Technical appendix

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A9.1 Methods

Exclusion of indirect anthropogenic effects from inventory-aligned national proposals.

Separating the components of the land CO_2 sink that happen because of direct human activity (which is a prerequisite for CDR) and indirectly as a result of human-caused changes to environmental conditions is difficult, and not feasible through direct observations. This is the reason why this separation is typically not made by national greenhouse gas inventories, as they generally use direct measurements. Estimates of CO_2 fluxes from direct human activity are thus based on models or is derived from national inventories combined with modelling (see Chapter 7).

To exclude indirect anthropogenic effects from proposed levels of conventional CDR, the same conceptual approach as in Grassi et al. and the Global Carbon Budget has been followed.[1,2] First, national inventory-based estimates of removals for 2011–2020 were re-calculated by taking, for each country, the sum of carbon fluxes on forest land minus carbon fluxes from harvested wood products and subtracting the mean natural land sink estimated by dynamic global vegetation models (with all data in the period 2011–2020). The estimates for baseline national removals sum to a slightly different global total as compared with Chapter 7: -2.1 (-1.5 to -2.7) $GtCO_2$ per year in this chapter, instead of -1.9 (-1.2 to -2.3) $GtCO_2$ per year in Chapter 7. This is primarily due to the different time frames used (2011-2020 in this chapter versus 2013-2022 in Chapter 7).

From this baseline, we interpreted any proposed national increases in removals to be direct only. As an example, the European Union (EU) has a current forest land flux inventory of -394 $MtCO_2$ per year, excluding emissions from soils. This includes indirect removals, alongside -142 $MtCO_2$ per year of direct removals. The most ambitious scenario evaluated for the EU proposes -472 $MtCO_2$ per year in 2050, also presumably including indirect removals. The difference between the total current forest land flux and the 2050 land flux (-78 $MtCO_2$ per year) is assumed to refer solely to direct removals, however (i.e. mostly afforestation/reforestation efforts). This figure is therefore added to the current direct-only removals (-142 $MtCO_2$ per year) to get a final value of -220 $MtCO_2$ per year in 2050.

In cases where countries propose decreases to national removals, their current proportion of direct versus indirect removals was used to re-scale their targeted CDR levels. As an example, Canada has a current forest land flux inventory of -138 $MtCO_2$ per year. This includes indirect removals, alongside -47 $MtCO_2$ per year of direct removals. The current proportion of direct versus indirect removals for Canada is thus 0.34. The most ambitious scenario evaluated for Canada proposes -100 $MtCO_2$ per year in 2050, also presumably including indirect removals. This proposed level is multiplied by the direct:indirect ratio (0.34 * -100 $MtCO_2$ per year) to get a final value of -34 $MtCO_2$ per year in 2050.

Differences in methodology compared to Lamb et al. 2024

This chapter builds on results from a recent publication in Nature Climate Change (NCC).[3] While the underlying scenario and national reporting data are the same, two important changes were made compared with the NCC article to ensure consistency with this report: (1) The level of "current CDR" was adjusted to exclude the "other" category of soil carbon fluxes in national inventories, consistent with the approach detailed in Chapter 7 – Current levels of CDR and recognising the higher uncertainties in these fluxes; (2) Instead of applying a global ratio of direct:indirect removals to exclude the latter from national long-term strategies, the country-level mean from dynamic global vegetation models was used, as described in the section above. These two changes had the combined effect of slightly increasing projected amounts of removals in the long-term strategies (e.g. from -1.9 to -2.3 $GtCO_2$ per year, for the NCC article and this chapter, respectively, in the most ambitious case).

References

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