Supporting Information

Afforestation to mitigate climate change: impacts on food prices under consideration of albedo effects

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Model description

Figure S1 MAgPIE model regions AFR: Sub-Saharan Africa, CPA: Centrally planned Asia including China, EUR: Europe including Turkey, FSU: States of the former Soviet Union, LAM: Latin America, MEA: Middle East and North Africa, NAM: North America, PAO: Pacific OECD including Japan, Australia, New Zealand, PAS: Pacific Asia, SAS: South Asia including India.

Figure S2 Regional food demand in EJ and in kcal/cap/d. Identical for all scenarios. Per capita demand is driven by the assumed increase in wealth, demand in EJ by per capita demand and population.

Figure S3 Regional shares of livestock in total food consumption. Identical for all scenarios.
Figure S4 Share in trade pools. Two trade pools are considered in the model. Trade according to the first pool follows historic trade patterns, where regions have to fulfil historically observed self-sufficiencies in food provision. In the second trade pool trade is completely according to regional comparative advantages. The influence of historic trade patterns is reduced over time (Schmitz et al., 2012). The default trade liberalization was assumed for all scenarios besides the only tropical tradelib afforestation where we assumed faster trade liberalization.

Results

Figure S5 Regional food price index (coloured lines) and normalized GDP (MER) (black line). Both indexed to a value of 100 in 2010. Cut off at an index value of 1100 (in AFR and SAS); GDP index in 2100 then given in numbers.
Figure S6 Net trade in crops. Values > 0: Exports, Values < 0: Imports.

Figure S7 Net trade in livestock products. Values > 0: Exports, Values < 0: Imports.
Figure S8 Land use intensity (τ). Values represent the regional agricultural land-use intensity and show the assumed crop yield development through investments into yield-increasing R&D. They are indexed to a global average of 1 in 1995. Historical values are from Dietrich et al. (2012), where also a more detailed description of the approach can be found.

Figure S9 Carbon price sensitivity of the food price index. While we assumed a price on CO₂ emissions starting at 30 US$ per ton of CO₂ in 2020 and increasing by 5% per year, we here also show the food price response for scenarios of unrestricted afforestation with CO₂ prices starting at 10$ and 20$. 
Figure S10 Maps of afforested area in the unrestricted, no boreal, and only tropical afforestation scenarios. Depicted are the shares of grid cells that were newly afforested between 2010 and 2100.

References

Dietrich, J.P., Schmitz, C., Müller, C., Fader, M., Lotze-Campen, H., Popp, A., 2012. Measuring agricultural land-use intensity – A global analysis using a model-assisted approach. Ecol. Modell. 232, 109–118. doi:10.1016/j.ecolmodel.2012.03.002

Schmitz, C., Biewald, A., Lotze-Campen, H., Popp, A., Dietrich, J.P., Bodirsky, B., Krause, M., Weindl, I., 2012. Trading more food: Implications for land use, greenhouse gas emissions, and the food system. Glob. Environ. Chang. 22, 189–209. doi:10.1016/j.gloenvcha.2011.09.013