German Environment Agency

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Funding climate-friendly soil management– key issues

Land use competition[1]

1 Background

Definition: Land use competition refers to competing claims for using land - a finite resource - for different purposes by different actors.

Importance: Enhancing the carbon stored in soils can conflict with other forms of using the land, such as expanding settlements, infrastructure, the production of renewable energy or the use of land for biomass cultivation or food production. This competition arises as land is a limited resource and demand for land is increasing with a growing world population (Niewöhner et al. 2016; IPCC 2014). Land use competition might entail negative effects from the shift of competing land uses to other areas, as well as potentially causing leakage[2].

Relevance: The problem of land use competition is relevant for all types of soil carbon mitigation including mitigation projects that aim to reduce or avoid emissions as well as activities that aim to sequester additional carbon. Conflicting land use claims need to be taken into account and addressed for all types of funding approaches for climate-friendly soil management as it might lead to leakage effects and thus reverse the positive climate impact of a specific soil carbon-related mitigation activity. For offsetting approaches[3], the risk is particularly high as unaddressed negative effects on the other land (i.e. leakage) would undermine the environmental integrity of such mechanisms.

2 Key issues

Land competition is unavoidable, as land is a finite resource. Land competition in itself is not a positive or negative issue, but the land use changes that can result from a new policy may have positive (e.g. more climate-friendly farming) or negative impacts (e.g. monoculture forests that reduce biodiversity), as well as equity implications, and therefore need to be taken into consideration. Mechanisms that increase the economic value of climate-friendly soil management do not create land competition, they simply shift the incentives for land management, with climate-friendly management becoming more attractive. This will benefit some (e.g. those who can implement climate-friendly practices) but disadvantage others (e.g. those who cannot).

Land use conflicting with climate-friendly soil management activities: Measures to enhance climate-friendly soil management and increase carbon stocks in soils can compete with several other claims to the land (see for example IPCC 2014; Smith et al. 2010):

- Using the land for forage or energy crops which are usually cultivated in monocultures;

[1] This factsheet was also published as part of the UBA report “Funding climate-friendly soil management”, available at http://www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management.

[2] See factsheet on leakage available at http://www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management.

[3] Under offsetting approaches, the buyer is using the certificates for mitigation outcomes as a substitute for within value chain abatement or mitigation activities in their own sphere and counts it towards their own (voluntary) climate target.

- Reforestation or afforestation of land to enhance aboveground biomass, restore cleared forest land, increase biodiversity or to use the land for timber production;
- Using the land for more intensive forms of agriculture that store less carbon but might lead to higher yields in the short run, which play a particularly important role if food security is an issue;
- Continued use of drained organic soils for agricultural purposes instead of rewetting;
- Expansion of settlements or infrastructure to land that has not been sealed previously.

Factors impacting the prevalence of land use competition: An important factor impacting the extent of competition for land are diets and food supply chains. This is because more than half of the entire biomass used by humans globally is used as fodder for livestock (Haberl 2015). The demand for biomass more generally is a driver of land use competition; increased demand for bio-based products generally increases land demand (IPCC 2014).

Negative effects of land use competition: The competition for land can entail pressures on biodiversity, rising food prices and increasing GHG emissions. Competition between affluent countries with poorer people in the global South is likely to result in adverse social and development outcomes (Haberl 2015). Land competition can even cause violent conflicts or wars: population growth, overlapping land rights, ethnic fragmentation, economic inequality and corruption are factors than can contribute to the violent escalation of conflicting claims to land (de Jong et al. 2021).

Climate impact of land use competition: Firstly, competing claims to land can have negative climate impacts if the more unsustainable land use, which is often linked to vested and powerful economic interests, prevails. These land uses can entail soil erosion and soil degradation (Haberl 2015). Secondly, competing claims to land may not disappear even if conflicting claims have been reconciled at a certain point in time. This may lead to future reversals of achieved mitigation that cause damage to the climate and can undermine the effectiveness of funding mechanisms as well as the environmental integrity of offsetting mechanisms.[4] This situation is aggravated in the context of weak governance systems or corruption, socio-economic inequality and existing social conflicts. Thirdly, land use competition can lead to leakage effects if environmentally harmful activities are displaced to other locations.[5] This also implies a risk to the effectiveness of funding mechanisms including the environmental integrity of offsetting mechanisms. Overall, land use competition can therefore limit the mitigation potential of sustainable land use activities including soil carbon sequestration. Land use competition also implies that mitigation potentials provided for specific mitigation measures are likely to be overestimated as they may compete for land (e.g. potentials for reduced deforestation and soil carbon sequestration in croplands or biochar application) (IPCC 2019; Reise et al. 2022).

3 Examples

Several patterns of land use competition can be identified at a global level. Firstly, **deforestation** in the Amazon region or in Indonesia for the purpose of expanding agricultural activities, particularly for **cultivating forage crops or palm oil plantations**, or extracting resources such as oil or timber have been clashing with indigenous living spaces and efforts to preserve the forest for mitigation, biodiversity and other environmental purposes. Secondly, **agricultural development on communal lands** has often led to land use conflicts, e.g. in rural parts of

[4] See also factsheet on non-permanence, available at http://www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management.

[5] See factsheet on leakage available at http://www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management.

Africa. In such cases, communal areas used for pastoralism and/or informal extensive agriculture have been claimed by local actors for sedentary agriculture or by external actors for large-scale agricultural practices. Thirdly, **urban expansion** can conflict with other land uses, including the use of land in a way that enhances its sink function (de Jong 2021).

The production of **biochar** is an example of a specific measure to increase SOC stocks that can lead to competition for land. Biochar can potentially have positive effects on nutrient availability and thus increase crop yields as well as sequester carbon. However, the application of biochar may have negative effects on biodiversity and knowledge gaps exist regarding further effects on soils as well as applications at larger scale (Budai et al. 2016; Fuss et al. 2018; Smith 2016; Tammeorg et al. 2016; Vijay et al. 2021).[6] Additionally, to produce biochar, biomass such as wood, organic waste or natural feedstocks are needed. Their production can compete with other land uses. Also, if such biomass is removed from cropland areas for the production of biochar, biomass inputs to soils will decrease on these lands. This is an example of leakage: the availability of excess feedstock biomass is limited and therefore, mitigation potentials for biochar are often overestimated (Reise et al. 2022).[7]

4 Relevance for the EU

At the EU level, **land take**[8] is a major threat to enhancing the sink function of soils. According to the European Environment Agency (EEA) (2019), the main drivers of land take in Europe during the period 2000-2018 were the increasing demand for housing, services and recreation, industrial and commercial sites, transport networks and infrastructure, mines quarries and waste dumpsites and construction sites. In total in this period 14,049 km^2 land was lost to land take, with 78% of the land take affecting agricultural areas, i.e. arable lands and pastures, and mosaic farmlands (EEA 2019). According to the EEA, "conflicting demands on land impact significantly on the land's potential to supply key services" (EEA 2015). The 7th EU Environmental Action Programme as well as the EU Roadmap to a Resource Efficient Europe set the target to achieve 'No Net Land Take' in the EU in 2050 to mitigate the effect of urban sprawl. Land use competition in the EU can also have negative socio-economic impacts, such as rising land or tenure prices.

Voluntary certification mechanisms operating in Europe: To manage land competition risks, some voluntary certification mechanisms operating in the EU (e.g. Label Bas Carbone) require that participating farmland remains in productive use (i.e. cannot be retired or changed into another land use type).

5 Addressing challenges

Comprehensive policy frameworks are necessary in order to address the negative effects related to mitigation resulting from land use competition. To manage land sustainably, environmental considerations need to be integrated into territorial planning decisions on land use (EEA 2015; OECD 2019). Policies should regulate sectoral emissions for the whole land use sector in order to prevent the expansion or displacement of agricultural production (FAO 2013).

Competition for land can be mitigated by consuming less animal products and reducing food losses (Smith et al. 2013; Stehfest et al. 2013; IPCC 2019). Also, reducing the demand for AFOLU products more generally can help to decrease the demand for land, e.g. by increasing the use of residue and recycling of biogenic materials, although this might result in trade-offs such as soil erosion (IPCC 2014). Agricultural intensification has also been proposed as an approach

[6] See factsheet on biochar, available at www.umweltbundesamt.de/publikationen/Role-of-soils-in-climate-change-mitigation.

[7] Additionally, the precise interactions of biochar with soils are uncertain and experiences with large-scale production and use of biochar is still missing so that long-term potentials are highly unsecure (Reise et al. 2022).

[8] See factsheet on land take www.umweltbundesamt.de/publikationen/Role-of-soils-in-climate-change-mitigation.

to mitigate land use competition (IPCC 2019), but is likely to imply other ecological, social and economic costs as well as rebound effects, though these can be mitigated to some extent if intensification is done in a sustainable way (IPCC 2014).

6 Relevant literature

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