Land based mitigation within the SDG agenda

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Methodology

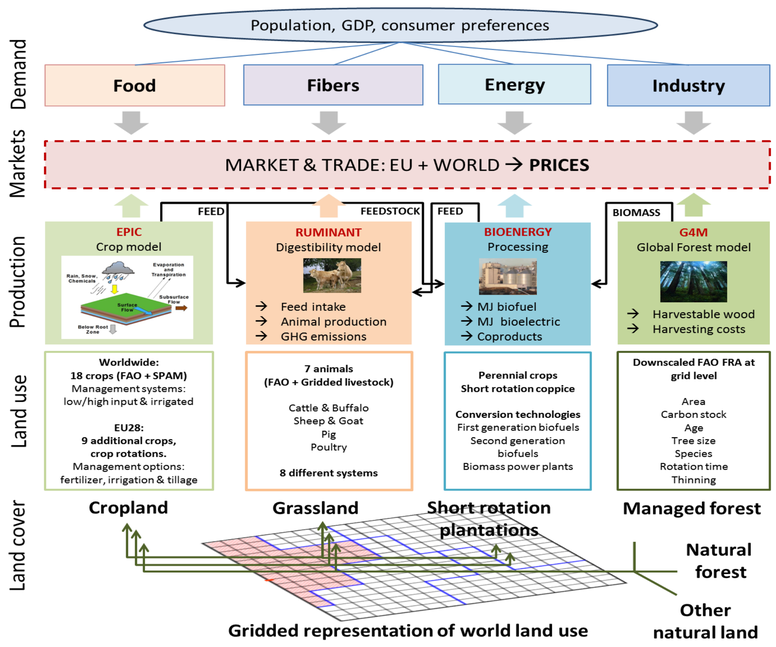
Research objective:

Here we assess the capacity of the land use sector to contribute to 1.5 °C climate stabilization target without deteriorating selected land-related SDGs. We apply a partial equilibrium land use model (GLOBIOM) linked with a detailed forest sector model (G4M) to provide an integrated assessment of land related SDGs, climate mitigation efforts, and environmental & socio-economic implications. We quantify a multi-dimensional scenario matrix (carbon prices x bioenergy prices x SDGs) that can be used by other models e.g. IAMs to develop SDG compliant climate stabilization pathways.

SDGs represented in the analysis by 2030:

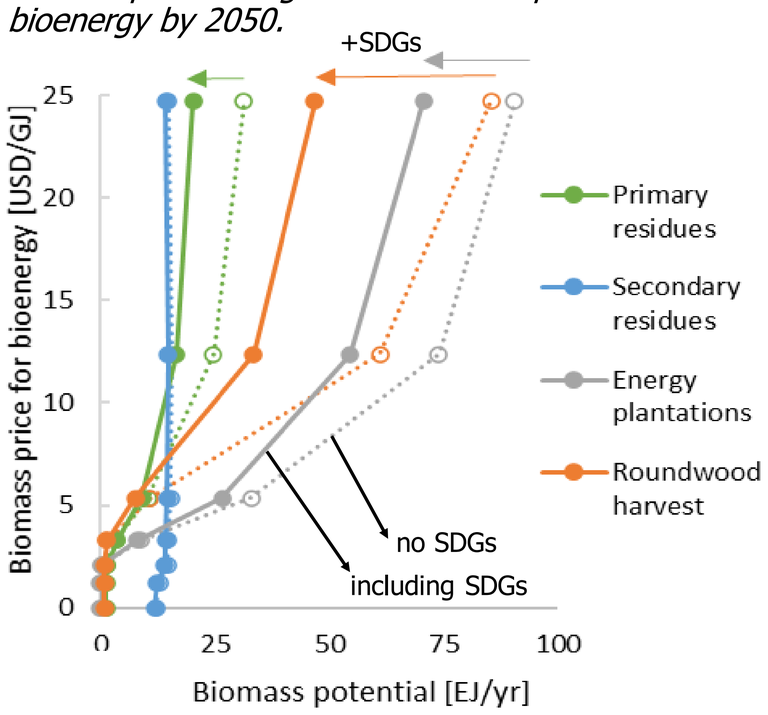
- SDG2 - Limiting undernourishment <1% by 2030
- SDG6 - Respecting environmental water flow requirements for irrigation water demands
- SDG12 - Reducing livestock calorie intake in overconsuming countries to healthy levels and halving food waste
- SDG13 – Land based mitigation efforts (bioenergy, emission abatement, sink enhancement) consistent with 1.5 °C target
- SDG15 - Increase the share of protected areas to 17% and avoid conversion of biodiversity hot-spots

GLOBIOM model



Biomass potentials

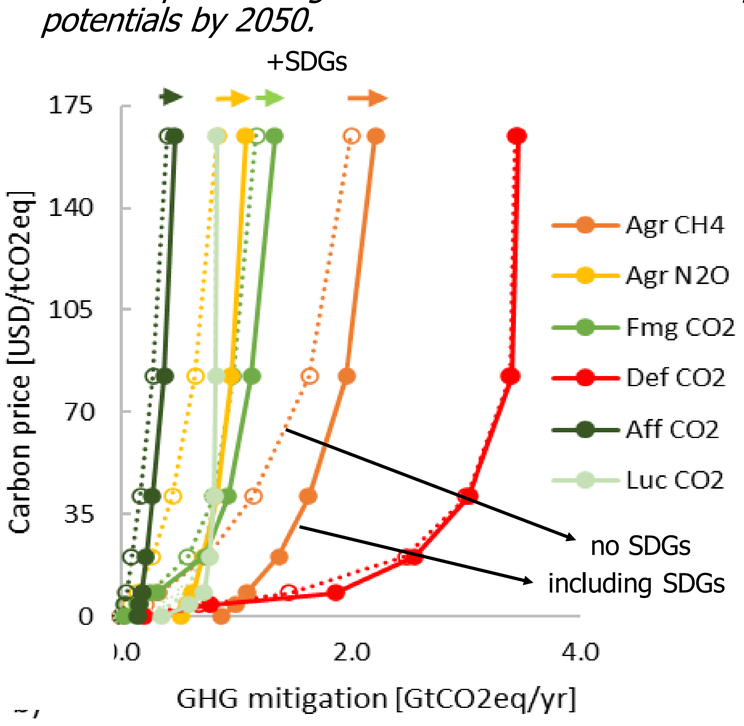
SDG impact on global biomass potentials for bioenergy by 2050.



- Existing 1.5 °C climate stabilization scenarios anticipate an up to fivefold increase in primary biomass demand for energy by 2050 in SSP2.
- However, considering land related SDGs reduces biomass potential for bioenergy at 25 USD/GJ by up to 30% from 240 EJ to only 170 EJ in 2050.
- In particular forest roundwood harvest and establishment of dedicated energy plantations is much more restricted due to protection of highly biodiverse areas when considering SDG15.

GHG mitigation potentials

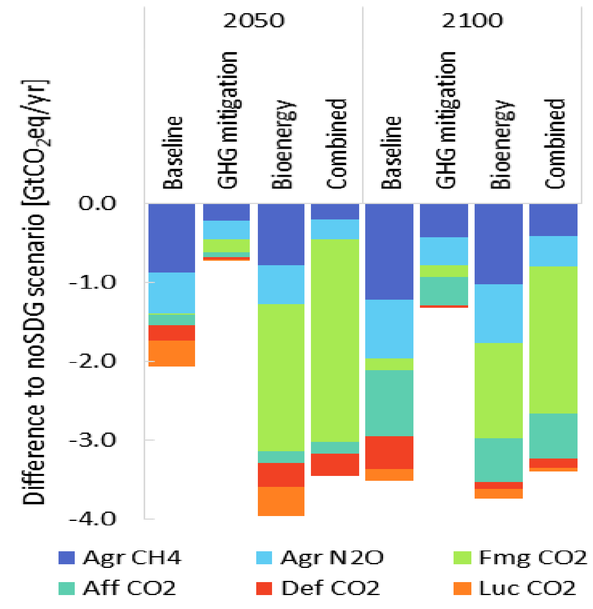
SDG impact on global land-based GHG mitigation potentials by 2050.



- Reducing CO_2 emissions, i.e. from deforestation, is the most important low-cost mitigation option providing 40% of the mitigation at carbon prices <50 USD/tCO_2eq.
- Mitigation of agricultural non-CO2 emissions becomes increasingly important when moving towards higher carbon prices.
- Mitigation potentials between SDG and noSDGs set-up tend to converge with increasing carbon prices because part of the agricultural mitigation potential when considering SDGs is already realized through the diet shift.

SDG vs. noSDG

Change in AFOLU emissions by GHG source between SDG and noSDGs scenarios applying a carbon price of 165 (400) USD/tCO2eq and a biomass price of 25 (60) USD/GJ in 2050 (2100).



- SDGs are found to have positive synergies for GHG abatement and allow to reduce GHGs from AFOLU even in the absence of any mitigation efforts by 2.1 $GtCO_2$eq/yr in 2050.
- Without additional mitigation SDGs yield already cumulative GHG savings of ~45 $GtCO_2$eq by 2050 which represents 25% of the expected mid-century AFOLU GHG abatement according to IAMs compatible with the 1.5 °C target.
- Combining mitigation action with the SDG agenda enhances GHG abatement potentials by up to 4 $GtCO_2$eq/yr in 2050 and delivers synergies for the preservation of the forest carbon sink.

Conclusions

- Land-related SDGs are found to reduce the biomass potentials for bioenergy by 30% which may curb BECCs deployment in the energy sector
- Considering land-related SDGs allows to realize more rapid and deeper emission reductions from AFOLU.
- When considering SDGs, a 1.5 °C compatible land-use emission pathway could already be realized at 50 USD/tCO2eq by 2050 as compared to around 165 USD/tCO_2eq in Rogelj et al. (2018).

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Open access dataset
github.com/iiasa/GLOBIOM-G4M_LookupTable

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