Supplementary materials

Table S1. Relative differences (% changes) in total annual biomass (timber and energy biomass) yield (Mg ha^{-1} $year^{-1}$), NPV (€ ha^{-1}), NEE (Mg CO_2 ha^{-1} $year^{-1}$), avoided emissions (Mg CO_2 ha^{-1} $year^{-1}$) and net CO_2 exchange (Mg CO_2 ha^{-1} $year^{-1}$) for alternative management scenarios and harvest intensities, compared to baseline management (T26) over the 40-year period under the final felling made at breast height diameter (DBH) of 26 cm and 22 cm in southern, western and eastern sub-regions of Finland. For the key of the management scenarios, see Table 1.

% changes compared to those in baseline (T26)															
Sub-regions	South					West					East				
Parameters	Biomass yield	NPV	NEE	Avoided emissions	Net CO_2 exchange	Biomass yield	NPV	NEE	Avoided emissions	Net CO_2 exchange	Biomass yield	NPV	NEE	Avoided emissions	Net CO_2 exchange
Management scenarios															
T26+	-8	-13	33	-7	3	-10	-17	40	-10	3	-8	-12	29	-8	2
T26-	4	8	-38	3	-7	5	12	-49	4	-9	4	9	-45	3	-9
BN26	17	1	24	7	0	13	0	16	5	-1	18	3	19	8	0
BN26+	10	-11	56	1	3	7	-13	55	-1	4	12	-8	50	3	4
BN26-	22	11	-18	11	-7	19	14	-33	10	-9	21	12	-26	11	-9
BNR26	47	7	55	21	0	42	8	43	20	1	46	7	51	21	0
BNR26+	41	-5	92	15	4	30	-10	79	9	3	41	-3	84	16	4
BNR26-	50	16	16	24	-6	43	19	-3	22	-8	48	17	7	24	-7
T22	3	10	-17	2	-2	4	13	-22	4	-3	4	11	-18	3	-2
T22+	-2	2	5	-2	0	-3	0	7	-3	0	-1	3	3	-1	0
T22-	5	15	-45	3	-8	7	20	-61	5	-11	4	15	-50	2	-10
BN22	25	13	10	11	-2	23	16	-3	13	-3	25	13	3	12	-2
BN22+	22	7	31	9	0	15	2	27	5	-1	21	7	28	9	1
BN22-	27	19	-22	14	-8	25	24	-39	14	-10	24	17	-26	11	-9
BNR22	60	19	51	28	-1	52	21	32	26	-2	59	21	46	29	0
BNR22+	58	13	80	26	4	49	12	63	23	2	53	10	71	23	2
BNR22-	61	26	22	29	-5	54	30	-6	28	-8	56	24	15	26	-6

Table S2. Mean annual yield (Mg ha^{-1} year^{-1}) and % change in annual yield of timber (compared to baseline management) for four 10-year periods for different management scenarios under the final felling made at DBH of 26 cm and 22 cm in southern, western and eastern sub-regions of Finland. The yield obtained in alternative management scenarios was compared to that in the baseline management (T26) for the same period and expressed in percentage (%). For the key of the management scenarios, see Table 1.

		Sawlogs yield (Mg ha^{-1} year^{-1})						% change compared to baseline (T26)				
Management scenarios		T26	T26+	T26-	T22	T22+	T22-	T26+	T26-	T22	T22+	T22-
Sub-regions	Period											
South	2016–2025	0.4	0.4	0.5	0.6	0.5	0.7	-12	23	52	30	74
	2026–2035	1.0	0.8	1.1	1.2	1.1	1.3	-20	16	21	14	31
	2036–2045	1.5	1.5	1.5	1.4	1.4	1.3	-5	-4	-7	-9	-14
	2046–2055	1.4	1.5	1.2	1.1	1.2	1.0	6	-12	-21	-13	-30
West	2016–2025	0.3	0.3	0.4	0.5	0.4	0.5	-12	34	49	23	68
	2026–2035	0.7	0.6	0.9	1.0	0.8	1.1	-24	21	39	12	53
	2036–2045	1.4	1.2	1.4	1.3	1.3	1.3	-13	0	-6	-3	-3
	2046–2055	1.5	1.5	1.3	1.2	1.2	1.0	5	-12	-19	-16	-34
East	2016–2025	0.4	0.3	0.5	0.6	0.6	0.7	-13	30	58	39	80
	2026–2035	1.0	0.9	1.1	1.2	1.1	1.3	-15	14	23	11	25
	2036–2045	1.5	1.4	1.5	1.4	1.4	1.4	-6	0	-10	-7	-8
	2046–2055	1.5	1.5	1.2	1.2	1.2	0.9	0	-17	-20	-16	-38
		Pulpwood yield (Mg ha^{-1} year^{-1})						% change compared to baseline (T26)				
Management scenarios		T26	T26+	T26-	T22	T22+	T22-	T26+	T26-	T22	T22+	T22-
Sub-regions	Period											
South	2016–2025	0.6	0.4	0.8	0.6	0.4	0.7	-34	38	10	-23	32
	2026–2035	0.6	0.5	0.7	0.7	0.6	0.8	-19	15	17	0	26
	2036–2045	0.6	0.6	0.6	0.6	0.7	0.6	-2	-7	2	6	-5
	2046–2055	0.5	0.5	0.4	0.5	0.5	0.4	5	-8	2	10	-9
West	2016–2025	0.5	0.4	0.7	0.6	0.4	0.8	-31	41	14	-23	48
	2026–2035	0.6	0.4	0.7	0.7	0.5	0.7	-28	20	14	-10	24
	2036–2045	0.6	0.6	0.6	0.6	0.7	0.6	-6	-8	1	7	2
	2046–2055	0.5	0.6	0.4	0.5	0.5	0.4	16	-9	3	11	-13
East	2016–2025	0.6	0.4	0.8	0.7	0.5	0.9	-31	41	16	-15	48
	2026–2035	0.6	0.6	0.7	0.7	0.6	0.8	-15	13	15	-1	19
	2036–2045	0.6	0.6	0.6	0.7	0.7	0.6	-1	-2	6	8	1
	2046–2055	0.5	0.5	0.4	0.5	0.5	0.4	1	-15	-2	6	-15

Table S3. Mean annual yield (Mg ha^{-1} year^{-1}) of energy biomass (logging residues, without and with coarse roots and stumps) and % change in annual yield of energy biomass (compared to BN26 and BNR26) for four 10-year period for different management scenarios under the final felling made at DBH of 26 cm and 22 cm in southern, western and eastern sub-regions of Finland. For the key of the management scenarios, see Table 1.

		Logging residues (Mg ha^{-1} year^{-1})						% change compared to BN26				
Management scenarios		BN26	BN26+	BN26-	BN22	BN22+	BN22-	BN26+	BN26-	BN22	BN22+	BN22-
Sub-regions	Period											
South	2016–2025	0.1	0.1	0.1	0.3	0.3	0.3	-11	2	93	83	86
	2026–2035	0.3	0.3	0.3	0.5	0.5	0.5	-16	8	52	51	61
	2036–2045	0.4	0.5	0.4	0.5	0.5	0.4	6	-6	4	15	-1
	2046–2055	0.4	0.4	0.3	0.4	0.4	0.3	13	-18	-7	5	-27
West	2016–2025	0.1	0.1	0.1	0.2	0.2	0.2	12	22	112	99	104
	2026–2035	0.2	0.2	0.2	0.3	0.3	0.3	-23	5	51	42	64
	2036–2045	0.3	0.3	0.3	0.4	0.4	0.3	3	-2	21	24	9
	2046–2055	0.3	0.4	0.2	0.3	0.3	0.2	22	-20	-4	6	-23
East	2016–2025	0.1	0.1	0.1	0.2	0.2	0.2	7	12	91	69	101
	2026–2035	0.3	0.3	0.3	0.4	0.5	0.4	-14	9	43	46	39
	2036–2045	0.4	0.4	0.4	0.5	0.5	0.4	3	-12	11	13	1
	2046–2055	0.4	0.4	0.3	0.3	0.4	0.3	13	-20	-9	4	-28
		Logging residues, coarse roots and stumps (Mg ha^{-1} year^{-1})						% change compared to BNR26				
Management scenarios		BNR26	BNR26+	BNR26-	BNR22	BNR22+	BNR22-	BNR26+	BNR26-	BNR22	BNR22+	BNR22-
Sub-regions	Period											
South	2016–2025	0.3	0.3	0.3	0.6	0.6	0.6	-9	9	88	87	85
	2026–2035	0.7	0.7	0.8	1.1	1.0	1.2	-2	8	56	41	62
	2036–2045	1.2	1.1	1.1	1.3	1.3	1.1	-7	-12	4	4	-6
	2046–2055	1.0	1.2	0.9	0.9	1.1	0.7	19	-10	-11	11	-24
West	2016–2025	0.2	0.2	0.2	0.4	0.3	0.4	-13	-4	71	69	87
	2026–2035	0.5	0.4	0.6	0.8	0.7	0.8	-11	18	69	52	70
	2036–2045	0.9	0.9	0.8	1.0	1.1	1.0	1	-8	12	19	9
	2046–2055	0.9	0.9	0.7	0.8	0.9	0.6	1	-23	-16	1	-33
East	2016–2025	0.3	0.3	0.3	0.6	0.6	0.6	0	10	94	83	110
	2026–2035	0.7	0.7	0.8	1.1	1.0	1.1	-6	5	48	33	44
	2036–2045	1.1	1.1	1.0	1.2	1.2	1.0	-3	-8	2	8	-7
	2046–2055	1.0	1.1	0.8	0.9	1.0	0.7	12	-17	-7	0	-29

Table S4. The shares of different components of the net CO_2 exchange (in **a**bsolute values, Mg CO_2 ha^{-1} $year^{-1}$) over the 40-year period using default substitution factors for different management scenarios and three different harvest intensities including timber (T), timber and logging residues, without (BN) and with coarse roots and stumps (BNR) in the final felling made at DBH of 26 cm and 22 cm in southern, western and eastern sub-regions of Finland. For the key of the management scenarios, see Table 1.

		Absolute values of different components of the net CO_2 exchange (Mg CO_2 ha^{-1} $year^{-1}$)																	
Sub-regions	Management scenarios	T26	T22	T26+	T22+	T26-	T22-	BN26	BN22	BN26+	BN22+	BN26-	BN22-	BNR26	BNR22	BNR26+	BNR22+	BNR26-	BNR22-
South	Components																		
	NEE	-1.5	-1.2	-1.9	-1.5	-0.9	-0.8	-1.8	-1.6	-2.3	-1.9	-1.2	-1.1	-2.3	-2.2	-2.8	-2.6	-1.7	-1.8
	Stock change (sawn)	-1.2	-1.2	-1.1	-1.2	-1.2	-1.2	-1.2	-1.2	-1.1	-1.2	-1.2	-1.2	-1.2	-1.2	-1.1	-1.2	-1.2	-1.2
	Stock change (pulp)	-1.0	-1.0	-0.8	-0.9	-1.1	-1.1	-0.9	-1.0	-0.8	-0.9	-1.1	-1.1	-0.9	-1.0	-0.8	-0.9	-1.1	-1.1
	Emission (waste)	1.5	1.6	1.4	1.5	1.6	1.6	1.5	1.5	1.4	1.5	1.6	1.6	1.5	1.5	1.4	1.5	1.6	1.6
	Emission (eb)	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.6	0.7	0.5	0.7	1.5	1.8	1.5	1.8	1.4	1.7
	Avoided emissions	-3.3	-3.3	-3.0	-3.2	-3.3	-3.4	-3.5	-3.6	-3.3	-3.6	-3.6	-3.7	-3.9	-4.2	-3.7	-4.1	-4.0	-4.2
West																			
	NEE	-1.4	-1.1	-1.9	-1.5	-0.7	-0.5	-1.6	-1.3	-2.1	-1.8	-0.9	-0.8	-2.0	-1.8	-2.5	-2.2	-1.3	-1.3
	Stock change (sawn)	-1.0	-1.1	-0.9	-1.0	-1.1	-1.1	-1.0	-1.1	-1.0	-1.0	-1.1	-1.1	-1.0	-1.1	-0.9	-1.1	-1.1	-1.1
	Stock change (pulp)	-0.9	-1.0	-0.8	-0.9	-1.1	-1.1	-0.9	-1.0	-0.8	-0.9	-1.0	-1.1	-0.9	-1.0	-0.8	-0.9	-1.0	-1.1
	Emission (waste)	1.4	1.5	1.3	1.4	1.5	1.5	1.4	1.5	1.3	1.3	1.5	1.5	1.4	1.5	1.3	1.4	1.5	1.5
	Emission (eb)	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.4	0.5	0.4	0.5	1.1	1.4	1.1	1.4	1.1	1.3
	Avoided emissions	-3.0	-3.1	-2.7	-2.9	-3.1	-3.1	-3.1	-3.4	-2.9	-3.1	-3.3	-3.4	-3.6	-3.8	-3.3	-3.7	-3.6	-3.8
East																			
	NEE	-1.5	-1.2	-2.0	-1.6	-0.8	-0.8	-1.8	-1.6	-2.3	-1.9	-1.1	-1.1	-2.3	-2.2	-2.8	-2.6	-1.6	-1.7
	Stock change (sawn)	-1.2	-1.2	-1.1	-1.2	-1.2	-1.2	-1.2	-1.2	-1.1	-1.2	-1.2	-1.2	-1.2	-1.2	-1.1	-1.2	-1.2	-1.2
	Stock change (pulp)	-1.0	-1.1	-0.9	-1.0	-1.1	-1.2	-1.0	-1.1	-0.9	-1.0	-1.1	-1.2	-1.0	-1.1	-0.9	-1.0	-1.1	-1.2
	Emission (waste)	1.6	1.6	1.4	1.5	1.6	1.6	1.6	1.6	1.5	1.5	1.6	1.6	1.5	1.6	1.4	1.5	1.6	1.6
	Emission (eb)	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.6	0.7	0.5	0.6	1.5	1.7	1.5	1.7	1.4	1.6
	Avoided emissions	-3.3	-3.4	-3.1	-3.3	-3.4	-3.4	-3.6	-3.8	-3.4	-3.7	-3.7	-3.7	-4.1	-4.3	-3.9	-4.1	-4.1	-4.2

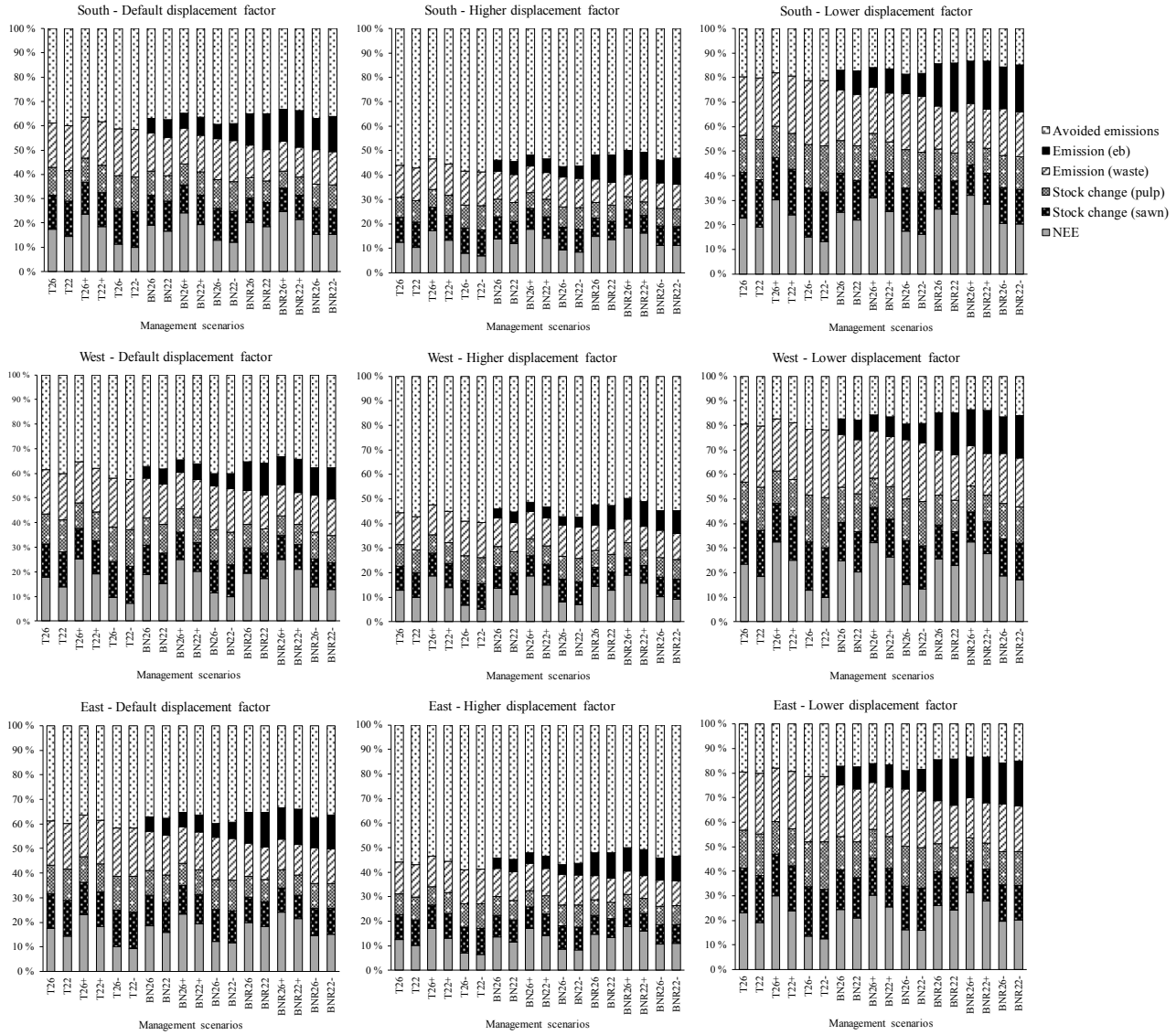

Figure S1. Relative shares of each component of the net CO_2 exchange against the sum of their absolute values over the 40-year period using default, higher (doubled) and lower (halved) substitution factors for different management scenarios and three different harvest intensities including timber (T), timber and logging residues, without (BN) and with coarse roots and stumps (BNR) in the final felling made at DBH of 26 cm and 22 cm in southern, western and eastern sub-regions of Finland. For the key of the management scenarios, see Table 1.