

Illustrative pathways linking policy, land use and climate change

Socioeconomic development influences the evolution of the land system including the relative amount of land allocated to agriculture, energy crops, and forest. This has implications for climate change mitigation, adaptation and other sectoral characteristics. The lines shows the range across models for three alternative shared socioeconomic pathways: **SSP1 (green)**, **SSP2 (blue)**, and **SSP3 (magenta)**, under **two different warming targets in 1.5°C and 2.5 to 3°C scenarios**. Note that 1.5 °C is not possible from SSP3 and thus is excluded.

AGRICULTURE and Socio-Economic Development

SSP1 has the lowest agricultural land expansion. This socio-economic pathway is characterised by sustainable land management, the achievement of Land Degradation Neutrality targets, sustainable intensification, enhancement of ecosystem services, changing dietary patterns, and the reduction of food waste. Sustainable land management and demand side changes are not included in SSP3. SSP2 is similar to SSP1, but changes start later and are less effective.

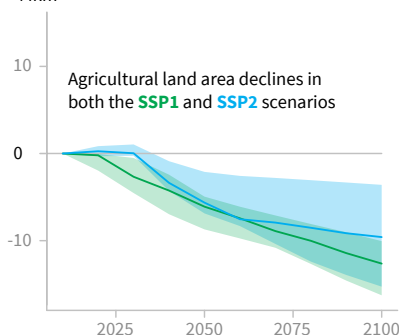
BIOENERGY and Socio-Economic Development

All pathways use bioenergy, with more use in the SSP2 and SSP3 than in the SSP1. All three pathways include carbon prices that incentivise bioenergy use. The presence of other response options, including sustainable land management, however, results in less bioenergy in the SSP1 than the SSP3. In the SSP2, more bioenergy is needed sooner than in the SSP1 to compensate for other emissions.

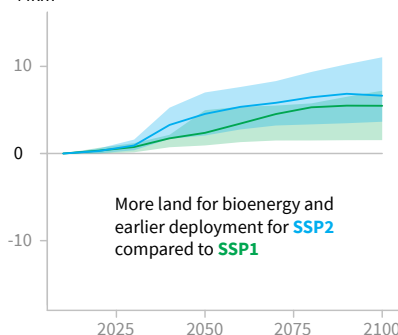
FOREST and Socio-Economic Development

SSP1 has the greatest forest expansion. This socio-economic pathway is characterised by land use regulation, forest protection, and biodiversity preservation, including incentives for reforestation and afforestation. Forest expansion is primarily on abandoned agricultural land, resulting in less competition for land than in SSP2. SSP2 is similar to SSP1, but changes start later and have less impact. Land use regulation and biodiversity conservation are absent in SSP3.

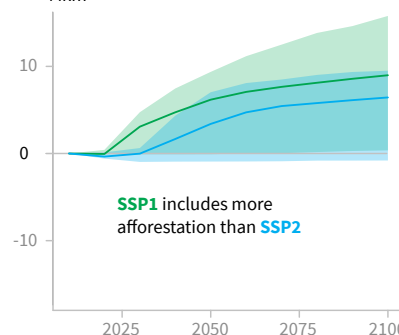
Change in Agriculture Land 1.5 °C
Mkm²



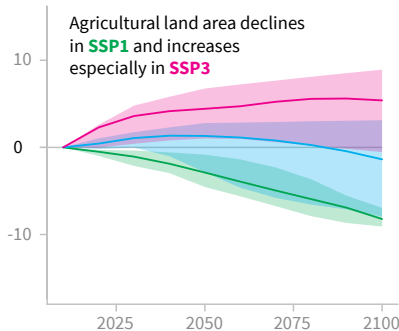
Change in Energy Cropland 1.5 °C
Mkm²



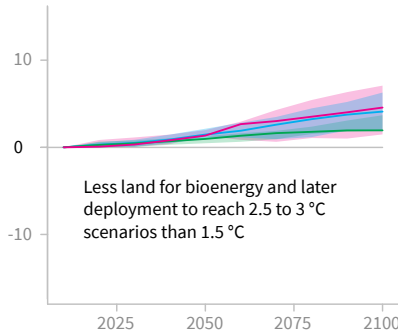
Change in Forest Cover 1.5 °C
Mkm²



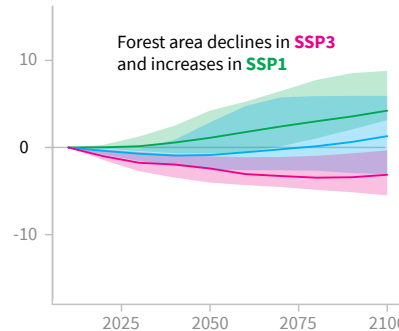
Change in Agriculture Land 2.5 to 3 °C
Mkm²



Change in Energy Cropland 2.5 to 3 °C
Mkm²



Change in Forest Cover 2.5 to 3 °C
Mkm²



Quantitative indicators for the Shared Socio Economic Pathways (SSPs)

		1.5 °C		2.5 to 3 °C		
		SSP1	SSP2	SSP1	SSP2	SSP3
Change in Non-Energy Cropland from 2010 (Mkm ²)	2050	-1.2 (-0.3, -4.6)	-1.2 (0.3, -2.0)	0.1 (1.5, -3.2)	1.2 (2.7, -0.9)	2.3 (3.0, 1.2)
	2100	-5.2 (-1.8, -7.6)	-2.9 (0.1, -4.0)	-2.3 (-1.6, -6.4)	0.7 (3.1, -2.6)	3.4 (4.5, 1.9)
Change in Pasture from 2010 (Mkm ²)	2050	-4.1 (-2.5, -5.6)	-4.8 (-0.4, -6.2)	-2.4 (-0.9, -3.3)	-0.1 (1.6, -2.5)	2.1 (3.8, -0.1)
	2100	-6.5 (-4.8, -12.2)	-7.6 (-1.3, -11.7)	-4.6 (-2.7, -7.3)	-2.8 (1.9, -5.3)	2.0 (4.4, -2.5)
Change in Energy Cropland from 2010 (Mkm ²)	2050	2.1 (5.0, 0.9)	4.5 (7.0, 2.1)	0.8 (1.3, 0.5)	1.5 (2.1, 0.1)	1.3 (2.0, 1.3)
	2100	4.3 (7.2, 1.5)	6.6 (11.0, 3.6)	1.9 (3.7, 1.4)	4.1 (6.3, 0.4)	4.6 (7.1, 1.5)
Change in Forest from 2010 (Mkm ²)	2050	3.4 (9.4, -0.1)	3.4 (7.0, -0.9)	0.6 (4.2, -0.7)	-0.9 (2.9, -2.5)	-2.4 (-1.0, -4.0)
	2100	7.5 (15.8, 0.4)	6.4 (9.5, -0.8)	3.9 (8.8, 0.2)	-0.5 (5.9, -3.1)	-3.1 (-0.3, -5.5)
Change in Other Natural Land from 2010 (Mkm ²)	2050	0.5 (1.0, -4.9)	-2.2 (0.6, -7.0)	0.5 (1.7, -1.0)	-2.2 (0.7, -2.2)	-3.4 (-2.0, -4.4)
	2100	0.0 (7.1, -7.3)	-2.3 (2.7, -9.6)	1.8 (6.0, -1.7)	-3.4 (1.5, -4.7)	-6.2 (-5.4, -6.8)
Carbon Price (US\$2010/t CO ₂)	2050	510 (4304, 151)	756 (1080, 280)	9 (35, 1)	38 (73, 14)	67 (75, 61)
	2100	2164 (35038, 263)	4354 (10150, 2993)	65 (287, 43)	172 (598, 112)	590 (727, 320)
Agriculture Price (Index 2010=1)	2050	1.2 (1.8, 0.8)	1.6 (2.0, 1.4)	0.9 (1.1, 0.7)	1.1 (1.2, 1.0)	1.2 (1.7, 1.1)
	2100	1.9 (7.0, 0.4)	6.5 (13.1, 1.8)	0.8 (1.2, 0.4)	1.1 (2.5, 0.9)	1.7 (3.4, 1.3)
Emissions CH ₄ AFOLU (% rel to 2010)	2050	-39.0 (-3.8, -68.9)	-11.7 (31.4, -59.4)	-2.9 (22.4, -23.9)	7.5 (43.0, -15.5)	15.0 (20.1, 3.1)
	2100	-60.5 (-41.7, -77.4)	-40.3 (33.1, -58.4)	-47.6 (-24.4, -54.1)	-13.0 (63.7, -45.0)	8.0 (37.6, -9.1)
Emissions N ₂ O AFOLU (% rel to 2010)	2050	-13.1 (-4.1, -26.3)	8.8 (38.4, -14.5)	0.1 (34.6, -14.5)	25.4 (37.4, 5.5)	34.0 (50.8, 29.3)
	2100	-42.0 (4.3, -49.4)	-1.7 (46.8, -37.8)	-25.6 (-3.4, -51.2)	19.5 (66.7, -21.4)	53.9 (65.8, 30.8)
Cumulative AFOLU CO ₂ Emissions until 2100 (GtCO ₂)		-127.3 (5.9, -683.0)	-126.8 (153.0, -400.7)	-54.9 (52.1, -545.2)	40.8 (277.0, -372.9)	188.8 (426.6, 77.9)