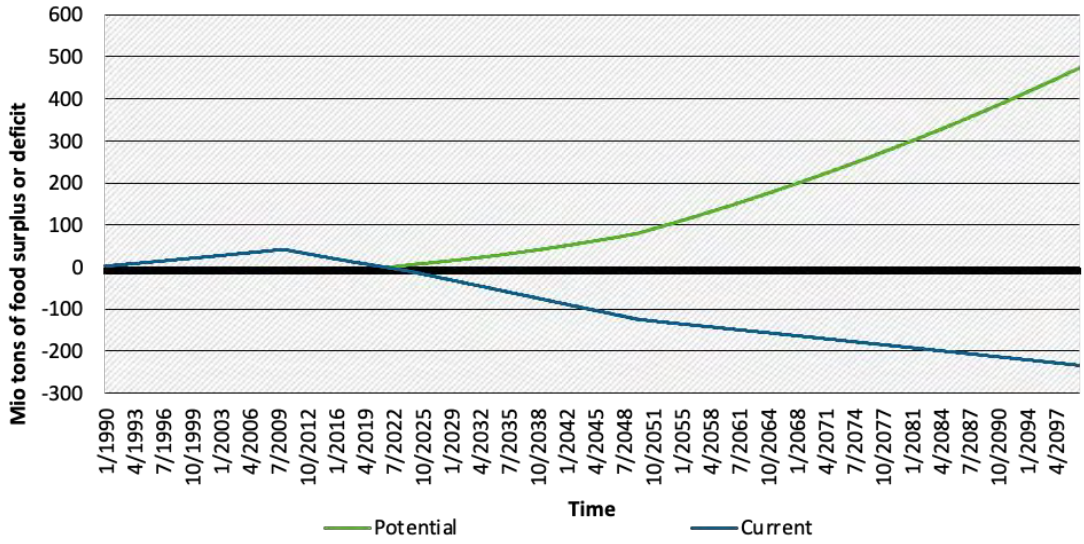
Fact sheet #5/6: The global potential of biotic resources to support decarbonisation of material use and the transition towards 100% renewables

This fact sheets explores the global potentials from biotic resources for substituting greenhouse gas intensive materials like steel and concrete as well as for energetic use after a cascade of material use.

To examine the potentials for biotic resources we have developed a global ICARE LULUCF model (land use, land use change, and forestry) based on FAO land use data[1] and OECD projections on the world population[2] (see Fact sheet #1/6). The model looks at global agriculture (conventional and organic), forestry, need for plant-based and animal-based food, food waste, and conversions of land, all of which can be changed in future scenarios. It then simulates the resulting changes on greenhouse gas (GHG) emissions (from land-use, material use and energetic use) and the potentials for substituting steel and concrete as well as its end-of-life energetic use.

Figure 1 shows the "Current" use of biomass theoretically continued into the future, which would lead to a major deficit in food availability. The "Potential" scenario shown in figure 1 assumes - in a constant development until the year 2100 - 50% less food waste, 50% less consumption of animal products (based on Germany's per capita consumption today) and the use of 50% of underutilised potential agricultural areas[3].

Fig. 1: Bandwidth of possible developments of global food availability



Source: Screenshot from the ICARE LULUCF Model

That potential development would allow for a conversion of agricultural land into forests and hence more cascading material use of wood with end-of-life energetic use, as it would allow for more organic farming. In addition, we assume that some areas remain unharnessed for ecological purposes.

Changes in diets towards less animal protein could not only reduce the need for areas for animal feed, allow for more extensive farming practices and more afforestation, but they could also lead to a preference for

[1] https://www.fao.org/faostat/en/#data

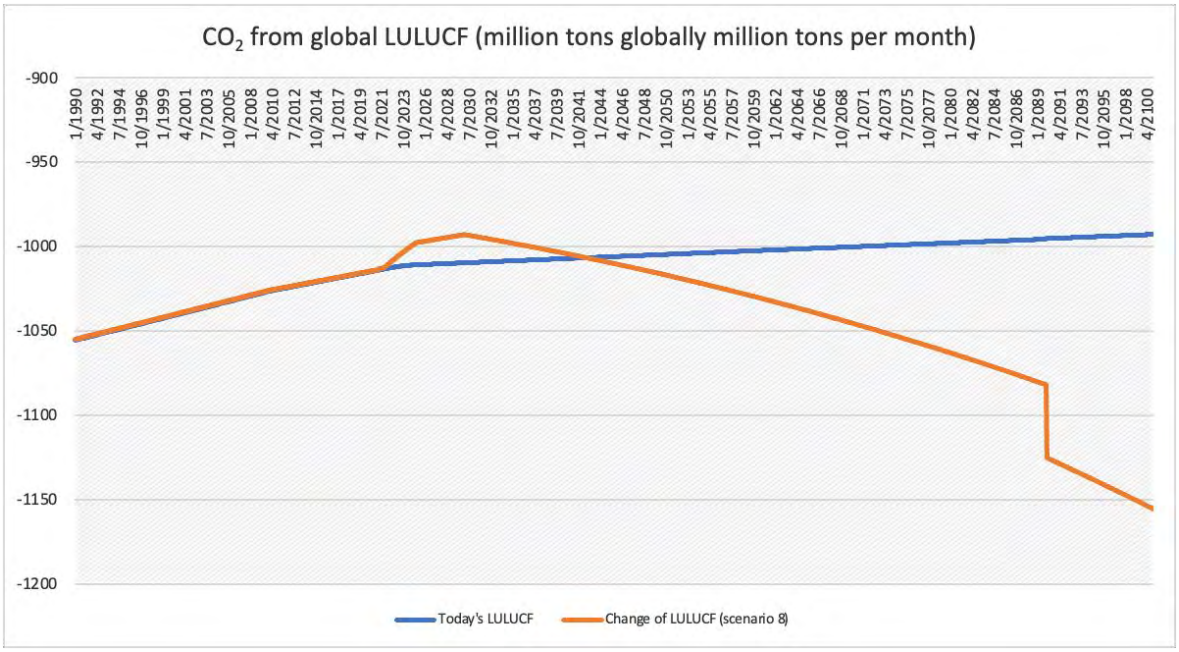
[2] http://www.fao.org/faostat/en/#data/OA

[3] Jering A, Klatt A, Seven J, Ehlers K, Günther J, Ostermeier A, Mönch L. Using global land area and biomass sustainably and resource efficient (in German). Umweltbundesamt, Dessau, 2013.

legumes (instead of wheat) that would allow for organic farming (with improved carbon storage) with yields comparable to conventional farming (which causes GHG emissions from mineral fertiliser use).[4]

The effects of the substitution of greenhouse gas intensive materials like steel and concrete and the additional energetic end of life use – though far in the future – is further examined with the ICARE Energy Model with a scenario 8 (see fact sheet #1/6). The ICARE Energy Model looks at the global energy demand and the global transition towards renewable energy. Substituting steel and concrete reduces the energy demand and the end-of-life energetic use increases the potential for energy from biomass. The overall effect could be around 10% less need for capacities of wind power and photovoltaics (see fact sheet #2, figure 2, the comparison of the base scenario 2 with the 'biotic' scenario 8). Figure 2 also shows the implications on GHG emissions from the LULUCF sector with more carbon capturing from forests and less emissions from livestock farming and conventional farmland as assumed in scenario 8.

Fig. 2: Effects on the need for renewables from increased use of biotic resources



Source: Data from the ICARE LULUCF Model

At the beginning of the change there is a decrease of the sink function because of the early start of energetic use of biomass that later continues to follow only at the end of a cascading material use.

Overall, these simulations yield a promising path: Changing land use and diets, decreasing food waste generation, and increasing the material use of biotic resources (not for direct energetic use). However, without such ambitious change there is hardly any potential for using biotic resources for other purpose than a planetary health diet for growing world population in the future.

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[4] https://cordis.europa.eu/article/id/430692-agroecology-transitioning-toward-sustainable-climate-and-ecosystem-friendly-farming-and-food