

Supplementary Materials for

Forests: Carbon sequestration, biomass energy, or both?

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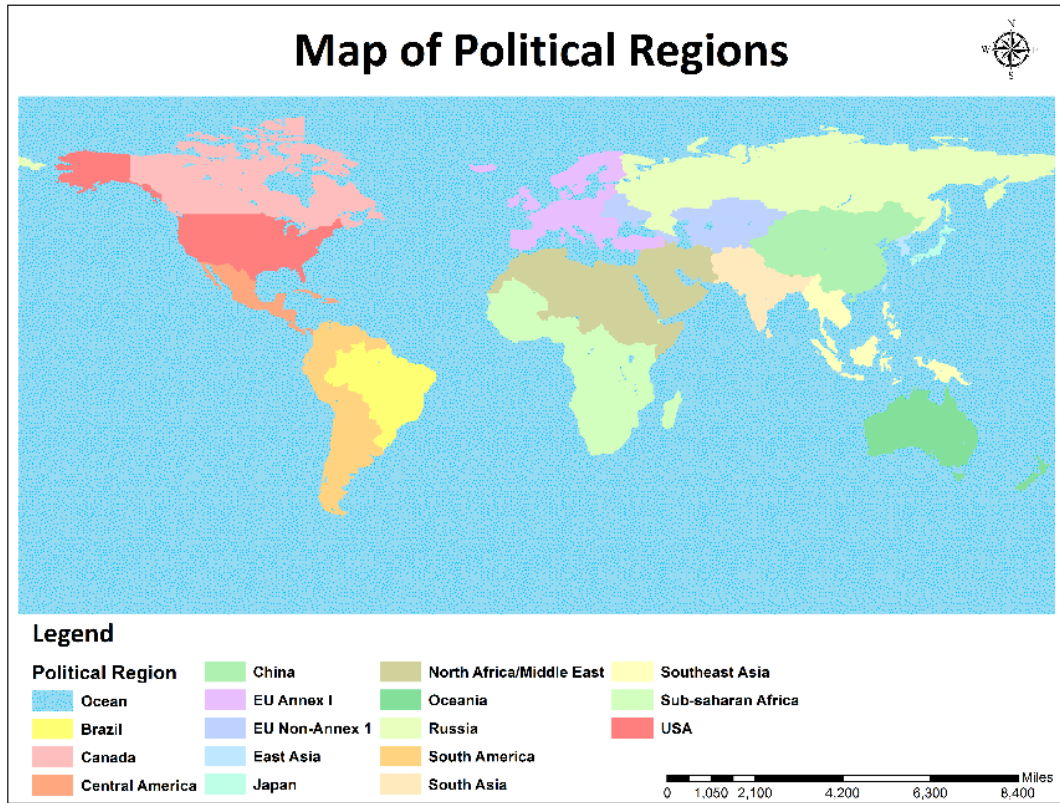


Fig. S1. GTM—Regional Aggregation.

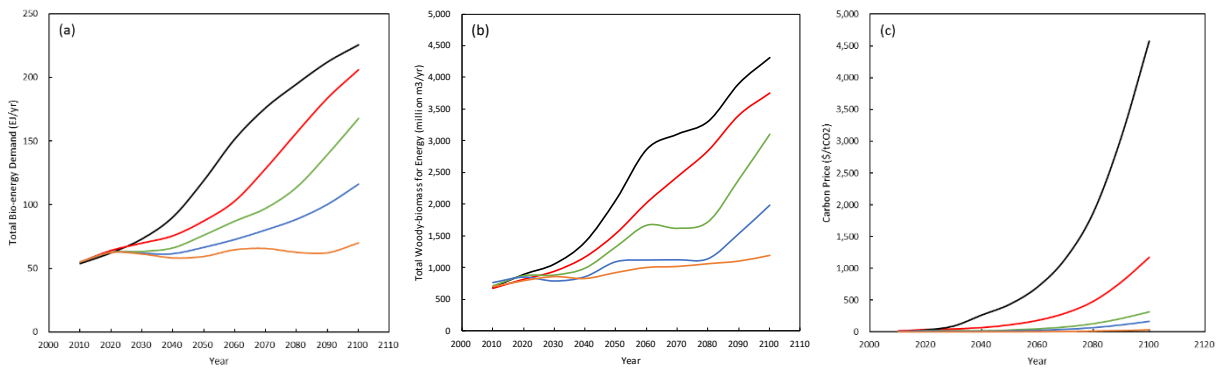


Fig. S2. Global assumptions for alternative RCP scenarios. (a) Total bio-energy consumption (EJ/yr), (b) Woody biomass supply (million m³/yr), and (c) Carbon price paths under each RCP. Black = RCP 1.9; Red = RCP 2.6; Green = RCP 3.4; Blue = RCP 4.5, Orange = RCP 6.0.

Table S1. GTM parameter values.

Parameter	Symbol	Value
Income elasticity	θ	0.9
Price elasticity	ω	1.1
Stocking Elasticity	τ	0.05-0.13
Initial stocking	φ	Species dependent
Growth and yield	δ, π	Species dependent
Biomass to carbon conversion	σ	Species dependent
Proportion of harvest to wood products	κ	0.3
Harvest biomass to carbon conversion	β	Species dependent
Soil carbon growth rate	μ	0.03
Slash decomposition	ϑ	Varies by region
Land supply elasticity	ζ	0.25

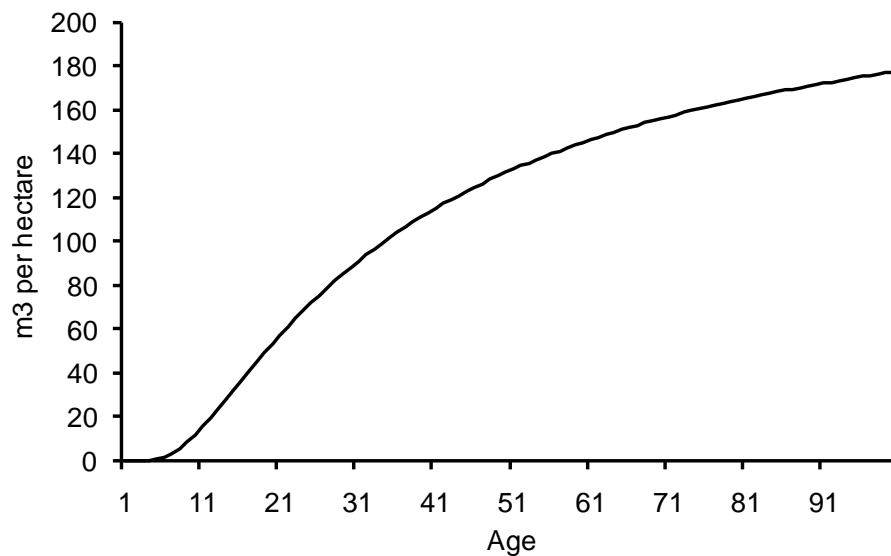


Fig. S3. Yield for representative species in the GTM.

Model estimates

Table S2. Baseline key GTM estimates, 2010–2100.

Year	Woody Bio-energy (Mm3)	Forest C Stock (GtCO2e)	Total Forest Area (Mha)	Plantation Area (Mha)	Natural Inaccessible/Unmanaged Forest Area (Mha)	Global Timber price (\$/m3)	Mean Mgmt Expend (\$/ha)
2010	0	3,336	3,466	72	2,289	\$127	\$355
2020	0	3,351	3,350	70	2,193	\$140	\$189
2030	0	3,351	3,333	68	2,107	\$152	\$199
2040	0	3,347	3,348	80	2,023	\$169	\$311
2050	0	3,343	3,356	82	1,938	\$191	\$258
2060	0	3,336	3,393	84	1,850	\$206	\$310
2070	0	3,334	3,426	89	1,761	\$230	\$382
2080	0	3,344	3,469	94	1,671	\$257	\$368
2090	0	3,361	3,516	97	1,580	\$290	\$407
2100	0	3,376	3,548	103	1,489	\$329	\$435

Table S3. Baseline global forest area (Mha) by major ecosystem, 2010–2100.

Year	Temperate	Boreal	Tropical	Total
Natural Unmanaged/Inaccessible Forest				
2010	1,002	515	772	2,289
2020	977	507	709	2,193
2030	961	502	644	2,107
2040	948	500	576	2,023
2050	935	498	505	1,938
2060	923	496	431	1,850
2070	911	495	356	1,761
2080	898	494	279	1,671
2090	886	492	202	1,580
2100	872	491	127	1,489
Low-Managed Forest				
2010	693	106	306	1,105
2020	683	117	287	1,087
2030	724	123	312	1,158
2040	743	129	372	1,245
2050	762	131	442	1,336
2060	806	136	517	1,459
2070	834	144	599	1,576
2080	868	149	687	1,704
2090	912	153	775	1,840
2100	944	158	853	1,956
Intensive Plantation Forest				
2010	48	4	20	72
2020	43	3	23	70
2030	38	4	26	68
2040	50	3	26	80
2050	50	4	27	82
2060	51	4	29	84
2070	55	4	29	89
2080	59	5	31	94
2090	60	5	32	97
2100	64	5	34	103
Total Forest				
2010	1,743	625	1,098	3,466
2020	1,704	627	1,019	3,350
2030	1,723	629	981	3,333
2040	1,741	633	974	3,348
2050	1,748	633	975	3,356
2060	1,780	636	977	3,393
2070	1,799	643	984	3,426
2080	1,825	647	997	3,469
2090	1,857	650	1,009	3,516
2100	1,880	654	1,014	3,548

Table S4. Baseline global total forest carbon stocks by major ecosystem, 2010–2100.

Year	Temperate		Boreal		Tropical		Total	
	<i>GtCO_{2e}</i>	<i>tCO_{2e}/ha</i>	<i>GtCO_{2e}</i>	<i>tCO_{2e}/ha</i>	<i>GtCO_{2e}</i>	<i>tCO_{2e}/ha</i>	<i>GtCO_{2e}</i>	<i>tCO_{2e}/ha</i>
2010	1,601	919	761	1,217	974	887	3,336	962
2020	1,620	951	762	1,215	969	951	3,351	1,000
2030	1,631	947	762	1,212	957	976	3,351	1,005
2040	1,639	941	763	1,206	945	971	3,347	1,000
2050	1,646	942	765	1,208	932	956	3,343	996
2060	1,656	930	766	1,204	914	935	3,336	983
2070	1,665	925	767	1,193	903	918	3,334	973
2080	1,673	917	768	1,187	903	906	3,344	964
2090	1,684	907	769	1,182	909	901	3,361	956
2100	1,698	903	770	1,177	908	896	3,376	952

* Forest carbon is tracked in four pools: aboveground carbon, soil carbon, forest product carbon, and slash.

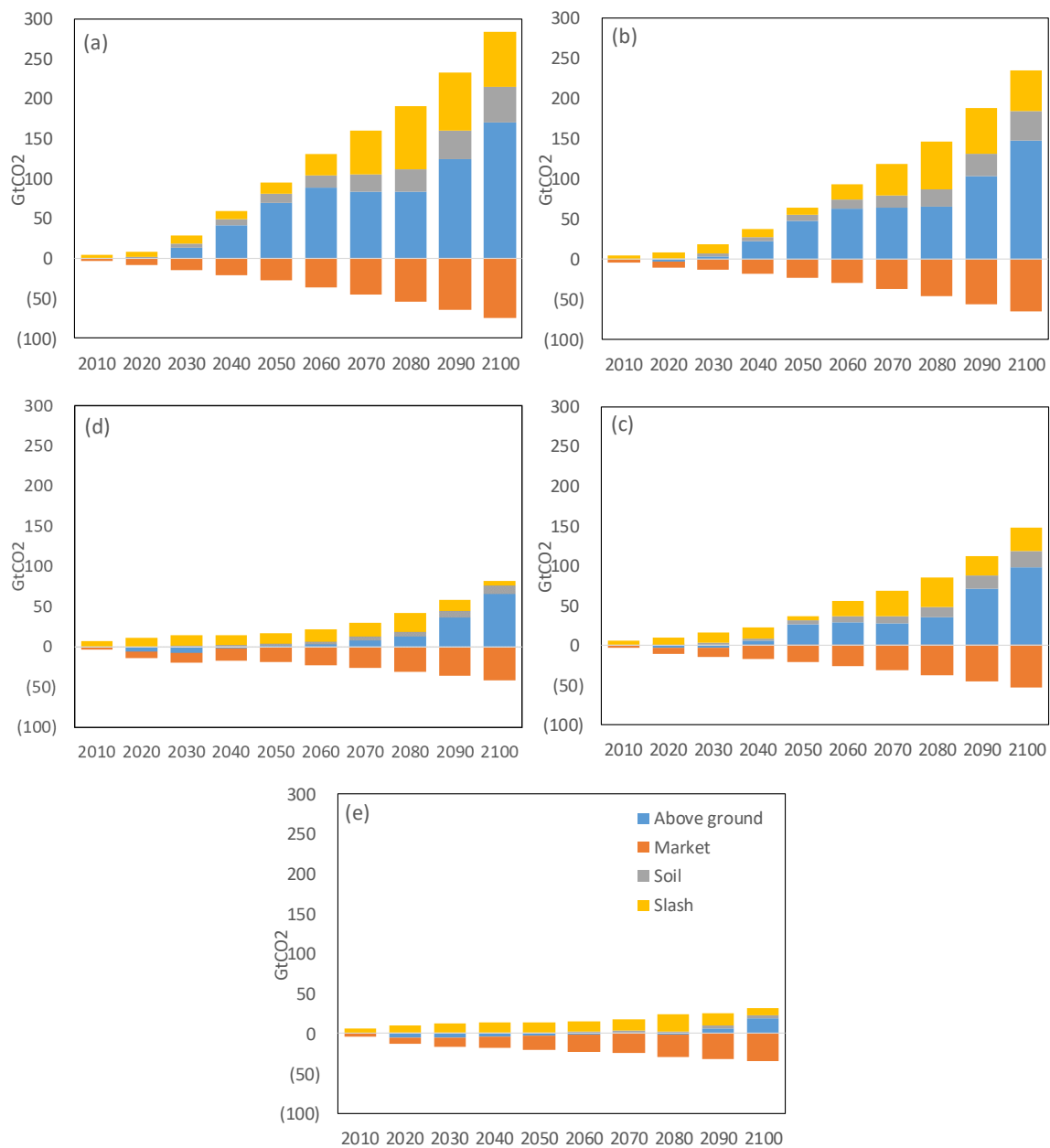


Fig. S4. Estimated changes in global forest carbon stock pools in GtCO₂ relative to the baseline scenario under each RCP. (a) RCP 1.9; (b) RCP 2.6; (c) RCP 3.4; (d) RCP 4.5; (e) RCP 6.0

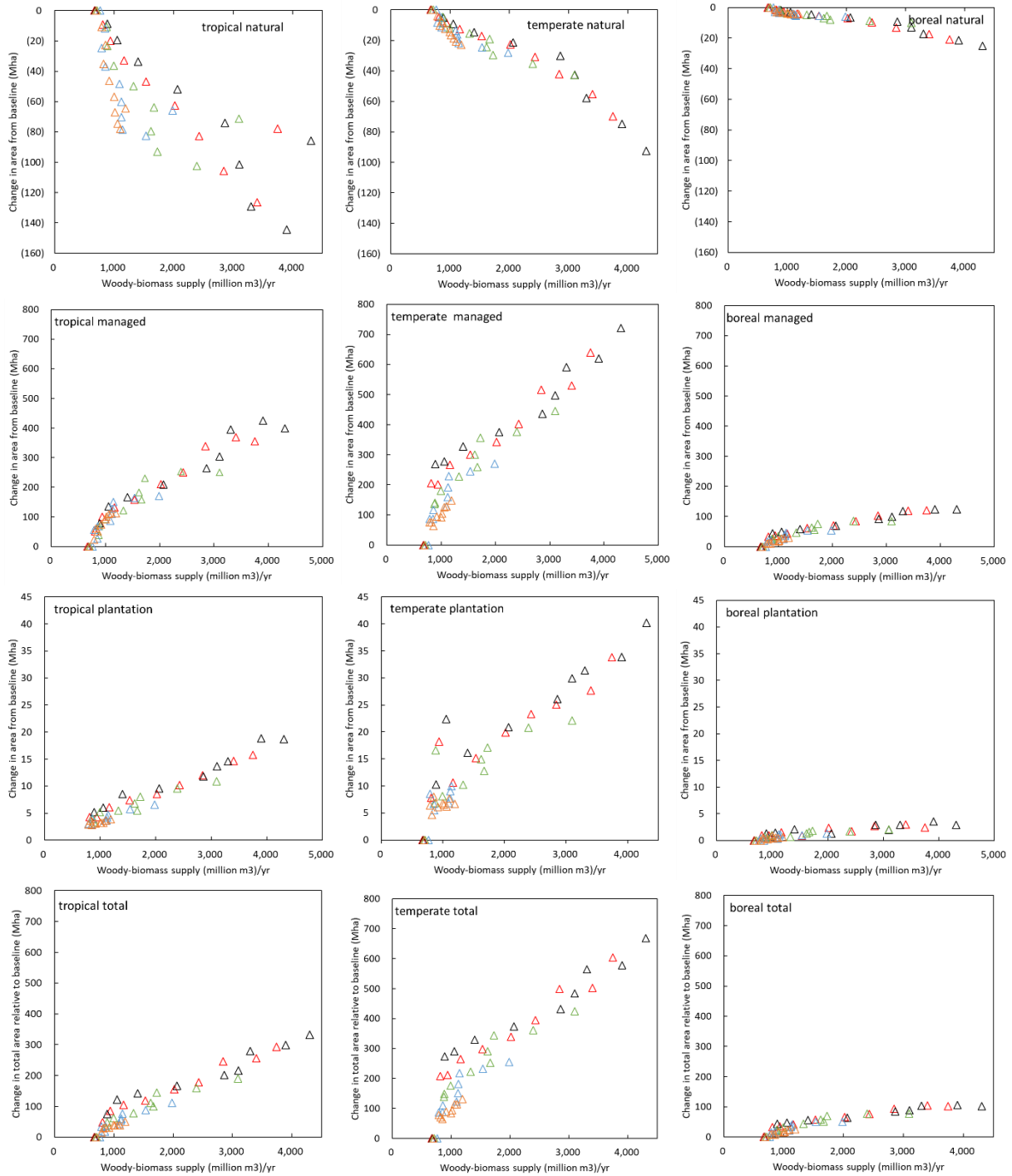
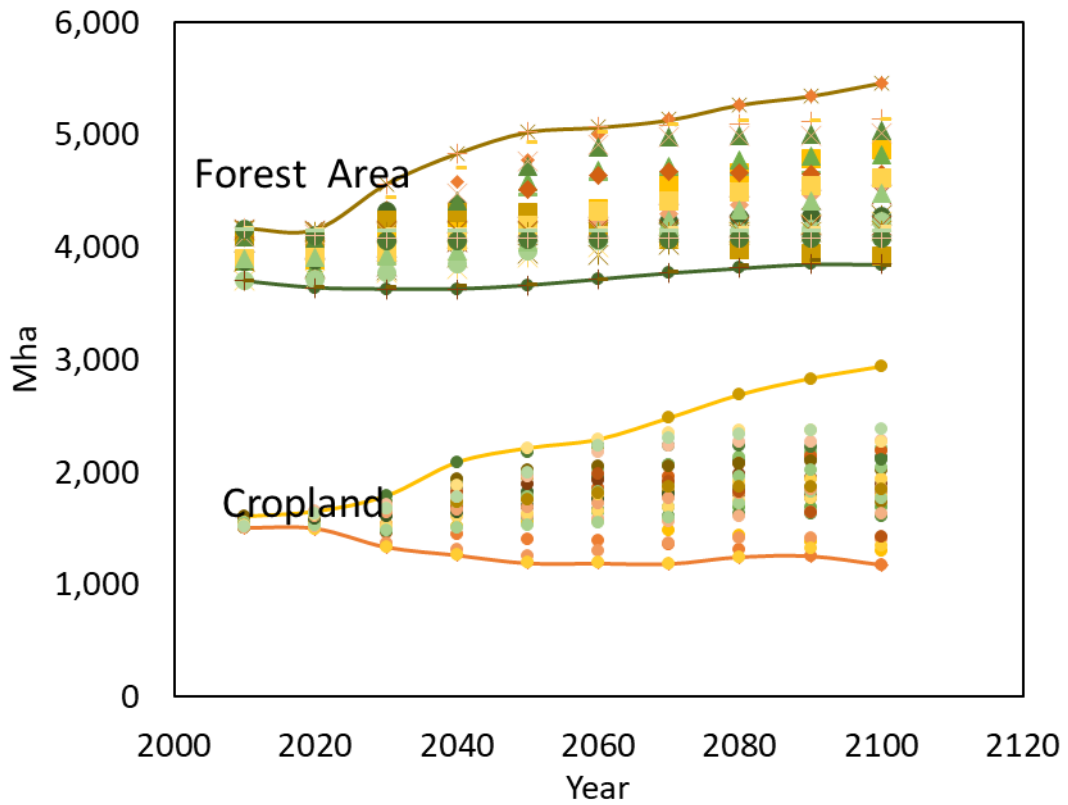


Fig. S5. Changes in global forest area by major ecosystem versus woody biomass supply under the bioenergy demand scenario relative to the baseline scenario. Black = RCP 1.9; Red = RCP 2.6; Green = RCP 3.4; Blue = RCP 4.5, Orange = RCP 6.0.



Note: Each mark represents one land value from one IAM for each SSP and RCP combination.
Fig. S6. IAMs' estimates of forest areas and crop areas (2010–2100) under the RCP 1.9 and RCP 2.6 from the IIASA SSP database.

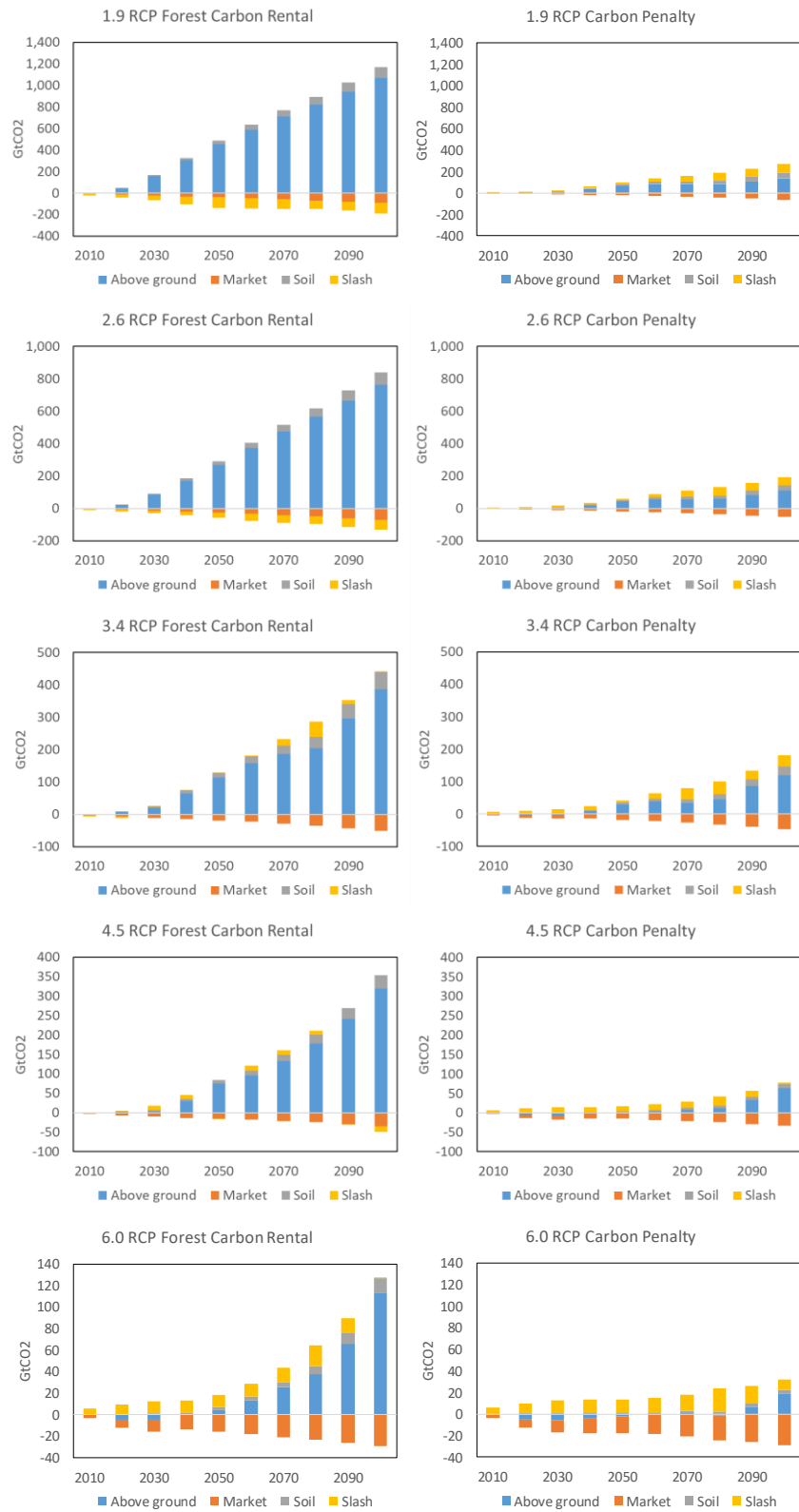


Fig. S7. Estimated changes in global forest carbon stock pools in GtCO₂ relative to the baseline scenario under each RCP and the two policy approaches.

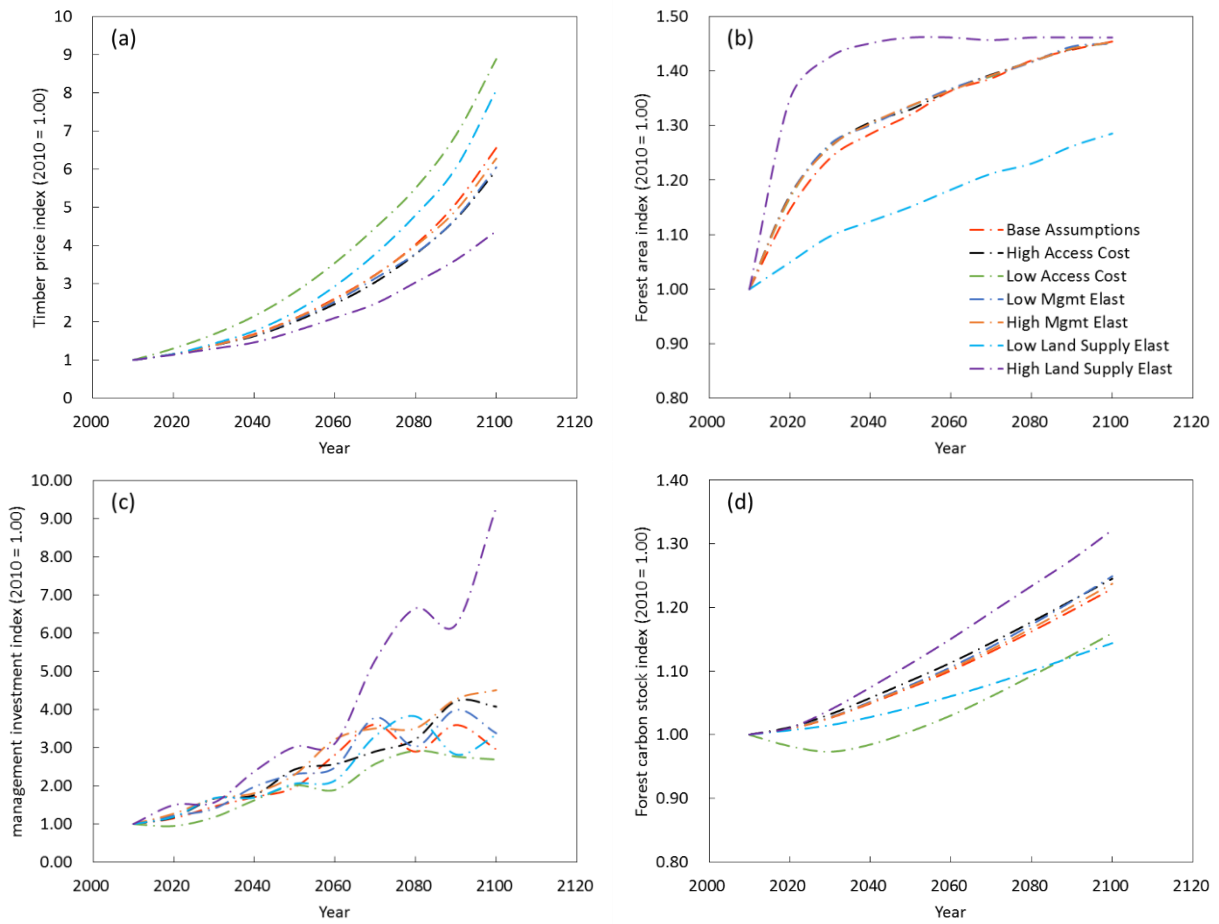


Fig. S8. Key parameter sensitivity impacts relative to 2010 for RCP 2.6 Forest Carbon Rental scenario. (a) Timber prices, (b) total forest area, (c) management investment, and (d) forest carbon stocks.