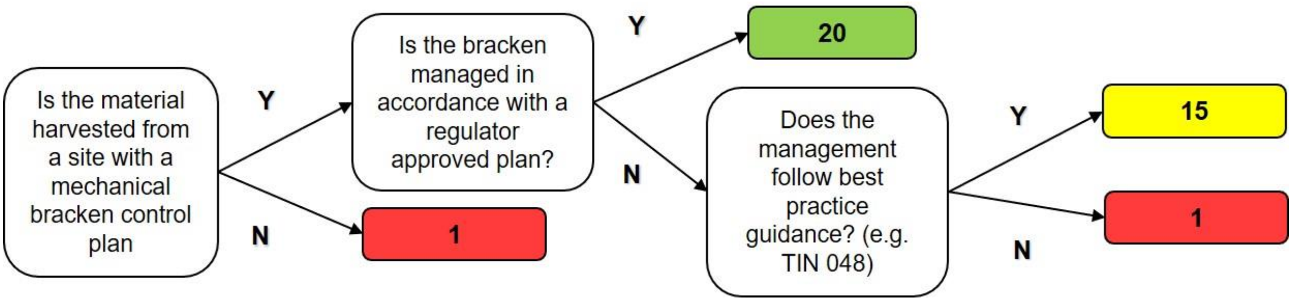


Figure 16: Habitat and biodiversity bracken decision tree (100% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste

Where bracken is sourced from multiple sites an individual score should be generated for each site. The annual volume of materials supplied by each site should be used to generate a weighted average score for the Bracken.

Documentary evidence required
• Supply chain map including sources of bracken. • Documentary evidence that bracken management is carried out following a bracken management plan, that this management plan follows best practice guidance* and that it has regulatory approval (where required or as needed).
Improvement process
• Source from locations which follow a bracken management plan which complies with best practice guidance. • Source from locations that follow a bracken management plan which has had regulator approval.

Note: * One example of best practice guidance is Natural England Technical Information Note TIN048 - Bracken management and control.
http://publications.naturalengland.org.uk/publication/35013

Wool (sheep only)

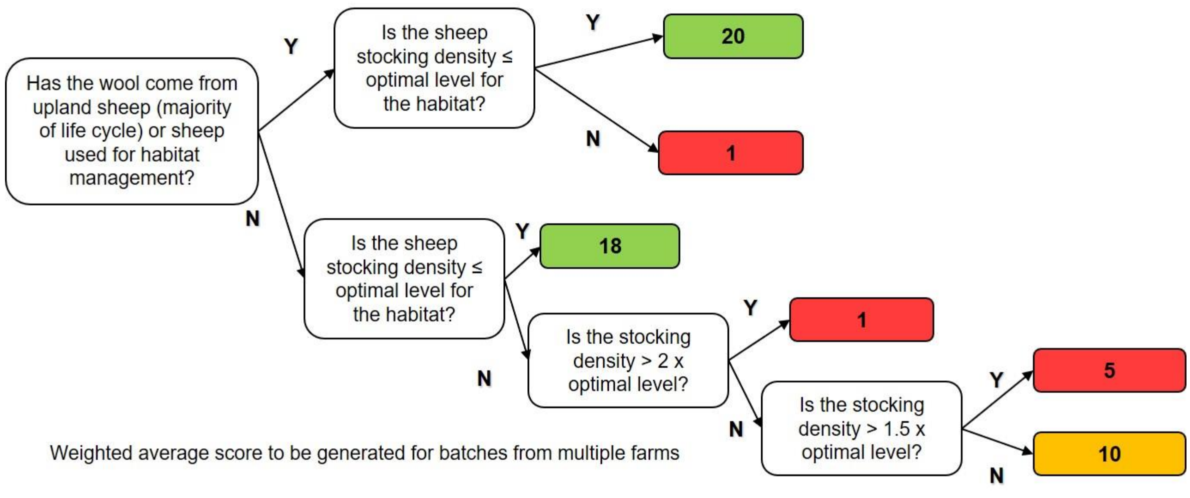


Figure 17: Habitat and biodiversity Wool (sheep only) decision tree (3% allocated impact)

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste

As per Table 4, the effort to collect specific data from the proposed starting point is not always justified for wool. However, the starting point for wool is not modified for the habitat and biodiversity criterion and a weighted average farm approach is applied.

As per Table 3 virgin by-products (including wool) are allocated different levels of impact for different production stages. For the in-scope life cycle stage (farm) the allocated level of impact is 3%. Figure 17 takes the 3% level of impact into account.

Where wool fleeces are sourced from multiple farms an individual score should be generated for each farm. The annual volume of materials supplied by each farm should be used to generate a weighted average score for the wool.

Optimal stocking densities for sheep on different UK habitats can be found at: https://www.fas.scot/downloads/tn686-conservation-grazing-semi-natural-habitats/

Documentary evidence required

• Supply chain map including sources of wool.
• Documentary evidence of the source of material
  ○ Location of farm (upland vs lowland). To meet the definition of an upland sheep farm the sheep should spend the majority of their life cycle in an upland extensive grazing system.
  ○ Evidence that sheep grazing is being used as part of a habitat conservation plan if not in an upland extensive grazing system
• Documentary evidence of the stocking density of sheep on each of the habitat types present on the farm.

Improvement process
• Source from farms where the stocking density is less than or equal to that of the optimum stocking density for the habitat being grazed.

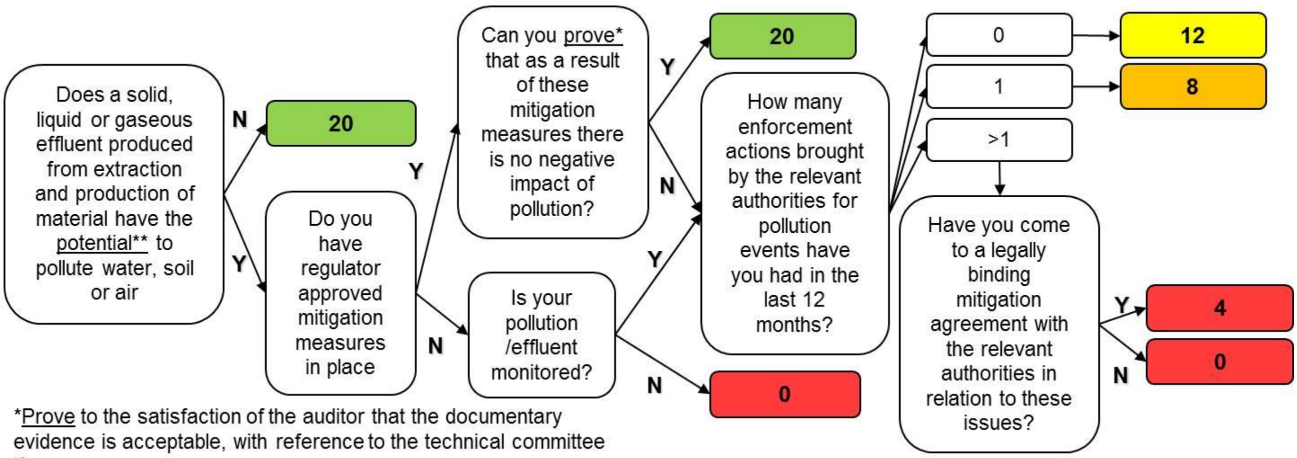
Cork

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest	× Transport × Processing and Production × Bagging (including packaging) × Office/Production plant × Use/disposal by consumer × Re-use/recycling of waste

There is agreement in the literature that the harvesting of cork is beneficial for habitat and biodiversity at the site level and that the economic value of harvested cork is beneficial in conserving and retaining these valuable habitats at a landscape or national level. Therefore, all sources of cork are allocated a score of 20.

Documentary evidence required
• Supply chain map.
Improvement process
• None.

Pollution

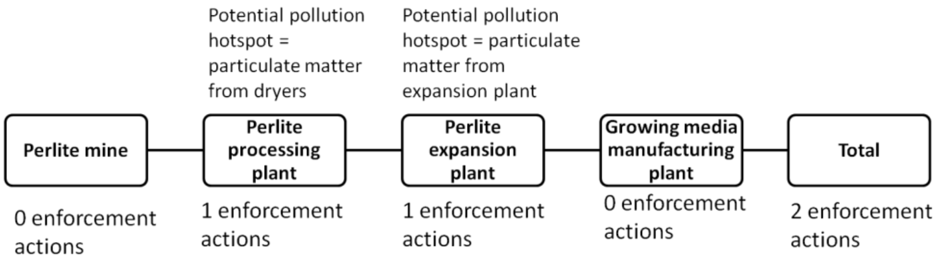


*Prove to the satisfaction of the auditor that the documentary evidence is acceptable, with reference to the technical committee if necessary
** Potential to pollute is a theoretical possibility without mitigation measures

Figure 18: Pollution scoring decision tree

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest ✓ Processing and Production ✓ Start of mixing system	× Mixing system × Bagging (including packaging) × Transport to manufacturer × Transport from manufacturer to consumer × Use/disposal by consumer
Pollutants (which can impact on human health and/or the environment)	✓ Solid (including dust) ✓ Liquid (including spillage of fuel used by handling machinery) ✓ Gaseous (including odour)	× Those arising from energy/fuel use by handling machinery × Greenhouse gases × Those for which there are no current legal targets for individual businesses to comply with
Coir pith	Starting point is Fibre Mill (Table 4)	× Coconut small holding/plantation × Husk traders
Cork	Starting point is the processor (Table 4)	× Forest/Farm
Wood based materials	Starting point is Sawmill (Table 4)	× Forest operations
Anaerobic digestate (from energy crops)	Starting point is the AD facility (Table 4)	× Farm (digestate responsible for 6% of impact)
Oilseed rape straw	Starting point is the farm (Table 4)	
All other materials	✓ Starting point is as set out in Table 1	

Figure 19: Example pollution calculation



The number of enforcement actions across the supply chain in the last 12 months is added together. Documentary evidence is required.

See Part 3: Worked examples.

If no one is monitoring effluent or emissions at a site, be it the company or the regulator, then no control of harmful pollution can be assumed and a score of zero is given. Evidence is required to prove that mitigation measures have been successful for a score of 20. Absence of negative data is not considered sufficient proof (with no enforcement action the score would be 12). Moreover, a score of 20 can only be awarded if the answer is “yes” for the entire supply chain. If any part of the supply chain scores zero then the material score is zero.

If extraction only occurs for part of the year consideration of the impact of extraction should not be limited to the period of active extraction, but should also consider the extraction site during its inactive phase.

Documentary evidence required
• Supply chain map including sources of all materials and known potential pollutant hotspots • Details of pollutant including quantity • Details of any mitigation measures required • Regulatory approval of any mitigation measures • Confirmation of mitigation measures • Demonstration of no negative impact • Monitoring records • Records of enforcement actions • Details of legally binding mitigation agreement
Improvement process
• Bring effluent levels down and under control. This must be demonstrated and the regulator satisfied. • Monitor own discharges and prove that there are no negative impacts.

Renewability

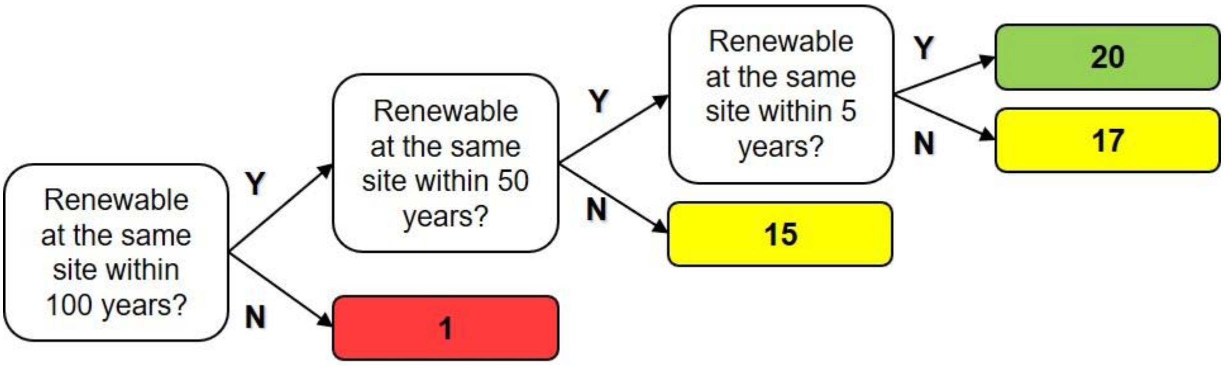


Figure 20: Renewability decision tree

	In scope	Out of scope
Life cycle stages	✓ Formation of virgin deposits ✓ Growth of virgin materials	× Extraction/harvest × Transport × Manufacturing × Use/disposal by consumer
Recycled materials	✓ Formation/growth of virgin material being generated at a site	× Rate at which waste is generated
Renewability [a]	✓ Replacement time of the material within living cycles at the same site.	× Global replacement rates × National replacement rates × Company replacement rates

Notes: [a] This is also a proxy for the impact of the material on atmospheric carbon dioxide levels and carbon cycling through the period over which emitted carbon dioxide is recaptured through the regrowth of the raw material on the same site.

Table 13: Renewability decision tree: expected scores for materials

Material [a, b]	Comment	Score
Husks and shells from food crops (includes coir pith)	Plant based material which is renewable within five years (annually) at same site	20
Green compost (including worm compost and composted bracken) and anaerobic digestate	Plant based material which is renewable within five years (annually) at same site	20
Bracken, Oilseed rape straw, Sphagnum (farmed)	Plant based material which is renewable within five years at same site	20
Wool	Animal by-product which is renewable within five years (annually) at same site	20
Cork	Usually derived from the cork oak (Quercus suber) with repeat harvest from the same tree every 9-12 years. Therefore, is renewable within 50 years, but not within five years at the same site	17
Softwoods (Wood based material, including wood fibre, bark and biochar (from forestry products))	Usually derived from conifers which are renewable within 50 years, but not within five years at the same site	17
Hardwoods including biochar (from forestry products)	Renewable within 100 years	15
Minerals including vermiculite, perlite, rockwool, sand, grit, topsoil, clay granules	Not renewable within 100 years at the same site	1
Peat	Not normally considered renewable within 100 years	1

Material [a, b]	Comment	Score
	at the extraction site, unless demonstrated otherwise on a site by site basis	
Plastics and petrochemical derived products	Not renewable within 100 years at the same site	1

Notes: [a] If a recycled material is composed of a number of materials which would have different scores a weighted average should be calculated.

[b] Biochar may be created from a range of materials. The score allocated should be for the material(s) which has undergone the pyrolysis process.

Documentary evidence required

• Evidence of materials used
• Proportion of each material used in final product
• For wood based material – species used, differentiating between hardwood/softwood
• For peat, where potentially renewable within 100 years, documented:
  ○ evidence of peat type (sphagnum/sedge)
  ○ peat extraction plan including depth excavated annually
  ○ site restoration plan including timescales

Improvement process
• There is limited potential for an improvement process for most materials within this criterion as a material cannot be made more renewable. Improvement is achieved by replacement of non- or less-renewable materials with more renewable materials or, for example, by switching from hardwood to softwood.

Resource use efficiency

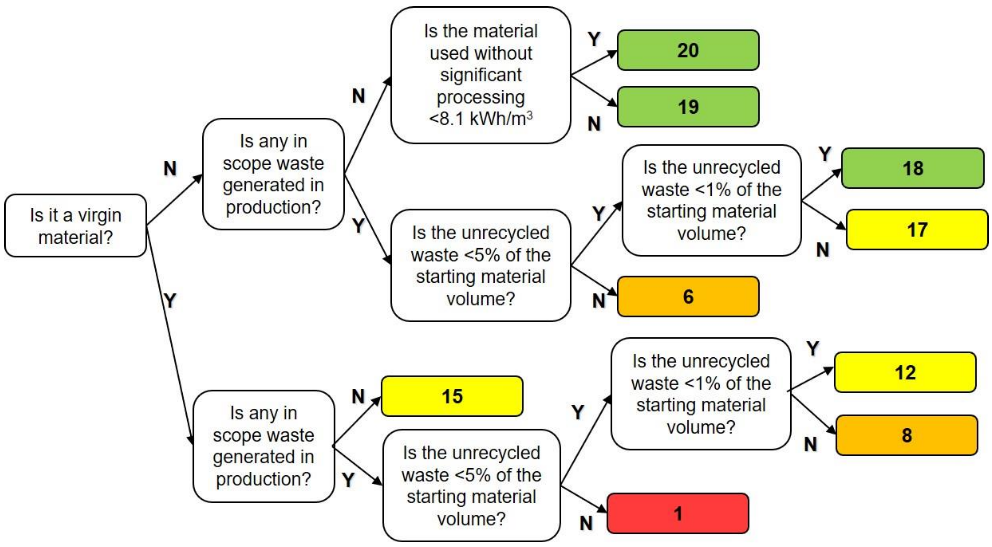
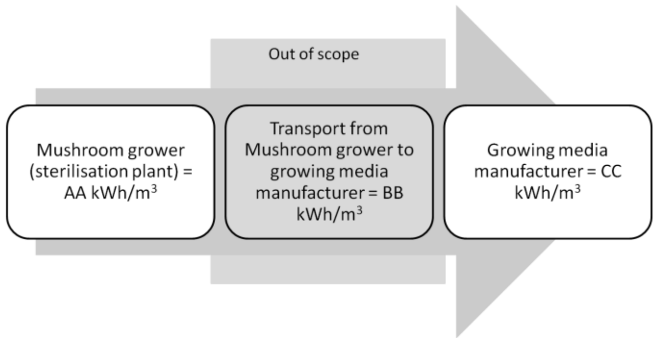


Figure 21: Resource use efficiency scoring decision tree

	In scope	Out of scope
Life cycle stages	✓ Extraction/growing and harvest ✓ Processing and Production ✓ Start of the mixing system	× Mixing system × Bagging (including packaging) × Use/disposal by consumer
Generated waste sources	✓ Unwanted material from production disposed of to landfill ✓ Physical contaminants screened out of input materials	× Material which is used to produce a by-product × Packaging materials used to transport materials between

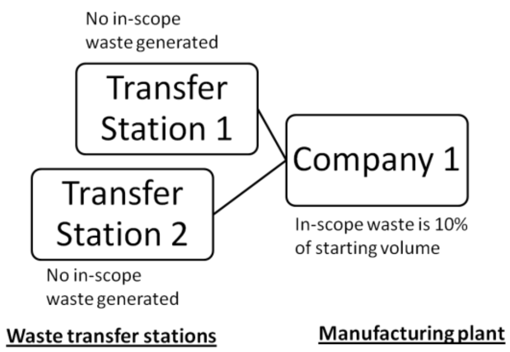
	In scope	Out of scope
		companies in the supply chain
Recycled materials processing energy	✓ Processing and Production	✗ Transport ✗ Offices
Coir pith	Starting point is Fibre Mill (Table 4)	✗ Coconut small holding/plantation ✗ Husk traders
Cork	Starting point is the processor (Table 4)	✗ Forest/Farm
Wood based materials	Starting point is Sawmill (Table 4)	✗ Forest operations
Anaerobic digestate (from energy crops)	Starting point is AD facility (Table 4)	✗ Farm (digestate responsible for 6% of impact)
Oilseed rape straw	Starting point is Growing media manufacturer (Table 4)	✗ Farm (oilseed rape straw responsible for 10% of impact)
All other materials	✓ Starting point is as set out in Table 1	

Figure 22: Example calculation of processing energy for a recycled material with no in-scope waste generated



The calculations used for the energy criterion should be used here. Transport energy use is out of scope so should be excluded from the total. Therefore, processing energy use here is AA+CC kWh/m^3. The score is dependent on whether this value is < or > 8.1 kWh/m^3. See Part 3: Worked examples.

Figure 23: Example calculation for resource use efficiency



The score for the supply chain is based on the total volume of unrecycled waste as a proportion of the input materials. Identify the volume of in-scope waste generated for each part of the supply chain; then calculate the proportion of unrecycled waste as a % of input materials. Average the % unrecycled waste for each tier of the supply chain based on the proportion of the material supplied by each company, then add together the % unrecycled waste for all of the tiers. Documentary evidence is required. See Part 3: Worked examples.

Documentary evidence required
• Evidence of materials used • Energy records - use during processing for recycled materials (kWh/m^3) • Volume of input materials (m^3) • Volume of in-scope waste generated during production (m^3)

• In-scope waste as a proportion of input material (%)
Improvement process
• There may be limited opportunity for a material to improve its score unless the amount of waste generated can be reduced. • Improvement is achieved by replacement of materials by others which have a better resource efficiency profile.

Consideration of carbon emissions and climate change

	In scope of other criteria [a]	Out of scope [b]
Carbon and climate change	✓ Fossil fuel use in extraction, transport and production (see Energy use (in extraction, transport and production) criterion) ✓ Land use change and loss/creation of carbon storing habitats (see Habitat and biodiversity criterion) ✓ Carbon turnover and cycling with the atmosphere (see Renewability criterion) ✓ Reuse and recycling of materials to limit emissions (see Resource use efficiency criterion)	× Greenhouse gas emissions × Loss of carbon sinks

Notes:

[a] Many of the criteria include elements of carbon and climate change, a separate criterion would lead to double counting. For example, the renewability criterion, due to its consideration of the long term sustainability of the material through its replacement time on site, is already capturing the impact of the substrate on atmospheric carbon dioxide levels and carbon cycling by means of the period over which emitted carbon dioxide is recaptured by the regrowth of the raw material on the same site.

[b] These are presently out of scope due to a lack of suitable methodology for their inclusion. In time it is intended that these will become in-scope.

Part 3: Worked examples

The following worked examples are designed to demonstrate the thought processes and data required to complete the calculations and generate a score. They are not real examples, but are based on available literature where possible.

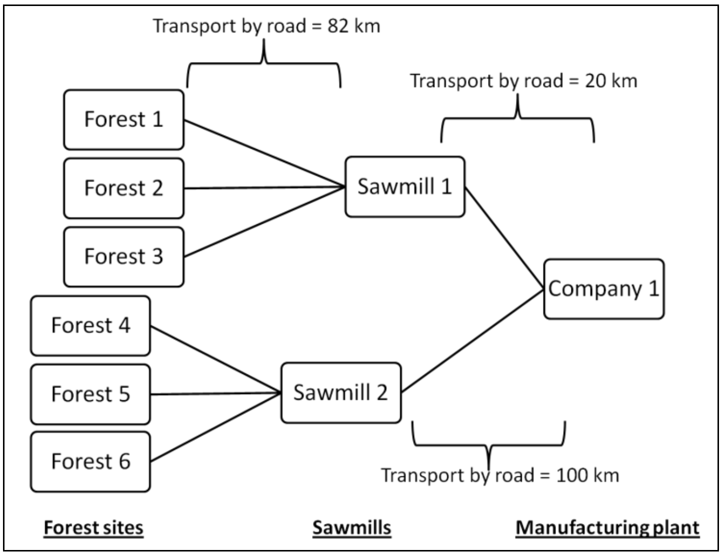
Except where standard data is used from the tables in Parts 1 and 2 of this document, the data presented should not be treated as standard data. This data will need to be replaced with actual data specific to the supply chain being scored.

Material 1: Wood fibre produced by Company 1

This is manufactured from a virgin material (by-product) (Table 1); therefore the starting point for this material is the forest. However, as per Table 4, for some criteria (energy use and water use) generic data should be used at the forest and for transport to the sawmill (unless site specific data is available) and for other criteria (social compliance, pollution and resource use efficiency) the starting point for assessment is the sawmill. The end point is the start of the mixing system (Table 1).
The material is produced from wood chips; therefore, per Table 2 it is responsible for 33% of the impact at the forest, 33% of the impact at the sawmill and 100% of the impact after the sawmill (e.g. processing of wood chips into wood fibre) up to the mixing system.

1 m^3 of wood chips produces 3 m^3 of extruded wood fibre (Company 1).

Supply chain map for Company 1 wood fibre



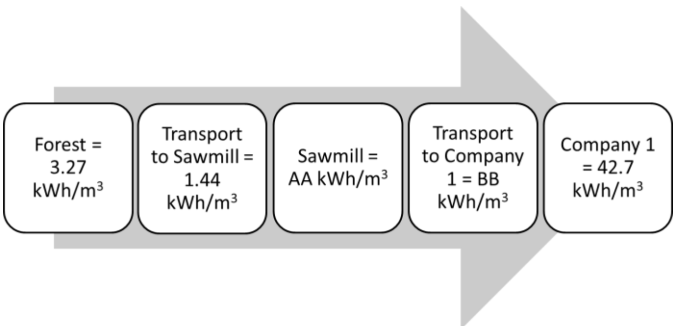
The UK forests that supply the sawmills are multiple and change with time.

The average timber haulage distance is 82 km (Table 8) from forest to sawmill.

Company 1 is supplied by two sawmills (1, which is 20 km away and 2, 100 km).

55% of the wood chips purchased by Company 1 come from Sawmill 1 and the remaining 45% from Sawmill 2.

Energy use (in extraction, transport and production)



As per Table 4, generic data should be used for the operations in the forest and for transport of material to the sawmill.

As per Table 8, UK forests use 6.8 kWh per m^3 of wood for site preparation and establishment (excluding building and maintaining forest roads – construction of infrastructure is out of scope). Diesel fuel consumption for felling is estimated at 1.2 litres per m^3 of biomass and for forwarding at 0.9 litres per m^3 of biomass (Table 8). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Wood chips are responsible for 33% of the impact at the forest (Table 2). $1m^3$ of wood chips produces $3m^3$ of wood fibre. Therefore, the energy use at the forest that the wood fibre is responsible for ((6.8 + (1.2*10.9) + (0.9*10.9))*0.33)/3 = 3.27 kWh/m^3

The average timber haulage distance is 82 km (164 km for the round trip as the return journey for empty vehicles is in scope) (Table 8). 20% of the journey is on forest roads (Table 8). Fuel use (diesel) is 0.459 l/km for forest roads and 0.342 l/km for public roads (Table 8). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). The load capacity of road timber transport is limited by weight rather than volume, due to the weight of fresh roundwood (>400 kg/m^3) (Whittaker *et al*, 2010). Therefore a 40 tonne vehicle with a load capacity of 25.5 tonnes can carry a maximum of 63.75m^3 in a load. It is assumed that the vehicle is not overloaded and that a typical load is 50m^3. Wood chips are responsible for 33% of the impact of transport from the forest to the sawmill (Table 2). $1m^3$ of wood chips produces $3m^3$ of wood fibre.

= (((((164*0.2*0.459) + (164*0.8*0.342))*10.9)/50)*0.33)/3 = 1.44 kWh/m^3

Sawmill 1 uses S kWh per m^3 of roundwood. Wood chips are responsible for 33% of the impact at the sawmill (Table 2). $1m^3$ of wood chips produces $3m^3$ of wood fibre. Therefore, fossil fuel energy use is S*0.33/3 = SS kWh/m^3.

Sawmill 2 uses T kWh per m^3 of roundwood. Wood chips are responsible for 33% of the impact at the sawmill (Table 2). $1m^3$ of wood chips produces $3m^3$ of wood fibre. Therefore, fossil fuel energy use is T*0.33/3 = TT kWh/m^3.

55% of the wood chips purchased by Company 1 come from Sawmill 1 and the remaining 45% from Sawmill 2. Therefore, average annual energy use at the sawmill is SS*0.55 + TT*0.45 = AA kWh/m^3

Wood chips are transported 20km by road from Sawmill 1 to Company 1 (the return journey for empty vehicles is out of scope – third party haulage). A typical load is Xm^3. The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). $1m^3$ of wood chips produces $3m^3$ of wood fibre. Therefore, the fossil fuel energy use for transport of the wood chips to Company 1 is (((20*0.379)*10.9)/X)/3 = 27.5/X = M kWh/m^3 (Sawmill 1)

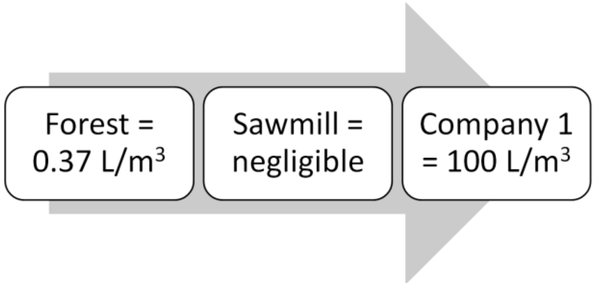
Wood chips are transported 100km by road from Sawmill 2 to Company 1 (the return journey for empty vehicles is out of scope – third party haulage). A typical load is Xm^3. The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). $1m^3$ of wood chips produces $3m^3$ of wood fibre. Therefore, the fossil fuel energy use for transport of the wood chips to Company 1 is (((100*0.379)*10.9)/X)/3 = 137.5/X = N kWh/m^3 (Sawmill 2)

55% of the wood chips purchased by Company 1 come from Sawmill 1 and the remaining 45% from Sawmill 2. Therefore, average annual energy use to transport wood chips from the sawmill is M*0.55 + N*0.45 = BB kWh/m^3

Non-renewable energy use at Company 1 to convert wood chips into wood fibre is 10 kWh of electricity per m^3 of fibre and 3 L of diesel per m^3 of fibre. 1 litre of diesel is equivalent to 10.9 kWh (Table 5). = 10 + (3*10.9) = 42.7 kWh/m^3

Therefore, the total non-renewable energy used from forest to the mixing system is 3.27+1.44+AA+BB+42.7 kWh/m^3 = 47.41+AA+BB kWh/m^3. Assuming that (AA+BB) < 118.59 kWh/m^3 the material scores 6 (Figure 5) (if (AA+BB) < 52.59 kWh/m^3 the material score would be 8).

Water use (in extraction and production)



As per Table 4, generic data should be used for the operations in the forest.

As per Table 9 UK forests are un-irrigated so no potable or abstracted water is used. No water is used in harvesting the forest. The tree nursery is assumed to be irrigated and uses 3.39 L of water per m^3 of wood (Table 9). Wood chips are responsible for 33% of the impact at the forest (Table 2). 1m^3 of wood chips produces 3m^3 of wood fibre. Therefore, wood fibre is responsible for (3.39*0.33)/3 = 0.37 L/m^3.

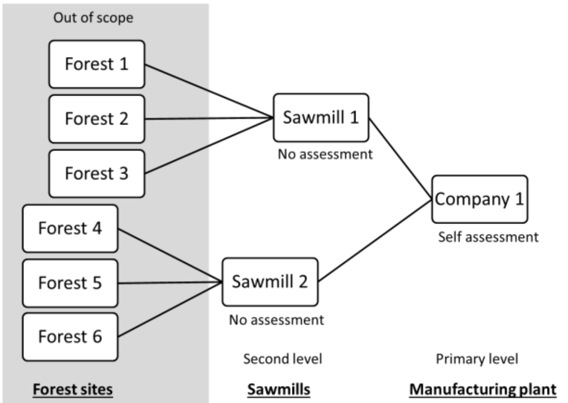
Use of water at the sawmill is negligible (Pers. Comm. Forestry Commission, 2015).

Potable or abstracted water used at Company 1 to convert wood chips into wood fibre is 0.1 m^3/m^3 of fibre. At a conversion rate of 1 m^3 = 1000 L this is 100 L/m^3.

Therefore, the total potable or abstracted water used from forest to mixing system is 0.37+0+100 = 100.37 L/m^3 and the material scores 16 (Figure 7).

Social compliance

The social compliance assessment for wood based materials begins at the sawmill (Table 4). Company 1 has completed a self-assessment questionnaire to demonstrate social compliance. As per Table 11, this is valued at 0.5 of an audited third party assessment. Neither Sawmills (1 and 2) have undertaken any form of assessment and have no proof of their social compliance.



The level of proof of social compliance, as calculated using the social compliance calculator is 30% and the material scores 5 (Figure 9).

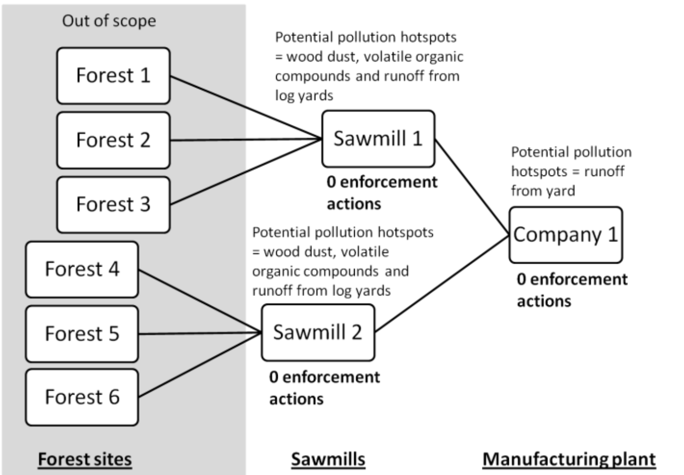
Growing media material type	Number of tiers / steps in supply chain	Primary level	Second level	Third level	Fourth level	Fifth level
Woodfibre_woodchips	2	1	2			
Percent of material obtained by level	1	100%	55%			
	2		45%			
	3					
	4					
	5					
		100%	100%	0%	0%	0%
SAQ or Audit	1	SAQ	None			
	2		None			
	3					
	4					
	5					
OVERALL MATERIAL SCORE	30.00%					

Habitat and biodiversity

Wood fibre is a wood based material; therefore, the wood based material tree applies. All of the wood sourced by Company 1 is from the UK and, therefore, comes from sustainably managed forests (or has a low risk of not coming from a sustainably managed forest - FSC Controlled Wood National Risk Assessment). Company 1 is Forest Stewardship Council Chain of Custody Certified; with a rolling average input of 72% FSC material. Wood chips are responsible for 33% of the impact at the forest (Table 2). Therefore, the habitat and biodiversity score for this material is 13 (Figure 12, column 3).

Pollution

The pollution assessment for wood based materials begins at the sawmill (Table 4). The IFC (2007) identify potential pollution hotspots from sawmills as wood dust, volatile organic compounds and wastewater effluent generated from runoff from irrigated storage areas known as log yards.



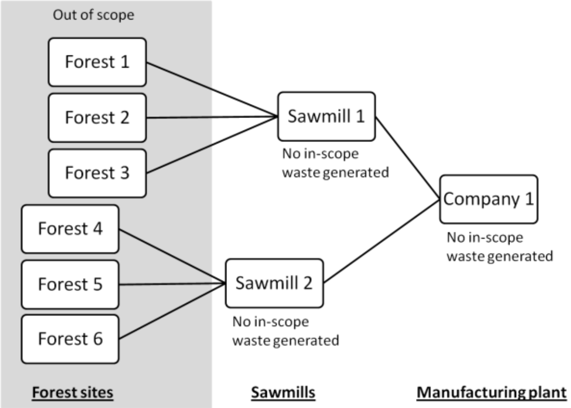
The Environment Agency monitors emission to air and water by Sawmills 1 and 2 and Company 1. They have brought no enforcement actions against any of the companies. Therefore, the pollution score for this material is 12 (Figure 18).

Renewability

The material is derived from softwood which is renewable at a single site within 50 years, but not within 5 years (Table 13). Therefore, the material score is 17 (Figure 20).

Resource use efficiency

The resource use efficiency assessment for wood based materials begins at the sawmill (Table 4). The wood chips are a virgin by-product (Table 1) and no in-scope waste is generated in their production. Therefore, the material score is 15 (Figure 21).



Summary: material score

The material score is:

Criteria	Score
Energy	6
Water	16
Social compliance	5
Habitat and biodiversity	13
Pollution	12
Renewability	17
Resource use efficiency	15
Material score	84

References

Whittaker CL, Mortimer ND, Matthews RW. (2010) Understanding the Carbon Footprint of Timber Transport in the United Kingdom. Sheffield, UK: North Energy Associates LTD. http://www.timbertransportforum.org.uk/Upload/Documents/22_TimberTransportFootprintReport.pdf

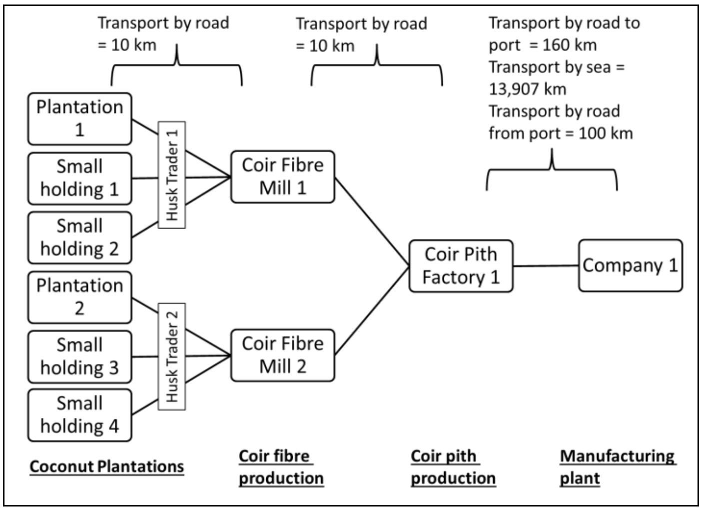
IFC (2007). Environmental, Health, and Safety Guidelines for Sawmilling and Manufactured Wood Products. International Finance Corporation, World Bank Group http://www.ifc.org/wps/wcm/connect/ce72a58048855ac48704d76a6515bb18/Final+-+Sawmills+and+MWP.pdf?MOD=AJPERES

Material 2: Coir pith produced by Company 1

This is manufactured from a virgin material (by-product) (per Table 1); therefore the starting point for this material is the plantation/small holding. However, as per Table 4, for some criteria (energy use and water use) generic data should be used at the plantation/small holding and for transport to the fibre mill (unless site specific data is available) and for other criteria (compliance, pollution and resource use efficiency) the starting point for assessment is the fibre mill. The end point is the start of the mixing system (Table 1).
The material is produced from the outer husk of the coconut; per Table 3 it is responsible for 5% of the impact at the plantation/small holding, 50% of the impact at the fibre mill and 100% of the impact from the pith factory up to the mixing system.

1 ton of coconuts produce 1.9m^3 of coir pith (Table 9). 4m^3 of coconut husks produces 1m^3 of coir pith (Table 8).

Supply chain map for Company 1 coir pith



The small holdings and plantations that supply the Fibre Mills in the Tamil Nadu region of India are multiple (more than shown in the supply chain map).

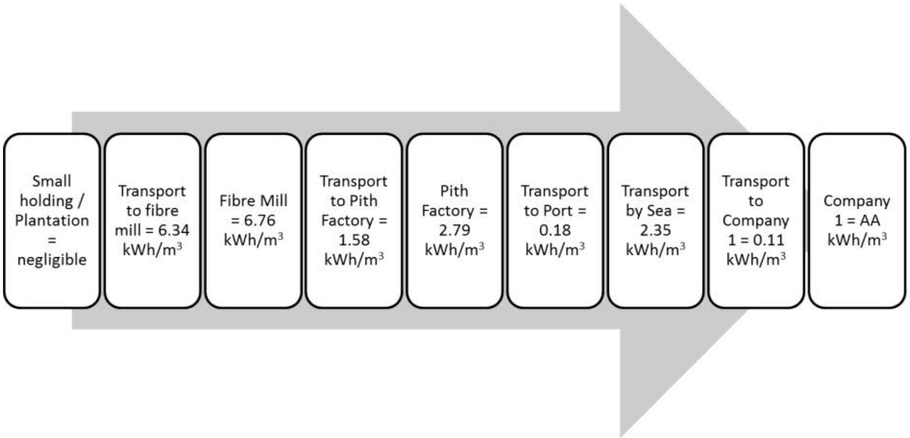
Husk Traders acts as intermediaries between the coconut growers and the fibre mills, collecting and transporting the husks.

Defra project SP1214 found that generally coir pith is collected from fibre mills within a 20km radius of the pith processing unit due to the rising cost of fossil fuels in India. It is assumed here that 20km is also the maximum economic distance for collection of coconut husks from the small holding or plantation. An average distance of 10km is used in each case.

The pith factory is 160km from the port of Tuticorin, which is 13,907 km from Felixstowe (Table 7). Company 1 is located 100 km from Felixstowe. The coir pith is shipped in compressed blocks and reconstituted by Company 1.

40% of the coir pith purchased by Coir Pith Factory 1 comes from Fibre Mill 1 and the remaining 60% from Fibre Mill 2.

Energy use (in extraction, transport and production)



As per Table 4, generic data should be used for the operations in the small holding/plantation and for transport of material to the fibre mill.

According to SP1214 the main use of fossil fuels on coconut plantations is for pumps to extract water from boreholes and wells. The amount of energy used has not been calculated, but as coir pith is responsible for 5% of the impact at the plantation (Table 3) this fossil fuel energy use is assumed to be negligible per m^3.

The Husk Trader transports coconut husks by road an average of 10km to the fibre mill (20km for the round trip as the return journey for empty vehicles is in scope). A typical load is $16m^3$. The truck (medium commercial vehicle) uses diesel and travels 4.3 km per litre of fuel (Table 8). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Coir pith is responsible for 50% of the energy use from transport of the coconut husk (Table 3). $4m^3$ of coconut husks produces $1m^3$ of coir pith (Table 8). Therefore, the fossil fuel energy use for transport of the coconut husks to the fibre mill that the pith is responsible for is a maximum of (((20/4.3)*10.9)/16)*0.5*4 = 6.34 kWh/m^3

Fibre Mill 1 uses 3.35 kWh of electricity per m^3 of husk in crushing the husks and fibre extraction. Coir pith is responsible for 50% of the energy use at the fibre mill and $4m^3$ of coconut husks produces $1m^3$ of coir pith (Table 8), therefore coir pith is responsible for 3.35*0.5*4 = 6.7 kWh/m^3 (Mill 1).

Fibre Mill 2 uses 3.40 kWh of electricity per m^3 of husk in crushing the husks and fibre extraction. Coir pith is responsible for 50% of the energy use at the fibre mill and $4m^3$ of coconut husks produces $1m^3$ of coir pith (Table 8), therefore coir pith is responsible for 3.40*0.5*4 = 6.8 kWh/m^3 (Mill 2).

40% of the coir pith purchased by Coir Pith Factory 1 comes from Fibre Mill 1, the remaining 60% comes from Fibre Mill 2. Therefore, the average energy use at the fibre mill is 6.7*0.4 + 6.8*0.6 = 6.76 kWh/m^3.

The coir pith is transported by road a maximum of 10km to the factory (from both mills) (the return journey for empty vehicles is out of scope – third party haulage). A typical load is $16m^3$. The truck (medium commercial vehicle) uses diesel and travels 4.3 km per litre of fuel (Table 8). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Coir pith is responsible for 100% of the energy use from transport of the coconut pith (Table 3). Therefore, the fossil fuel energy use for transport of the coir pith to the factory that the pith is responsible for is ((10/4.3)*10.9)/16 = 1.58 kWh/m^3

Pith Factory 1 uses 3.1 kWh of electricity per m^3 for transporting the material around the factory, sieving and grading and compression into blocks of which 10% is supplied by wind power. Therefore, the fossil fuel energy used is 3.1*0.9 = 2.79 kWh/m^3.

The compressed coir pith blocks are transported 160km by road to the port of Tuticorin (the return journey for empty vehicles is out of scope – third party haulage). A typical load is 300m^3 (reconstituted volume). The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Coir pith is responsible for 100% of the energy use from transport of the coconut pith (Table 3). Therefore, the fossil fuel energy use for transport of the coir pith to the port that the pith is responsible for is ((160*0.379)*10.9)/300 = 2.20 kWh/m^3

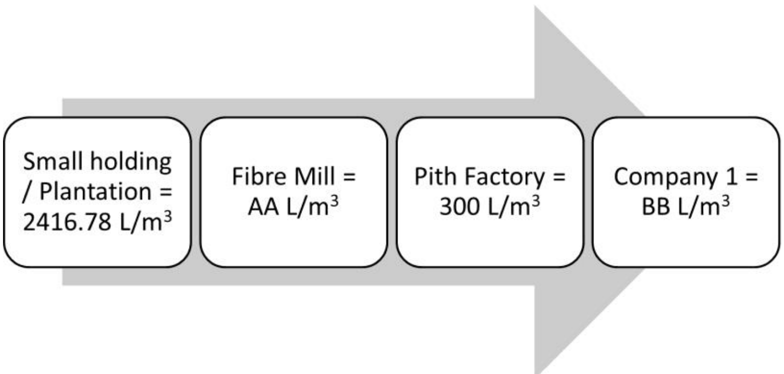
The compressed coir blocks are transported by sea to Felixstowe, a distance of 13,907 km (the return journey is out of scope – not by road). The volume of the typical load is 300m^3 (reconstituted volume) and is shipped in a 40 foot container (2 TEU). The 9,300 TEU ship uses 250 tonnes of bunker fuel per day travelling at 24 knots (44.4 km/hour). 1 tonne bunker fuel oil is 12078.5 kWh (Table 5, litres per ton * kWh per litre for fuel oil). Therefore, the fossil fuel energy use for transport of the coir pith by sea is (((((13907/44.4)/24)*250)*12078.5)*(2/9300))/300 = 28.25 kWh/m^3

The compressed coir pith blocks are transported 100km by road from Felixstowe to Company 1 (the return journey for empty vehicles is out of scope – third party haulage). A typical load is 300m^3 (reconstituted volume). The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Therefore, the fossil fuel energy use for transport of the coir pith from the port to the factory that the pith is responsible for is ((100*0.379)*10.9)/300 = 1.38 kWh/m^3

Company 1 uses X litres of diesel per m^3 of final product. 1 litre of diesel is equivalent to 10.9 kWh (Table 5). = X*10.9 = AA kWh/m^3

Therefore, the total non-renewable energy used from plantation to the mixing system is 0+6.34+6.76+1.58+2.79+2.20+28.25+1.38+AA kWh/m^3 = 49.3+AA kWh/m^3. Assuming that AA < 50.7 kWh/m^3 the material scores 8 (Figure 5).

Water use (in extraction and production)



As per Table 4, generic data should be used for the operations in the small holding/plantation.

According to Mekonnen and Hoekstra (2010) the global average water footprint (blue and green water) for coconuts (1996-2005) was 2669 m^3 of water per ton (Table 9), with a regional assessment for Tamil Nadu of 2449 m^3/ton (Table 10). At a conversion rate of 1 m^3 = 1000L this is 2,449,000 L/ton. Both the global average and Tamil Nadu assessment assume all of this water is supplied by rainwater. However, SP1214 noted the requirement for irrigation of the coconut palm, particularly in the water stressed areas of Tamil Nadu. An estimated 25% of coconut plantations are irrigated in Tamil Nadu, therefore it is assumed that one in four of the plantations supplying the Fibre Mills (both 1 and 2) are irrigated. It is assumed that on irrigated plantations only half of the water is supplied by irrigation (the remainder by direct rainfall); 60% of the irrigation water comes from rainwater storage lagoons, 10% of the irrigation water comes from the pith factory (recycling) and the remainder from a private borehole. Therefore, 30% of the water used for irrigation needs to be accounted for. Coir pith is responsible for 5% of the water use at the small holding/plantation (Table 3). 1 ton of coconuts produce 1.9m^3 of coir pith (Table 9). Therefore, the potable water use at the small holding/plantation that the pith is responsible for is ((((2449000*0.5)*0.3)*0.05)/4)/1.9 = 2416.78 L/m^3

Fibre Mill 1 uses S L of water per m^3 of husk for wetting crushed husks for 2 days before placing in the decorticator (i.e. mechanical system with no retting). Coir pith is responsible for 50% of the water use at the fibre mill and 4m^3 of coconut husks produces 1m^3 of coir pith (Table 8), therefore coir pith is responsible for S*0.5*4 = SS L/m^3 (Mill 1).

Fibre Mill 2 uses T L of water per m^3 of husk for wetting crushed husks for 5 days before placing in the decorticator (i.e. mechanical system with no retting). Coir pith is responsible for 50% of the water use at the fibre mill and 4m^3 of coconut husks produces 1m^3 of coir pith (Table 8), therefore coir pith is responsible for S*0.5*4 = SS L/m^3 (Mill 2).

40% of the coir pith purchased by Coir Pith Factory 1 comes from Fibre Mill 1, the remaining 60% comes from Fibre Mill 2. Therefore, the average water use at the fibre mill is SS*0.4 + TT*0.6 = AA L/m^3.

Pith Factory 1 uses 300 L/m^3 to wash (and buffer) coir pith in a controlled (tanked) environment. The waste water is treated and used to irrigate coconuts (this recycling is already taken into account above).

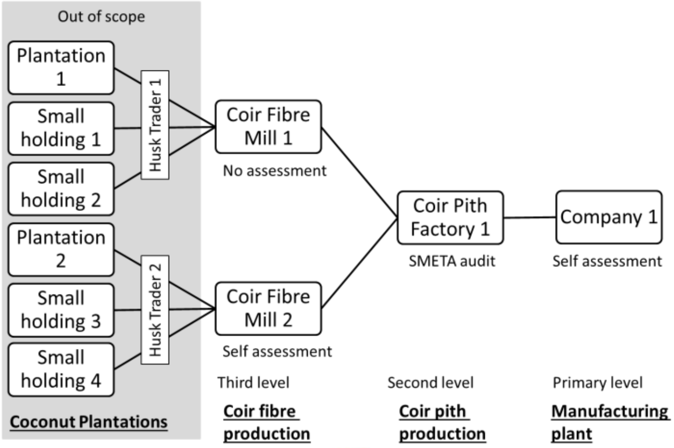
Company 1 uses BB L/m^3 of potable water to reconstitute compressed coir blocks. The remainder of the water used is rainwater.

Therefore, the total potable water used from plantation to mixing system is 2416.78+AA+300+BB L/m^3 = 2716.78+AA+BB L/m^3. Assuming that (AA+BB) < 12083.22 L/m^3 the material scores 5 (Figure 7) (if (AA+BB) < 583.22 L/m^3 the material score would be 6).

Social compliance

The social compliance assessment for coir pith begins at the fibre mill (Table 4). Company 1 has completed a self-assessment questionnaire to demonstrate social compliance, as has Coir Fibre Mill 2. As per Table 11, this is valued at 0.5 of an audited third party assessment. Coir Pith Factory 1 has undergone a SMETA audit. Coir Fibre Mill 1 has not undertaken any form of assessment and has no proof of its social compliance.

The level of proof of social compliance, as calculated using the social compliance calculator is 61% and the material scores 13 (Figure 9).



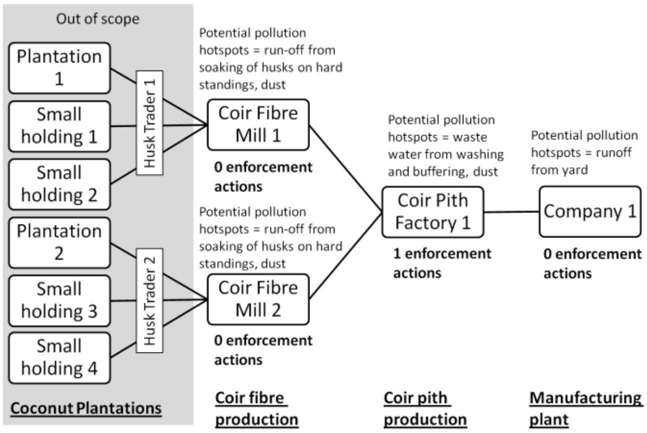
Growing media material type	Number of tiers / steps in supply chain	Primary level	Second level	Third level	Fourth level	Fifth level
Coir	3	1	1	2		
Percent of material obtained by level	1	100%	100%	40%		
	2			60%		
	3					
	4					
	5					
		100%	100%	100%	0%	0%
SAQ or Audit	1	SAQ	Audit	None		
	2			SAQ		
	3					
	4					
	5					
OVERALL MATERIAL SCORE	61.00%					

Habitat and biodiversity

The small holdings and plantations that supply the Fibre Mills in the Tamil Nadu region of India are multiple and due to the use of Husk Traders it is not possible to track all of them back to the exact growing location, therefore a regional approach is taken. The region has not been subject to expansion of coconut growing into non-agricultural land in the last 10 years; therefore the habitat and biodiversity score for this material is 12 (Figure 13).

Pollution

The pollution assessment for coir pith begins at the fibre mill (Table 4). Newleaf (2012) identifies the potential pollution hotspots at the fibre mill as run-off from hard standings and dust and at the pith factory as waste water from washing and buffering and dust.



The waste water from Coir Fibre Mill 1 and 2 and Coir Pith Factory 1 are monitored by the Tamil Nadu Pollution Control Board. Coir Fibre Mills 1 and 2 have had no enforcement actions brought against them in the last 12 months. Coir Pith Factory 1 had a significant pollution event 6 months ago and the TNPCB took action against them. The issue has now been resolved and this is the only enforcement action in the last 12 months.

The waste water discharges by Company 1 are monitored by the Environment Agency. They have brought no enforcement actions against Company 1.

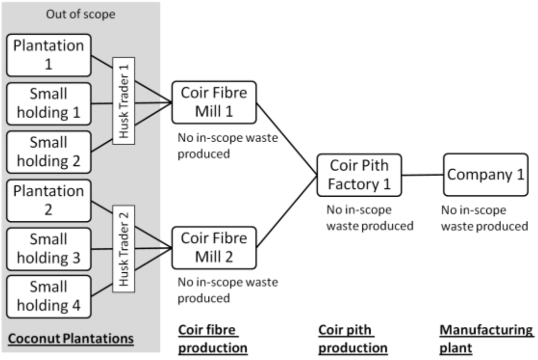
Therefore, with a total of 1 enforcement action in the last 12 months across the supply chain, the pollution score for this material is 8 (Figure 18).

Renewability

The material is produced annually at each site (Table 13). Therefore, the material score is 20 (Figure 20).

Resource use efficiency

The resource use efficiency assessment for coir pith begins at the fibre mill (Table 4). Coir pith is a virgin by-product (Table 1). No in-scope waste is generated in its production. Therefore, the material score is 15 (Figure 21).



Summary: material score

The material score is:

Criteria	Score
Energy	8
Water	5
Social compliance	13
Habitat and biodiversity	12
Pollution	8
Renewability	20
Resource use efficiency	15
Material score	81

References

ICRA Management Consulting Services Limited (IMaCS)(2013): Market Survey leading to Fuel Consumption norms for Diesel (Engine Driven) Trucks & Buses in India. Final Report for the Petroleum Conservation Research Association

Newleaf (2012): Coir: a sustainability assessment. Final report for Defra project SP1214. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=18114&FromSearch=Y&Publisher=1&SearchText=sp1214&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

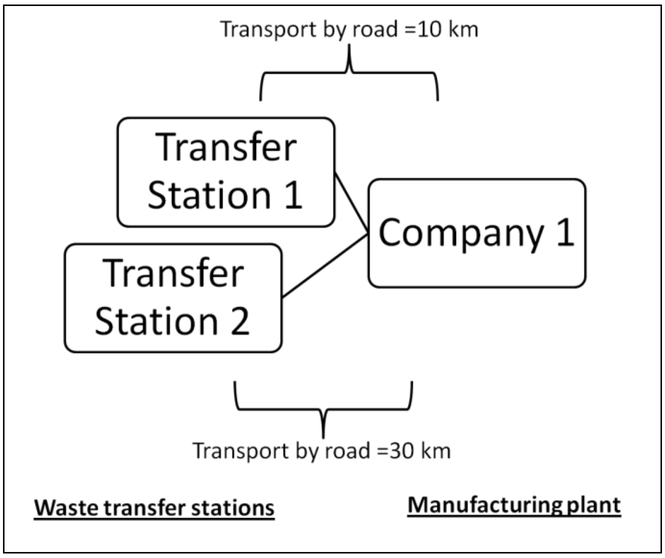
Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. http://www.waterfootprint.org/?page=files/WaterStat-ProductWaterFootprints

Material 3: Green compost produced by Company 1

This is a recycled material (per Table 1) which is PAS100 certified, but produced to the WRAP Guidelines for the Specification of Quality Compost for use in Growing Media; therefore the starting point for this material is the transfer station or composting site for material not arriving from a transfer station (Table 1). The end point is the start of the mixing system (Table 1).

2m^3 of green waste produces 1m^3 of green compost (physical contaminants make up 10% of the input material (annual average for Company 1) and 40% loss of volume on composting).

Supply chain map for Company 1 green compost

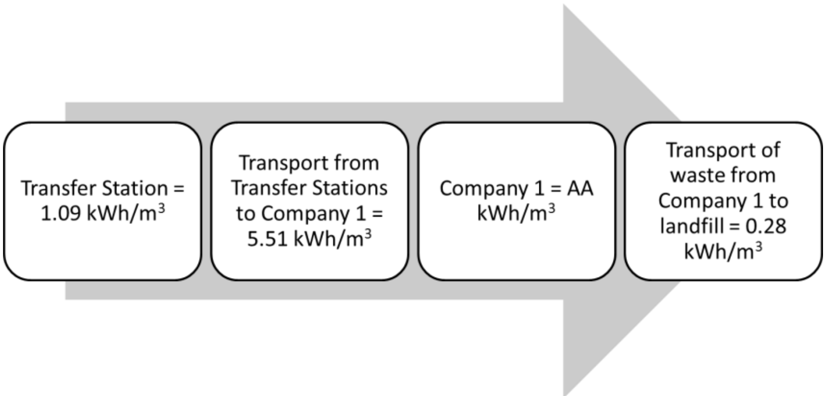


The composting operation (windrow) at Company 1 is supplied by two transfer stations (1, which is 10 km away and 2, 30 km) and by direct deliveries.

50% of the material (on an annual basis) comes from direct delivery and 25% of the material comes from each of transfer stations.

Physical contaminants are screened out of the compost and transported to a landfill site 10 km away.

Energy use (in extraction, transport and production)



Fuel use at the Transfer Station is from loading lorries for transport. The loader uses 18 litres of diesel per hour and it takes 10 minutes to load each lorry, so 3 L/load. An average load is 30m^3 (after shredding). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). 2m^3 of green waste produces 1m^3 of green compost. 50% of the material used by Company 1 comes from a transfer station. Therefore, the fossil fuel energy use at the Transfer Station that the green compost is responsible for is = (3/30)*10.9*2*0.5 = 1.09 kWh/m^3

The green waste is transported 10km by road from Transfer Station 1 to Company 1 (20 km for the round trip as the return journey for empty vehicles is in scope). An average load is 30m^3 (after shredding). The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). 2m^3 of green waste produces 1m^3 of green compost. Therefore, the fossil fuel energy use for transport of the green waste to Company 1 is (((20*0.379)*10.9)/30)*2 = 5.51 kWh/m^3 (Transfer Station 1)

The green waste is transported 30km by road from Transfer Station 2 to Company 1 (60 km for the round trip as the return journey for empty vehicles is in scope). An average load is 30m^3 (after shredding). The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). 2m^3 of green waste produces 1m^3 of green compost. Therefore, the fossil fuel energy use for transport of the green waste to Company 1 is (((60*0.379)*10.9)/30)*2 = 16.52 kWh/m^3 (Transfer Station 2)

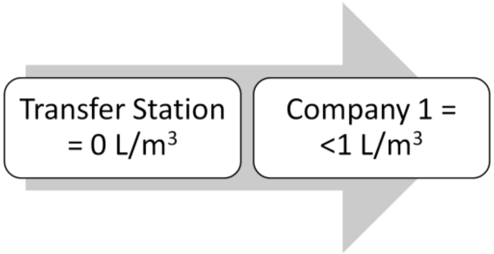
25% of the green waste used by Company 1 comes from Transfer Station 1, 25% from Transfer Station 2 and the remaining 50% comes direct deliveries (which are out of scope). Therefore, the average energy for transport of material to Company 1 is 5.51*0.25 + 16.52*0.25 = 5.51 kWh/m^3.

Company 1 uses diesel fuelled machinery to transport materials around the site (P L/m^3), to shred the green waste (80 L/h shredding 120 tonnes/h, mean bulk density of food and garden waste is 338kg/m^3 (WRAP, 2009) = 80/(120/0.338) = 0.23 L/m^3), to turn the windrows (80 L/h turning 4400m^3/h done once a week for 16 weeks = 80/4400*16 = 0.29 L/m^3) and to run the screening machines (8 L/h screening 120m^3/h = 8/120 = 0.07 L/m^3) (all other uses are out of scope – beyond mixing system). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Therefore, the fossil fuel use by Company 1 is (P+0.23+0.29+0.07)*10.9 = 6.43 + (P*10.9) = AA kWh/m^3.

Physical contaminants are screened out of the compost and transported to a landfill site 10 km away (the return journey for empty vehicles is out of scope – third party haulage). Physical contaminants make up 10% of the input material (annual average for Company 1). 2m^3 of green waste produces 1m^3 of green compost. An average load is 30m^3. The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Therefore, the fossil fuel use for transport of waste to landfill is (((10*0.379)*10.9)/30)*0.1*2 = 0.28 kWh/m^3.

Therefore, the total non-renewable energy used from transfer station to mixing system is 1.09+5.51+AA+0.28 kWh/m^3 = 6.88+AA kWh/m^3. Assuming that AA < 10.12 kWh/m^3 the material scores 14 (Figure 5). If AA < 1.12 kWh/m^3 the material score would be 12, however, AA is > 6.43 (= 6.43 + (P*10.9)).

Water use (in extraction and production)



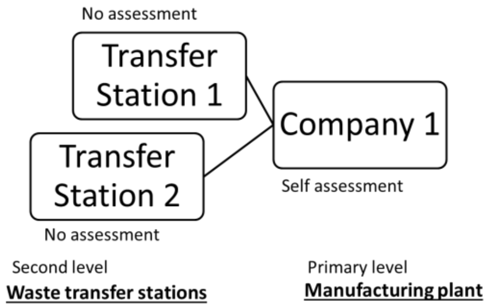
There is no water use attributable to green compost at the transfer station.

Company 1 uses <1 L of water per m^3 of green compost (for wetting down the windrow when it becomes too dry).

Therefore, the total potable water use is <1 L/m^3 and the material scores 20 (Figure 7).

Social compliance

Company 1 has completed a self-assessment questionnaire to demonstrate social compliance. As per Table 11, this is valued at 0.5 of an audited third party assessment. Neither Transfer Station (1 and 2) has undertaken any form of assessment. They have no proof of their social compliance.



Growing media material type	Number of tiers / steps in supply chain	Primary level	Second level	Third level	Fourth level	Fifth level
Green_compost	2	1	2			
Percent of material obtained by level	1	100%	50%			
	2		50%			
	3					
	4					
	5					
		100%	100%	0%	0%	0%
SAQ or Audit	1	SAQ	None			
	2		None			
	3					
	4					
	5					
OVERALL MATERIAL SCORE	30.00%					

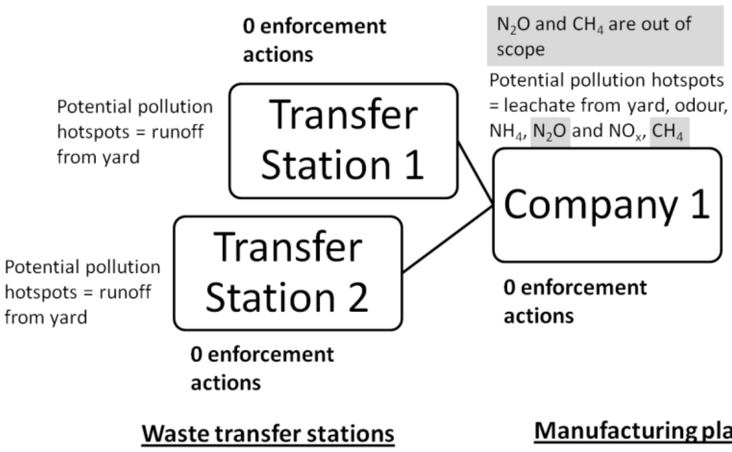
The level of proof of social compliance, as calculated using the social compliance calculator is 30% and the material scores 5 (Figure 9).

Habitat and biodiversity

The material is a recycled material, therefore, the habitat and biodiversity score for this material is 20.

Pollution

The B.C. Ministry of Agriculture (1996) identified the potential pollution hotspots from composting as leachate, odour, ammonia, nitrous oxide and other NO_x gases and methane. Of these, nitrous oxide and methane are out of scope as they are greenhouse gases.



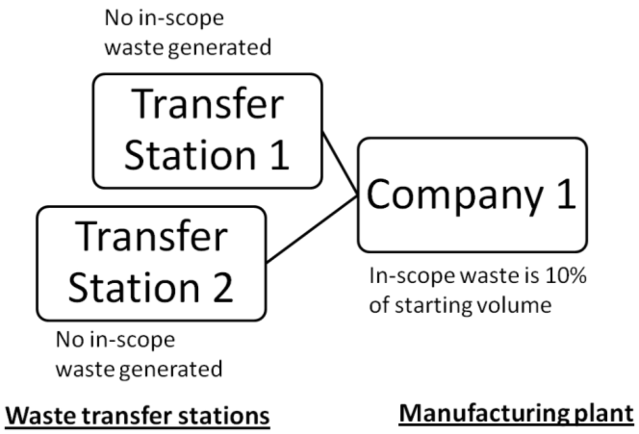
The Environment Agency monitors emissions to air and water from the Transfer Stations (1 and 2) and Company 1. They have brought no enforcement actions against any of the companies. Therefore, the pollution score for this material is 12 (Figure 18).

Renewability

The material is manufactured from green waste which is renewable at a single site within 5 years (Table 13). Therefore, the material score is 20 (Figure 20).

Resource use efficiency

The material is not virgin (Table 1) and in-scope waste is generated in production. No in-scope waste is generated by the Transfer Stations (average of 0%), 10% of the starting volume from Company 1 is sent to landfill. Therefore, the total % of unrecycled materials is 10% and the material scores 6 (Figure 21).



Summary: material score

The material score is:

Criteria	Score
Energy	14
Water	20
Social compliance	5
Habitat and biodiversity	20
Pollution	12
Renewability	20
Resource use efficiency	6
Material score	97

References

Breitenbeck, G. A. and Schellinger, D. (2004). Calculating the Reduction in Material Mass and Volume during Composting, Compost Science & Utilization Vol. 12, Iss. 4. DOI:10.1080/1065657X.2004.10702206

B.C. Ministry of Agriculture (1996). Composting environmental concerns. Factsheet No. 382.500-11. British Columbia, Canada. http://www.agf.gov.bc.ca/resmgmt/publist/300Series/382500-11.pdf

WRAP (2009). Summary Report – Material Bulk Densities. Report prepared by Resource Futures http://www2.wrap.org.uk/downloads/Bulk_Density_Summary_Report_-_Jan2010.cfa474bc.8525.pdf

Product 1: Multi-purpose compost produced by Company 1

Product 1, a multi-purpose compost produced by Company 1 (using only the previous worked examples) is 50% Material 1 (wood fibre), 30% Material 2 (coir pith) and 20% Material 3 (green compost).

Criteria	Material 1 Score	Material 2 Score	Material 3 Score	Product 1 calculation	Product 1 Score
Energy	6	8	14		
Water	16	5	20		
Social compliance	5	13	5		
Habitat and biodiversity	13	12	20		
Pollution	12	8	12		
Renewability	17	20	20		
Resource use efficiency	15	15	6		
Material score	84	81	97	84*0.5 + 81*0.3 + 97*0.2	85.7

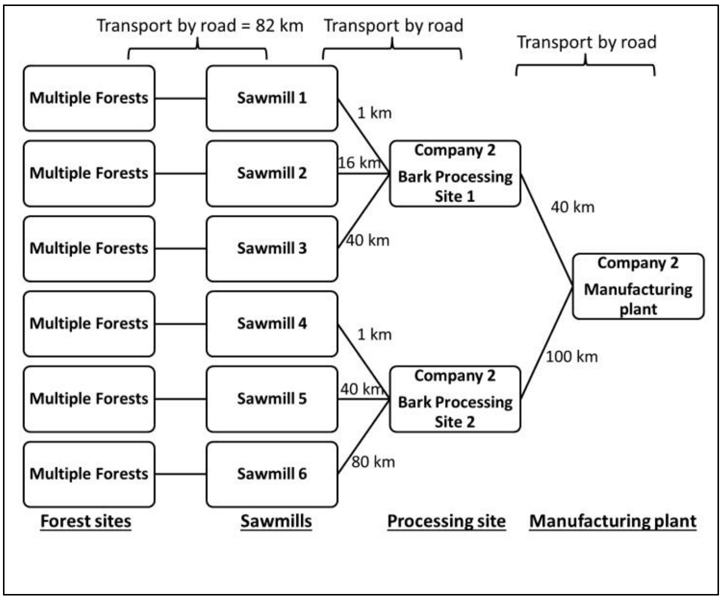
Responsibility Index – C.

Material 4: Bark produced by Company 2

This is manufactured from a virgin material (by-product) (Table 1); therefore the starting point for this material is the forest. However, as per Table 4, for some criteria (energy use and water use) generic data should be used at the forest and for transport to the sawmill (unless site specific data is available) and for other criteria (social compliance, pollution and resource use efficiency) the starting point for assessment is the sawmill. The end point is the start of the mixing system (Table 1).

The material is bark; therefore, per Table 2 it is responsible for 7% of the impact at the forest, 7% of the impact at the sawmill and 100% of the impact after the sawmill up to the mixing system.

Supply chain map for Company 2 bark



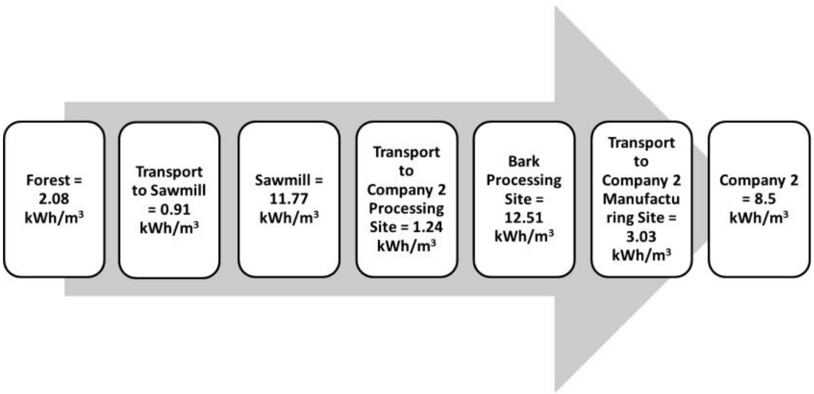
The UK forests that supply the sawmills are multiple and change with time.

The average timber haulage distance is 82 km (Table 8) from forest to sawmill.

Company 2 is supplied by 6 sawmills. Sawmill 1 is 1 km away, 2 is 16 km, 3 is 40 km, 4 is 1 km, 5 is 40 km and 6 is 80 km from one of the two bark processing sites. The company's two processing sites are 40 and 100 km away from its manufacturing site. Sawmills 1-3 supply processing site 1 and 4-6 supply site 2.

75% of the bark purchased by Company 2 comes from Sawmills 1-3 (25% each), 10% each comes from Sawmills 4 and 5 and Sawmill 6 supplies 5%.

Energy use (in extraction, transport and production)



As per Table 4, generic data should be used for the operations in the forest and for transport of material to the sawmill.

As per Table 8, UK forests use 6.8 kWh per m^3 of wood for site preparation and establishment (excluding building and maintaining forest roads – construction of infrastructure is out of scope). Diesel fuel consumption for felling is estimated at 1.2 litres per m^3 of biomass and for forwarding at 0.9 litres per m^3 of biomass (Table 8). 1 litre of diesel is equivalent to 10.9 kWh (Table 5).

Bark is responsible for 7% of the impact at the forest (Table 2). Therefore, the energy use at the forest that the bark is responsible for is (6.8 + (1.2*10.9) + (0.9*10.9))*0.07 = 2.08 kWh/m^3

The average timber haulage distance is 82 km (164 km for the round trip as the return journey for empty vehicles is in scope) (Table 8). 20% of the journey is on forest roads (Table 8). Fuel use (diesel) is 0.459 l/km for forest roads and 0.342 l/km for public roads (Table 8). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). The load capacity of road timber transport is limited by weight rather than volume, due to the weight of fresh roundwood (>400 kg/m^3) (Whittaker *et al*, 2010). Therefore a 40 tonne vehicle with a load capacity of 25.5 tonnes can carry a maximum of 63.75m^3 in a load. It is assumed that the vehicle is not overloaded and that a typical load is 50m^3. Bark is responsible for 7% of the impact of transport from the forest to the sawmill (Table 2).

= ((((164*0.2*0.459) + (164*0.8*0.342))*10.9)/50)*0.07 = 0.91 kWh/m^3

Sawmill 1 uses 1.6 kWh per m^3 of roundwood to run the debarker; bark is responsible for 7% of this energy use (Table 2). Sawmill 1 uses 11.5 kWh per m^3 of bark to transport the bark around the site and to load the lorry. Therefore, fossil fuel energy use at Sawmill 1 is (1.6*0.07)+11.5 = 11.61 kWh/m^3.

Sawmill 2 uses 2 kWh per m^3 of roundwood to run the debarker; bark is responsible for 7% of this energy use (Table 2). Sawmill 2 uses 10 kWh per m^3 of bark to transport the bark around the site and to load the lorry. Therefore, fossil fuel energy use at Sawmill 2 is (2*0.07)+10 = 10.14 kWh/m^3.

Sawmill	Energy use (bark) (kWh/m^3)	% of Company 2 volume	Weighted energy by volume (kWh/m^3)
1	11.61	25	11.61*0.25 = 2.90
2	10.14	25	10.14*0.25 = 2.54
3	12.05	25	12.05*0.25 = 3.01
4	11.82	10	11.82*0.10 = 1.18
5	15.79	10	15.79*0.10 = 1.58
6	11.13	5	11.13*0.05 = 0.56
		Average annual energy use	11.77

Bark is transported 1km by road from Sawmill 1 to the Company 2 Bark Processing Site 1 (the return journey for empty vehicles is out of scope – third party haulage). A typical load is 75m^3. The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Therefore, the fossil fuel energy use for transport of the bark to the Company 2 processing site is ((1*0.379)*10.9)/75 = 0.06 kWh/m^3 (Sawmill 1).

Sawmill	Energy use in transport to processing plant (kWh/m^3)	% of Company 2 volume	Weighted energy by volume (kWh/m^3)
1	((1*0.379)*10.9)/75 = 0.06	25	0.06*0.25 = 0.02
2	((16*0.379)*10.9)/75 = 0.88	25	0.88*0.25 = 0.22
3	((40*0.379)*10.9)/75 = 2.20	25	2.20*0.25 = 0.55
4	((1*0.379)*10.9)/75 = 0.06	10	0.06*0.10 = 0.01
5	((40*0.379)*10.9)/75 = 2.20	10	2.20*0.10 = 0.22
6	((80*0.379)*10.9)/75 = 4.41	5	4.41*0.05 = 0.22
		Average annual energy use	1.24

Bark Processing Site 1 uses 0.9 kWh/m^3 to screen the bark and 11.5 kWh/m^3 to transport bark around the site and load the lorry. Therefore, fossil fuel use by Company 2 at site 1 is 0.9+11.5 = 12.4 kWh/m^3.

Site	Energy use in at processing plant (kWh/m^3)	% of Company 2 volume	Weighted energy by volume (kWh/m^3)
1	0.9+11.5 = 12.4	75	12.4*0.75 = 9.30
2	0.85+12.0 = 12.85	25	12.85*0.25 = 3.21
		Average annual energy use	12.51

Bark is transported 40km by road from Bark Processing Site 1 to the Company 2 Manufacturing Site (the return journey for empty vehicles is out of scope – third party haulage). A typical load is 75m^3. The articulated lorry uses 0.379 litres of diesel per kilometre (Table 6, 50% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). Therefore, the fossil fuel energy use for transport of the bark to the Company 2 manufacturing plant is ((40*0.379)*10.9)/75 = 2.20 kWh/m^3 (Site 1).

Site	Energy use in transport to manufacturing plant (kWh/m^3)	% of Company 2 volume	Weighted energy by volume (kWh/m^3)
1	((40*0.379)*10.9)/75 = 2.20	75	2.20*0.75 = 1.65
2	((100*0.379)*10.9)/75 = 5.51	25	5.51*0.25 = 1.38
		Average annual energy use	3.03

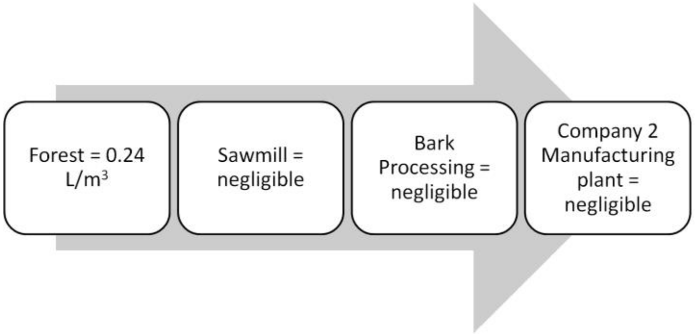
The non-renewable energy use at Company 2's manufacturing plant is 8.5 kWh/m^3.

Therefore, the total non-renewable energy used from forest to the mixing system is 2.08 + 0.91 + 11.77 + 1.24 + 12.51 + 3.03 + 8.5 = 40.04 kWh/m3 and the material scores 10 (Figure 5).

Water use (in extraction and production)

As per Table 4, generic data should be used for the operations in the forest.

As per Table 9 UK forests are un-irrigated so no potable or abstracted water is used. No water is used in harvesting the forest. The tree nursery is assumed to be irrigated and uses 3.39 L of water per m^3 of wood (Table 9). Bark is responsible for 7% of the impact at the forest (Table 2). Therefore, bark is responsible for is 3.39*0.07 = 0.24 L/m^3.



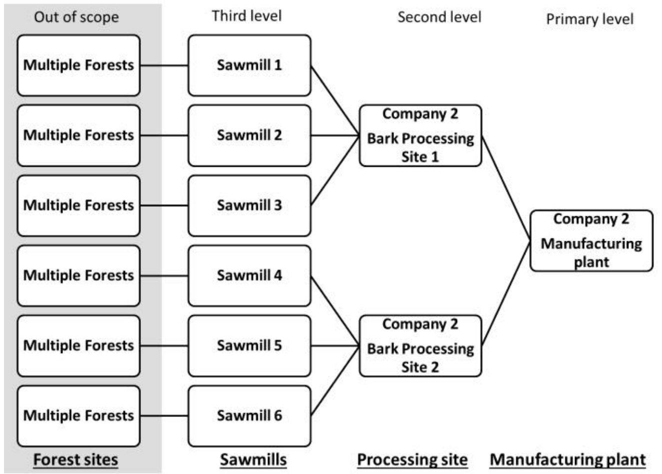
Use of water at the sawmill is negligible (Pers. Comm. Forestry Commission, 2015).

Use of water at the bark processing sites and manufacturing plant (for the bark) is negligible on a per m^3 basis (used for occasional washing down of machinery).

Therefore, the total potable or abstracted water used from forest to the mixing system is 0.24 L/m^3 and the material scores 20 (Figure 7).

Social compliance

The social compliance assessment for wood based materials begins at the sawmill (Table 4). Company 2 has completed a self-assessment questionnaire to demonstrate social compliance. As per Table 11, this is valued at 0.5 of an audited third party assessment.



The social compliance calculator only has space for a maximum of 5 suppliers at each chain of the supply chain, but there are 6 sawmills which supply bark to Company 2, therefore, they are grouped by the form of proof (Table 11) available for each and the total volume supplied by that group of sawmills is entered in the top half of the calculator. Sawmill 1 has undergone a BSCI audit (25% of volume supplied), Sawmills 2 and 5 have completed self-assessments (combined 35% of volume supplied) and the remainder have no proof of their social compliance (combined 40% of volume supplied).

Growing media material type	Number of tiers / steps in supply chain	Primary level	Second level	Third level	Fourth level	Fifth level
Bark_Sawdust_Woodfines	2	1	3			
Percent of material obtained by level	1	100%	25%			
	2		35%			
	3		40%			
	4					
	5					
		100%	100%	0%	0%	0%
SAQ or Audit	1	SAQ	Audit			
	2		SAQ			
	3		None			
	4					
	5					
OVERALL MATERIAL SCORE	47.00%					

The level of proof of social compliance, as calculated using the social compliance calculator is 47% and the material scores 9 (Figure 9).

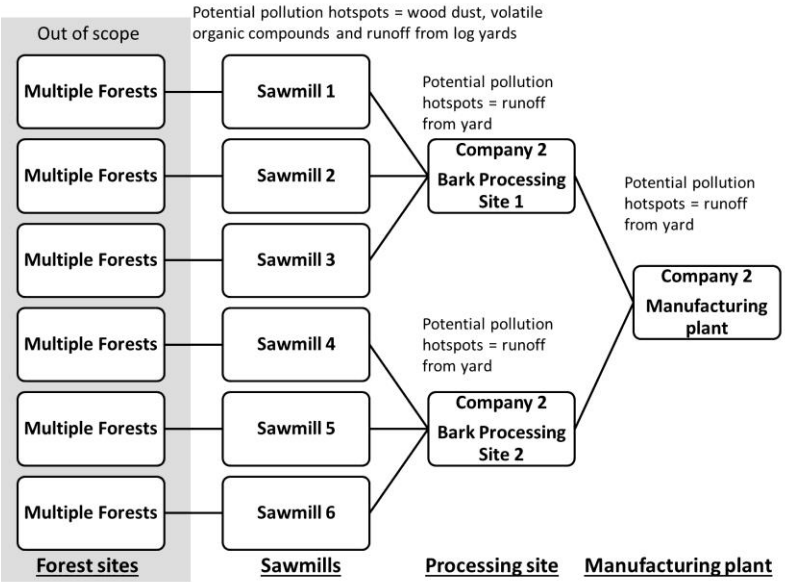
Habitat and biodiversity

Bark is a wood based material; therefore, the wood based material tree applies. All of the wood sourced by Company 2 is from the UK and, therefore, comes from sustainably managed forests (or has a low risk of not coming from a sustainably managed forest - FSC

Controlled Wood National Risk Assessment). Company 2 is Forest Stewardship Council Chain of Custody Certified; with a rolling average input of 70% FSC material. Bark is responsible for 7% of the impact at the forest (Table 2). Therefore, the habitat and biodiversity score for this material is 15 (Figure 12, column 2).

Pollution

The pollution assessment for wood based materials begins at the sawmill (Table 4). The IFC (2007) identify potential pollution hotspots from sawmills as wood dust, volatile organic compounds and wastewater effluent generated from runoff from irrigated storage areas known as log yards.



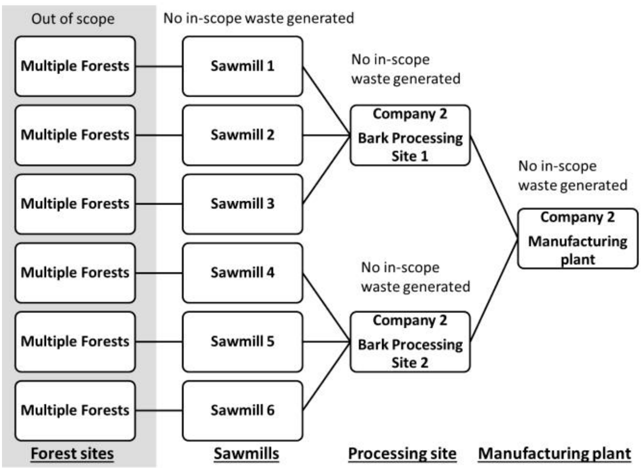
The Environment Agency monitors emissions to air and water from each of the sawmills and Company 2 (including its bark processing sites). They have brought no enforcement actions against any of the companies. Therefore, the pollution score for this material is 12 (Figure 18).

Renewability

The material is derived from softwood which is renewable at a single site within 50 years, but not within 5 years (Table 13). Therefore, the material score is 17 (Figure 20).

Resource use efficiency

The resource use efficiency assessment for wood based materials begins at the sawmill (Table 4). The bark is a virgin by-product (Table 1) and no in-scope waste is generated in production. Therefore, the material score is 15 (Figure 21).



Summary: material score

The material score is:

Criteria	Score
Energy	10
Water	20
Social compliance	9
Habitat and biodiversity	15
Pollution	12
Renewability	17
Resource use efficiency	15
Material score	98

References

Whittaker CL, Mortimer ND, Matthews RW. (2010) Understanding the Carbon Footprint of Timber Transport in the United Kingdom. Sheffield, UK: North Energy Associates LTD. http://www.timbertransportforum.org.uk/Upload/Documents/22_TimberTransportFootprintReport.pdf

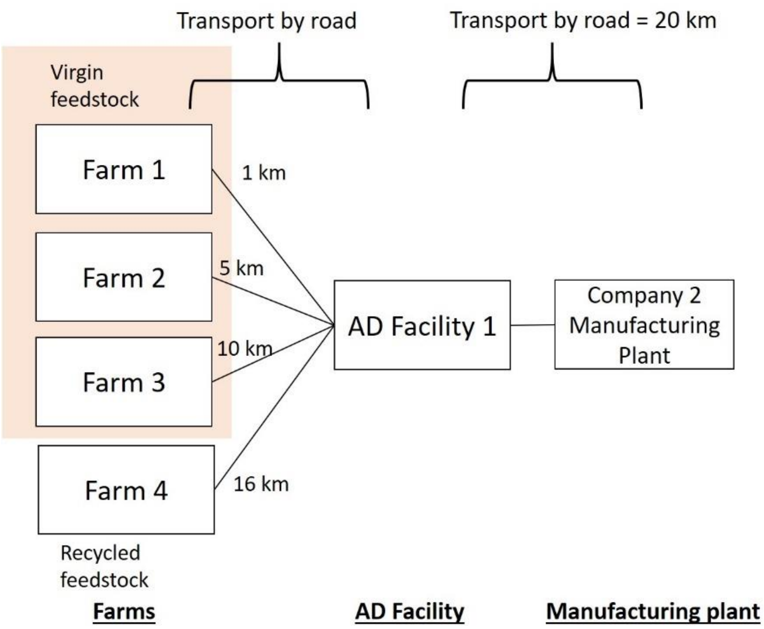
IFC (2007). Environmental, Health, and Safety Guidelines for Sawmilling and Manufactured Wood Products. International Finance Corporation, World Bank Group http://www.ifc.org/wps/wcm/connect/ce72a58048855ac48704d76a6515bb18/Final+-+Sawmills+and+MWP.pdf?MOD=AJPERES

Material 5: Anaerobic digestate produced by Company 2

Company 2 is supplied with solid anaerobic digestate from a single AD facility. The feedstock used by the AD facility is 70% energy crops (a virgin material) and 30% poultry manure (a recycled material).

As per Table 1, anaerobic digestate should be treated as a virgin material or a recycled material depending on the source material. Where the digestate is a blend of sources the scores for the material should be the weighted average for the proportion of each source in the blend on an annual basis. The weighting should be applied after the individual score is generated for each source even though they are in a blend for parts of the production process. Therefore, individual scores are generated for each category of feedstock (based on anaerobic digestate being produced 100% from each feedstock) before a product score is derived.

Supply chain map for Company 2 digestate



Company 2 is supplied with anaerobic digestate from a single AD facility 20 km away. This facility is a farming operation (Farm 1) with an on-farm digestor (AD Facility 1). 75% of the energy crop feedstock (maize silage) is produced on-farm (Farm 1). The remaining 25% of the energy crop feedstock comes from two neighbouring farms (Farm 2 and Farm 3). Farm 2 is rented land that is 5 km away. The land is managed by Farm 1 and supplies 15% of the feedstock. Farm 3 is 10 km away and supplies 10% of the feedstock. All farm operations at Farm 3 are carried out by Farm 3, except for the maize harvest and transport of the silage to Farm 1, which is carried out by Farm 1.

The poultry manure comes from a poultry farm (Farm 4) that is 16 km away and is supplied by specialist contractors.

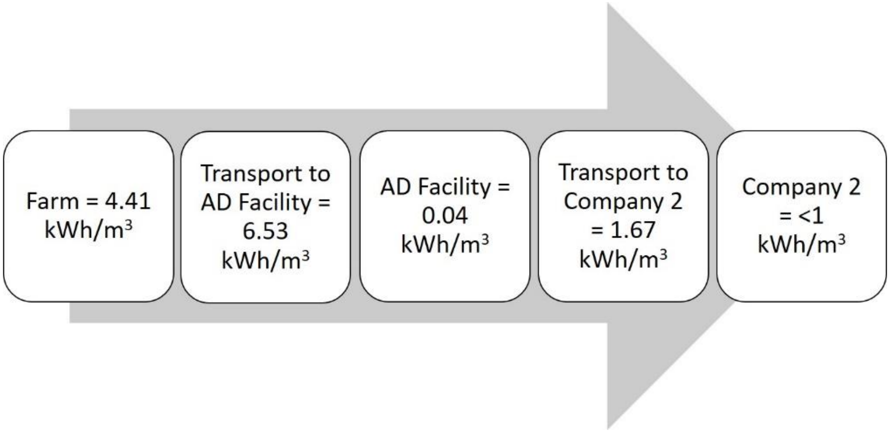
Energy crop feedstock

This is a virgin material (by-product) (Table 1); therefore the starting point for this material is the field. However, as per, for some criteria (energy use and water use) generic data should be used at the farm and for transport to the AD facility (unless site specific data is available) and for other criteria (social compliance, pollution and resource use efficiency) the starting point for assessment is the farm (social compliance only) or the AD facility. The end point is the start of the mixing system (Table 1).

The product is a solid digestate; therefore, per Table 3 it is responsible for 6% of the impact at the farm, 6% of the impact at the digestor, 67% of the impact at the separator and 100% of the impact after the separator up to the mixing system.

As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3.

Energy use (in extraction, transport and production)



As per Table 4, generic data should be used for the operations at the farm and for transport to the anaerobic digestion facility (unless real data is available).

As per Table 8, typical energy use for farm practices associated with energy crops are available from a range of sources. One example is the AD tool produced by the Bioenergy and Organic Resources Research Group at the University of Southampton. This is used to generate generic data in this worked example.

Using the tool the average UK yield of maize silage is 45 t/ha and the total energy use in crop production (excluding fertiliser applications) is 82 l/ha (including average 1 km transport on-farm). 1 litre of diesel is equivalent to 10.9 kWh (Table 4). Anaerobic digestate (from energy crops) is responsible for 6% of the impact at the farm (Table 2). As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3. Therefore, the energy use at the farm that the anaerobic digestate (from energy crops) is responsible for ((82*10.9)/(45*0.1*2.7))*0.06 = 4.41 kWh/m^3

There is no additional energy used in transport of maize silage from Farm 1 to the AD Facility 1 as this is covered by the average 1 km on-farm transport.

Maize silage is transported 5 km by road from Farm 2 to the AD Facility 1 (10 km for the round trip as the return journey for empty vehicles is in scope). An average load is 16 tonnes. The tractor and trailer uses 25 litres of diesel per hour. 1 litre of diesel is equivalent to 10.9 kWh (Table 5). It is assumed that 6 km of the return journey is made at the maximum speed limit for agricultural tractors and trailer of 40 kph and the rest of the journey is made at an average speed of 20 kph, therefore the 10 km round trip has a drive time of 21 minutes. As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3. Anaerobic digestate (from energy crops) is responsible for 6% of the impact of transport from the farm to the AD facility (Table 3). Therefore, the fossil fuel energy use for transport of the maize silage to AD Facility 1 is ((10*((21/60)*25)*10.9)/(16*0.1*2.7))*0.06 = 13.25 kWh/m^3 (Farm 2)

Maize silage is transported 10 km by road from Farm 3 to the AD Facility 1 (20 km for the round trip as the return journey for empty vehicles is in scope). It is assumed that 16 km of the return journey is made at the maximum speed limit for agricultural tractors and trailer of 40 kph and the rest of the journey is made at an average speed of 20 kph, therefore the 20 km round trip has a drive time of 36 minutes.

Farm	Energy use in transport to AD Facility (kWh/m^3)	% of Company 2 volume (virgin material only)	Weighted energy by volume (kWh/m^3)
1	0 (fully covered in crop production)	75	0
2	((10*((21/60)*25)*10.9)/(16*0.1*2.7))*0.06 = 13.25	15	13.25*0.15 = 1.99
3	((20*((36/60)*25)*10.9)/(16*0.1*2.7))*0.06 = 45.42	10	45.42*0.10 = 4.54
		Average annual energy use	6.53

As per Figure 5 only energy use from fossil fuels is in scope. AD Facility 1 is powered by the renewable energy produced by the facility itself, as is the separator and drying operations. However, AD Facility 1 uses diesel fuelled manitou, teleporter type machine to load the digestor. This consumes 3 litres of diesel per hour and is run for one hour per day. The volume of maize silage loaded per day is 200 tonnes. 1 litre of diesel is equivalent to 10.9 kWh (Table 5). As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3. Anaerobic digestate (from energy crops) is responsible for 6% of the impact at the AD facility (Table 3). Therefore, the fossil fuel use by AD Facility 1 is ((3*1*10.9)/(200*0.1*2.7))*0.06 = 0.04 kWh/m^3.

Solid anaerobic digestate is transported 20 km by road from AD Facility 1 to Company 2. (the return journey for empty vehicles is out of scope – third party haulage). An average load is 20 tonnes. The articulated lorry uses 0.414 litres of diesel per kilometre (Table 6, 75% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). As per Table 8, it is assumed that 1 tonne of fibre has a volume of 2.7 m^3. Anaerobic digestate (from energy crops) is responsible for 100% of the impact of transport from the AD facility to the manufacturing plant (Table 3). Therefore, the fossil fuel energy use for transport of the fibre to manufacturing plant is (20*0.414*10.9)/(20*2.7) = 1.67 kWh/m^3

Company 2 uses Q litres of diesel per m^3 of final product. 1 litre of diesel is equivalent to 10.9 kWh (Table 4). = Q*10.9 = BB kWh/m^3. It is assumed BB is <1 kWh/m^3.

Therefore, the total non-renewable energy used from farm to the mixing system is 4.41+6.53+0.04+1.67+<1 kWh/m^3 = 13.15±0.50 kWh/m^3. Therefore, the material scores 14 (Figure 5).

Water use (in extraction and production)

As per Table 4, generic data should be used for crop production.

As per Table 9 energy crops (including maize silage) used to supply AD facilities are typically un-irrigated in the UK so no potable or abstracted water is used.

The AD Facility uses stored rainwater harvested from the site, so no potable or abstracted water is used.

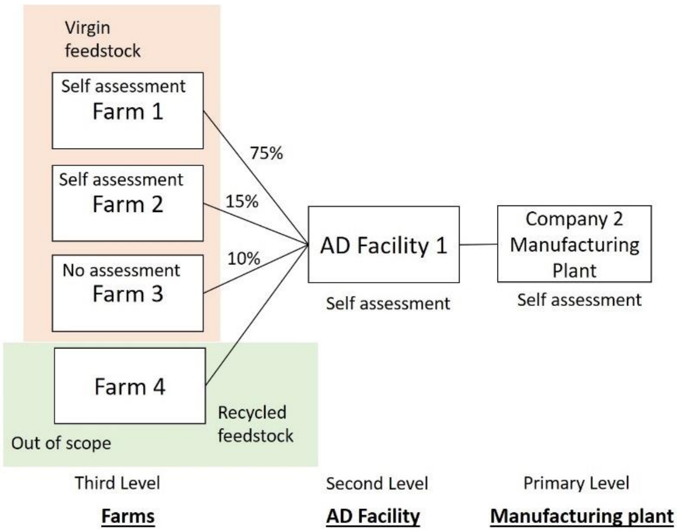
No water is used by Company 2 to manufacture the final product.

Therefore, no (zero) potable or abstracted water is used from farm to mixing system and the material scores 20 (Figure 7).

Social compliance

Company 2, the AD Facility and its own Farm (Farm 1, including the rented land at Farm 2 managed by Farm 1) have completed self-assessment questionnaires to demonstrate social compliance. As per Table 11, this is valued at 0.5 of an audited third party assessment.

Farm 3 has not undertaken any form of assessment. They have no proof of their social compliance.



Ingredient Rater for Growing Media Material

Growing media material type	Number of tiers / steps in supply chain	Primary level	Second level	Third level	Fourth level	Fifth level
Another	3	1	1	3		
Percent of material obtained by level	1	100%	100%	75%		
	2			15%		
	3			10%		
	4					
	5					
		100%	100%	100%	0%	0%
SAQ or Audit	1	SAQ	SAQ	SAQ		
	2			SAQ		
	3			None		
	4					
	5					
OVERALL MATERIAL SCORE	49.00%					

The level of proof of social compliance, as calculated using the social compliance calculator is 49% and the material scores 9 (Figure 9).

Habitat and biodiversity

All the land in Farms 1, 2 and 3 used to grow maize was not semi-natural habitat immediately before planting of these energy crops and have been in agricultural use for decades. Farms 2 and 3 are not in a higher level environmental scheme or being managed to a similar standard. Farm 1 is signed up to a Countryside Stewardship agreement.

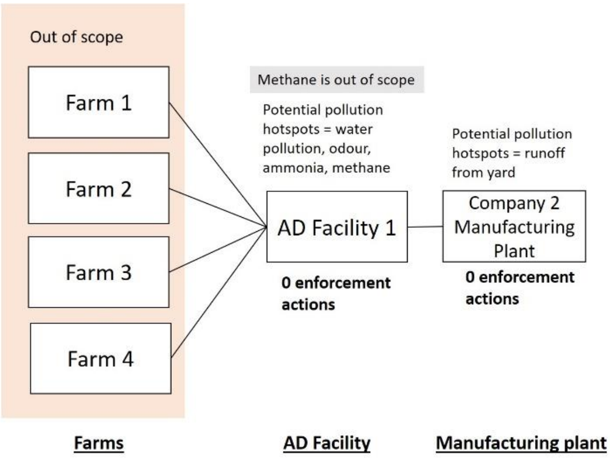
Therefore, Farms 2 and 3 score 6 and Farm 1 scores 18. As per Figure 15 a weighted average score needs to be generated for batches from multiple farms.

Farm	Habitat and biodiversity score	% of Company 2 volume (virgin material only)	Weighted habitat score by volume
1	18	75	18*0.75 = 13.5
2	6	15	6*0.15 = 0.9
3	6	10	6*0.10 = 0.6
Average habitat and biodiversity score			15

Pollution

As per Table 4, the starting point for anaerobic digestate (from energy crops) for pollution is the AD Facility.

The potential pollution hotspots at the AD Facility are water pollution from storage of feedstock or digestate, runoff from yard, odour, dust, ammonia and loss of biogas. As the biogas is methane it is out of scope because it is a greenhouse gas.



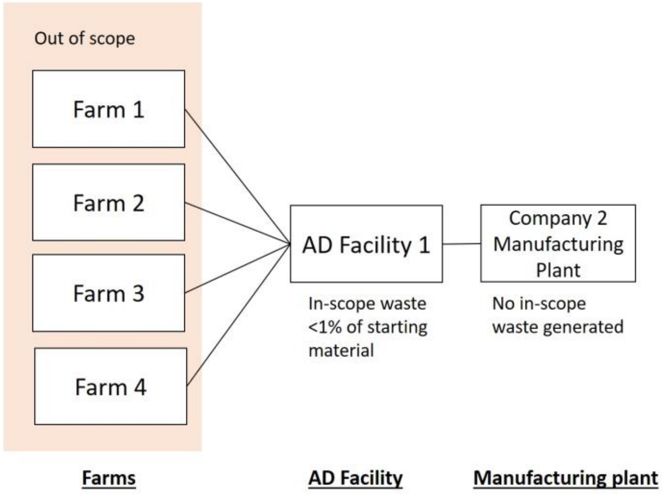
The potential pollution hotspots at the Growing Media Manufacturer (Company 2) is runoff from the yards.

The Environment Agency monitors emissions to air and water from the AD Facility and Company 2. They have brought no enforcement actions against any of the companies. Therefore, the pollution score for this material is 12 (Figure 18).

Renewability

Maize is renewable within 5 years at a single site (Table 13), therefore, the material score is 20 (Figure 20).

Resource use efficiency



As per Table 4 the starting point for resource use efficiency for anaerobic digestate (from energy crops) is the AD Facility.

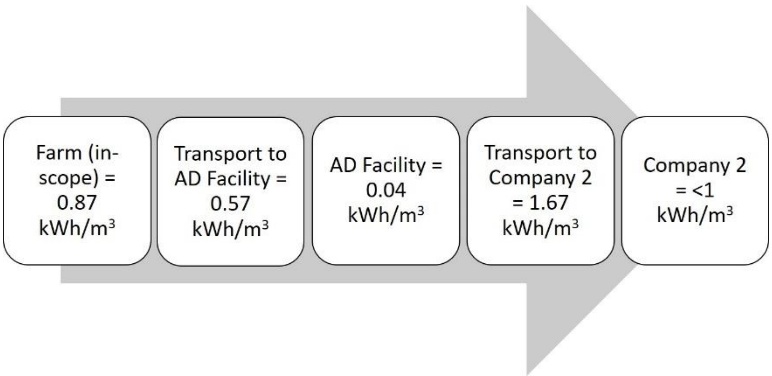
As per Table 1 anaerobic digestate (from energy crops) is a virgin by-product. A small volume of in-scope waste is generated in its production (non-biodegradable plastic sheeting used over silage stores) which is disposed of to landfill. The volume of unrecycled waste is less than 1% of the volume of the starting material. Therefore, the material score is 12 (Figure 21).

Waste material feedstock

The poultry manure is a recycled material (per Table 1), therefore the starting point for this material is the point at which transport is commercially viable (Table 1), which is the poultry farm. Removal of manure from the poultry houses is carried out by contractors who remove the material, load it on to lorries and have contracts to deliver the material to the AD Facility. The end point is the start of the mixing system (Table 1).

As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3.

Energy use (in extraction, transport and production)



In scope fuel use at Farm 4 is from loading lorries for transport. The telehandler uses 10 litres of diesel per hour and it takes 1 hour to load each lorry, so 10 L/load. An average load is 28 tonnes. 1 litre of diesel is equivalent to 10.9 kWh (Table 5). As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3. It is assumed that anaerobic digestate (from waste materials) has the same distribution of impacts as anaerobic digestate (from energy crops) and, therefore, is responsible for 6% of the impact before the AD facility from the point that transport is commercially viable (Table 3). Therefore, the in-scope fossil fuel energy use at Farm 4 that the anaerobic digestate is responsible for is = $((10*10.9)/(28*0.1*2.7))*0.06 = 0.87$ kWh/m^3

Poultry manure is transported 16 km by road from Farm 4 to the AD Facility 1 (the return journey for the empty vehicle is out of scope as it will not return to Farm 4 but go on to a different poultry farm). An average load is 28 tonnes. The articulated lorry uses 0.414 litres of diesel per kilometre (Table 6, 75% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3. Anaerobic digestate (from waste materials) is responsible for 6% of the impact of transport from Farm 4 to the AD facility (Table 3). Therefore, the fossil fuel energy use for transport of the poultry manure to AD Facility 1 is ((16*0.414*10.9)/(28*0.1*2.7))*0.06 = 0.57 kWh/m^3

As per Figure 5 only energy use from fossil fuels is in scope. AD Facility 1 is powered by the renewable energy produced by the facility itself, as is the separator and drying operations However, AD Facility 1 uses diesel fuelled manitou, teleporter type machine to load the digestor. This consumes 3 litres of diesel per hour and is run for one hour per day. The volume of maize silage loaded per day is 200 tonnes. 1 litre of diesel is equivalent to 10.9 kWh (Table 5). As per Table 8, it is assumed that there is 10% recoverable fibre by weight of input material and that 1 tonne of fibre has a volume of 2.7 m^3. Anaerobic digestate (from waste materials) is responsible for 6% of the impact at the AD facility (Table 3). Therefore, the fossil fuel use by AD Facility 1 is ((3*1*10.9)/(200*0.1*2.7))*0.06 = 0.04 kWh/m^3.

Solid anaerobic digestate is transported 20 km by road from AD Facility 1 to Company 2. (the return journey for empty vehicles is out of scope – third party haulage). An average load is 20 tonnes. The articulated lorry uses 0.414 litres of diesel per kilometre (Table 6, 75% weight laden). 1 litre of diesel is equivalent to 10.9 kWh (Table 5). As per Table 8, it is assumed that 1 tonne of fibre has a volume of 2.7 m^3. Anaerobic digestate (from waste materials) is responsible for 100% of the impact of transport from the AD facility to the manufacturing plant (Table 3). Therefore, the fossil fuel energy use for transport of the fibre to manufacturing plant is (20*0.414*10.9)/(20*2.7) = 1.67 kWh/m^3

Company 2 uses Q litres of diesel per m^3 of final product. 1 litre of diesel is equivalent to 10.9 kWh (Table 4). = Q*10.9 = BB kWh/m^3. It is assumed BB is <1 kWh/m^3.

Therefore, the total non-renewable energy used from the start of commercially viable transport to the mixing system is 0.87+0.57+0.04+1.67+<1 kWh/m^3 = 3.65±0.50 kWh/m^3. Therefore, the material scores 18 (unless BB > 0.95) (Figure 5).

Water use (in extraction and production)

There is no water use attributable to anaerobic digestate (from waste materials) at Farm 4.

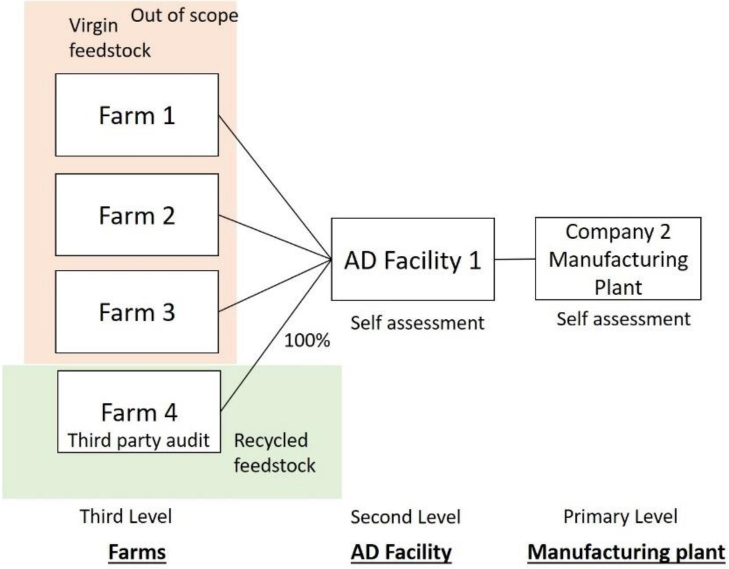
The AD Facility uses stored rainwater harvested from the site, so no potable or abstracted water is used.

No water is used by Company 2 to manufacture the final product.

Therefore, no (zero) potable or abstracted water is used from farm to mixing system and the material scores 20 (Figure 7).

Social compliance

Company 2 and AD Facility 1 have completed self-assessment questionnaires to demonstrate social compliance. As per Table 11, this is valued at 0.5 of an audited third party assessment. The Poultry Farm (Farm 4) has had a third party audit.



Growing media material type	Number of tiers / steps in supply chain	Primary level	Second level	Third level	Fourth level	Fifth level
Another	3	1	1	1		
Percent of material obtained by level	1	100%	100%	100%		
	2					
	3					
	4					
	5					
		100%	100%	100%	0%	0%
SAQ or Audit	1	SAQ	SAQ	Audit		
	2					
	3					
	4					
	5					
OVERALL MATERIAL SCORE	60.00%					

The level of proof of social compliance, as calculated using the social compliance calculator is 60% and the material scores 11 (Figure 9).

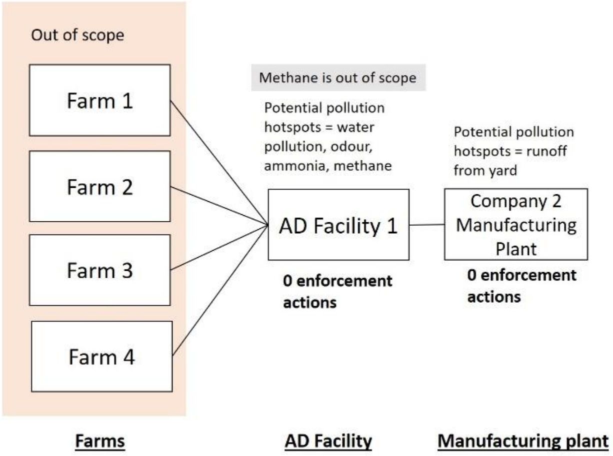
Habitat and biodiversity

The material is a recycled material, therefore, the habitat and biodiversity score for this material is 20.

Pollution

The potential pollution hotspots at the AD Facility are water pollution from storage of feedstock or digestate, runoff from yard, odour, dust, ammonia and loss of biogas. As the biogas is methane it is out of scope because it is a greenhouse gas.

The potential pollution hotspots at the Growing Media Manufacturer (Company 2) is runoff from the yards.



The Environment Agency monitors emissions to air and water from the AD Facility and Company 2. They have brought no enforcement actions against any of the companies. Therefore, the pollution score for this material is 12 (Figure 18).

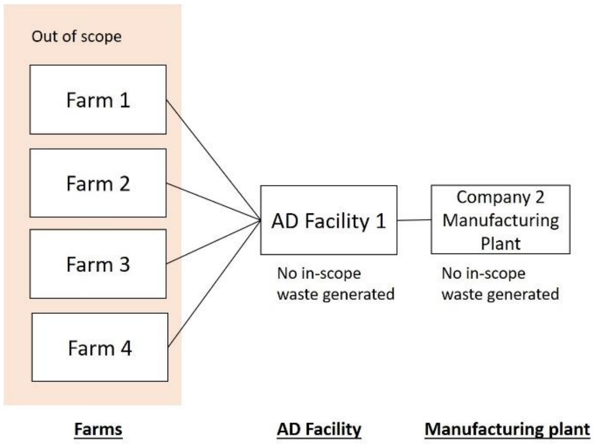
Renewability

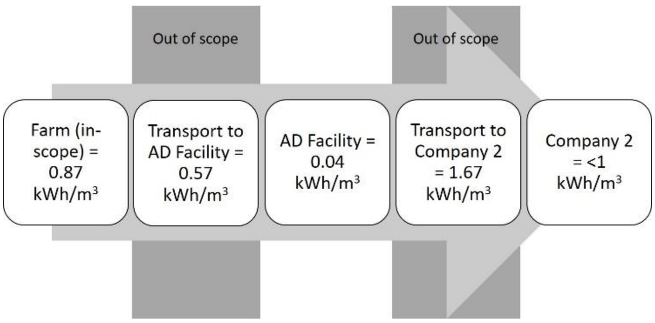
For recycled materials only the formation/growth of the original virgin material that is being recycled is in scope. The material is manufactured from poultry manure which results from the consumption of mainly plant material by poultry. This is renewable at a single site within 5 years (Table 13). Therefore, the material score is 20 (Figure 20).

Resource use efficiency

As per Table 1 anaerobic digestate (from waste) is a recycled material (with a starting point when transport is commercially viable) and no in-scope waste is generated in its production.

Therefore, as per Figure 21 it is necessary to determine the processing energy used for the recovery of this material before a score can be assigned.





The calculations used for the energy criterion should be used here. Transport energy use is out of scope so should be excluded from the total. Therefore, processing energy use here is 1.41±0.50 kWh/m^3. The score is dependent on whether this value is < or > 8.1 kWh/m^3. As this value is < 8.1 kWh/m^3 the material score is 20 (Figure 21).

Anaerobic digestate weighted average product score

Company 2 is supplied with solid anaerobic digestate from a single AD facility. The feedstock used by the AD facility is 70% energy crops and 30% poultry manure. Therefore, the product score will be 70% of the score for the energy crop plus 30% of the score for the poultry manure.

Where criteria scores are decided based on quantified units (i.e. kWh/m^3, l/m^3, %) it makes more sense to create weighted averages of these quantified units to determine a new score rather than creating weighted averages of the scores themselves. This approach is taken for the energy use, water use and social compliance criteria.

Energy use

Material	kWh/m3	% material	Weighted average
AD from energy crops	13.15±0.50	70	13.15±0.50*0.7 = 9.21±0.35
AD from waste	3.65±0.50	30	3.65±0.50*0.3 = 1.10±0.15
		Average annual energy use	10.31±0.50

Therefore, the material score is 14 (Figure 5). If the weighted average had been applied to the original scores rather the kWh/m^3 the material would have scored 15.2.

Water use

Material	L/m^3	% material	Weighted average
AD from energy crops	0	70	0
AD from waste	0	30	0
		Average annual water use	0

Therefore, the material score is 20 (Figure 7).

Social compliance

Material	% compliance	% material	Weighted average
AD from energy crops	49	70	49*0.7 = 34.3
AD from waste	60	30	60*0.3 = 18
		Average social compliance	52.3

Therefore, the material score is 11 (Figure 9). If the weighted average had been applied to the original scores rather the % compliance the material would have scored 9.6.

Habitat and biodiversity

Material	Score	% material	Weighted average
AD from energy crops	15	70	15*0.7 = 10.5
AD from waste	20	30	20*0.3 = 6
		Average score	16.5

Pollution

Material	Score	% material	Weighted average
AD from energy crops	12	70	12*0.7 = 8.4
AD from waste	12	30	12*0.3 = 3.6
		Average score	12

Renewability

Material	Score	% material	Weighted average
AD from energy crops	20	70	20*0.7 = 14
AD from waste	20	30	20*0.3 = 6
		Average score	20

Resource use efficiency

Material	Score	% material	Weighted average
AD from energy crops	12	70	12*0.7 = 8.4
AD from waste	20	30	20*0.3 = 6
		Average score	14.4

Summary: material score

The material score is:

Criteria	Score
Energy	14
Water	20
Social compliance	11
Habitat and biodiversity	16.5
Pollution	12
Renewability	20
Resource use efficiency	14.4
Material score	107.9

Annex 1: Glossary

Abstracted water	Water taken out of a watercourse or water body, other than where that water body was constructed by the user specifically for the collection of water for that use and the water collected is entirely rainwater or surface run-off during flood conditions.
Agricultural land	Land currently, or if unused last used, for the purposes agricultural or horticultural production.
Anaerobic digestate (fibre)	The fibrous material remaining after the anaerobic digestion of a biodegradable feedstock.
Anaerobic digestate (from energy crops)	Anaerobic digestate which has been produced from energy crops which have been specifically grown for the purpose of energy recovery.
Anaerobic digestate (from waste materials)	Anaerobic digestate which has been produced from waste organic materials.
Bark	The outer layer of a tree.
Biochar	The solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment.
Biochar (from forestry products)	Biochar which has been produced from forestry products (i.e. wood based materials).
Biochar (from waste materials)	Biochar which has been produced from waste organic materials.
Biodiversity offsetting	This is an approach to compensate for habitats and species lost to development at one site, with the creation, enhancement or restoration of habitat at another.
Biomass	Biological material derived from living, or recently living organisms.
Blue water	Water in freshwater lakes, rivers and aquifers.
Bracken	A tall fern with coarse lobed fronds, which occurs worldwide and can cover large areas.
BSCI	Business Social Compliance Initiative
Bulk ingredients	Raw materials (>5% by volume) that make up a growing media substrate or soil improver. Specifically excluding additives such as lime and fertiliser used to alter the chemical characteristics of the substrate.
By-product/Co-product	A raw material that is a virgin product but is produced as part of a process to obtain or manufacture another, closely related, raw material. Obtaining or manufacturing the by-product/co-product alone would not normally be economically viable. A waste product would not meet the definition of a by-product/co-product.
Carbon cycling	Exchange of carbon between different elements of the carbon cycle. In this context between biomass, soil and the atmosphere.
Carbon sink	A natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period, e.g. a peat bog.
Coir	The fibre and pith of the coconut husk.
Coir fibre	The fibre of the coconut husk.
Coir pith	Corky substance found between the fibres of the coconut husk.
Conservation designation	A label that denotes that an area is being protected for conservation purposes. They may be statutory or non-statutory.
Cork	Cork is an impermeable buoyant material, the phellem layer of bark tissue that is harvested for commercial use primarily from Quercus suber (the cork oak), which is native to southwest Europe and northwest Africa.

Cork (recycled)	Used Cork that has been through a recovery process. This does not include post-industrial cork which is still part of the business model for virgin cork.
Decorticator	A machine that tears apart the husk of the coconut; separating fibre from pith.
Embedded water	Water that is an integral requirement of the growing/manufacturing process, but is not normally part of the final product, for example, water used in the washing of coir at the fibre mill.
End of processing system or mixing system	The point for a finished product immediately prior to bagging or loading into a bulk container. For materials transported to a different location for bagging, transport to the bagging site should be included.
Enforcement action	Legally authorised action undertaken by the relevant regulator within that jurisdiction to require a breach of planning, environmental or other legal controls to be rectified.
Environment impact assessment (EIA)	'The systematic assessment of the environmental effects of a project, prior to the issue of a development consent, under the EU EIA Directive ((85/337/EEC), as transposed into law by the relevant legislation with member states; or an equivalent process in other countries.
Extraction	To remove a raw material from the ground. If extraction only occurs for part of the year consideration of the impact of extraction should not be limited to the period of active extraction, but should also consider the extraction site during its inactive phase.
Fibre mill	A facility for separating the fibre from the coconut husk.
Finished product	Product ready for use for its intended purpose, i.e. no further manufacturing needs to take place. This could include growing media or soil improver ingredient(s) that are sold separately.
Forest	An area covered by trees and other woodland species.
Forest land	Land where the primary historic land use was forest, even where the forest cover has been removed.
Fossil fuel	A carbon based fuel source created by natural processes over long periods of time.
Gaseous effluent	Emissions in the form of gas (as opposed to a liquid or solid) to the atmosphere from a raw material or process.
Green compost	The output of the 'composting' of waste organic matter, typically plant residues, derived from domestic, landscape and municipal sources. In the UK PAS100 is the minimum standard that must be met for the material to be 'recovered waste'.
Green energy supply certification scheme	A scheme that provides formal recognition of the use of energy generated from renewable resources.
Greenhouse gas (GHG)	A gas that contributes to climatic warming by changing the balance of absorption and emission of infrared radiation in the atmosphere.
Green water	The precipitation on land that does not run off or recharge the groundwater but is stored in the soil or temporarily stays on top of the soil or vegetation. Eventually, this part of precipitation evaporates or transpires through plants.
Grit	Particles of aggregate less than approximately 15 mm in size.
Handling machinery	Machinery used to process and transport material around a site.
Hardwood	Wood from deciduous trees and broad-leaf evergreen trees.

International conservation designation	An area of habitat, species or biodiversity value formally recognised as such by national governments under a scheme that operates to an agreed standard across national frontiers. Such recognition normally confers a high degree of protection to the designated interest.
In-scope waste	Waste that is in-scope of the assessment. Including: • Unwanted material from production disposed of to landfill • Physical contaminants screened out of input materials Excluding: • Material which is used to produce a by-product • Packaging materials used to transport materials between companies in the supply chain
ISO9001	The ISO 9000 family of quality management systems standards is designed to help organizations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements related to a product. ISO 9000 deals with the fundamentals of quality management systems, including the eight management principles upon which the family of standards is based. ISO 9001 deals with the requirements that organizations wishing to meet the standard must fulfil.
ISO14001	An internationally accepted standard that provides an outline for effective environmental management systems within businesses.
Legally binding mitigation agreement	An agreement with the relevant regulator within that jurisdiction that the regulator can require to be implemented, by recourse to legal action if necessary, to reduce, prevent or compensate for an adverse impact by carrying out specified works or measures.
Liquid effluent	Emissions from a raw material or process in the form of liquid (as opposed to a gas or solid).
Loam	Soil composed primarily of sand, silt and clay. In the context of growing media manufacture the terms 'loam' and 'soil' are largely interchangeable.
Minerals	An inorganic natural substance, but for the purposes of both legislation in the UK and this scheme taken to include any raw material extracted from the ground other than topsoil. However, for the purposes of the habitat and biodiversity criterion peat is treated separately from other minerals.
Mixing system (mixing belt)	That part of the growing media or soil improver manufacturing process where bulk substrates are combined and additives introduced to the mix. The 'mixing belt' is the first part of that process where only bulk substrates are combined. At the 'mixing belt' all raw materials must be in a ready to manufacture form – for example, coir pith must be re-wet, bark fines must be screened etc. – even if further screening is carried out as part of the manufacturing process.
Monocrop	Monocropping is the agricultural practice of growing a single crop year after year on the same land, in the absence of rotation through other crops or growing multiple crops on the same land (polyculture).
Monocrop plantation	A plantation (see below), or part of a plantation, where cultivation is limited exclusively to a single crop.
Mushroom substrate	Growing media used in production of mushrooms.
National conservation designation	An area of habitat, species or biodiversity value formally recognised as such by a national government under a scheme that operates to an agreed standard within that country. Such recognition normally confers a high degree of protection to the designated interest.

Notified species	Species identified as at risk by the statutory authority responsible for conservation in each country
OHSAS18001	Occupational Health and Safety Management Systems—Requirements is an internationally applied British Standard for occupational health and safety management systems. It exists to help all kinds of organizations put in place demonstrably sound occupational health and safety performance.
Oilseed rape straw	Straw obtained from the cultivation of oilseed rape.
PAS100	The British Standards Institution Publicly Available Specification 100 for producing quality compost.
Peat	'Peat is an organic soil formed mainly from the remains of plants that have accumulated in situ. Peat accumulates in wetland habitats, primarily because waterlogging and associated anoxia retards the decomposition of plant material' (Wheeler & Shaw, 1995).
Peat forming habitat	Habitat supporting peat forming species (wetland species), generally consisting of the *Sphagnum* bog mosses and cotton grasses, although other plant material such as non-*Sphagnum* mosses, purple moor grass, or heather stems and roots can sometimes make significant contributions to the peat matrix.
Perlite	An amorphous volcanic glass mineral normally formed by the hydration of obsidian used in some, primarily specialist, growing media mixes.
Plantation	A cultivation system where the natural vegetation is cleared and replaced with planted agricultural or horticultural species, which normally remain in place and produce a crop from the same plants for two or more seasons.
Point of entry	First point at which a finished product enters the country. If materials are transported by sea this will be the port at which the product arrives. If materials are transported by road this will be where the material crosses into the country, i.e. national boundary. For finished products produced outside mainland UK, transport to the mainland needs to be taken into account.
Pollutant	A substance (solid, liquid or gaseous) introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource.
Pollute (water soil or air)	To discharge emissions that have, or have the potential to have, an adverse impact on the environment.
Pollution	The discharge of a substance (solid, liquid or gaseous) that is likely to have an adverse effect on the natural environment or life.
Potable water	Water suitable for drinking under normal conditions by the population of that country in which the water is located.
Processing system	That part of the growing media or soil improver manufacturing process where individual raw materials are processed and prepared for sale. Processes may include screening, grading, reconstituting, expanding, etc.
Recovered waste	A substance that was defined as a waste material, but is no longer classified as such by the relevant regulator within that jurisdiction. Recovered waste will normally have been through a prescribed process and achieved the requisite standard.
Recycled materials	Employing materials for a useful purpose that have already been used for another purpose as a replacement for virgin materials. Recycled materials will often be 'recovered waste' but that is not necessarily the case.

Recycled peat	Peat is only considered a recycled material when it meets specific criteria; otherwise it is considered a virgin material. The specific criterion is: • Waste peat removed from development sites; where removal of peat is not the purpose of development, i.e. the purpose is not peat extraction (for fuel or horticulture) and where it is demonstrated that excavation and removal is unavoidable
Regulator approved mitigation measures	Specified works or measures to reduce prevent or compensate for an adverse impact of operations agreed with the relevant regulator within that jurisdiction.
Renewable	A resource that can be replenished through naturally occurring processes. The timescale for replenishment is normally considered to be an average human lifetime of say 75 years.
Responsible	In the context of growing media and soil improver production, to select raw materials and to manufacture with care and forethought and to comply with environmental and social standards.
Restoration/ rehabilitation/ aftercare plan	Site specific plan to ensure that worked land (extraction site) is reclaimed for a defined future purpose, e.g. biodiversity and conservation.
Retting	A process using the duel effects of water soaking and the action of micro-organisms to break down the cellular tissue of fibres facilitating the separation of fibres in the coconut husk.
Reused Water	Water used more than once or recycled.
Roundwood	Wood in its natural state as felled, with or without bark.
SA8000	Social Accountability 8000 International Standard. A voluntary standard for auditable third-party verification.
Sand	Very fine loose fragments of rock, normally created by a process involving the influence of water.
Sedex	Sedex, the Supplier Ethical Data Exchange, is a not for profit membership organisation dedicated to driving improvements in responsible and ethical business practices in global supply chains. Sedex offers a simple and effective way of managing ethical and responsible practices in the supply chain.
Site	Land within the boundary of the licence (or equivalent boundary)
SMETA	Sedex Members Ethical Trade Audit
Softwood	Wood from conifers.
Soil improver	Material added to soil in situ primarily to maintain or improve its physical properties, and which may improve its chemical and/or biological properties or activity. Also known as a soil conditioner.
Solid effluent	Emissions from a raw material or process in the form of solid particles (as opposed to a gas or liquid).
Spent mushroom substrate	Mushroom growing media removed from the mushroom growing trays at the end of the growing cycle.
Sphagnum (farmed)	Sphagnum (farmed) is the product of the cultivation of peat moss (Sphagnum) for the production and harvest of peat moss biomass. The Sphagnum is cultivated in order to gain renewable raw material for the production of horticultural growing media as an alternative to using peat soil. Wild harvested Sphagnum is not included.
Start of mixing system	The point for a finished product immediately prior to the mixing line.
Substrate	A material or combination of bulk raw materials used, where required with further additives such as lime and fertiliser, to support plant growth.

Sustainable	Use of materials that meet the needs of current consumers without compromising the ability of this or future generations to meet or enjoy their social, environmental and economic needs.
Topsoil	The upper layer of the soil, typically 0.15 to 0.30 metres deep. In the context of growing media a manufactured product using a proportion of loam/soil blended with other products is also referred to as 'topsoil'.
Vermiculite	A hydrous silicate mineral used in some, primarily specialist, growing media mixes.
Virgin material	A material obtained or manufactured for a specific purpose that has not previously been used for another purpose.
Volume where commercial transport becomes viable	This is a volume based assessment and not an economic measure of commercial viability.
Wetland habitat	An area with the water table at, close to or above land surface level for the majority of the year, where the flora or fauna are adapted to and rely on those conditions.
Windrow composting	The production of compost by piling organic matter or biodegradable waste in long rows (windrows). These rows are generally turned to improve porosity and oxygen content, mix in or remove moisture, and redistribute cooler and hotter portions of the pile.
Wood based material	This is material that comes from a tree, but excludes fruits, nuts, leaves, resins.
Wood fibre	A wood based substrate: • Where the structure is modified during the manufacturing process to mechanically separate the wood fibres and create a lighter more open product than the raw material. The manufacturing process involves more than shredding / chipping / screening to change the wood particle size and uses heat / steam / mechanical processing to alter the physical characteristics of the raw material; or • That is composed of fine composted wood residues
Wool	The fine, soft curly or wavy hair forming the coat of a sheep, goat, or similar animal. For the purposes of this scheme reference to wool should be taken to mean sheep wool.
Worm compost	Compost produced using worms

Annex 2: Social compliance self-assessment questionnaire minimum requirements

There is no requirement to use this template for undertaking a social compliance self-assessment. However, to qualify as a self-assessment questionnaire for scoring purposes it must as a minimum contain the questions set out in the 'self-assessment minimum requirements' spreadsheet and achieve no more than 2 major and/or 5 minor failures.

Annex 3: Documentary evidence checklist

This is a summary of the documentary evidence requirements set out under each of the criteria.

Energy use (in extraction, transport and production)

- Supply chain map with distances and methods of transport
- Production/manufacturing fossil fuel energy use records (diesel, electricity etc.) and calculations
- Transport energy use calculations covering the whole supply chain, using standard distances and conversion factors where necessary.
- For renewable energy generated by company and used in processing or manufacture of material, documented evidence of energy generation and consumption.
- For energy obtained through green tariff, documented evidence of certification of the tariff through the Green Energy Supply Certification Scheme or equivalent.

Water use (in extraction and production)

- Supply chain map
- Excavation/production/manufacturing water use records for all production and manufacturing processes.
- Records of any rainwater harvesting or water recycling used.

Social compliance

- Supply chain map including sources of all materials
- Details of the social compliance process, including any internal checks of suppliers.
    - Transparency is obtained through the use of either an internal management system or an external management system such as Sedex or BSCI.
    - Self-assessment questionnaires may be used as proof (see Annex 2: Social compliance self-assessment questionnaire minimum requirements), but they are scored at a lower value than independent audits (Table 11).
    - Neither ISO14001 nor ISO9001 are acceptable proof. OHSAS18001 only offers partial proof as it does not cover the labour standards elements required but does cover the health and safety requirements.
- Risk assessments
- Certification to confirm successful independent audits throughout the supply chain
- Independent audits of suppliers need to be conducted using recognised approaches such as SMETA, BSCI, SA8000 or similar

Habitat and biodiversity - Peat

- Supply chain map including sources of peat
- Evidence that the site has not been identified as being a local, national or international conservation site or part of a protected landscape
- Proof of development/drainage start date
- Restoration/rehabilitation plan – including proof that this has been approved by a licencing body or other competent authority, e.g. statutory conservation body

- Proof of provision to guarantee the financing of restoration – including documentation of the method of guarantee (and associated policy where relevant) and that the funds will be sufficient to deliver the restoration plan
- Proof of source of recycled peat and that excavation and removal of peat at that site is unavoidable

Habitat and biodiversity – Wood based materials

- Supply chain map including sources of wood based materials
- The source of material (virgin by-products and recycled material)
- That material comes from a sustainably managed forest. Could include:
  - Independent third party certification
  - Recognised national/retailer schemes
  - Recognised country of origin risk assessment (low risk)(e.g. FSC Controlled Wood National Risk Assessment) (material relying on this proof alone should not be included in % calculation)
- Membership/certification to appropriate scheme
- Total amount of material handled, detailing level of certification or other qualifying proof (i.e. not country of origin risk assessment).

Habitat and biodiversity – Coir pith

- Supply chain map including sources of coir pith/coconuts
- Documentary evidence of the source of material
- For known specific location sourced materials:
  - Evidence of previous land use
  - Evidence of first cultivation date for coconuts
  - Evidence of cultivation system (monocrop, etc.)
- For regional assessment:
- Evidence of regional land use change to deliver any expansion of coconut production

Habitat and biodiversity – Minerals

- Supply chain map including sources of minerals
- Evidence that the site has not been identified as a local, national or international conservation site or part of a protected landscape
- Restoration/rehabilitation plan – including proof that this has been approved by a licencing body or other competent authority, e.g. statutory conservation body
- Proof of provision to guarantee the financing of restoration – including documentation of the method of guarantee (and associated policy where relevant) and that the funds will be sufficient to deliver the restoration plan
- Proof of source of recycled minerals

Habitat and biodiversity – Recycled materials

- Supply chain map

Habitat and biodiversity – Agricultural crops (energy crops for AD, oilseed rape straw, farmed Sphagnum)

- Supply chain map including sources of agricultural crops.
- Documentary evidence of the source of material

  - Evidence of previous land use
  - Evidence of first cultivation date for agricultural crops
- Documentary evidence that the farm is in a higher level environmental scheme (applicable scheme to the country of origin) or is being managed to an equivalent standard.

Habitat and biodiversity – Bracken

- Supply chain map including sources of bracken.
- Documentary evidence that bracken management is carried out following a bracken management plan, that this management plan follows best practice guidance and that it has regulatory approval (where required or as needed).

Habitat and biodiversity – Wool (sheep only)

- Supply chain map including sources of wool.
- Documentary evidence of the source of material
  - Location of farm (upland vs lowland). To meet the definition of an upland sheep farm the sheep should spend the majority of their life cycle in an upland extensive grazing system.
  - Evidence that sheep grazing is being used as part of a habitat conservation plan if not in an upland extensive grazing system

- Documentary evidence of the stocking density of sheep on each of the habitat types present on the farm.

Habitat and biodiversity - cork

- Supply chain map including sources of cork.

Pollution

- Supply chain map including sources of all materials and known potential pollutant hotspots
- Details of pollutant including quantity
- Details of any mitigation measures required
- Regulatory approval of any mitigation measures
- Confirmation of mitigation measures
- Demonstration of no negative impact
- Monitoring records
- Records of enforcement actions
- Details of legally binding mitigation agreement

Renewability

- Evidence of materials used
- Proportion of each material used in final product
- For wood based material – species used, differentiating between hardwood/softwood
- For peat, where potentially renewable within 100 years, documented:
  - evidence of peat type (sphagnum/sedge)
  - peat extraction plan including depth excavated annually
  - site restoration plan including timescales

Resource use efficiency

- Evidence of materials used

- Energy records - use during processing for recycled materials (kWh/m^3)
- Volume of input materials (m^3)
- Volume of in-scope waste generated during production (m^3)
- In-scope waste as a proportion of input material (%)