

Descriptor Results and Calibrated Statements

Greenhouse gas emissions and soil organic carbon

Note that greenhouse gas (GHG) emissions summarize methane (CH₄) and nitrous oxide (N₂O) emissions from crop and livestock production. Net GHG emissions include methane and nitrous oxide emissions minus the change in soil organic carbon (SOC), expressed in CO₂eq using GWP₁₀₀ values of 25 and 298 for CH₄ and N₂O, respectively. Emission intensities are calculated by dividing net GHG emissions by total production.

All percentage changes for GHG emissions (CH₄ and N₂O) are associated with a “high confidence” and “high robustness”. Changes in SOC are associated with “low confidence” and “low robustness” as the results rely upon the following assumptions, for which there is limited evidence:

- a) % yield change equates linearly to a change in total crop biomass (i.e. no change in harvest index)
- b) Change in total crop biomass equates linearly with carbon inputs to the soil
- c) All other management practices stay the same, e.g. biomass is not removed for animal feeding when in excess in future high yield scenarios

Percentage change of net GHG emissions are therefore given a “medium confidence” and “medium robustness” where soil carbon stocks are projected to decline, but “low confidence” and “low robustness” where soil carbon stocks are projected to increase with greatly increased future yields.

Table 1: Summary of calibrated statement result (mean percentage change over 18 climate models)

		% changes from baseline (2000)			
		Net GHG emissions	Emission intensity (GHG/unit product)	GHG emissions (CH ₄ +N ₂ O)	SOC stocks
Malawi	LT RCP2.6	15.49	16.75	-22.01	-5.32
	LT RCP8.5	74.07	102.51	-30.63	-14.85
	HT RCP2.6	-261.57	-119.65	110.76	52.81
	HT RCP8.5	-304.54	-125.12	111.14	58.95
South Africa	LT RCP2.6	56.77	-27.77	51.73	-0.85
	LT RCP8.5	128.45	-16.35	51.43	-13.08
	HT RCP2.6	60.17	-20.98	51.47	-1.48
	HT RCP8.5	149.58	5.13	47.37	-17.36
Tanzania	LT RCP2.6	-274.75	-206.14	44.55	52.99
	LT RCP8.5	-272.29	-223.13	48.54	53.24
	HT RCP2.6	-160.51	-107.99	175.02	55.68
	HT RCP8.5	77.77	-89.53	295.15	36.07
Zambia	LT RCP2.6	32.31	23.18	-17.86	-5.52
	LT RCP8.5	69.47	71.82	-26.29	-10.54
	HT RCP2.6	-975.68	-349.35	245.30	134.38
	HT RCP8.5	-877.88	-220.43	183.42	116.81

Malawi

Low climate risk / LT (ineffective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the LT scenario are -22% compared to the year 2000. At the same time soil organic carbon stocks changed by -5%.

Overall, net GHG emissions changed by +15% in total. Emission intensities (GHG/unit product) changed by +17%.

High climate risk / LT (ineffective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the LT scenario are -31% compared to the year 2000. At the same time soil organic carbon stocks changed by -15%.

Overall, net GHG emissions changed by +74% in total and emission intensities (GHG/unit product) changed by +103%.

Low climate risk / HT (effective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the HT scenario are nearly twice as high (+110%) than in 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks increase (+53%) due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -261% in total. Emission intensities (GHG/unit product) changed by -119%.

High climate risk / HT (effective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the HT scenario are nearly twice as high (+111%) than in 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks increase (+59%) due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -305% in total. Emission intensities (GHG/unit product) changed by -125%.

South Africa

Low climate risk / LT (ineffective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the LT scenario are +52% compared to the year 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks changed by -1%.

Overall, net GHG emissions changed by +57% in total. Emission intensities (GHG/unit product) changed by -28%.

High climate risk / LT (ineffective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the LT scenario are +51% compared to the year 2000 based on the increase in crop production. At the same time soil organic carbon stocks changed by -13%.

Overall, net GHG emissions changed by +128% in total. Emission intensities (GHG/unit product) changed by -16%.

Low climate risk / HT (effective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the HT scenario are +51% compared to the year 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks changed by -1%.

Overall, net GHG emissions changed by +60% in total. Emission intensities (GHG/unit product) changed by -21%.

High climate risk / HT (effective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the HT scenario are +47% compared to the year 2000 based on the increase in crop production. At the same time soil organic carbon stocks changed by -17%.

Overall, net GHG emissions changed by +150% in total. Emission intensities (GHG/unit product) changed by +5%.

Tanzania

Low climate risk / LT (ineffective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the LT scenario are +45% compared to the year 2000. At the same time soil organic carbon stocks changed by +53% due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -275% in total. Emission intensities (GHG/unit product) changed by -206%.

High climate risk / LT (ineffective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the LT scenario are +49% compared to the year 2000 based on the increase in livestock production. At the same

time soil organic carbon stocks changed by +53% due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -272% in total. Emission intensities (GHG/unit product) changed by -223%.

Low climate risk / HT (effective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the HT scenario are +175% compared to the year 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks changed by +56% due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -160% in total. Emission intensities (GHG/unit product) changed by -108%.

High climate risk / HT (effective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the HT scenario are +295% compared to the year 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks changed by +36% due to higher carbon returns to the soil.

Overall, net GHG emissions changed by +78% in total. Emission intensities (GHG/unit product) changed by -90%.

Zambia

Low climate risk / LT (ineffective agricultural policy) scenario:

National greenhouse gas (GHG) emissions under the LT scenario are -18% compared to the year 2000. At the same time soil organic carbon stocks changed by -6%.

Overall, net GHG emissions changed by +32% in total. Emission intensities (GHG/unit product) changed by +23%.

High climate risk / LT (ineffective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the LT scenario are -26% compared to the year 2000. At the same time soil organic carbon stocks changed by -11%.

Overall, net GHG emissions changed by +69% in total. Emission intensities (GHG/unit product) changed by +72%.

Low climate risk / HT (effective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the HT scenario are +245% compared to the year 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks changed by +134% due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -976% in total. Emission intensities (GHG/unit product) changed by -349%.

High climate risk / HT (effective agricultural policy scenario):

National greenhouse gas (GHG) emissions under the HT scenario are +183% compared to the year 2000 based on the increase in crop and livestock production. At the same time soil organic carbon stocks changed by +117% due to higher carbon returns to the soil.

Overall, net GHG emissions changed by -878% in total. Emission intensities (GHG/unit product) changed by -220%.