Electronic Supplementary Material (ESI) for RSC Sustainability.

Supplementary Information to "Unraveling the Climate Neutrality of Wood Derivatives and Biopolymers"

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Chapter 1: Data Collection and Selection

Data on the climate change impacts from the production of the wood derivatives cellulose, hemicellulose, lignin, cellulose nanofibril (CNF), and cellulose nanocrystal (CNC) were gathered from the literature and assessed for inclusion or exclusion in the lifecycle scenarios modeled for the paper. Data points were excluded on the basis of 1) unusually high values stemming from lab-scale production processes, 2) unusually high values stemming from the utilization of waste or agricultural biomass as input, or 3) any value that already incorporated any form of carbon crediting, since carbon crediting would be performed later manually.

All data points gathered regarding the climate change impacts from the production of the selected wood derivatives (cellulose, hemicellulose, lignin, microfibrillated cellulose, and cellulose nanocrystals) that were taken from the literature in Supplementary Table 1 were then graphically plotted in Supplementary Figure 1 to visualize the data and identify extreme outliers.

Supplementary Table 1. The literature reviewed on the climate change impacts of the production of wood derivatives. All the environmental impacts tabulated below have been plotted in Supplementary Figure 1. Data points may be included or rejected for only lignin and CNF; for all other wood derivatives not considered in the assessment, inclusion or rejection is not applicable (N.A.). The extended table can be found in Supplementary_Table.xlsx

Reference	Feedstock	Feedstock Type	Process	Wood Derivative	Environmental Impact (kg CO2 eq. per 1kg of derivative)	Included or Rejected	Notes or Reasoning for Rejection
1	Eucalyptus Wood	Primary Wood	Viscose Process	Cellulose	3.8	**N.A.**	**CO2 uptake considered;**
	Eucalyptus Wood	Primary Wood	Viscose Process	Cellulose	5.3	**N.A.**	
	Eucalyptus and Beech Wood	Primary Wood	Lyocell Process	Cellulose	1.1	**N.A.**	**CO2 uptake considered**
	Eucalyptus and Beech Wood	Primary Wood	Lyocell Process	Cellulose	2.5	**N.A.**	
	Eucalyptus and Beech Wood	Primary Wood	Lyocell Process	Cellulose	0.05	**N.A.**	**CO2 uptake considered**
	Eucalyptus and Beech Wood	Primary Wood	Lyocell Process	Cellulose	1.5	**N.A.**	
	European Beech Wood	Primary Wood	Viscose Process	Cellulose	0.03	**N.A.**	**CO2 uptake considered**
	European Beech Wood	Primary Wood	Viscose Process	Cellulose	1.5	**N.A.**	
	European Beech Wood	Primary Wood	Viscose Process	Cellulose	-0.25	**N.A.**	**CO2 uptake considered**
	European Beech Wood	Primary Wood	Viscose Process	Cellulose	1.2	**N.A.**	
2	Norwegian Spruce	Primary Wood	Borregaard	Cellulose	1.160	**N.A.**	
	Norwegian Spruce	Primary Wood	Borregaard	Lignin	0.666	**Included**	
	Norwegian Spruce	Primary Wood	Borregaard	Lignin	1.12	**Included**	
3	Eucalyptus Wood - Bleached Sulphate Pulp	Primary Wood Pulp	Kraft wood pulping	Cellulose	2	**N.A.**	

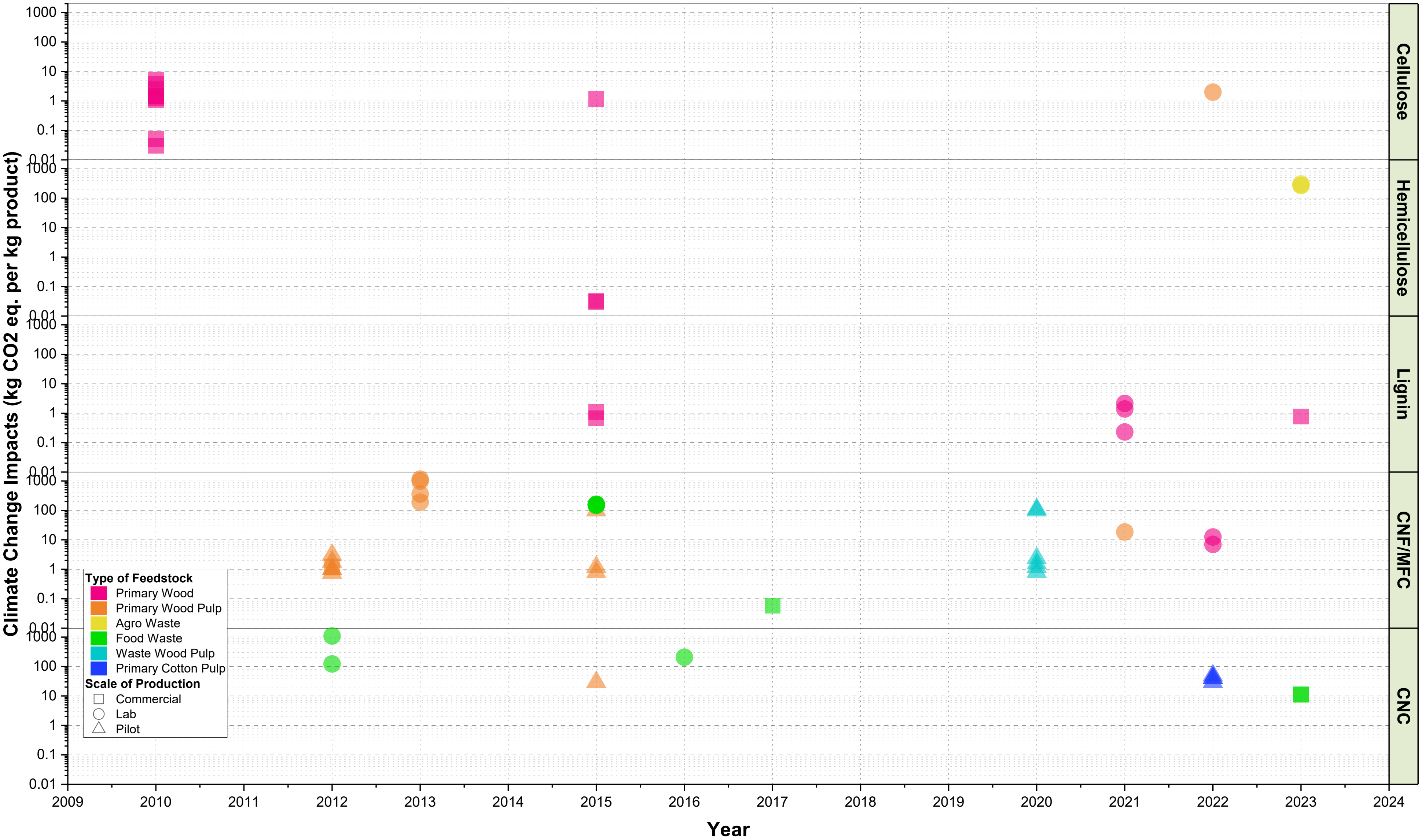
Reference	Feedstock	Feedstock Type	Process	Wood Derivative	Environmental Impact (kg CO2 eq. per 1kg of derivative)	Included or Rejected	Notes or Reasoning for Rejection
	Eucalyptus Wood	Primary Wood	Refining	CNF	7	**Rejected**	**Lab-scale process**
	Eucalyptus Wood	Primary Wood	Refining and homogenization	CNF	12.5	**Rejected**	**Lab-scale process**
4	Mixed Hardwood Woodchips	Primary Wood	Extraction and concentration of hemicellulose to 70% dry content via evaporation	Hemicellulose	0.0298	**N.A.**	
	Mixed Hardwood Woodchips	Primary Wood	Extraction and concentration of hemicellulose to 50% dry content via evaporation	Hemicellulose	0.0332	**N.A.**	
5	Sugarcane Bagasse Pith	Agro Waste	Ultrasound-assisted alkaline extraction	Hemicellulose	277	**N.A.**	**Agricultural feedstock; lab-scale process; impact unusually high**
	Sugarcane Bagasse Pith	Agro Waste	Ultrasound-assisted alkaline extraction	Hemicellulose	306	**N.A.**	**Agricultural feedstock; lab-scale process; impact unusually high**
	Sugarcane Bagasse Pith	Agro Waste	Ultrasound-assisted alkaline extraction	Hemicellulose	267	**N.A.**	**Agricultural feedstock; lab-scale process; impact unusually high**
6	Spruce Bark	Primary Wood	Organosolv	Lignin	2.14	**Included**	
	Tannin-Free Spruce Bark	Primary Wood	Organosolv	Lignin	1.39	**Included**	
	Tannin-Free Spruce Bark	Primary Wood	Organosolv	Lignin	0.23	**Included**	
7	Beech	Primary Wood	Fabiola Organosolv	Lignin	0.77	**Included**	
	Beech	Primary Wood	Fabiola Organosolv	Lignin	−4.71	**Rejected**	**CO2 uptake considered**

Reference	Feedstock	Feedstock Type	Process	Wood Derivative	Environmental Impact (kg CO2 eq. per 1kg of derivative)	Included or Rejected	Notes or Reasoning for Rejection
8	Sulfite Pulp	Primary Wood Pulp	Enzymatic + HPH (Homogenization)	CNF	1.2	**Included**	
	Sulfite Pulp	Primary Wood Pulp	Enzymatic + HPH (Homogenization)	CNF	3.1	**Included**	
	Sulfite Pulp	Primary Wood Pulp	TEMPO oxidation + HPH (Homogenization)	CNF	1	**Included**	
	Sulfite Pulp	Primary Wood Pulp	TEMPO oxidation + HPH (Homogenization)	CNF	1.8	**Included**	
	Sulfite Pulp	Primary Wood Pulp	TEMPO oxidation + mechanical refinement	CNF	0.75	**Included**	
	Sulfite Pulp	Primary Wood Pulp	TEMPO oxidation + mechanical refinement	CNF	1	**Included**	
9	Delignified Kraft Pulp	Primary Wood Pulp	TEMPO oxidation + Sonication + Centrifuge purifying (TOSO)	CNF	980	**Rejected**	**Lab-scale process; impact unusually high**
	Delignified Kraft Pulp	Primary Wood Pulp	TEMPO oxidation + Homogenization (TOHO)	CNF	190	**Rejected**	**Lab-scale process; impact unusually high**
	Delignified Kraft Pulp	Primary Wood Pulp	Chloroacetic acid etherification + Sonication + Centrifuge purifying (CESO)	CNF	1160	**Rejected**	**Lab-scale process; impact unusually high**
	Delignified Kraft Pulp	Primary Wood Pulp	Chloroacetic acid etherification + Homogenization (CEHO)	CNF	360	**Rejected**	**Lab-scale process; impact unusually high**

Reference	Feedstock	Feedstock Type	Process	Wood Derivative	Environmental Impact (kg CO2 eq. per 1kg of derivative)	Included or Rejected	Notes or Reasoning for Rejection
10	Unbleached Sulfate	Primary Wood Pulp	Enzymatic pretreatment+ microfluidization	CNF	0.79	**Included**	
	Sulphite Pulp	Primary Wood Pulp	Carboxymethylation pretreatment + microfluidization	CNF	99	**Rejected**	**Impact unusually high**
	Unbleached Sulfate	Primary Wood Pulp	Without pretreatment + homogenization treatment	CNF	1.2	**Included**	
11	Carrot Waste	Food Waste	MFC liberated (Aqueous Enzymatic treatment + homogenization) + Coating MFC with GripX + Wet spinning by adding Sodium Alginate	CNF	150	**Rejected**	**Agricultural feedstock; lab-scale process; impact unusually high**
	Carrot Waste	Food Waste	MFC liberated (Enzymatic + homogenization) + Coating MFC with GripX + Wet spinning by adding Sodium Alginate	CNF	160	**Rejected**	**Agricultural feedstock; lab-scale process; impact unusually high**
	Carrot Waste	Food Waste	MFC liberated (Enzymatic + homogenization) + Wet spinning by adding Sodium Alginate (without coating)	CNF	150	**Rejected**	**Agricultural feedstock; lab-scale process; impact unusually high**
	Carrot Waste	Food Waste	MFC liberated (Enzymatic + homogenization) + Wet spinning by adding Sodium Alginate (without coating)	CNF	160	**Rejected**	**Agricultural feedstock; lab-scale process; impact unusually high**
	Carrot Waste	Food Waste	MFC liberated (Enzymatic + homogenization) +	CNF	150	**Rejected**	**Agricultural feedstock; lab-scale process; impact unusually high**

Reference	Feedstock	Feedstock Type	Process	Wood Derivative	Environmental Impact (kg CO2 eq. per 1kg of derivative)	Included or Rejected	Notes or Reasoning for Rejection
			electrospinning by adding PEO as a carrier polymer				
	Carrot Waste	Food Waste	MFC liberated (Enzymatic + homogenization) + electrospinning by adding PEO as a carrier polymer	CNF	160	**Rejected**	**Agricultural feedstock; lab-scale process; impact unusually high**
12	Carrot Waste	Food Waste	Bleaching, washing, Masuko grinding	CNF	0.0586	**Included**	**Included despite the food waste feedstock as it was one of the only data points for upscaled production.**
13	Wood Waste Pulp	Waste Wood Pulp	High-pressure homogenization	CNF	1.2	**Rejected**	**CO2 uptake considered**
	Wood Waste Pulp	Waste Wood Pulp	High-pressure homogenization	CNF	2.4	**Rejected**	**CO2 uptake considered**
	Wood Waste Pulp	Waste Wood Pulp	Enzymatic pretreatment + Microfluidization	CNF	0.8	**Rejected**	**CO2 uptake considered**
	Wood Waste Pulp	Waste Wood Pulp	Enzymatic pretreatment + Microfluidization	CNF	1.6	**Rejected**	**CO2 uptake considered**
	Wood Waste Pulp	Waste Wood Pulp	Carboxy-methylation pretreatment + Microfluidization	CNF	99	**Rejected**	**CO2 uptake considered**
	Wood Waste Pulp	Waste Wood Pulp	Carboxy-methylation pretreatment + Microfluidization	CNF	110	**Rejected**	**CO2 uptake considered**
14	Hardwood Kraft Pulp	Primary Wood Pulp	Enzymatic Treatments & Homogenization (ENZHO)	CNF	18.6	**Rejected**	**Lab-scale process**
15	Coconut Fibers	Food Waste	EUC extraction (hydrolysis)	CNC	1086.412	**N.A.**	**Agricultural feedstock; lab-scale process; impact unusually high**

Reference	Feedstock	Feedstock Type	Process	Wood Derivative	Environmental Impact (kg CO2 eq. per 1kg of derivative)	Included or Rejected	Notes or Reasoning for Rejection
	Cotton Fibers	Primary Cotton Pulp	EC extraction (hydrolysis)	CNC	122.171	**N.A.**	**Agricultural feedstock; lab-scale process; impact unusually high**
16	Bleached Kraft Pulp from Wood Chips	Primary Wood Pulp	pilot acid hydrolysis process	CNC	29.64	**N.A.**	
17	Coconut Fibers	Food Waste	Extraction of CNC with high powered ultrasound (CNU)	CNC	207	**N.A.**	**Agricultural feedstock; lab-scale process; impact unusually high**
18	Cotton Pulp	Primary Cotton Pulp	Sulphuric acid hydrolysis without acid separation	CNC	49.4	**N.A.**	
	Cotton Pulp	Primary Cotton Pulp	Sulphuric acid hydrolysis + gravity settling with acid separation	CNC	40.35	**N.A.**	
	Cotton Pulp	Primary Cotton Pulp	Sulphuric acid hydrolysis + centrifugation with acid separation	CNC	40.87	**N.A.**	
	Cotton Pulp	Primary Cotton Pulp	Sulphuric acid hydrolysis + microfiltration with acid separation	CNC	29.6	**N.A.**	
19	Wood Pulp	Primary Wood Pulp	Acid hydrolysis with acid recovery	CNC	11.39	**N.A.**	
	Wood Pulp	Primary Wood Pulp	Acid hydrolysis without acid recovery	CNC	11.18	**N.A.**	



Supplementary Figure 1. All of the compiled data points in Supplementary Table 1 represent the climate change impacts from the production of different wood derivatives.

Chapter 2: Carbon Dioxide Uptake Calculations for Bio-based Materials

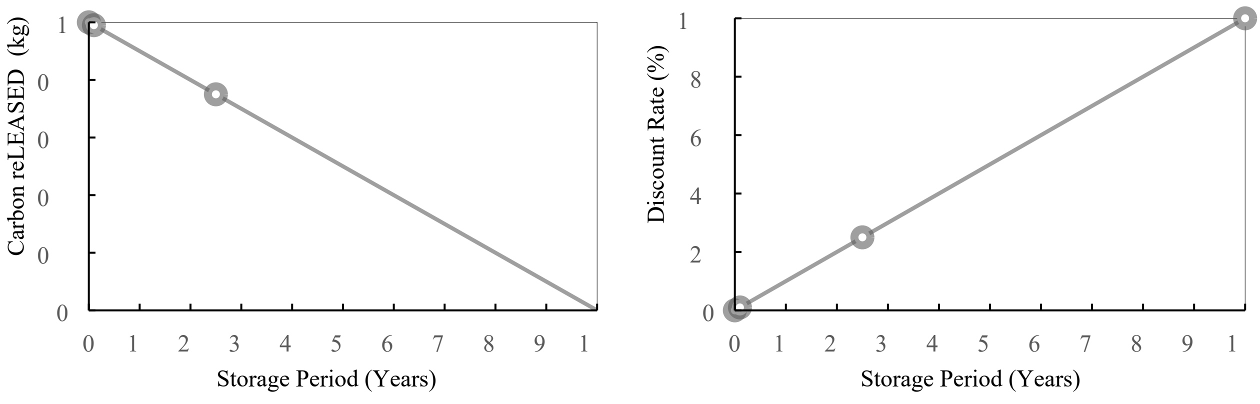
The carbon dioxide uptake and release amounts for 1 kg each of the bio-based materials lignin, CNF, and PLA were calculated for each material. Stoichiometrically, 0.273 kg of carbon (C) produces 1 kg of carbon dioxide (CO2) and this value was used for calculating the biogenic carbon uptake/release values.

Supplementary Table 2. Calculated carbon dioxide uptake and release amounts for 1 kg of lignin, CNF, and PLA.

Material (1 kg)	Carbon content [%]	CO2 uptake and release [kg/kg material]	Source for carbon content
Lignin	62.5	2.292	[20]
CNF	44.4	1.628	[21]
PLA	50	1.833	[21]

Chapter 3: Discounting Rate

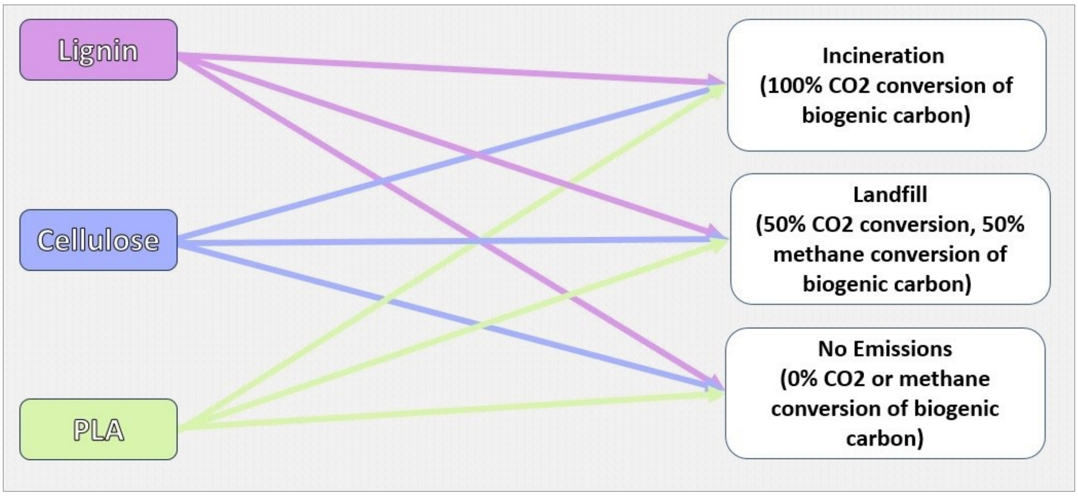
The amount of biogenic carbon considered to be released after different storage periods from an original materially-stored 1 kg of biogenic carbon using an annual discount rate of 1% and a time horizon of 100 years was calculated for each scenario involving dynamic carbon accounting. 1 kg of biogenic carbon successfully stored within materials for 100 years and then released would be considered to have no emissions impact due to the long storage period achieved, while 1 kg of biogenic carbon released after a storage period of zero years would be considered to have the full emissions impact of the release of 1 kg of biogenic carbon. In this way, biogenic carbon emissions in the near future are weighted more heavily than emissions in the more distant future.



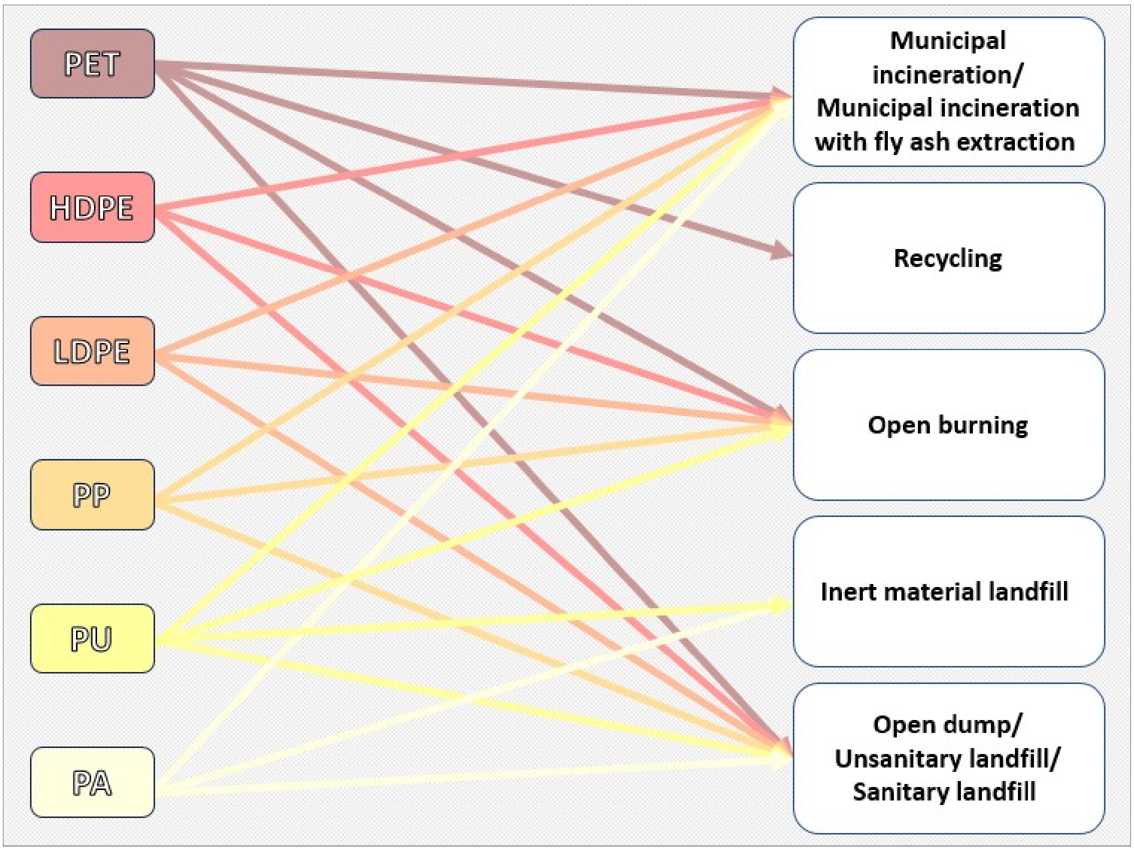
Supplementary Figure 2. An illustration of dynamic carbon accounting over 100 years involving an annual discount rate of 1%.

Chapter 4: End-of-Life Options

Three End-of-Life (EoL) scenarios (incineration, landfilling, and a 'no emissions' scenario) were identified and all three were incorporated into the lifecycle scenarios for each of the bio-based materials lignin, cellulose (i.e. CNF), and PLA. It was assumed that an incineration scenario would result in the full release of stored biogenic carbon as carbon dioxide and that a landfill scenario would result in stored biogenic carbon being released as 50% carbon dioxide and 50% methane due to partial anaerobic conditions. The 'no emissions' scenario assumes that no carbon is emitted at the EoL and represents scenarios in which PLA, lignin, and cellulose end up in landfills and are non-biodegradable.



Supplementary Figure 3. End-of-life scenarios analyzed for the bio-based materials.



Supplementary Figure 4. End-of-life scenarios analyzed for the fossil-based plastic polymers.

Five potential EoL scenarios were identified and these were incorporated into the lifecycle scenarios for each petroleum-based plastic polymers PET, HDPE, LDPE, PP, PU, and PA. However, the selected EoL options were taken from the data available in ecoinvent v3.9.1 and are not necessarily inclusive of all EoL options available for every polymer, e.g., recycling is possible for plastics besides PET, but the data on these scenarios was not available in ecoinvent[22]. Additionally, the number of production data sets varied between different polymers in ecoinvent, with PET having the highest number of data sets along with three possible EoL options (landfilling, recycling, and incineration). HDPE and LDPE both had fewer data points than PET, followed by PP, PU, and PA. None of the polymers, except for PET, had the datasets to model the EoL as recycling. This is particularly apparent in Figure 2(c) of the main text, wherein only PET has a trimodal life cycle impact distribution, where the middle mode represents the recycling of PET as an impact.

Chapter 5: Life Cycle Climate Change Impacts of Materials

The total cumulative lifecycle climate change impacts for lignin, CNF, PLA, PET, HDPE, LDPE, PP, PU, and PA were calculated for each lifecycle scenario of the material and collated into the table below for reference.

Supplementary Table 3. Total lifecycle climate change impacts for each material (in kg CO2 eq. per kg of polymer) in each scenario.

Lignin		CNF		PLA	PET						HDPE		LDPE	PP	PU	PA
10.73	2.96	-0.43	2.83	4.95	1.13	2.98	3.46	5.06	1.39	1.55	3.56	2.10	2.08	2.46	7.58	11.63
11.27	3.41	-1.57	4.73	5.03	0.53	3.33	3.32	5.25	1.25	1.92	3.75	2.51	2.43	2.05	5.23	11.65
12.91	4.43	10.30	2.63	3.11	0.53	3.33	1.60	2.45	1.16	1.64	3.54	2.52	2.45	2.45	5.27	11.66
13.36	3.68	12.20	3.43	3.20	2.89	3.52	1.46	3.73	0.48	0.72	3.65	0.95	2.68	4.85	5.23	9.43
14.38	2.52	10.10	2.38	4.93	3.06	0.72	1.37	5.22	1.25	1.36	3.66	0.76	2.70	4.43	7.80	9.29
13.63	3.06	10.90	2.63	5.02	1.13	2.00	0.69	5.08	1.76	0.76	2.03	0.93	2.11	4.84	5.13	9.39
12.47	0.67	9.85	2.42	3.09	2.99	3.49	1.46	3.36	1.30	1.37	2.45	1.11	4.91	4.85	5.13	9.29
13.01	1.12	10.10	2.83	3.18	3.33	3.35	1.97	3.22	1.68	0.77	2.45	0.93	5.26	4.44	7.83	9.39
10.61	2.14	9.89	1.69	4.49	5.03	1.63	1.51	3.13	1.39	0.77	0.88	1.11	5.28	4.84	5.23	11.65
11.07	1.39	10.30	1.20	4.58	5.22	1.48	1.89	2.45	0.47	3.13	0.69	1.03	5.50	2.41	7.51	11.68
12.09	0.23	9.16	3.10	2.65	2.42	1.40	1.60	3.22	1.11	3.30	0.86	0.76	5.53	1.99	5.17	11.69
11.34	0.77	8.67	1.00	2.74	3.70	0.72	0.68	3.73	0.52	1.37	1.04	0.95	4.94	2.39	5.21	9.46
10.18	2.93	10.57	1.80	3.11	5.19	1.48	1.32	3.27	1.12	3.23	0.86	0.75	2.03	2.42	5.17	9.31
10.72	3.39	8.47	0.75	3.20	5.05	2.00	0.73	3.65	0.53	3.57	1.04	0.85	2.38	2.00	7.73	9.42
11.19	4.41	9.27	1.00	1.28	3.33	1.54	1.33	3.36	0.53	3.31	0.96	0.86	2.40	2.41	5.06	9.32
11.64	3.66	8.22	0.79	1.37	3.19	1.92	0.74	2.44	2.89	3.51	0.69	4.92	2.62	4.96	5.06	9.42
12.66	2.50	8.47	1.20	13.36	3.10	1.63	0.74	3.08	3.06	0.71	0.88	5.34	2.65	4.55	7.76	11.72
11.91	3.04	8.26	0.06	13.45	2.42	0.71	3.10	2.49	1.12	1.99	0.68	5.35	2.06	4.95	5.17	11.74
10.75	0.64	8.67	2.81	11.53	3.19	1.35	3.26	3.10	2.99	3.47	0.78	3.78	2.02	4.83		11.75
11.29	1.10	7.53	4.71	11.62	3.70	0.75	1.33	2.50	3.33	3.33	0.79	3.58	2.37	4.42		9.53
8.90	2.12	10.29	2.61	13.34	3.24	1.36	3.20	2.50	5.15	1.62	5.03	3.76	2.39	4.82		9.38
9.35	1.37	12.19	3.41	13.43	3.62	0.76	3.54	4.86	5.34	1.47	5.45	3.94	2.61	2.40		9.48
10.37	0.21	10.09	2.36	11.51	3.33	0.76	3.43	5.03	2.54	1.39	5.46	3.76	2.63	1.99		9.38
9.62	0.75	10.89	2.61	11.60	2.41	3.12	3.62	3.10	3.82	0.71	3.89	3.94	2.05	2.39		9.48
8.46	2.38	9.84	2.40	12.90	3.05	3.29	0.82	4.96	5.31	1.47	3.69	3.85	4.88			11.63
9.00	2.84	10.09	2.81	12.99	2.46	1.36	2.10	5.30	5.17	1.99	3.87	3.58	5.23			11.66
	3.86	9.88	1.67	11.07	3.06	3.22	3.59	5.07	3.45	1.52	4.05	3.78	5.25			11.66
	3.11	10.29	1.18	11.16	2.47	3.56	3.45	5.26	3.31	1.90	3.87	3.57	5.48			9.44
	1.95	9.14	3.08	11.53	2.47	3.24	1.73	2.46	3.22	1.62	4.05	3.67	5.50			9.29
	2.49	8.66	0.98	11.62	4.83	3.43	1.58	3.74	2.54	0.70	3.96	3.69	4.91			9.40
	0.09	10.56	1.78	9.70	4.99	0.63	1.50	5.23	3.31	1.34	3.69	2.05	2.01			9.29
	0.55	8.46	0.73	9.78	3.06	1.91	0.82	5.09	3.82	0.74	3.89	2.46	2.36			9.40
	1.57	9.26	0.98		4.93	3.40	1.58	3.37	3.36	1.35	3.68	2.47	2.39			10.60
	0.82	8.21	0.77		5.27	3.26	2.10	3.22	3.74	0.75	3.78	0.90	2.61			10.62
	-0.34	8.46	1.18		3.13	1.54	1.64	3.14	3.45	0.75	3.80	0.71	2.63			10.63
	0.20	8.25	0.04		3.32	1.40	2.02	2.46	2.53	3.11	4.93	0.88	2.04			8.41
	0.67	8.66	2.42		0.53	1.31	1.73	3.22	3.17	3.28	5.35	1.06	5.02			8.26
	1.12	7.52	4.32		1.81	0.63	0.81	3.74	2.58	1.35	5.35	0.88	5.37			8.36
	2.14	9.90	2.22		3.29	1.40	1.45	3.28	3.18	3.21	3.78	1.06	5.39			8.26

Lignin		CNF		PLA	PET						HDPE		LDPE	PP	PU	PA
	1.39	11.80	3.02		3.15	1.91	0.85	3.66	2.59	3.55	3.59	0.97	5.61			8.36
	0.23	9.70	1.97		1.44	1.45	1.46	3.37	2.59	3.31	3.76	0.71	5.64			10.57
	0.77	10.50	2.22		1.29	1.83	0.86	2.45	4.95	3.51	3.94	0.90	5.05			10.59
	-1.63	9.45	2.01		1.21	1.54	0.86	3.09	5.12	0.71	3.76	0.69	4.91			10.60
	-1.17	9.70	2.42		0.53	0.62	3.22	2.49	3.18	1.99	3.94	0.80	5.26			8.38
	-0.15	9.49	1.28		1.29	1.26	3.39	3.10	5.05	3.48	3.86	0.81	5.28			8.23
	-0.90	9.90	0.79		1.81	0.66	1.46	2.50	5.39	3.34	3.59	2.03	5.51			8.34
	-2.06	8.75	2.69		1.34	1.27	3.32	2.50	3.09	1.62	3.78	2.45	5.53			8.23
	-1.52	8.27	0.59		1.72	0.68	3.66	4.86	3.28	1.47	3.58	2.46	4.94			8.34
	13.48	10.17	1.39		1.44	0.68	3.38	5.03	0.48	1.39	3.68	0.89				10.66
	13.93	8.07	0.34		0.52	3.03	3.57	3.10	1.76	0.71	3.69	0.69				10.69
	14.95	8.87	0.59		1.16	3.20	0.77	4.96	3.25	1.47		0.86				10.69
	14.20	7.82	0.38		0.56	1.27	2.06	5.30	3.11	1.99		1.04				8.47
	13.04	8.07	0.79		1.17	3.13	3.54	3.09	1.39	1.53		0.86				8.32
	13.58	7.86	-0.35		0.57	3.48	3.40	3.29	1.25	1.90		1.04				8.43
	11.19	8.27	1.20		0.57	3.33	1.68	0.49	1.16	1.62		0.96				8.32
	11.64	7.13	3.10		2.93	3.53	1.54	1.77	0.48	0.70		0.69				8.43
	12.66	8.67	1.00		3.10	0.73	1.45	3.26	1.25	1.34		0.89				10.57
	11.91	10.57	1.80		1.17	2.01	0.77	3.12	1.76	0.74		0.68				10.60
	10.75	8.47	0.75		3.03	3.50	1.54	1.40	1.30	1.35		0.78				10.61
	11.29	9.27	1.00		3.37	3.36	2.06	1.25	1.68	0.75		0.80				8.38
	13.46	8.22	0.79		3.09	1.64	1.59	1.17	1.39	0.75		4.90				8.23
	13.91	8.47	1.20		3.28	1.49	1.97	0.49	0.47	3.11		5.31				8.34
	14.93	8.26	0.06		0.48	1.41	1.68	1.25	1.11	3.28		5.32				8.23
	14.18	8.67	-0.43		1.76	0.73	0.76	1.77	0.51	1.35		3.75				8.34
	13.02	7.53	1.47		3.25	1.49	1.40	1.31	1.12	3.21		3.56				
	13.56	7.05	-0.63		3.11	2.01	0.81	1.68	0.53	3.55		3.73				
	11.16	8.95	0.17			3.35	1.42	1.40	0.53	3.30		3.91				
	11.62	6.85	-0.88			1.42	0.82	0.48	2.88	3.49		3.73				
	12.64	7.65	-0.63			3.28	0.82	1.12	3.05	0.69		3.91				
	11.89	6.60	-0.84			3.62	3.18	0.52	1.12	1.97		3.82				
		6.85														
		6.64														
		7.05														
		5.90														

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