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Supplement of

Regional variation in the effectiveness of methane-based and land-based climate mitigation options

Garry D. Hayman et al.

Correspondence to: Garry D. Hayman (garr@ceh.ac.uk)

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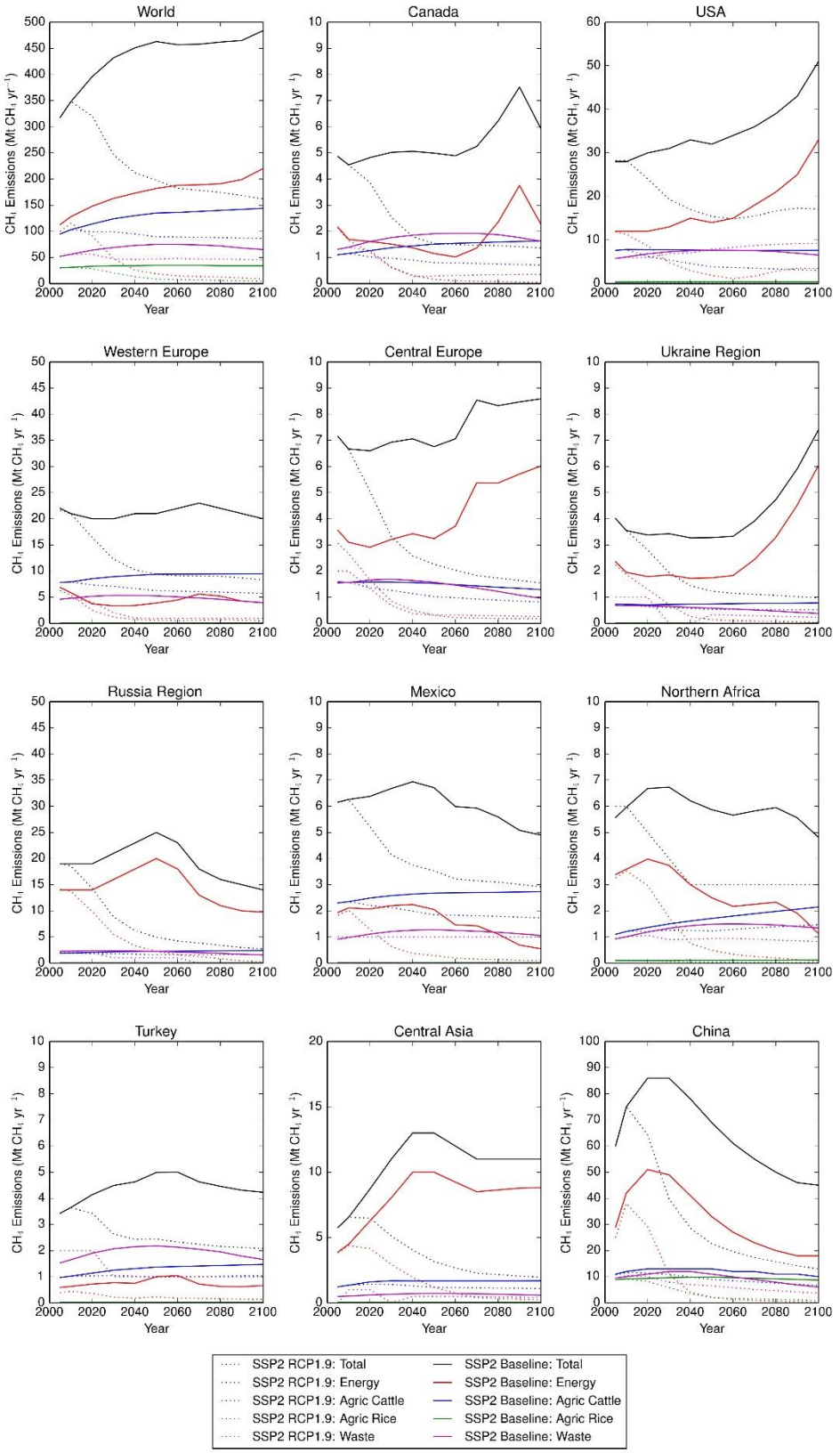

Fig. S1. | Time series of annual methane emissions between 2005 and 2100 from all and selected anthropogenic sources according to the IMAGE SSP2 Baseline (solid lines) and SSP2-RCP1.9 (dotted lines) scenarios, globally and for each of the 26 IMAGE regions, with total emissions in black, energy sector in red, agriculture-cattle in blue, agriculture-rice in green and waste in magenta. Note the y-axes have different scales for clarity.

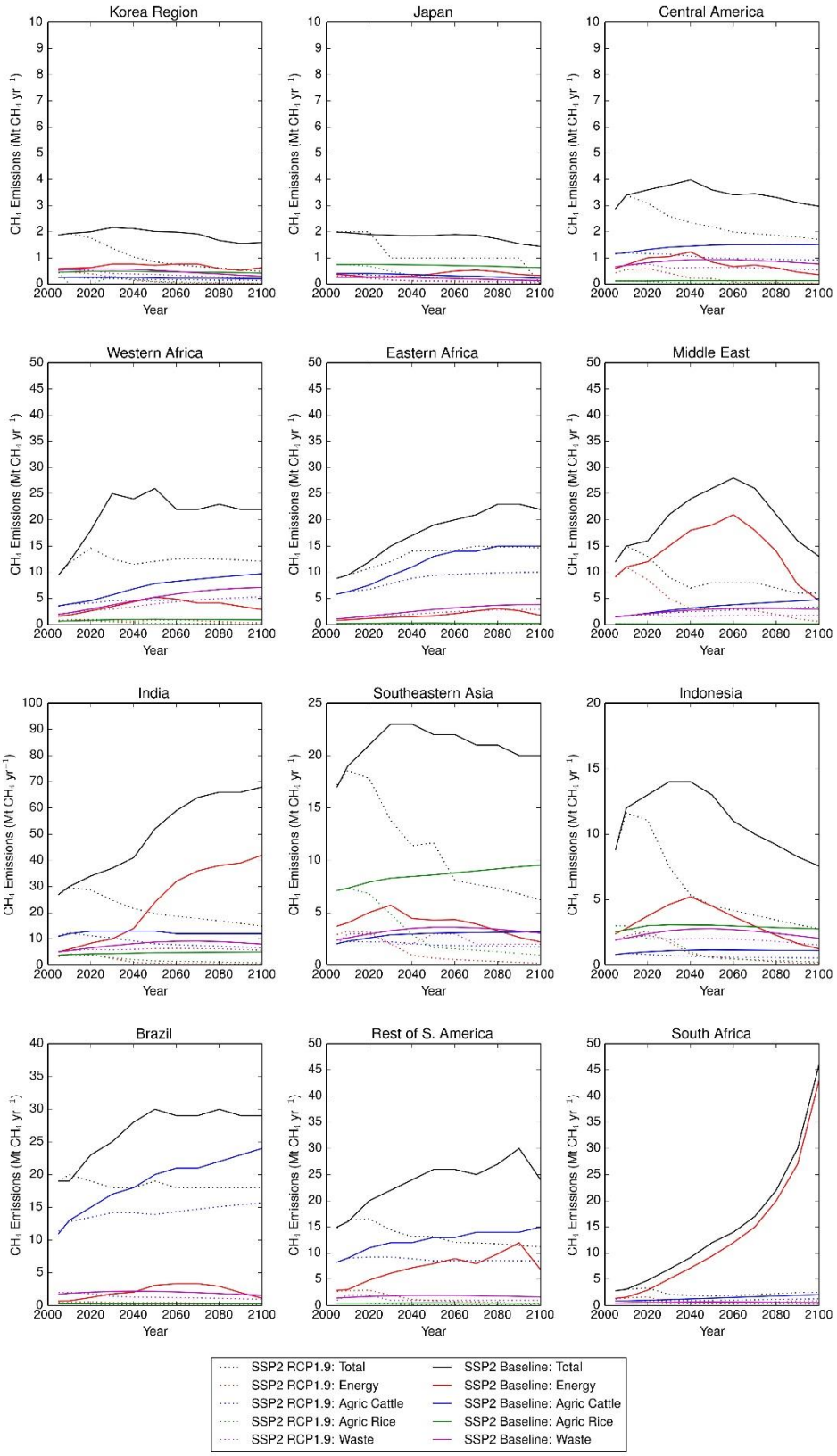

Fig. S1. (continued) | Time series of annual methane emissions between 2005 and 2100 from all and selected anthropogenic sources. Note the y-axes have different scales for clarity.

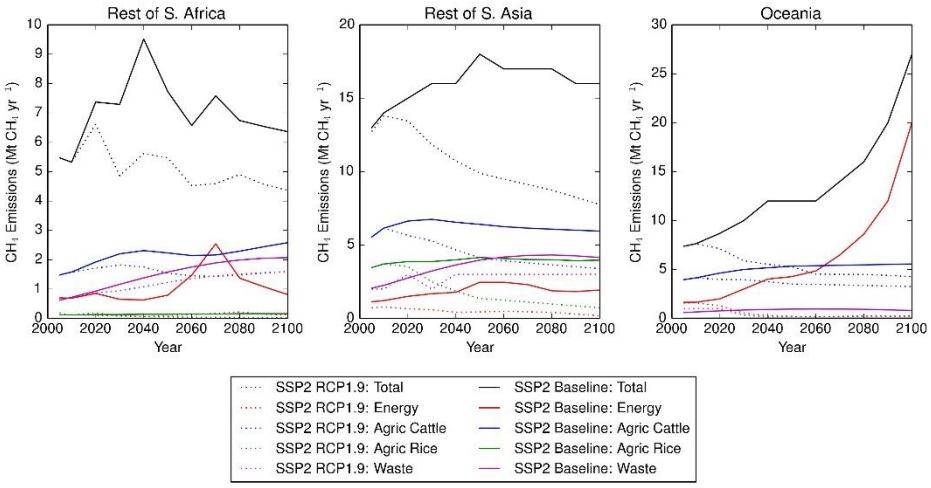

Fig. S1. (continued) | Time series of annual methane emissions between 2005 and 2100 from all and selected anthropogenic sources. Note the y-axes have different scales for clarity.

Fig. S2. | Time series of the land areas (in Mha) calculated for trees and prescribed for agriculture (including bioenergy crops) and bioenergy crops for the "BECCS" (orange) and "NATURAL" (green) scenarios, as a difference to the baseline scenario ("CTL" = IM-BL), for the 26 IMAGE regions between 2000 and 2100. The dotted lines are the median and the spread the interquartile range for the 34 GCMs emulated and 4 factorial sensitivity simulations.

a) Canada
b) USA
c) Mexico
d) Central America
e) Brazil
f) Rest of South America
g) Northern Africa
h) Western Africa
i) Eastern Africa
j) South Africa
k) Rest of Southern Africa
l) Western Europe
m) Central Europe
n) Turkey
o) Ukraine Region
p) Central Asia
q) Russia Region
r) Middle East
s) India
t) Rest of South Asia
u) China
v) Korea Region
w) Japan
x) South East Asia
y) Indonesia
z) Oceania

Fig. S2a: Canada

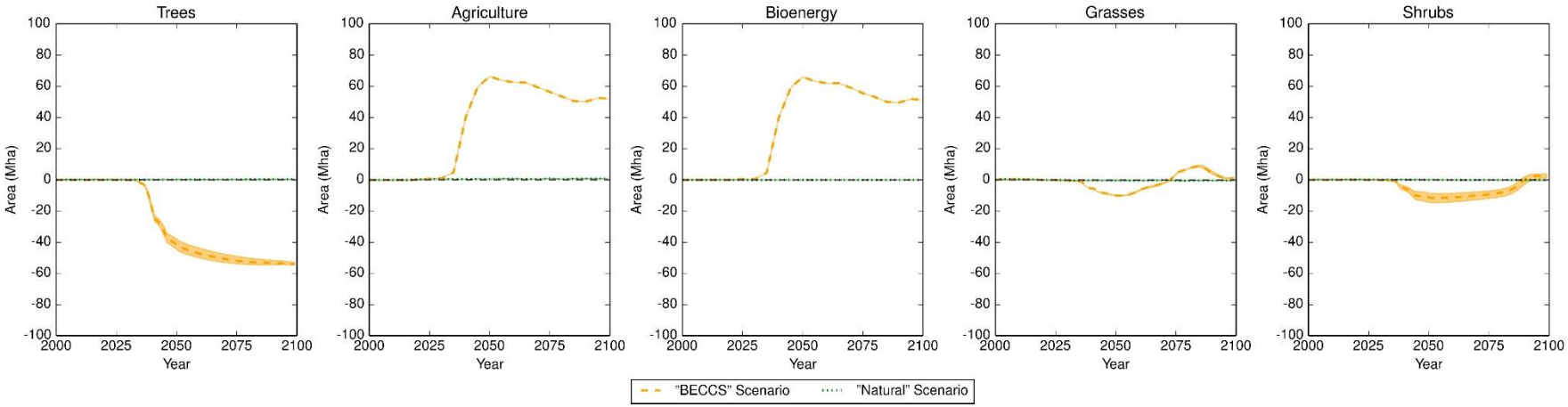

Fig. S2b: USA

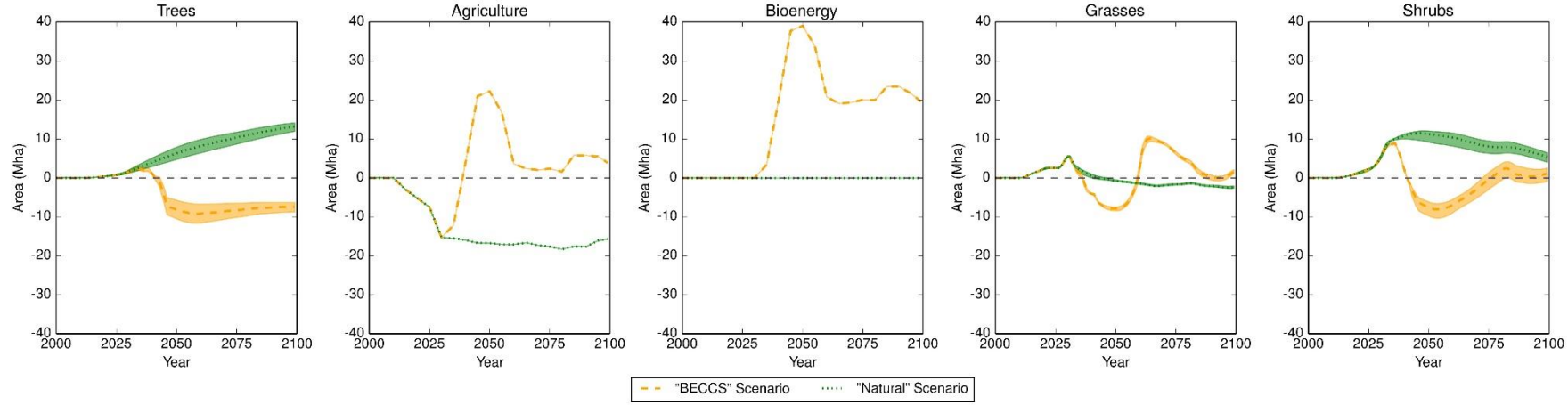

Fig. S2c: Mexico

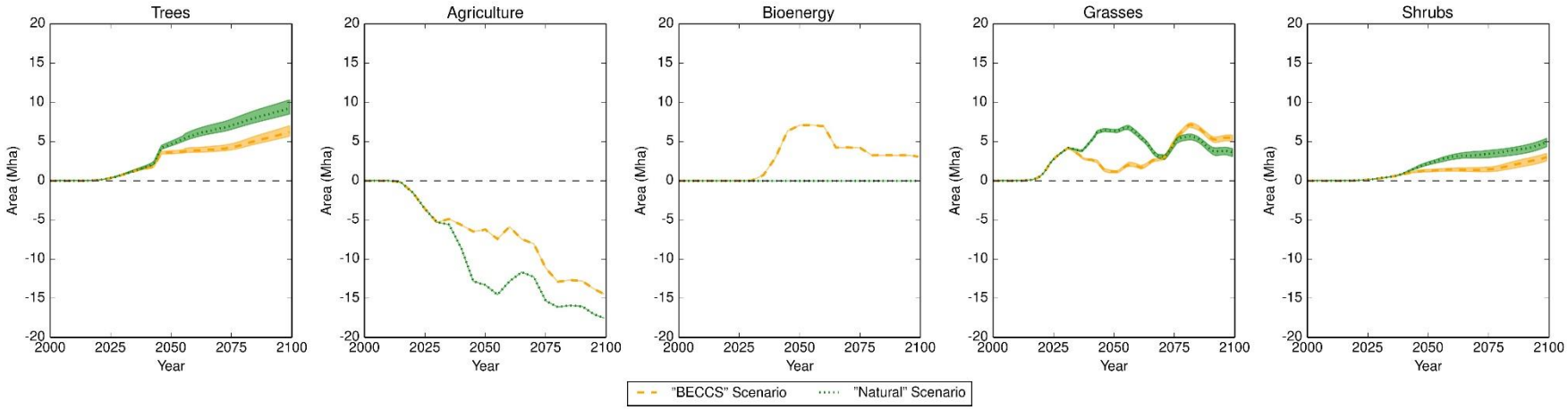

Fig. S2d: Central America

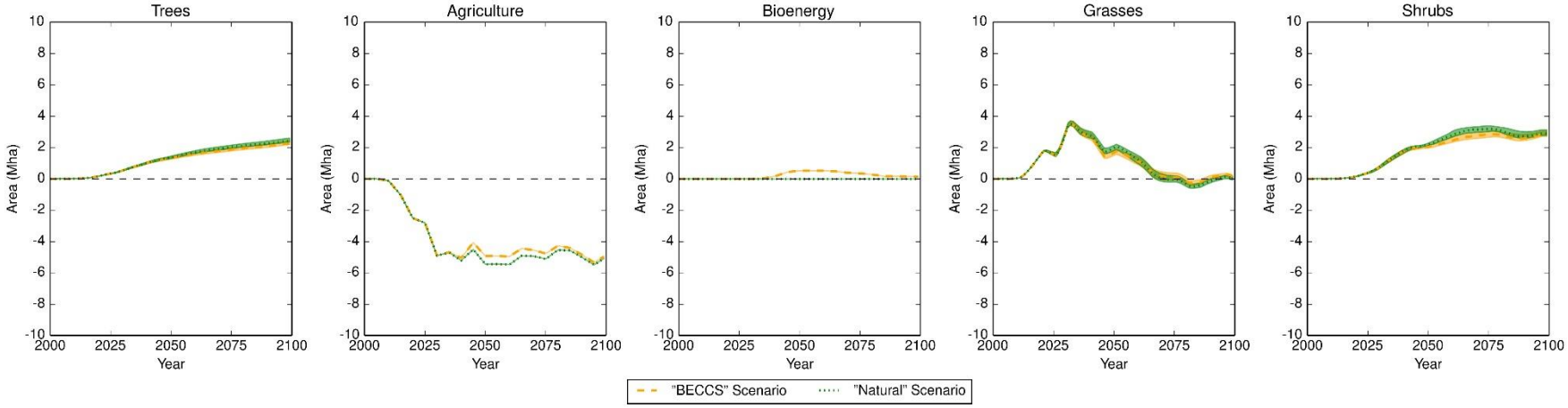

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Fig. S2e: Brazil

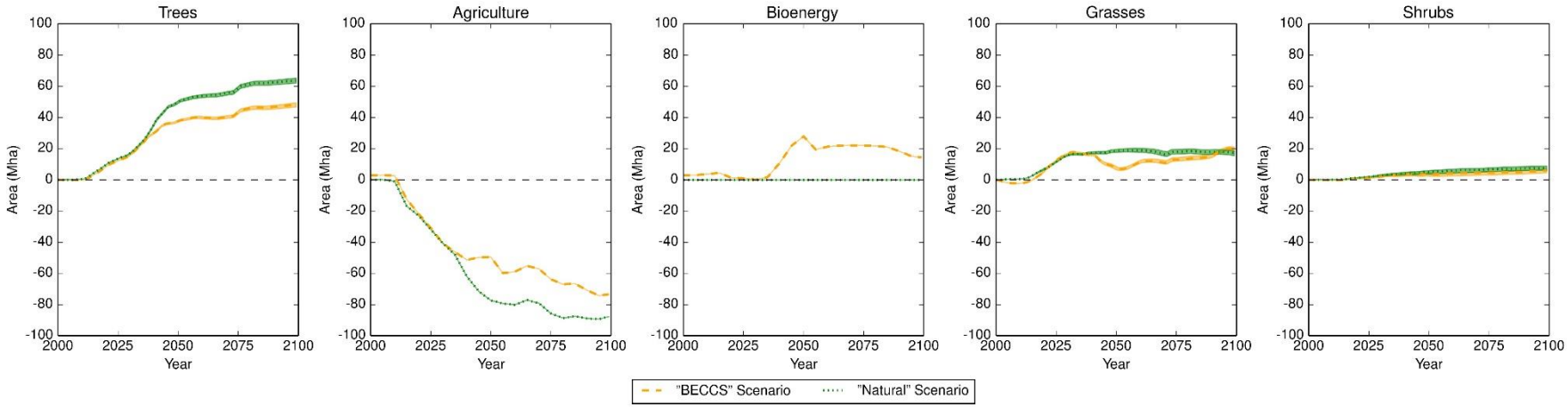

Fig. S2f: Rest of South America

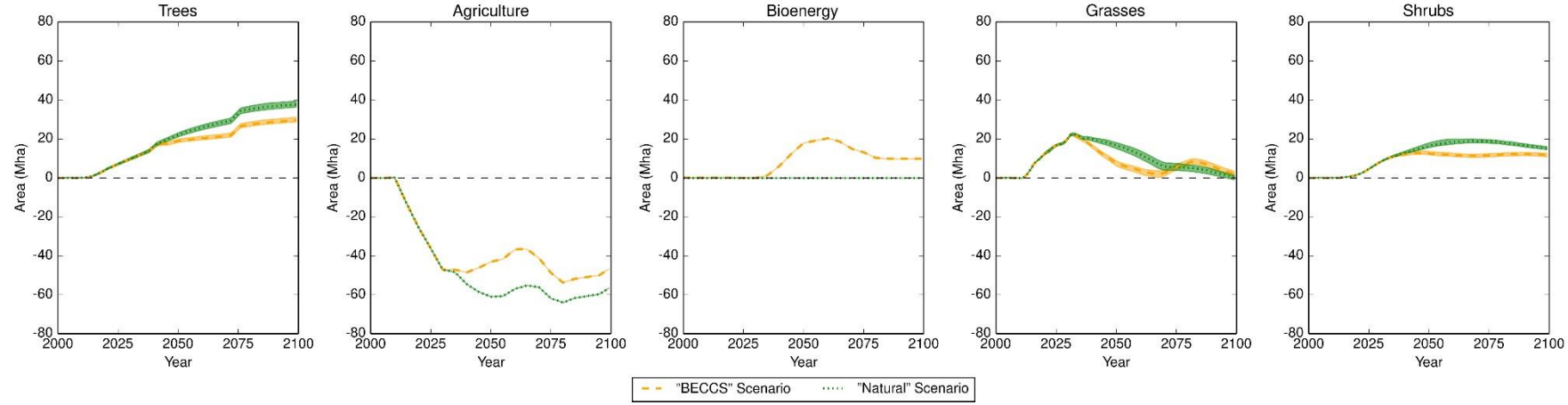

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Fig. S2g: Northern Africa

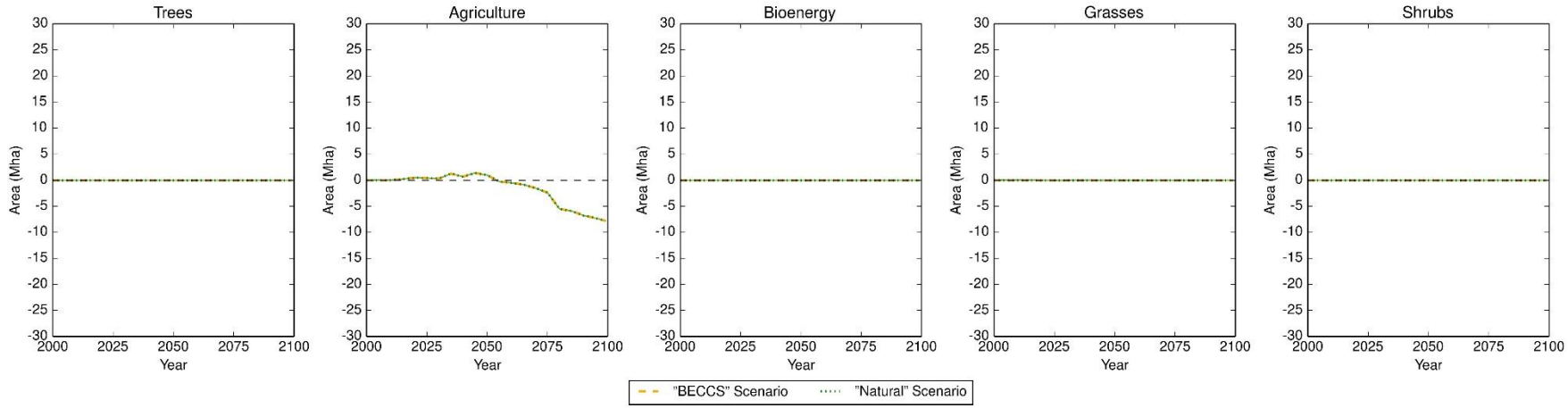

Fig. S2h: Western Africa

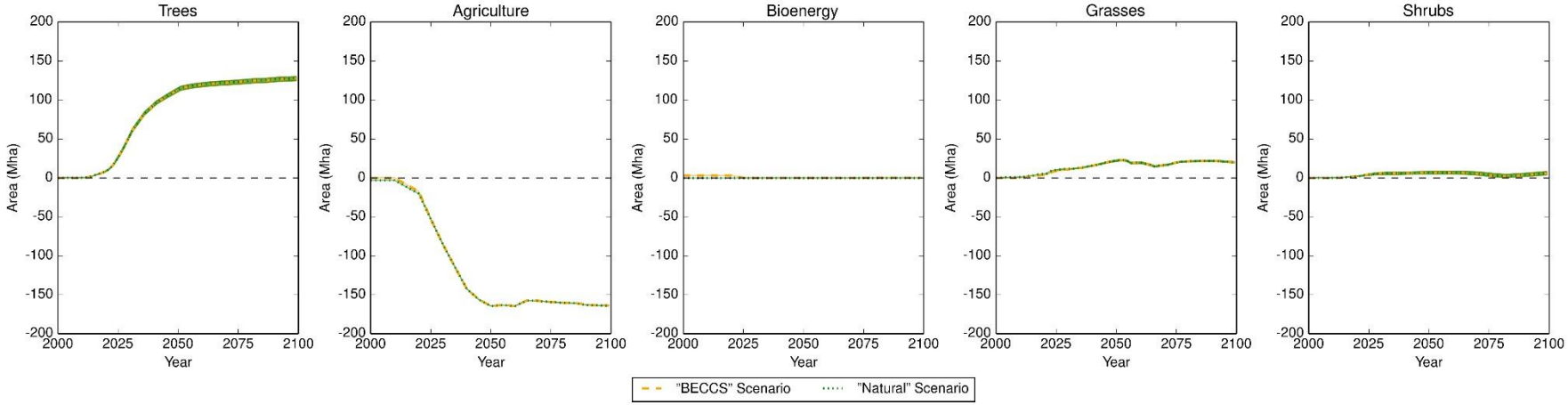

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Fig. S2i: Eastern Africa

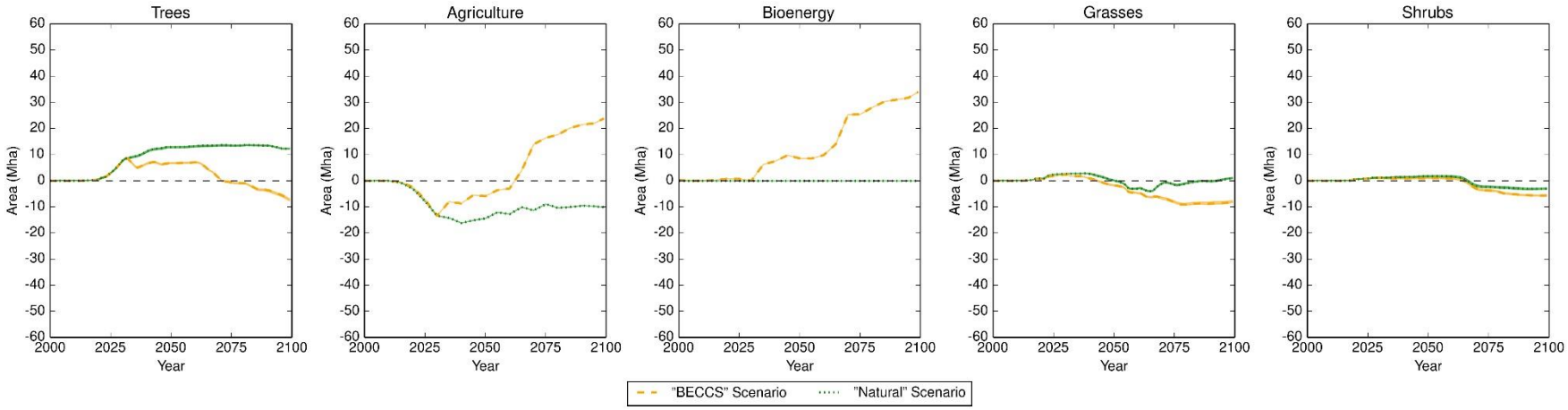

Fig. S2j: South Africa

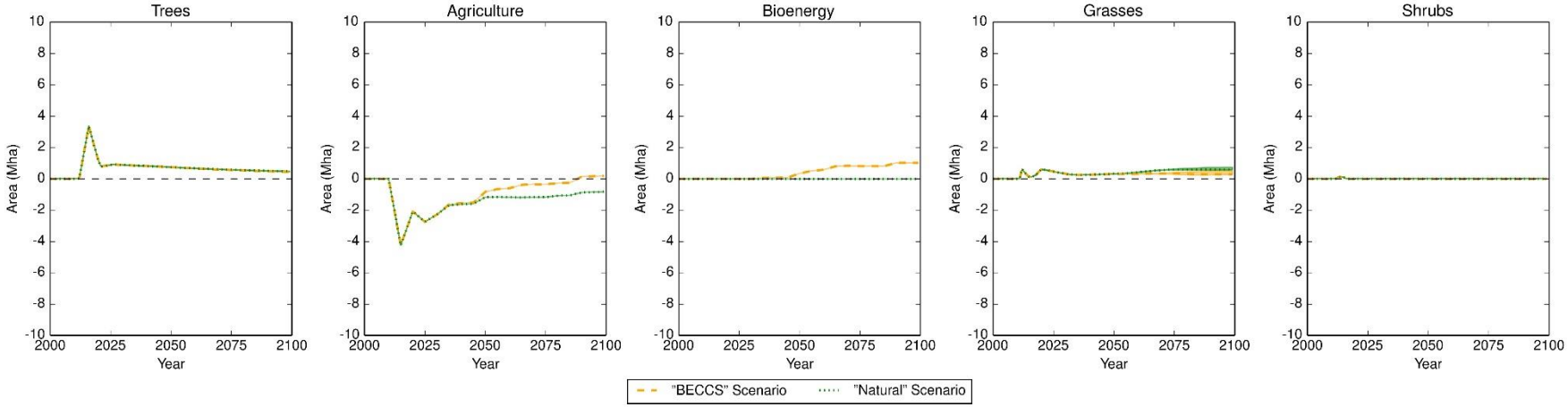

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Fig. S2k: Rest of Southern Africa

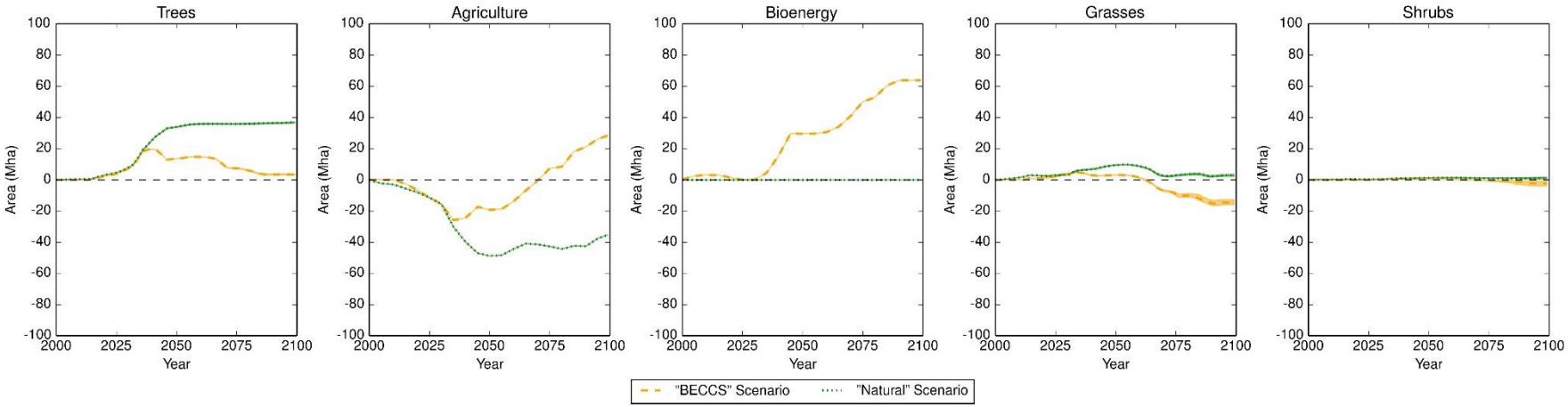

Fig. S2l: Western Europe

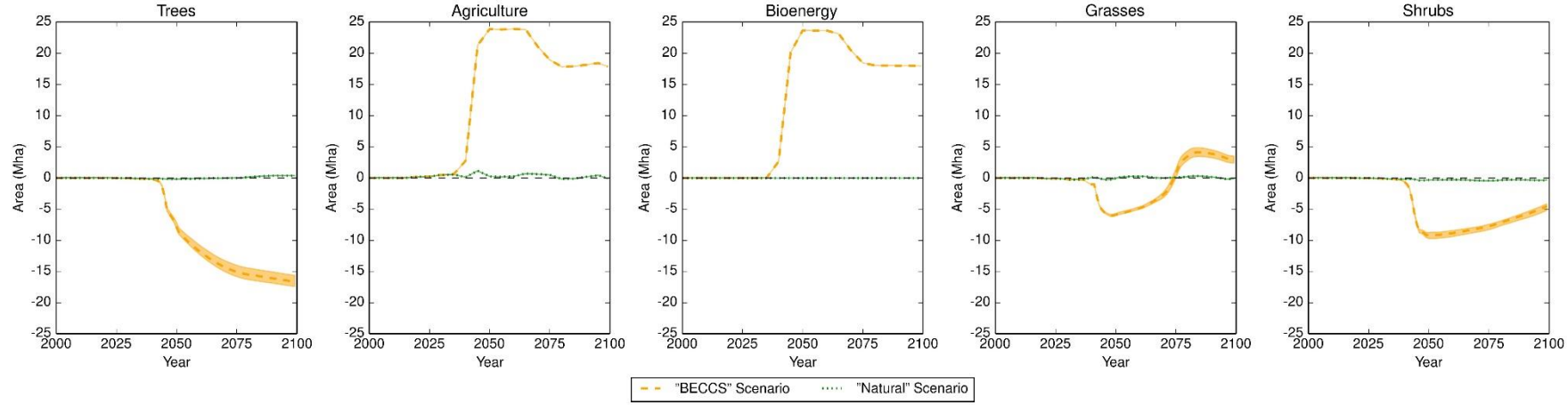

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Fig. S2m: Central Europe

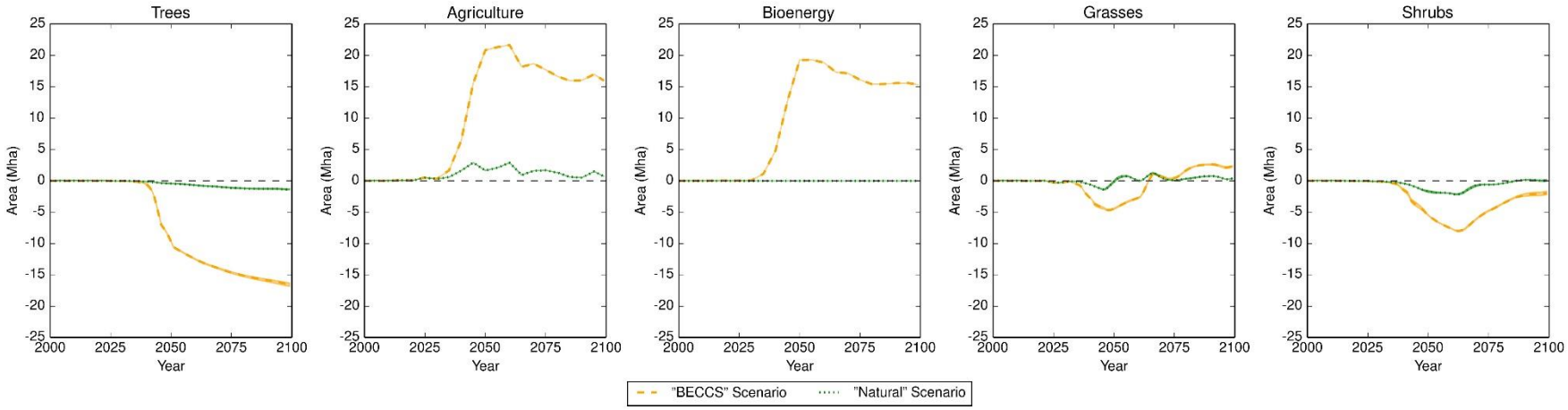

Fig. S2n: Turkey

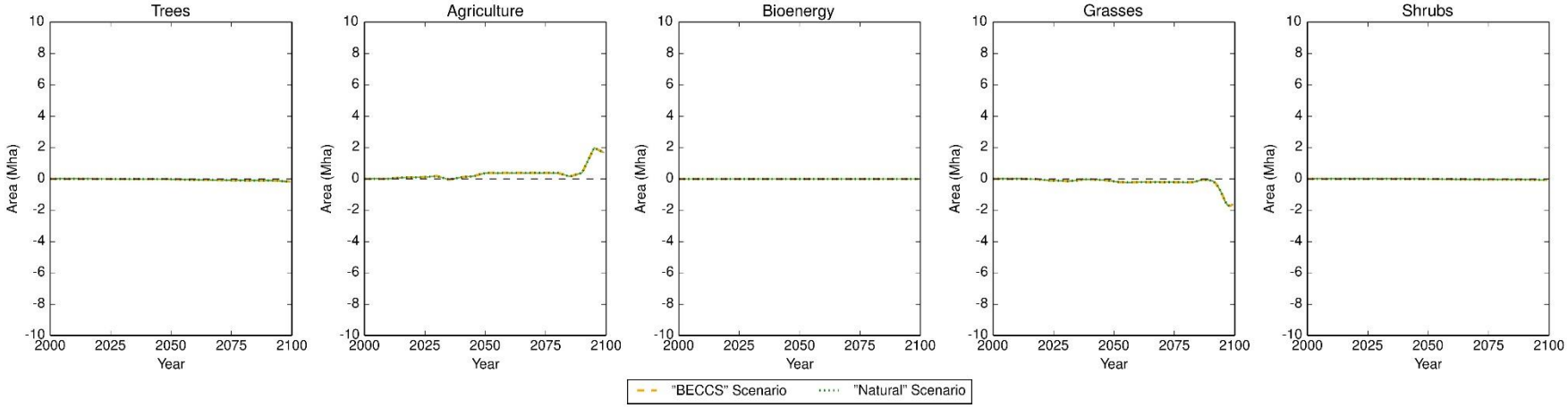

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Fig. S2o: Ukraine Region

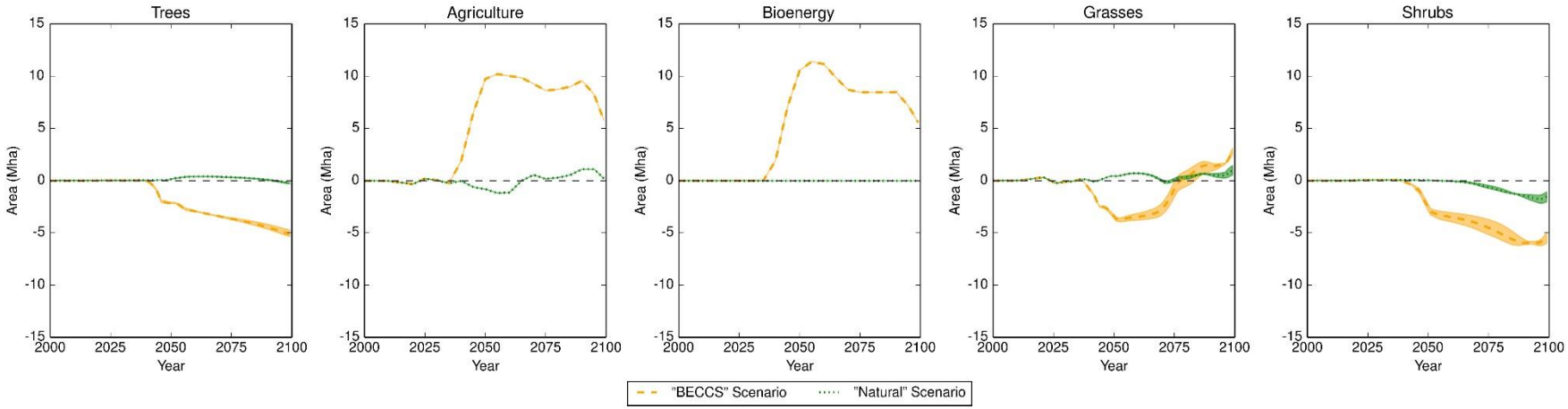

Fig. S2p: Central Asia

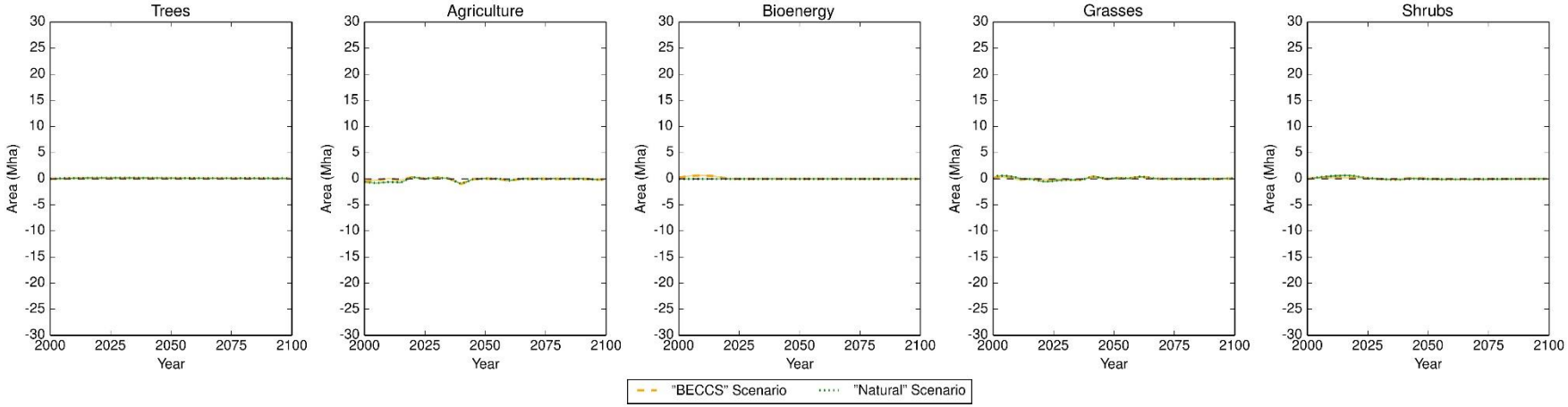

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Fig. S2q: Russia Region

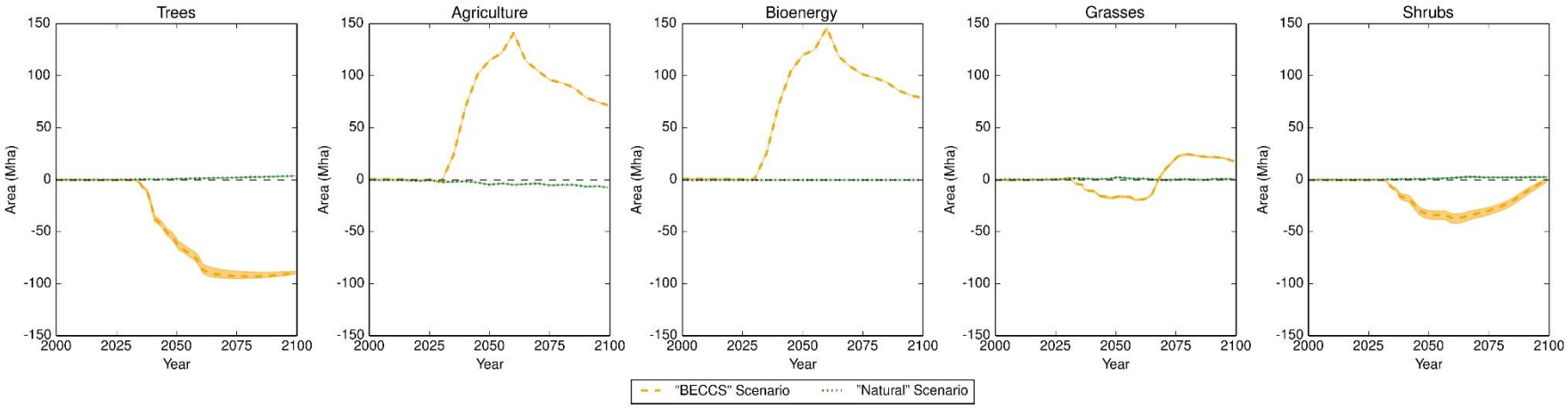

Fig. S2r: Middle East

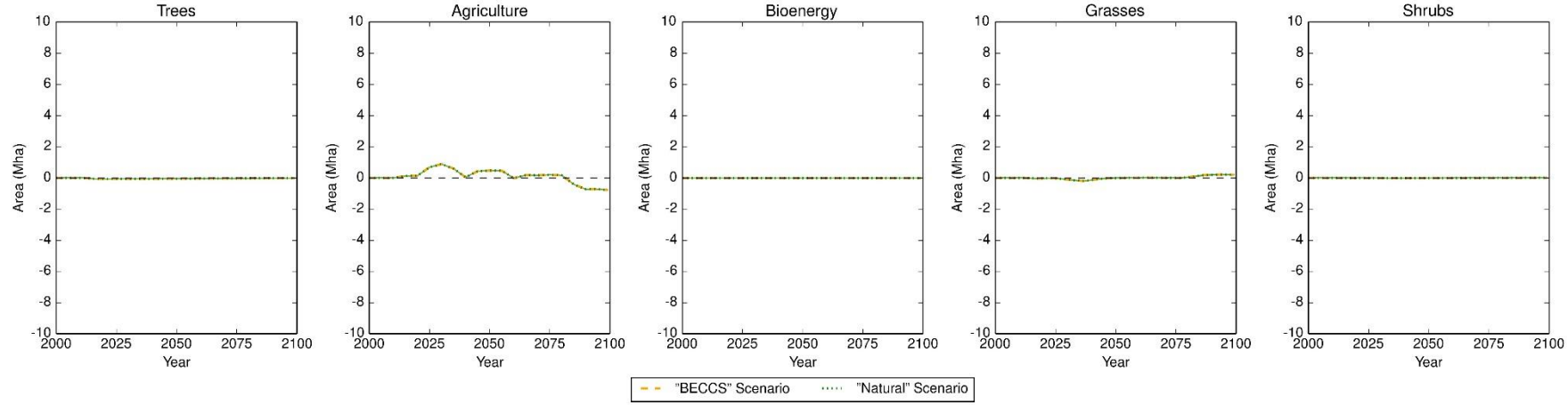

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Fig. S2s: India

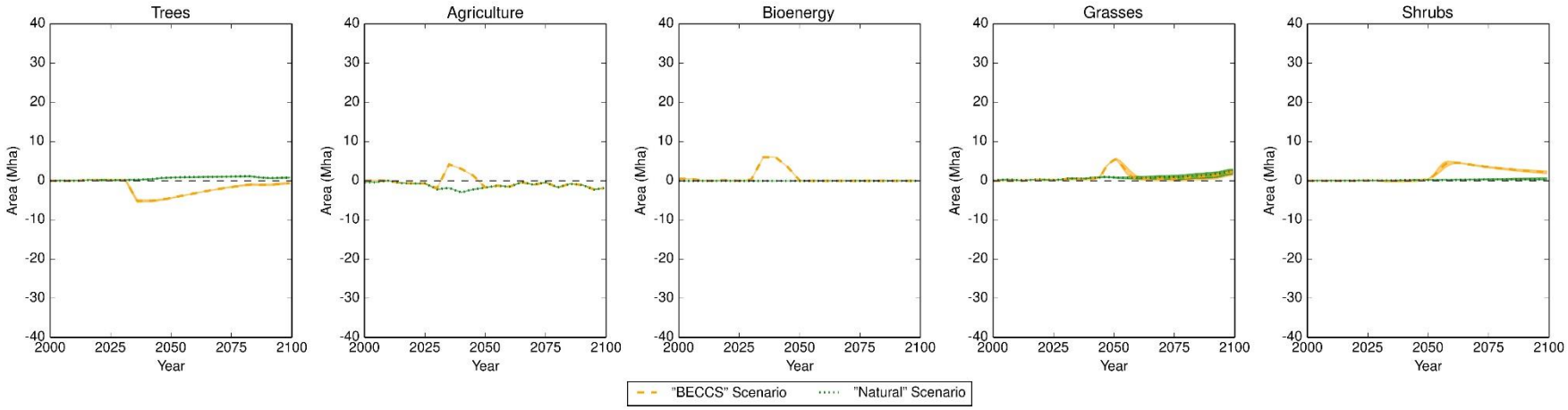

Fig. S2t: Rest of South Asia

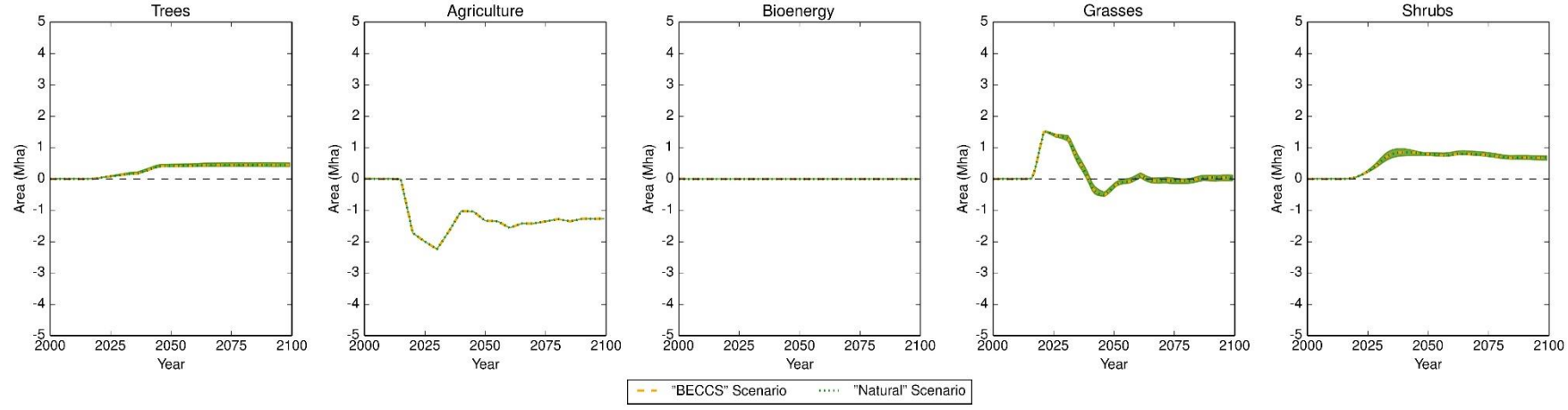

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Fig. S2u: China

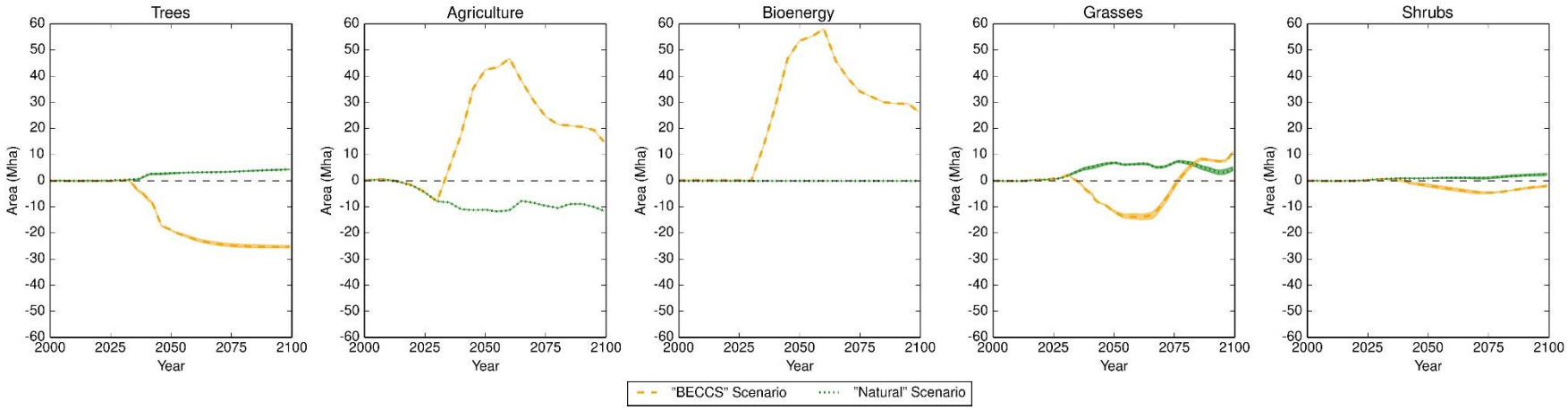

Fig. S2v: Korea Region

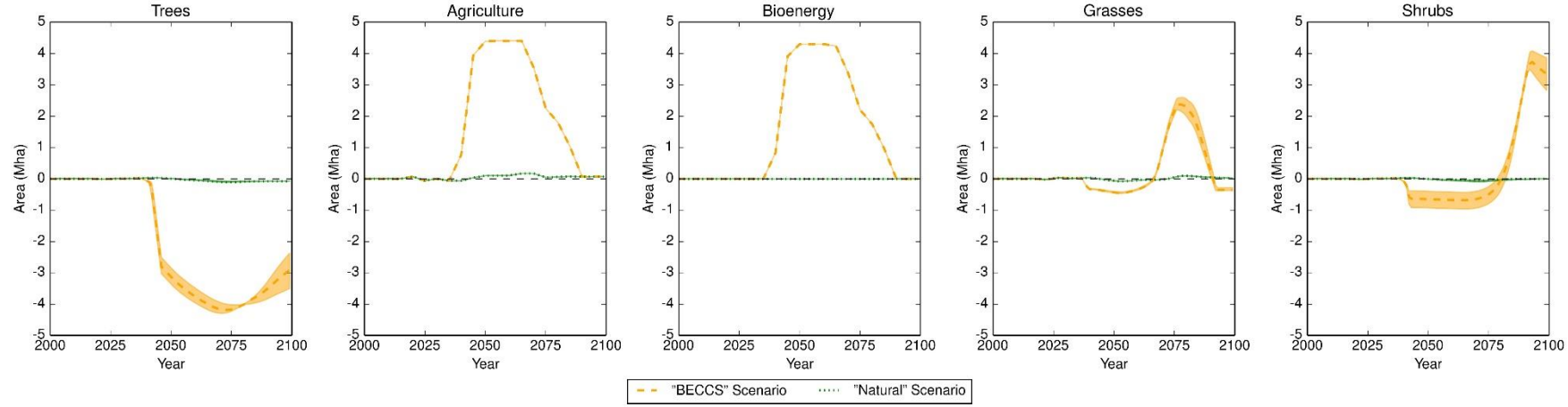

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Fig. S2w: Japan

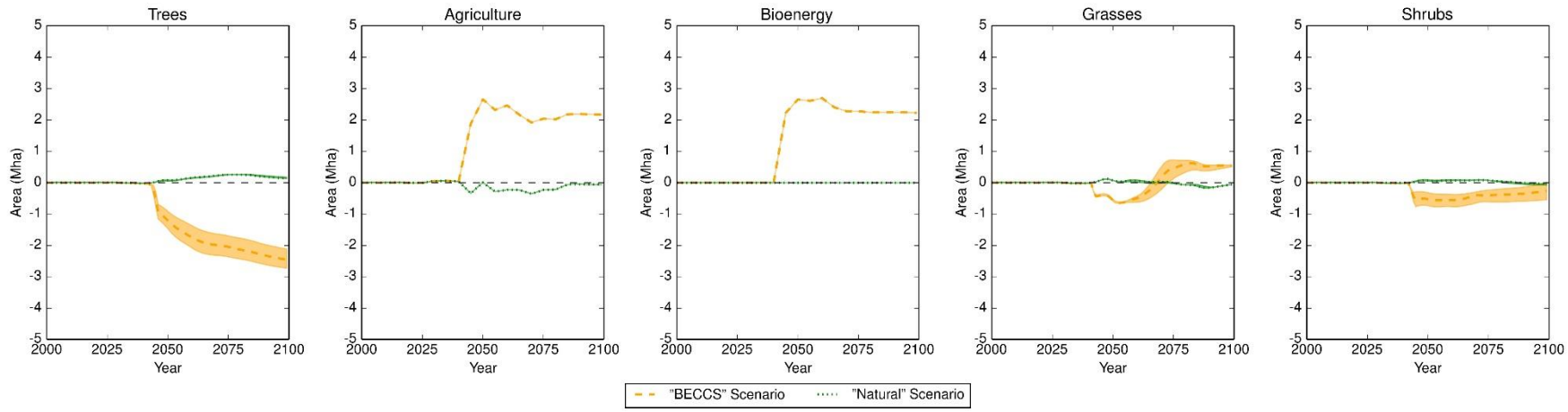

Fig. S2x: South East Asia

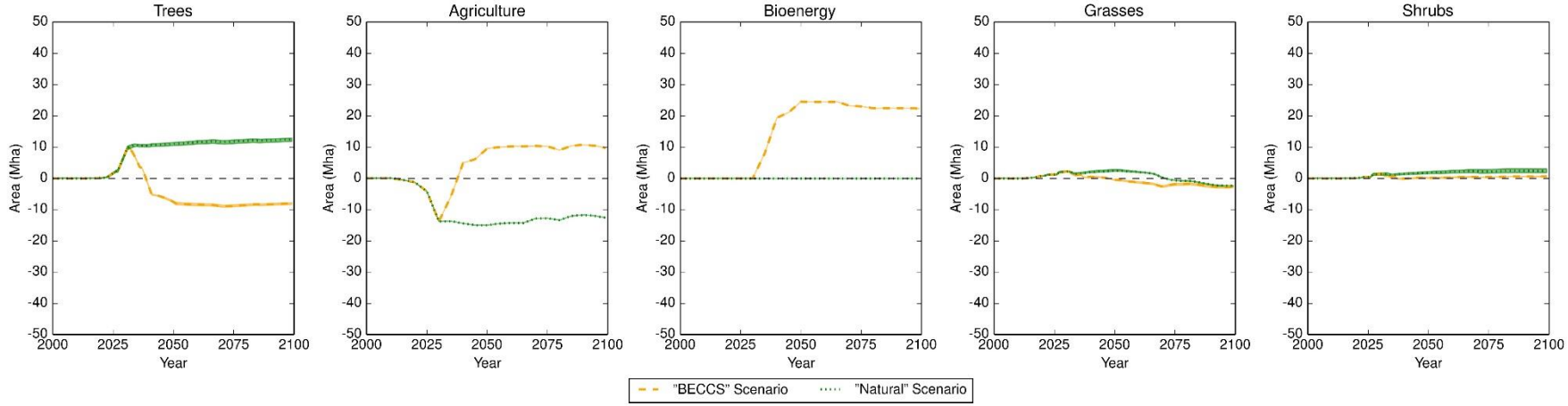

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Fig. S2y: Indonesia

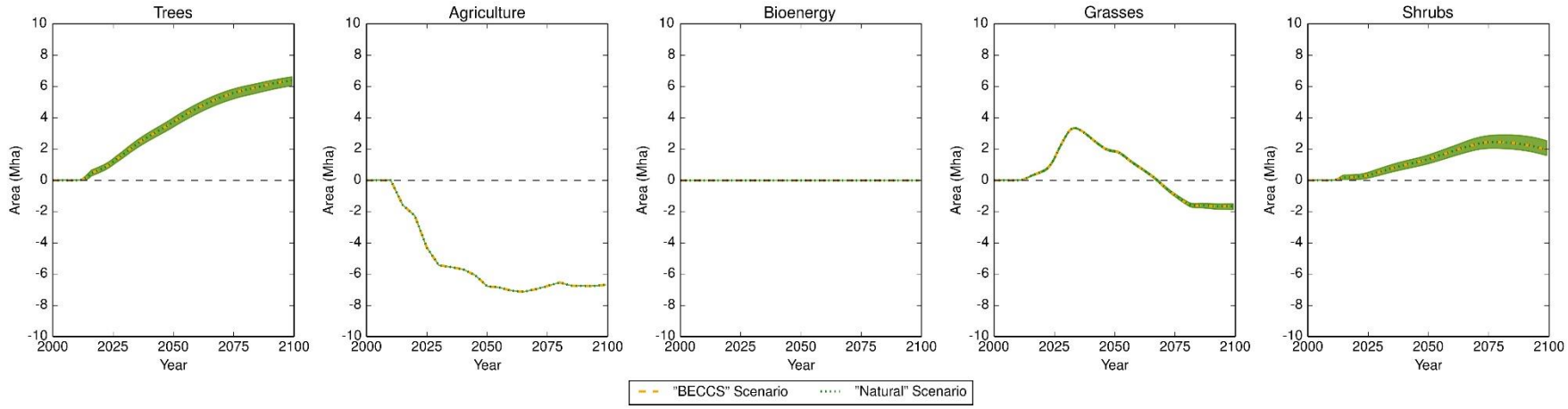
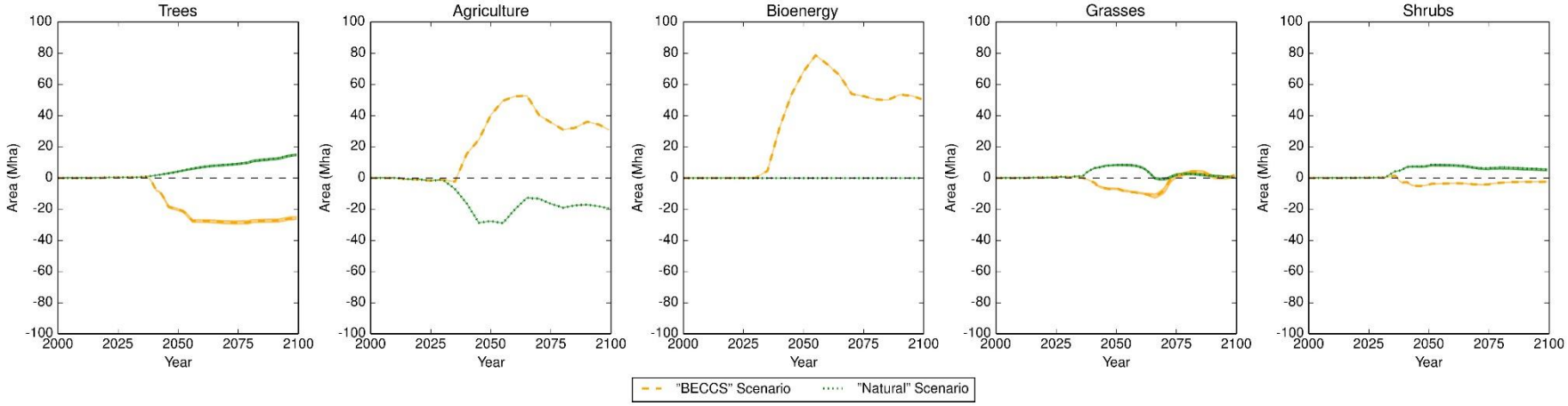


Fig. S2z: Oceania



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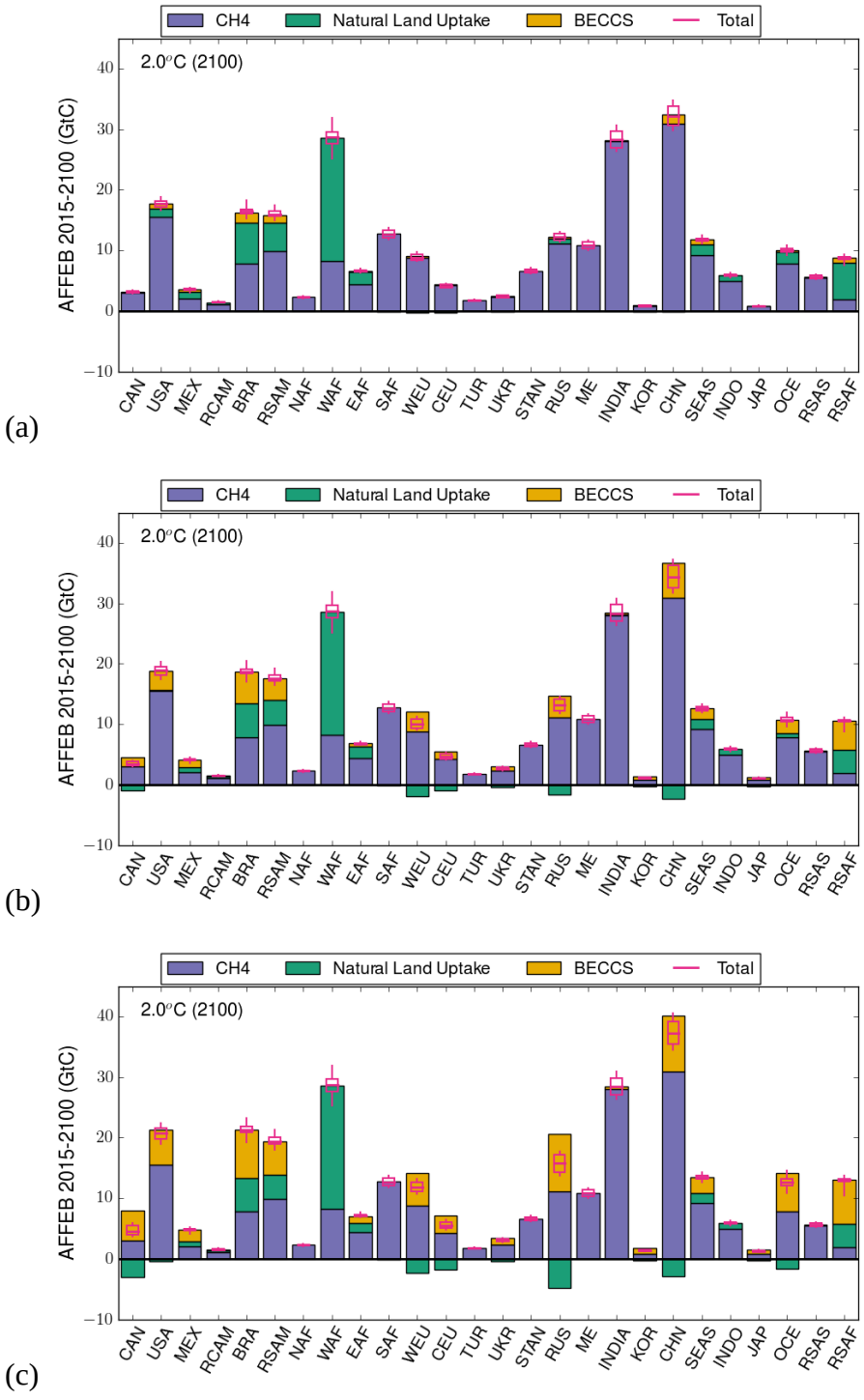

Fig. S3. | Contribution of different mitigation options to the increase in allowable anthropogenic fossil fuel emission budgets by IMAGE region to meet the 2°C target. The stacked bars represent the median methane mitigation potential (purple bars) and median land-based mitigation potential (natural land uptake, green; BECCS, brown). Panel (a) is based on a BECCS scaling factor of unity, (b) a BECCS scaling factor of 2 and (c) a BECCS scaling factor of 3. The total (pink) shows the median and interquartile range for the 34 GCMs emulated and 4 factorial sensitivity simulations.

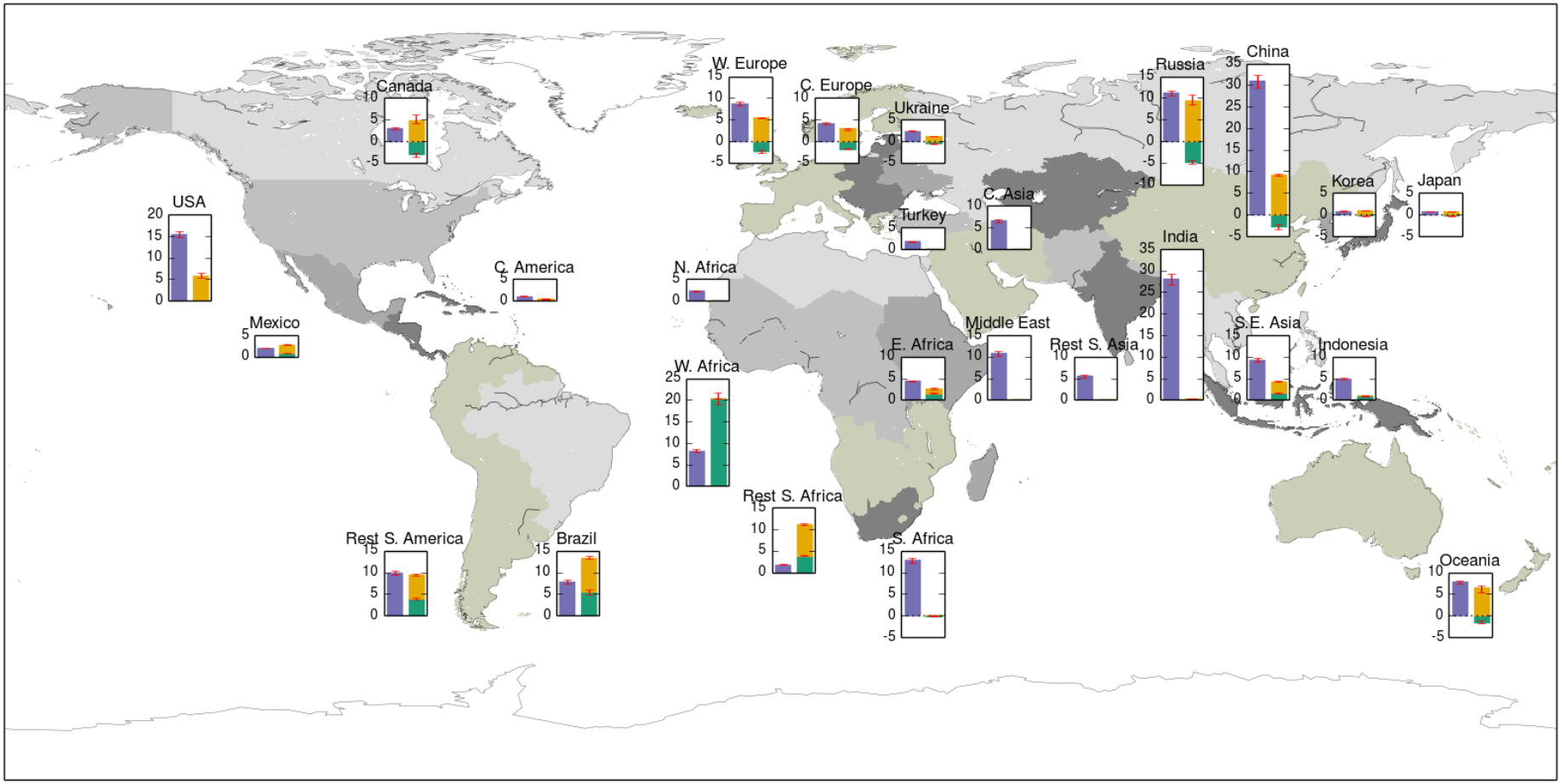

Fig. S4. | Contribution of different mitigation options to the allowable anthropogenic carbon emission budgets by region. The contribution to the allowable carbon emission budgets (GtC) between 2015 and 2100 for each of the 26 IMAGE IAM regions from methane mitigation (purple bars) and land-based mitigation options (green: natural land uptake; yellow: BECCS with $\kappa = 3$), for the temperature pathway stabilising at 2°C warming without overshoot. The bars and error bars respectively show the median and the interquartile range~~,~~ from the 34 GCMs emulated and 4 factorial runs.

Table S1. | Mitigation options, estimated maximum reduction potential and the accompanying marginal price for mitigation of different anthropogenic methane source sectors for 2050 and 2100 [based on Lucas et al., 2007].

Source Sector	**Mitigation option(s)**	**Max. possible reduction relative to baseline (%)**	**Marginal price of max. reduction (1995 US$/tC$_{eq}$)**
Coal production	Maximising methane recovery from underground mining of hard coal	90 (2050) 90 (2100)	500 (2050) 500 (2100)
Oil/gas production & distribution	Control of fugitive emissions from equipment and pipeline leaks, and from venting during maintenance and repair.	75 (2050) 90 (2100)	300 (2050) 500 (2100)
Enteric fermentation	Change of animal diet and use of more productive animal types.	50 (2050) 60 (2100)	1000 (2050) 1000 (2100)
Animal waste	Capture and use of methane emissions through anaerobic digesters.	50 (2050) 60 (2100)	1000 (2050) 1000 (2100)
Wetland rice production	Changes to (1) the water management regime to reduce the period of anaerobic conditions in flooded fields; (2) the soils to reduce methanogenesis.	80 (2050) 90 (2100)	1000 (2050) 1000 (2100)
Landfills	(1) Reduced amount of organic material deposited in landfills; (2) capture of methane	90 (2050) 90 (2100)	500 (2050) 500 (2100)
Sewage and wastewater	(1) More wastewater treatment plants and also recovery of the methane from the plants; (2) More aerobic wastewater treatment.	80 (2050) 90 (2100)	500 (2050) 500 (2100)
Other anthropogenic sources	Note 1	-	-

Note: (1) These sources are either difficult to abate (e.g., land clearing for agricultural extension, and the use of traditional biomass for energy production and cooking) or are too small (e.g., methane emissions from industry, iron and steel production and the chemical sector).

Reference: Lucas, P. L., van Vuuren, D. P., Olivier, J. G. J. & den Elzen, M. G. J., 2007: Long-term reduction potential of non-CO_2 greenhouse gases. *Environmental Science & Policy* **10**, 85-103, doi: https://doi.org/10.1016/j.envsci.2006.10.007.

Table S2. | For the 2°C temperature profile, the mean of the 34-GCM member ensembles for the "CTL" and mitigation scenarios for the different factorial runs (low Q_{10}/low O_3, low Q_{10}/high O_3, high Q_{10}/low O_3 and high Q_{10}/high O_3), the standard deviation of the full 136-member ensemble (GtC), the derived standard deviations for land processes (σ_{land}) and climate ($\sigma_{climate}$, as represented by the 34 GCMs) and the ratio of $\sigma_{climate}/\sigma_{land}$ for (a) the Anthropogenic Fossil Field CO_2 Emission Budgets and (b) the Mitigation Potential (= scenario – CTL)

(1) AFFEB

Scenario	Mean of 34-member Factorial Run (GtC)				Standard Deviation (GtC)			Ratio
	Low Q_{10} Low O_3	Low Q_{10} High O_3	High Q_{10} Low O_3	High Q_{10} High O_3	136-member Ensemble	Land σ_{land}	Climate $\sigma_{climate}$	$\sigma_{climate}$:σ_{land}
CTL	229.67	230.28	213.87	213.23	86.80	8.22	86.41	10.51
CH_4	423.93	443.83	405.57	424.31	89.03	13.53	88.00	6.50
BECCS	249.83	257.92	234.59	242.12	87.99	8.69	87.56	10.08
Natural	287.79	281.62	273.47	266.44	89.02	8.08	88.65	10.97
Optimised Land-based	291.34	285.95	276.06	270.11	88.94	8.28	88.55	10.69
Linear BECCS+CH_4	444.09	471.47	426.30	453.20	90.63	16.29	89.15	5.47
Linear_Natural+CH_4	482.04	495.17	465.17	477.51	90.86	10.73	90.22	8.41
Linear optimised	485.60	499.50	467.76	481.19	90.84	11.33	90.13	7.95
Coupled BECCS+CH_4	447.69	474.68	429.79	456.36	90.39	16.16	88.93	5.50
Coupled Natural+CH_4	487.77	501.94	470.88	484.20	90.81	11.06	90.13	8.15
Coupled optimised	491.24	505.99	473.25	487.54	90.85	11.65	90.10	7.73

(2) Mitigation Potential

Scenario	Mean of 34-member Factorial Run (GtC)				Standard Deviation (GtC)			Ratio
	Low Q_{10} Low O_3	Low Q_{10} High O_3	High Q_{10} Low O_3	High Q_{10} High O_3	136-member Ensemble	Land σ_{land}	Climate $\sigma_{climate}$	$\sigma_{climate}$:σ_{land}
CTL	-	-	-	-	-	-	-	-
CH_4	194.25	213.55	191.70	211.08	9.95	9.75	1.98	0.20
BECCS	20.16	27.64	20.72	28.89	4.21	3.94	1.48	0.37
Natural	58.11	51.34	59.60	53.20	4.22	3.40	2.50	0.74
Optimised Land-based	61.67	55.67	62.19	56.88	3.73	2.87	2.39	0.83
Linear BECCS+CH_4	214.41	241.19	212.43	239.96	13.97	13.60	3.18	0.23
Linear_Natural+CH_4	252.37	264.89	251.30	264.28	7.55	6.39	4.02	0.63
Linear optimised	255.92	269.22	253.89	267.95	7.94	6.89	3.94	0.57
Coupled BECCS+CH_4	218.02	244.40	215.93	243.13	13.76	13.42	3.03	0.23
Coupled Natural+CH_4	258.10	271.66	257.01	270.96	7.94	6.89	3.94	0.57
Coupled optimised	261.56	275.71	259.38	274.31	8.30	7.33	3.90	0.53

Table S3. | IMAGE regions, the sum of the projected anthropogenic CH_4 emissions between 2020 and 2100 for the SSP2-Baseline and SSP2-RCP1.9 scenarios, and the difference between these summed emissions. The regional scale factor is calculated as the regional fraction of the global difference in the summed emissions.

Region	Abbreviation	Sum of ProjectedAnthropogenic CH_4 Emissions 2020-2100 (PgCH4)		Difference	Scale Factor
		SSP2-Baseline	SSP2-RCP1.9		
Canada	CAN	0.497	0.169	0.328	0.01471
USA	USA	3.281	1.573	1.708	0.07670
Mexico	MEX	0.542	0.320	0.222	0.00995
Central America	RCAM	0.312	0.195	0.117	0.00525
Brazil	BRA	2.502	1.638	0.865	0.03884
Rest of South America	RSAM	2.249	1.159	1.090	0.04896
Northern Africa	NAF	0.533	0.286	0.247	0.01110
Western Africa	WAF	2.035	1.128	0.907	0.04074
Eastern Africa	EAF	1.722	1.245	0.478	0.02146
South Africa	SAF	1.615	0.207	1.408	0.06324
Rest of Southern Africa	RSAF	1.883	0.924	0.959	0.04307
Western Europe	WEU	0.683	0.220	0.463	0.02081
Central Europe	CEU	0.409	0.219	0.190	0.00854
Turkey	TUR	0.387	0.128	0.259	0.01163
Ukraine Region	UKR	1.021	0.299	0.722	0.03241
Central Asia	STAN	1.743	0.514	1.228	0.05517
Russia Region	RUS	1.910	0.720	1.190	0.05343
Middle East	ME	4.873	1.788	3.085	0.13856
India	INDIA	0.170	0.081	0.089	0.00400
Korea Region	KOR	5.757	2.351	3.406	0.15296
China	CHN	1.923	0.908	1.015	0.04558
South East Asia	SEAS	1.005	0.457	0.547	0.02458
Indonesia	INDO	0.160	0.077	0.082	0.00369
Japan	JAP	1.316	0.460	0.856	0.03846
Rest of South Asia	RSAS	1.496	0.893	0.603	0.02710
Oceania	OCE	0.657	0.455	0.202	0.00907
World	World	40.680	18.415	22.265	1.00000

Table S4a. | By IMAGE region for the 1.5°C temperature profile, the modelled bioenergy crop productivity (ton DM ha^{-1} yr^{-1}) and that required to match the land carbon uptake in the variant "Natural" land-based mitigation scenario, the grid-cell scale-factors (Required/Modelled BECCS productivity), the maximum area of BECCS (Mha) and the area of bioenergy crops (Mha) in the optimised land-based scenario as a function of the BECCS scale factor κ, (all entries are median [10%, 90% percentiles] of the grid cells in the IMAGE region from the 136-member ensembles).

Region	Maximum area of BECCS (Mha)	BECCS Productivity (ton DM ha^{-1} yr^{-1})		Required Scale Factor	Area of BECCS (Mha) in optimised land-based scenario			
		Modelled	Required to match Natural		BECCS scale factor κ = 1	BECCS scale factor κ = 2	BECCS scale factor κ = 3	BECCS scale factor κ = 4
Canada	65.9	2.99 (0.00-4.75)	6.39 (0.00-20.16)	2.93 (0.81-24.94)	1.02 (0.74-1.24)	6.69 (4.84-11.41)	23.49 (14.23-30.93)	31.93 (25.29-35.80)
USA	39.0	5.40 (0.00-6.86)	3.36 (0.00-10.88)	1.16 (0.42-3.68)	10.42 (5.06-15.73)	23.71 (19.65-32.99)	29.88 (25.55-37.69)	35.98 (34.87-38.93)
Mexico	7.1	6.86 (2.12-9.30)	3.09 (0.98-5.84)	0.73 (0.31-1.26)	5.25 (5.25-5.81)	7.28 (7.28-7.28)	7.28 (7.28-7.28)	7.28 (7.28-7.28)
Central America	0.5	7.61 (0.07-9.60)	2.64 (0.05-4.63)	0.59 (0.03-0.92)	0.56 (0.56-0.56)	0.56 (0.56-0.56)	0.56 (0.56-0.56)	0.56 (0.56-0.56)
Brazil	27.8	8.21 (0.00-10.89)	3.46 (0.00-8.45)	0.79 (0.34-2.32)	14.64 (13.72-16.06)	26.21 (26.21-31.42)	33.27 (29.36-33.27)	33.27 (31.89-33.27)
Rest of South America	20.3	5.88 (0.01-9.98)	3.53 (0.01-11.08)	0.82 (0.40-6.29)	12.14 (11.21-14.65)	16.05 (16.03-16.96)	18.54 (17.62-18.90)	18.55 (17.62-18.90)
Northern Africa	-	-	-	-	-	-	-	-
Western Africa	3.1	0.02 (0.00-4.72)	0.00 (0.00-16.62)	1.29 (0.33-8.01)	1.96 (1.89-1.96)	2.10 (2.10-2.10)	2.10 (2.10-2.10)	2.10 (2.10-2.10)
Eastern Africa	33.9	4.67 (0.00-7.84)	3.27 (0.00-35.69)	2.43 (0.43-53.31)	2.98 (2.58-3.41)	5.05 (4.72-5.74)	8.17 (7.78-8.37)	8.37 (8.16-11.37)
South Africa	1.0	0.00 (0.00-3.16)	0.00 (0.00-2.71)	1.03 (0.44-1.40)	0.72 (0.72-1.02)	1.02 (0.96-1.02)	1.02 (1.01-1.02)	1.02 (1.02-1.02)
Western Europe	23.6	4.79 (0.00-5.71)	3.80 (0.00-7.40)	1.17 (0.74-2.50)	4.84 (1.61-6.98)	19.47 (19.47-19.47)	22.52 (21.54-23.49)	23.49 (23.49-23.49)
Rest of Southern Africa	63.7	5.38 (0.00-8.83)	4.42 (0.00-13.68)	1.31 (0.57-10.90)	13.17 (8.29-14.28)	24.76 (24.76-25.25)	24.76 (24.76-27.22)	24.76 (24.76-27.59)
Central Europe	19.3	5.05 (4.07-6.10)	4.60 (1.96-11.93)	1.32 (0.69-3.27)	3.56 (1.21-6.49)	9.60 (7.50-11.71)	13.55 (13.55-13.55)	17.14 (13.55-19.62)
Turkey	-	-	-	-	-	-	-	-
Ukraine Region	11.4	4.78 (3.63-5.38)	4.73 (2.87-41.12)	1.35 (0.82-13.81)	2.46 (0.00-5.20)	5.20 (5.20-5.20)	5.20 (5.20-5.20)	8.06 (5.20-8.06)
Central Asia	0.5	2.14 (0.00-4.58)	0.00 (0.00-0.00)	-	0.47 (0.47-0.47)	0.47 (0.47-0.47)	0.47 (0.47-0.47)	0.47 (0.47-0.47)
Russia region	146.1	3.39 (0.03-4.50)	6.52 (0.02-44.97)	3.34 (1.14-33.58)	2.51 (0.48-4.59)	24.36 (13.68-36.87)	49.21 (36.39-69.33)	75.28 (68.13-81.69)
Middle East	-	-	-	-	-	-	-	-
India	6.0	6.92 (6.72-7.22)	2.50 (1.38-9.07)	0.53 (0.29-1.85)	0.14 (0.14-6.08)	6.08 (6.08-6.08)	6.08 (6.08-6.08)	6.08 (6.08-6.08)
Korea region	4.3	6.09 (5.86-6.29)	4.42 (3.41-5.54)	1.07 (0.84-1.30)	2.15 (0.00-4.30)	4.30 (4.30-4.30)	4.30 (4.30-4.30)	4.30 (4.30-4.30)
China region	58.1	5.08 (0.05-7.06)	3.00 (0.04-7.64)	0.89 (0.48-4.41)	18.13 (13.20-22.02)	35.11 (32.61-36.85)	38.84 (37.77-39.79)	46.08 (41.53-48.81)
Southeastern Asia	24.5	7.19 (0.03-9.65)	4.22 (0.02-16.68)	0.83 (0.48-11.75)	6.92 (6.92-6.92)	7.30 (7.30-7.30)	7.30 (7.30-7.30)	7.30 (7.30-7.30)
Indonesia region	-	-	-	-	-	-	-	-
Japan	2.7	5.59 (1.61-6.27)	6.38 (3.33-23.76)	1.56 (0.87-18.64)	1.08 (0.00-2.46)	2.46 (2.46-2.46)	2.46 (2.46-2.46)	2.46 (2.46-2.46)
Rest of South Asia	-	-	-	-	-	-	-	-
Oceania	78.7	2.66 (0.00-7.52)	3.26 (0.00-10.71)	1.88 (0.79-4.67)	18.36 (17.71-19.58)	33.78 (30.20-39.76)	64.41 (59.14-67.85)	77.58 (74.43-81.72)

Table S4b. | As Table S4a for the 2°C temperature profile.

Region	Maximum area of BECCS (Mha)	BECCS Productivity		Required Scale Factor	Area of BECCS (Mha) in optimised land-based scenario			
		Modelled	Required to match Natural		BECCS scale factor $\kappa = 1$	BECCS scale factor $\kappa = 2$	BECCS scale factor $\kappa = 3$	BECCS scale factor $\kappa = 4$
Canada	65.9	3.41 (0.00-5.26)	6.23 (0.00-19.88)	2.48 (0.81-18.40)	0.93 (0.74-1.14)	10.61 (4.89-18.12)	26.13 (17.68-34.09)	38.96 (30.97-44.66)
USA	39.0	5.93 (0.00-7.35)	3.66 (0.00-11.77)	1.15 (0.41-3.52)	9.98 (5.07-15.73)	24.77 (23.35-32.23)	33.65 (25.55-37.71)	36.34 (35.63-38.91)
Mexico	7.1	6.95 (1.78-9.63)	3.46 (1.01-6.38)	0.81 (0.33-1.36)	5.25 (4.70-5.25)	7.28 (7.05-7.28)	7.28 (7.28-7.28)	7.28 (7.28-7.28)
Central America	0.5	7.12 (0.07-9.95)	2.96 (0.05-5.06)	0.63 (0.08-1.09)	0.56 (0.41-0.56)	0.56 (0.56-0.56)	0.56 (0.56-0.56)	0.56 (0.56-0.56)
Brazil	27.8	8.25 (0.00-10.94)	3.83 (0.00-9.36)	0.88 (0.41-2.48)	14.01 (12.35-15.57)	27.68 (26.09-30.84)	29.36 (28.06-31.42)	33.27 (30.11-33.27)
Rest of South America	20.3	6.29 (0.02-10.21)	3.81 (0.01-11.79)	0.84 (0.41-5.60)	12.14 (11.19-13.08)	16.05 (16.03-16.96)	18.54 (17.62-18.90)	18.55 (17.77-18.90)
Northern Africa	-	-	-	-	-	-	-	-
Western Africa	3.1	0.02 (0.00-4.82)	0.00 (0.00-16.45)	1.50 (0.33-7.99)	1.89 (1.89-1.96)	2.10 (2.10-2.10)	2.10 (2.10-2.10)	2.10 (2.10-2.10)
Eastern Africa	33.9	4.87 (0.00-8.16)	3.64 (0.00-38.66)	2.39 (0.46-54.83)	2.98 (2.58-3.41)	4.77 (3.90-5.24)	8.17 (7.74-8.37)	8.38 (8.17-12.20)
South Africa	1.0	0.00 (0.00-3.42)	0.00 (0.00-2.95)	1.24 (0.65-1.36)	0.72 (0.72-0.72)	1.02 (1.02-1.02)	1.02 (1.02-1.02)	1.02 (1.02-1.02)
Western Europe	23.6	5.18 (0.00-6.15)	3.99 (0.00-7.80)	1.16 (0.71-2.40)	4.29 (2.37-8.77)	19.47 (19.47-19.47)	22.52 (21.54-23.49)	23.49 (23.49-23.49)
Rest of Southern Africa	63.7	5.45 (0.00-8.92)	4.85 (0.00-15.90)	1.44 (0.68-11.31)	6.59 (5.68-11.60)	24.76 (23.65-25.25)	25.12 (24.76-27.12)	25.25 (24.76-27.12)
Central Europe	19.3	5.50 (4.50-6.48)	4.70 (1.91-12.59)	1.28 (0.66-3.21)	2.65 (1.21-5.91)	8.42 (7.50-13.55)	13.55 (13.55-18.49)	19.05 (13.55-19.62)
Turkey	-	-	-	-	-	-	-	-
Ukraine Region	11.4	5.23 (3.94-5.91)	4.92 (3.02-46.34)	1.31 (0.79-14.56)	1.84 (0.00-5.20)	5.20 (5.20-5.20)	5.20 (5.20-5.20)	8.06 (5.20-8.06)
Central Asia	0.5	2.14 (0.00-4.61)	0.00 (0.00-0.00)	-	0.47 (0.47-0.47)	0.47 (0.47-0.47)	0.47 (0.47-0.47)	0.47 (0.47-0.47)
Russia region	146.1	3.70 (0.04-4.89)	6.60 (0.03-40.53)	3.04 (1.12-29.66)	2.69 (0.58-6.56)	25.92 (15.99-40.00)	60.45 (44.83-71.40)	78.97 (72.99-84.72)
Middle East	-	-	-	-	-	-	-	-
India	6.0	7.06 (6.84-7.71)	2.38 (1.43-14.27)	0.49 (0.30-2.70)	0.14 (0.14-6.08)	6.08 (0.14-6.08)	6.08 (6.08-6.08)	6.08 (6.08-6.08)
Korea region	4.3	6.65 (6.39-6.96)	4.82 (3.84-5.61)	1.05 (0.86-1.21)	2.15 (0.00-4.30)	4.30 (4.30-4.30)	4.30 (4.30-4.30)	4.30 (4.30-4.30)
China region	58.1	5.44 (0.06-7.42)	3.22 (0.04-8.05)	0.92 (0.48-4.28)	17.78 (13.89-21.67)	35.11 (32.97-36.89)	39.72 (38.84-41.01)	47.15 (42.31-49.46)
Southeastern Asia	24.5	7.01 (0.03-9.80)	4.82 (0.02-17.29)	0.98 (0.55-12.08)	6.82 (4.51-6.92)	7.30 (7.30-7.30)	7.30 (7.30-7.30)	7.30 (7.30-7.30)
Indonesia region	-	-	-	-	-	-	-	-
Japan	2.7	6.17 (2.19-6.82)	6.62 (3.58-29.58)	1.46 (0.85-16.68)	1.08 (0.00-2.46)	2.46 (2.46-2.46)	2.46 (2.46-2.46)	2.46 (2.46-2.46)
Rest of South Asia	-	-	-	-	-	-	-	-
Oceania	78.7	2.76 (0.00-7.81)	3.67 (0.00-12.17)	1.96 (0.76-5.44)	19.24 (15.74-20.25)	33.30 (30.28-35.15)	61.07 (59.03-67.85)	71.84 (63.39-77.58)

Table S4c. | By IMAGE region for the 1.5°C temperature profile, the carbon uptake by BECCS (GtC) and the change in the land carbon store (GtC) compared to the control in the optimised land-based mitigation scenario. All entries shown as median (interquartile range).

Region	Carbon Uptake by BECCS (GtC)/Change in the land carbon store (GtC)							
	BECCS	Land	BECCS	Land	BECCS	Land	BECCS	Land
	BECCS scale factor κ = 1	BECCS scale factor κ = 1	BECCS scale factor κ = 2	BECCS scale factor κ = 2	BECCS scale factor κ = 3	BECCS scale factor κ = 3	BECCS scale factor κ = 4	BECCS scale factor κ = 4
Canada	0.02 (0.01,0.02)	0.15 (0.12,0.21)	0.77 (0.59,1.41)	-0.49 (-0.87,-0.40)	3.88 (2.58,4.61)	-2.63 (-2.89,-1.83)	6.61 (5.88,6.95)	-3.91 (-4.00,-3.52)
USA	0.70 (0.36,1.07)	1.30 (0.58,1.88)	2.76 (2.67,3.22)	0.25 (-0.37,0.44)	4.72 (4.53,5.44)	-0.30 (-0.68,0.01)	7.39 (7.26,7.51)	-1.01 (-1.15,-0.86)
Mexico	0.44 (0.41,0.48)	1.00 (0.83,1.05)	1.25 (1.21,1.32)	0.76 (0.71,0.80)	1.88 (1.82,1.98)	0.76 (0.71,0.79)	2.50 (2.42,2.64)	0.76 (0.71,0.79)
Central America	0.06 (0.05,0.06)	0.24 (0.20,0.28)	0.11 (0.11,0.12)	0.24 (0.20,0.28)	0.17 (0.16,0.18)	0.24 (0.20,0.28)	0.23 (0.22,0.24)	0.24 (0.20,0.28)
Brazil	1.72 (1.63,2.03)	5.84 (5.28,6.58)	5.21 (5.02,5.35)	4.84 (4.51,5.33)	8.05 (7.68,8.21)	4.66 (4.28,5.13)	10.80 (10.44,10.96)	4.63 (4.28,5.06)
Rest of South America	1.32 (1.20,1.47)	4.20 (3.73,4.56)	3.41 (3.29,3.55)	3.69 (3.41,3.94)	5.28 (5.10,5.48)	3.57 (3.28,3.84)	7.05 (6.81,7.32)	3.57 (3.27,3.83)
Northern Africa	-	-	-	-	-	-	-	-
Western Africa	0.02 (0.01,0.02)	17.63 (16.30,19.04)	0.06 (0.06,0.06)	17.62 (16.28,19.02)	0.09 (0.09,0.09)	17.62 (16.28,19.02)	0.12 (0.12,0.12)	17.62 (16.28,19.02)
Eastern Africa	0.12 (0.09,0.15)	1.97 (1.88,2.14)	0.50 (0.41,0.58)	1.76 (1.61,1.97)	1.11 (1.05,1.22)	1.44 (1.38,1.63)	1.48 (1.39,2.04)	1.40 (1.19,1.63)
South Africa	0.00 (0.00,0.01)	-0.13 (-0.14,-0.13)	0.03 (0.02,0.03)	-0.15 (-0.15,-0.13)	0.04 (0.04,0.04)	-0.15 (-0.15,-0.13)	0.05 (0.05,0.06)	-0.15 (-0.15,-0.13)
Western Europe	0.39 (0.10,0.59)	-0.27 (-0.43,-0.04)	3.13 (3.08,3.19)	-1.83 (-2.25,-1.61)	4.97 (4.90,5.05)	-2.15 (-2.46,-1.84)	6.69 (6.57,6.80)	-2.16 (-2.57,-1.84)
Rest of Southern Africa	1.49 (0.96,1.59)	4.87 (4.68,5.60)	4.84 (4.74,4.93)	3.57 (3.47,3.71)	7.27 (7.11,7.44)	3.57 (3.46,3.70)	9.70 (9.48,9.92)	3.56 (3.43,3.70)
Central Europe	0.24 (0.07,0.46)	-0.33 (-0.44,-0.22)	1.33 (1.09,1.61)	-0.90 (-0.96,-0.88)	2.62 (2.58,2.66)	-1.66 (-1.76,-1.07)	3.87 (3.52,4.16)	-1.71 (-1.76,-1.62)
Turkey	-	-	-	-	-	-	-	-
Ukraine Region	0.14 (0.00,0.31)	-0.13 (-0.25,-0.03)	0.64 (0.63,0.66)	-0.36 (-0.47,-0.25)	0.96 (0.95,0.99)	-0.44 (-0.47,-0.25)	1.57 (1.32,1.64)	-0.54 (-0.57,-0.47)
Central Asia	0.00 (0.00,0.00)	0.02 (0.01,0.03)	0.00 (0.00,0.00)	0.02 (0.01,0.03)	0.01 (0.01,0.01)	0.02 (0.01,0.03)	0.01 (0.01,0.01)	0.02 (0.01,0.03)
Russia region	0.15 (0.03,0.28)	0.84 (0.64,1.02)	3.15 (1.95,4.32)	-1.43 (-2.08,-0.52)	7.85 (6.43,9.22)	-3.81 (-4.38,-3.36)	13.05 (12.41,13.60)	-5.84 (-6.55,-5.49)
Middle East	-	-	-	-	-	-	-	-
India	0.00 (0.00,0.12)	0.18 (0.15,0.20)	0.25 (0.24,0.26)	0.02 (-0.01,0.12)	0.38 (0.37,0.39)	0.01 (-0.02,0.08)	0.51 (0.49,0.52)	0.01 (-0.02,0.08)
Korea region	0.13 (0.00,0.26)	-0.11 (-0.23,-0.01)	0.54 (0.53,0.55)	-0.29 (-0.36,-0.23)	0.81 (0.79,0.83)	-0.29 (-0.36,-0.23)	1.09 (1.05,1.11)	-0.29 (-0.36,-0.23)
China region	1.36 (1.03,1.61)	-0.23 (-0.43,-0.01)	5.42 (5.27,5.56)	-2.16 (-2.47,-2.07)	8.54 (8.42,8.65)	-2.63 (-3.06,-2.19)	12.10(11.61,12.49)	-3.18 (-3.23,-3.12)
Southeastern Asia	0.88 (0.86,0.90)	1.52 (1.33,1.65)	1.82 (1.77,1.85)	1.49 (1.31,1.61)	2.72 (2.66,2.78)	1.49 (1.31,1.61)	3.63 (3.55,3.71)	1.49 (1.31,1.61)
Indonesia region	-	-	-	-	-	-	-	-
Japan	0.10 (0.00,0.23)	-0.04 (-0.16,0.05)	0.47 (0.45,0.48)	-0.24 (-0.32,-0.16)	0.70 (0.68,0.72)	-0.24 (-0.32,-0.16)	0.93 (0.91,0.96)	-0.24 (-0.32,-0.16)
Rest of South Asia	-	-	-	-	-	-	-	-
Oceania	0.20 (0.19,0.27)	1.71 (1.60,1.88)	2.37 (1.62,2.94)	0.47 (-0.14,1.15)	6.17 (5.72,6.90)	-1.54 (-1.88,-1.38)	9.18 (8.51,10.26)	-2.52 (-2.81,-2.17)
Global	9.31 (7.19,11.93)	41.82 (36.12,46.59)	37.83 (35.74,41.73)	27.50 (23.51,31.04)	67.96 (65.96,71.25)	18.82 (16.30,21.23)	98.62(95.98,100.77)	12.61 (11.16,13.67)

Table S4d. | As Table S4c for the 2°C temperature profile.

Region	Carbon Uptake (GtC)							
	BECCS	**Land**	**BECCS**	**Land**	**BECCS**	**Land**	**BECCS**	**Land**
	BECCS scale factor κ = 1	**BECCS scale factor κ = 1**	**BECCS scale factor κ = 2**	**BECCS scale factor κ = 2**	**BECCS scale factor κ = 3**	**BECCS scale factor κ = 3**	**BECCS scale factor κ = 4**	**BECCS scale factor κ = 4**
Canada	0.02 (0.02-0.02)	0.13 (0.09-0.17)	1.52 (0.66-2.27)	-1.03 (-1.49--0.44)	4.91 (3.69-5.73)	-3.09 (-3.46--2.62)	8.44 (7.37-9.00)	-4.65 (-4.89--4.47)
USA	0.82 (0.38-1.15)	1.42 (0.68-1.95)	3.18 (3.08-3.43)	0.16 (-0.25-0.32)	5.71 (4.97-6.04)	-0.50 (-0.83-0.04)	8.17 (8.03-8.32)	-1.06 (-1.20--0.91)
Mexico	0.40 (0.34-0.43)	1.13 (1.02-1.21)	1.27 (1.23-1.32)	0.85 (0.77-0.91)	1.91 (1.84-1.98)	0.85 (0.76-0.91)	2.55 (2.45-2.65)	0.85 (0.76-0.91)
Central America	0.05 (0.04-0.06)	0.30 (0.25-0.38)	0.11 (0.10-0.12)	0.30 (0.25-0.37)	0.17 (0.15-0.18)	0.30 (0.25-0.37)	0.23 (0.20-0.24)	0.30 (0.25-0.37)
Brazil	1.71 (1.56-1.94)	6.68 (6.14-7.48)	5.21 (5.01-5.38)	5.60 (5.21-6.15)	7.95 (7.64-8.17)	5.49 (5.09-6.06)	10.77 (10.41-11.05)	5.35 (4.99-5.88)
Rest of South America	1.30 (1.19-1.43)	4.65 (4.44-5.13)	3.52 (3.38-3.68)	4.16 (3.92-4.55)	5.46 (5.24-5.71)	4.00 (3.78-4.39)	7.29 (6.99-7.61)	3.99 (3.78-4.38)
Northern Africa	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
Western Africa	0.01 (0.01-0.02)	20.31 (19.00-21.68)	0.06 (0.06-0.06)	20.29 (18.99-21.66)	0.09 (0.09-0.09)	20.29 (18.99-21.66)	0.12 (0.12-0.12)	20.29 (18.99-21.66)
Eastern Africa	0.12 (0.09-0.15)	2.13 (2.04-2.28)	0.44 (0.35-0.53)	2.02 (1.77-2.12)	1.17 (1.05-1.45)	1.54 (1.43-1.73)	1.84 (1.40-2.21)	1.46 (1.13-1.65)
South Africa	0.00 (0.00-0.00)	-0.13 (-0.13--0.13)	0.03 (0.02-0.03)	-0.15 (-0.15--0.14)	0.04 (0.04-0.05)	-0.15 (-0.15--0.14)	0.06 (0.05-0.06)	-0.15 (-0.15--0.14)
Western Europe	0.37 (0.16-0.83)	-0.25 (-0.61--0.09)	3.39 (3.32-3.48)	-1.98 (-2.37--1.75)	5.40 (5.31-5.51)	-2.32 (-2.59--1.97)	7.26 (7.14-7.42)	-2.38 (-2.71--1.97)
Rest of Southern Africa	0.76 (0.71-0.94)	6.11 (5.42-6.30)	4.75 (4.40-4.94)	3.92 (3.77-4.27)	7.26 (7.07-7.47)	3.89 (3.76-3.97)	9.68 (9.43-9.98)	3.86 (3.74-3.97)
Central Europe	0.19 (0.08-0.48)	-0.28 (-0.47--0.24)	1.27 (1.18-1.82)	-0.97 (-1.11--0.92)	2.89 (2.78-3.32)	-1.76 (-1.84--1.61)	4.31 (3.80-4.55)	-1.81 (-1.87--1.76)
Turkey	0.00 (0.00-0.00)	-0.03 (-0.04--0.02)	0.00 (0.00-0.00)	-0.03 (-0.04--0.02)	0.00 (0.00-0.00)	-0.03 (-0.04--0.02)	0.00 (0.00-0.00)	-0.03 (-0.04--0.02)
Ukraine Region	0.12 (0.00-0.35)	-0.12 (-0.28--0.03)	0.71 (0.69-0.73)	-0.38 (-0.49--0.28)	1.07 (1.04-1.10)	-0.46 (-0.50--0.28)	1.72 (1.45-1.83)	-0.59 (-0.62--0.50)
Central Asia	0.00 (0.00-0.00)	0.02 (0.01-0.03)	0.00 (0.00-0.00)	0.02 (0.01-0.03)	0.01 (0.01-0.01)	0.02 (0.01-0.03)	0.01 (0.01-0.01)	0.02 (0.01-0.03)
Russia region	0.18 (0.03-0.45)	0.84 (0.52-1.01)	3.56 (2.30-4.87)	-1.67 (-2.48--0.67)	9.45 (8.11-10.49)	-4.79 (-5.18--4.38)	14.83 (14.13-15.22)	-6.67 (-7.29--6.05)
Middle East	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.01)
India	0.00 (0.00-0.12)	0.21 (0.18-0.23)	0.26 (0.01-0.27)	0.18 (0.03-0.22)	0.40 (0.39-0.42)	-0.02 (-0.09-0.16)	0.54 (0.52-0.55)	-0.04 (-0.12-0.09)
Korea region	0.14 (0.00-0.29)	-0.12 (-0.26--0.01)	0.60 (0.59-0.61)	-0.32 (-0.37--0.26)	0.90 (0.88-0.92)	-0.32 (-0.37--0.26)	1.20 (1.17-1.22)	-0.32 (-0.37--0.26)
China region	1.43 (1.08-1.72)	-0.22 (-0.41-0.05)	5.78 (5.62-6.02)	-2.38 (-2.60--2.22)	9.19 (9.03-9.35)	-2.85 (-3.30--2.34)	12.95 (12.35-13.45)	-3.38 (-3.46--3.31)
Southeastern Asia	0.85 (0.63-0.89)	1.71 (1.47-1.91)	1.80 (1.66-1.86)	1.59 (1.44-1.73)	2.70 (2.49-2.79)	1.59 (1.44-1.73)	3.60 (3.32-3.72)	1.59 (1.44-1.73)
Indonesia region	0.00 (0.00-0.00)	0.90 (0.83-0.97)	0.00 (0.00-0.00)	0.90 (0.83-0.97)	0.00 (0.00-0.00)	0.90 (0.83-0.97)	0.00 (0.00-0.00)	0.90 (0.83-0.97)
Japan	0.11 (0.00-0.25)	-0.05 (-0.18-0.05)	0.52 (0.51-0.54)	-0.26 (-0.34--0.18)	0.78 (0.76-0.80)	-0.26 (-0.34--0.18)	1.04 (1.02-1.07)	-0.26 (-0.34--0.18)
Rest of South Asia	0.00 (0.00-0.00)	0.13 (0.12-0.14)	0.00 (0.00-0.00)	0.13 (0.12-0.14)	0.00 (0.00-0.00)	0.13 (0.12-0.14)	0.00 (0.00-0.00)	0.13 (0.12-0.14)
Oceania	0.21 (0.20-0.27)	1.96 (1.86-2.14)	2.13 (1.77-2.72)	0.75 (0.15-1.30)	6.34 (5.82-7.28)	-1.68 (-2.14--1.46)	9.22 (8.07-10.47)	-2.20 (-2.82--1.67)
Global	9.00 (6.95-11.62)	48.12 (41.99-52.11)	39.84 (37.27-43.80)	32.16 (27.36-35.64)	73.36 (70.87-76.54)	21.20 (18.99-23.39)	105.3 (101.7-108.7)	15.11 (13.67-16.45)