Umwelt Bundesamt

German Environment Agency

30. June 2022

Funding climate-friendly soil management – key issues

Addressing non-permanence

1 Background

Definition: Non-permanence refers to a situation where the emission reductions or removals generated by a mitigation activity are reversed at a later point in time relative to the baseline scenario. A reversal can occur due to natural processes such as natural disturbances, or human-induced factors including mismanagement of the project or changes in local conditions that make it no longer attractive to keep carbon stored (Böttcher et al. 2022b).

Importance: Addressing non-permanence is crucial for the environmental integrity of transfer-based mechanisms[1] as net global emissions will ultimately increase if credits are used to compensate for emissions but the corresponding mitigation is reversed at a later point in time (Schneider and La Hoz Theuer 2019). For other results-based financing, a reversal of mitigation results does not present a risk to environmental integrity, but it would undermine efforts to meeting long-term climate objectives as well as the effectiveness of the climate finance used.

Relevance: Non-permanence is a relevant risk for mitigation activities that enhance or preserve carbon reservoirs. It is a crucial issue to address for mitigation activities in the land use sector including soil management activities, in particular where carbon stored in soils can be released very quickly.

2 Key issues

Environmental integrity: If credits are used to offset emissions in other sectors or areas but the underlying mitigation results are reversed at a later point in time, the total amount of GHG emissions in the atmosphere will be higher than if no transfer of the ownership rights of the mitigation had taken place under a transfer-based mechanism. In this case, the mechanism will effectively have over-issued credits (Schneider and La Hoz Theuer 2019).

Factors influencing the risk of non-permanence:

- The risk of non-permanence is impacted by the **extent to which carbon reservoirs are susceptible to natural or human-caused processes that reduce these reservoirs**. Carbon stored in soils (as one sort of biospheric reservoirs) can be depleted by natural disturbances like fire or drought (Anderegg et al. 2020; Deng et al. 2017). Demand for wood or for land are human drivers that can deplete biospheric reservoirs as well as fossil fuel reserves.[2] Additionally, short-term land tenure can pose practical challenges for maintaining climate-friendly soil management over long time periods (OECD 2017).
- The **size and scale of carbon reservoirs** impacts the risk of reversals. For small-scale

[1] Transfer-based mechanism: A results-based payment (i.e. where payment depends on mitigation result achieved), where the ownership rights of the mitigation are transferred from the seller to the buyer.

[2] This risk is much lower for carbon stored in fossil fuel reservoirs and for CO_2 stored in geological reservoirs.

projects (e.g. rewetting of peatland), a natural disturbance such as a drought or wildfire could reverse the achieved sequestration entirely. At a jurisdictional scale[3], such a disturbance is more likely to only reduce net mitigation temporarily. Also, human activities such as the intentional change of management practices as well as changes in land use can lead to quickly depleting small-scale natural carbon reservoirs.

- It also matters **whether and how human-caused drivers of reducing carbon reservoirs are addressed**. If carbon reservoirs are preserved without addressing drivers like human demand for land, wood or fuel, there is a high risk that mitigation results will be reversed later. While activities that reduce fossil fuel demand, e.g. through enhancing energy efficiency, increase fossil fuel carbon stocks compared to a baseline scenario over time, carbon in biospheric reservoirs such as forests can be reduced by multiple drivers such as demand for woody biomass, land or timber (as well as natural disturbances). By reducing demand for land, carbon reservoirs are indirectly preserved (e.g. by increasing agricultural productivity). All of these drivers need to be addressed in order to reduce the risk of reversals effectively and to prevent leakage to other geographical areas[4].
- Most types of soil management activities[5] pose significant reversal risks, including activities that aim to reduce or avoid emissions (e.g. mixed crop-livestock systems, prevention of land take, rewetting of organic soils, nitrification inhibitors) as well as activities that aim to sequester additional carbon (conversion from arable land to grassland, agroforestry, improved crop rotation, use of cover crops, organic farming, low-input grassland). Some activities that avoid or reduce emissions such as the use of nitrification inhibitors, precision farming or reduced emissions from rice cultivation do not imply reversal risks as they do not involve sequestration or storage of carbon that can be later released.

Time horizon for addressing non-permanence: Ideally, **emission reductions or removals should be preserved indefinitely** as the expected global warming depends on the level of cumulative carbon emissions, regardless of the timing of these emissions (Mackey et al. 2013; Ciais et al. 2013). In practice, however, it is not possible to eliminate reversal risks in perpetuity. A **time horizon of 100 years to monitor and compensate for reversals** can be considered a reasonable standard for evaluating approaches to address non-permanence by transfer-based mechanisms (Böttcher et al. 2022b). From a private investment perspective, this time span resembles nearly an indefinite commitment. Shorter time horizons will under-value the costs of mitigation reversal because the future costs of preserving carbon stocks would not be accounted for when making investment decisions (Schneider et al. 2022; Böttcher et al. 2022b).

Maintaining climate-friendly soil management: For the preservation of carbon stocks, soil carbon mitigation activities that reduce the pressure on soils, forests, peatland or other land need to be **permanently sustained**. If, e.g., changes to agricultural practices shift back to more unsustainable habits, carbon stored in soils can be released quickly or indirect pressures

[3] Jurisdictional approaches refer to land-use activities implemented at the scale of a jurisdiction. The jurisdiction may be at the national level, including an entire country, or at a subnational administrative level. See factsheet on jurisdictional vs. project-based approaches, http://www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management.

[4] The displacement of products or services to other geographical areas as a result of a mitigation activity is referred to as "carbon leakage" (see also factsheet on leakage, available at http://www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management). In contrast to leakage, reversals can occur within the geographical boundaries of a mitigation activity, can happen immediately or at a later point in time and are not necessarily caused by the mitigation activity but can be the result of unrelated drivers or natural disturbances.

[5] www.umweltbundesamt.de/publikationen/Role-of-soils-in-climate-change-mitigation.

through demand for more land for agricultural purposes could increase again (Böttcher et al. 2022b). If soils are or become carbon-saturated (i.e. soils reach an equilibrium where they are no longer able to store additional carbon), maintaining existing carbon needs to be the priority.

Long-term role of carbon credits: To mitigate the climate crisis, it is of utmost importance to reduce GHG emissions rapidly and permanently (Seddon et al. 2021). Carbon dioxide removal through enhancing natural and technical sinks will be required to meet the goals of the Paris Agreement. It is therefore crucial that **measures to enhance carbon sequestration are integrated into long-term mitigation strategies**. However, relying on offsetting to achieve mitigation targets risks to divert attention from the fact that considerable ambition raising is necessary in order to reach climate neutrality. The risk of non-permanence of land sector mitigation – along with other integrity challenges - suggests that offsetting with land-based mitigation **should play only a limited role in reaching long-term mitigation targets**, unless these risks are appropriately managed (Jeffery et al. 2018).

3 Examples

Crop rotation means cultivating different crops in a temporal sequence on the same land, compared to monocultures continuously growing the same crop. Integrating legumes (e.g. alfalfa) and fallow periods as well as grass ley can increase the carbon stocks in soils. Particularly in organic farming, extended and complex crop rotations with high diversification of crops play a crucial role to keep soils fertile and plants healthy. However, the sequestration gained through crop rotation can be reversed quickly by tilling/ploughing the soils due to fast mineralisation processes of organic compounds. If the agricultural management practices change, mitigation through crop rotation might therefore be only temporary.[6]

Agroforestry with cropland or silvoarable agroforestry is a system where woody perennials such as trees or hedges and agricultural, usually annual crops are grown on the same cropland in a specific spatial and/or temporal fashion. Besides aboveground carbon storage by trees, agroforestry can also increase belowground carbon stocks. However, the carbon sequestered can be reversed due to various natural or human-caused processes including harvesting of trees, cutting trees or fires.[7]

4 Relevance for the EU

LULUCF Regulation (EU/2018/841) revisions: The EU Commission's proposed revisions to the LULUCF regulation[8] includes a proposal with implications regarding non-permanence:

- **Combining the agriculture and LULUCF sectors into a single land sector:** Full flexibility between the two sectors implies full fungibility between fossil and non-permanent and relatively uncertain biogenic emissions through carbon markets. It will be essential to differentiate between units of carbon from land use and those from fossil fuels in a regulatory framework that accounts for the risk of non-permanence (Böttcher et al. 2022a).[9]
- **For other sectors, it remains unclear whether there will still be flexibilities with the combined land sector.** The Commission proposal envisages a "robust carbon removal

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

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

[8] COM (2021) 554 final, https://ec.europa.eu/info/sites/default/files/revision-regulation-ghg-land-use-forestry_with-annex_en.pdf

[9] The legislative proposal to set rules for carbon markets is scheduled for end of 2022.

certification system" with sectors other than agriculture that "have exhausted their emission reduction possibilities" or achieved more than 90% emission reductions that could participate in a carbon market mechanism (Böttcher et al. 2022a). For such a mechanism, it will be essential to set robust rules for addressing the risk of non-permanence.

Common Agricultural Policy (CAP): In the CAP, standards on good agricultural and environmental conditions of land (GAEC) are defined that farmers need to respect. These standards i.a. relate to maintaining soil organic matter and soil structure as well as maintaining permanent grassland.[10] Maintaining SOC stocks is thus an integral component of an environmentally-friendly agricultural practice. However, there is no focus on achieving and maintaining mitigation results, and changes to SOC stocks are not measured under the CAP. In the revised CAP (2023-2027), farmers are rewarded for implementing eco-scheme measures, including a number of soil management activities.[11] Yet, these payments are provided on an annual basis without providing incentives for ensuring long-term climate-friendly management practices. Risks of non-permanence are thus not addressed under the CAP.

Voluntary certification mechanisms operating in Europe and supporting climate-friendly soil management have different approaches in place for addressing non-permanence (Böttcher et al. 2022b; McDonald et al. 2021).

5 Addressing challenges

To address the risk of non-permanence, the following approaches are used by different mechanisms already in place (see Schneider et al. 2022; McDonald et al. 2021):

- **Reducing non-permanence risks** by conducting non-permanence risk assessments and either excluding mitigation activities with higher risks from eligibility or requiring measures to mitigate the risks;
- **Compensating for reversals** by monitoring carbon stocks over long time periods and provisions for cancelling other credits in case a reversal occurs or by **issuing temporary carbon credits** that expire after a certain time period and need to be replaced by other credits in any case;
- **Limiting credit issuance** by issuing only a discounted number of credits to account for possible future reversals or tonne-year accounting which issues only fractional amounts of credits for each year that carbon remains stored;
- **Participant liability** by making projects/participants liable for any removals within the duration of the project or beyond;
- **Contractual or legal approaches** by relying on contracts, legal restrictions or land use or other existing legislation that minimises the risk for reversals.

For soil management activities, the reversal risks are particularly high so these activities should be excluded from offsetting emissions elsewhere and be supported by other types of financing mechanisms.

[10] See https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/income-support/cross-compliance_en#gaec.

[11] See https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/new-cap-2023-27_en.

6 Relevant literature

Anderegg, W. R. L.; Trugman, A.T.; Badgley, G.; Anderson, C:M.; Bartuska; A.; Ciais, P.; Cullenward, D.; Field, C.B.; Freeman, J.; Goetz, S.J.; Hicke, J.A.; Huntzinger, D.; Jackson, R.B.; Nickerson, J.; Pacala, S.; Randerson, J.T. (2020): Climate-driven risks to the climate mitigation potential of forests. Science 368(6497), DOI: 10.1126/science.aaz7005.

Böttcher, H.; Gores, S.; Hennenberg, K.; Reise, J.; Graf, A. (2022a): Analysis of the European Commission proposal for revising the EU LULUCF Regulation. Available at https://www.oeko.de/publikationen/p-details/analysis-of-the-european-commission-proposal-for-revising-the-eu-lulucf-regulation.

Böttcher, H.; Schneider, L.; Urrutia, C.; Siemons, A.; Fallasch, F. (2022b): Land use as a sector for market mechanisms under Article 6 of the Paris Agreement. UBA Climate Change 49/2022, Dessau-Roßlau, available at https://www.umweltbundesamt.de/publikationen/land-use-as-a-sector-for-market-mechanisms-under.

Ciais, P.; Sabine, C.; Bala, G.: Bopp, L.; Brovkin, V.; Canadell, J.; Chhabra, A.; DeFries, R.; Galloway, J.; Heimann, M.; Jones, C.; Le Quéré, C.; Myneni, R.B.; Piao, S.; Thornt, P. (2013): Carbon and Other Biogeochemical Cycles. In Working Group I contribution to the IPCC fifth Assessment Report Climate Change 2013: The physical science basis. Technical Summary.

Deng, H., Bielicki, J. M., Oppenheimer, M., Fitts, J. P. & Peters, C. A. (2017): Leakage risks of geologic CO2 storage and the impacts on the global energy system and climate change mitigation. Climatic Change 144: 151–163, DOI: 10.1007/s10584-017-2035-8.

Jeffery, L.; Höhne, N.; Moisio, M.; Day, T.; Lawless, B. (2018): Options for supporting Carbon Dioxide Removal. Discussion Paper, NewClimate Institute. Available at https://newclimate.org/wp-content/uploads/2020/07/Options-for-supporting-Carbon-Dioxide-Removal_July_2020.pdf.

Mackey, B.; Prentice, I.C.; Steffen, W.; House, J.I.; Lindenmayer, D.; Keith, H.; Berry, S. (2013): Untangling the confusion around land carbon science and climate change mitigation policy. Nature Climate Change 3: 552-557; DOI: 10.1038/nclimate1804.

McDonald, H., Bey, N., Duin, L., Frelih-Larsen, A., Maya-Drysdale, L., Stewart, R., Pätz, C., Hornsleth, M., Heller, C., and Zakkour, P. (2021): Certification of Carbon Removals: Part 2. A review of carbon removal certification mechanisms and methodologies. Prepared for European Commission DG CLIMA under contract no.40201/2020/836974/SER/CLIMA.C.2 Environment Agency Austria, Wien, Reports, Band 0796. ISBN: 978-3-99004-620-3, available at https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0796.pdf.

OECD (2017): Overcoming barriers to the adoption of climate-friendly practices in agriculture. Available at https://www.oecd-ilibrary.org/agriculture-and-food/overcoming-barriers-to-the-adoption-of-climate-friendly-practices-in-agriculture_97767de8-en.

Schneider, L.; La Hoz Theuer, S. (2019): Environmental integrity of international carbon market mechanisms under the Paris Agreement. Climate Policy 19, 386–400; DOI: 10.1080/14693062.2018.1521332.

Schneider, L.; Fallasch, F.; De León, F.; Rambharos, M.; Wissner, N.; Colbert-Sangree, T.; Progscha, S. (2022): Methodology for assessing the quality of carbon credits. Carbon Credit Quality Initiative, available at https://carboncreditquality.org/download/MethodologyForAssessingTheQualityOfCarbonCredits-v2.0.pdf.

Seddon, N.; Chausson, A.; Berry, P.; Girardin, C. A. J.; Smith, A.; Turner, B. (2020): Understanding the value and limits of nature-based solutions to climate change and other global challenges. In: Philosophical transactions of the Royal Society of London. Series B, Biological sciences 375 (1794). DOI: 10.1098/rstb.2019.0120.

Imprint

Publisher

Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
buergerservice@uba.de
Internet: www.umweltbundesamt.de
/umweltbundesamt.de
/umweltbundesamt

Authors, Institutions

Anne Siemons, Dr. Lambert Schneider,
Öko-Institut
Hugh McDonald, Ecologic Institute

Completion: June 2022