Avoiding emissions versus creating sinks—Effectiveness and attractiveness to climate finance

Citation for published version:
Williams, M, Reay, D & Smith, P 2023, 'Avoiding emissions versus creating sinks—Effectiveness and attractiveness to climate finance', *Global Change Biology*, vol. 29, no. 8, pp. 2046-2049. https://doi.org/10.1111/gcb.16598

Digital Object Identifier (DOI):
10.1111/gcb.16598

Published In:
Global Change Biology

Received: 16 December 2022 | Accepted: 8 January 2023

DOI: 10.1111/gcb.16598

Global Change Biology WILEY

PERSPECTIVE

Avoiding emissions versus creating sinks—Effectiveness and attractiveness to climate finance

Mathew Williams[1] | Dave Reay[1] | Pete Smith[2]

[1]School of Geosciences, University of Edinburgh, Edinburgh, UK

[2]Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen, UK

Correspondence
Pete Smith, Institute of Biological and Environmental Sciences, University of Aberdeen, 23 St Machar Drive, Aberdeen, AB24 3UU, UK.
Email: pete.smith@abdn.ac.uk

Keywords: avoided emissions, carbon sinks, climate change mitigation, nature based solutions, natural climate solutions

1 | THE NEED FOR NATURAL CLIMATE SOLUTIONS

The Paris Agreement to limit global climate disruption relies on increasingly ambitious climate actions carried out by countries to reduce their greenhouse gas emissions. Such actions explicitly include land stewardship to reduce C emissions and enhance C sequestration in forest, wetland, and natural grassland biomes. These actions, termed natural climate solutions (NCS), include restoring natural ecosystems to (i) reduce the emissions associated with their degradation (e.g., peatland restoration) or (ii) generate new forest sinks through tree planting. The scale of NCS deployment to meet the Paris Agreement is vast and so requires significant private investment. There is a practical potential for NCS projects to deliver savings of ~7 Gt CO_2 per year, requiring annual investment of US\$70–280 billion (WEF, 2021). Reaching this potential requires overcoming a series of technical and conceptual hurdles, particularly on standards and certification of carbon credits and building investor confidence. In the United Kingdom, two standards have been created to support restoration-based NCS, one for woodland creation and the other for peatland restoration. Globally, these two NCS approaches have equal potential to deliver for climate. In the UK by 2022, investments into projects under the woodland code had led to 20 Mt CO_2e of projected sequestration, but only 3 Mt CO_2e of projected emissions reduction under the peatland code. The imbalance of investments into these two alternative NCS raises questions as to why the market favors tree planting over peatland restoration. Here, we explore why this imbalance might have arisen and how it might be resolved. Does creation of new sinks (tree planting) have greater potential than avoiding emissions (peatland restoration)? Is monitoring and verification of new sinks easier than avoided emissions' actions? Do co-benefits (e.g., enhanced biodiversity, soil, water, and air quality) differ between these actions?

2 | MITIGATION POTENTIALS OF AVOIDING EMISSIONS VERSUS CREATING NEW SINKS

In their seminal study on natural climate solutions, Griscom et al. (2017) estimated the economic potential (<100 US\$/tCO_2e) for reforestation and avoided forest conversion to be similar, at around 3 GtCO_2e/year in 2030, but the low cost (<10 US\$/tCO_2e) potential was much greater for avoided forest conversion (just under 2 GtCO_2e/year) compared to reforestation (~zero). For peatland and coastal restoration versus avoided peatland and coastal conversion, the avoided emissions' options had greater potential at both carbon prices. In their deep dive in the tropics, Griscom et al. (2020) found that the avoided emissions' options (avoided forest conversion, avoided peat impacts, and avoided mangrove impacts) accounted for 53% of the total mitigation potential, compared to 21% for the options that create new sinks through restoration (reforestation, peat restoration, and mangrove restoration). Roe et al. (2019) estimated a greater technical mitigation potential for afforestation than for reduced deforestation, but these estimates included sectoral studies with enormous forest areas; the comparison between estimates from models simulating a 1.5 degree pathway, suggest a greater potential for reduced deforestation than for afforestation. These studies show at least comparable, if not greater, economic potential from options that avoid emissions than those that create new sinks.

3 | MONITORING AND VERIFICATION OF AVOIDED EMISSIONS AND NEW SINKS

The challenges of monitoring, reporting, and verification (MRV) of changes in above-ground and below-ground carbon pools are fundamentally similar for interventions that avoid emissions and those that create new sinks; changes in above-ground and below-ground biomass and soil organic carbon pools need to be measured. But MRV also involves collection of activity data (see Smith et al., 2019), and activity data related to options that deliver avoided emissions might be easier and cheaper to collect than data for options that create carbon sinks. For example, it has long been possible to detect deforestation from earth observation, whereas reforestation, at least in the early stages of tree growth, is more difficult to detect. We postulate that the challenges and cost of MRV are at least comparable, if not lower, for options that avoid emissions than those that create new sinks.

4 | CO-BENEFITS OF AVOIDED EMISSIONS VERSUS NEW SINKS

In terms of the co-benefits provided by options that deliver avoided emissions and those that create new sinks, Smith et al. (2020) found that reduced deforestation and degradation led to large-to-moderate positive co-benefits for mitigation, adaptation, land degradation and desertification, and food security, whereas afforestation/reforestation had potential mixed effects on food security. McElwee et al. (2020) found that reduced deforestation and degradation had co-benefits for all 18 Nature's Contributions to People (NCP), except NCP 11 (energy), 12 (food and feed), and 17 (supporting identities) for which the impacts were context dependent. While reforestation was also largely positive, afforestation showed potential negative impacts on NCP 2 (pollination), 6 (freshwater flow and timing), 12 (food and feed), and 18 (maintenance of options). Smith et al. (2022) reported positive co-benefits for biodiversity of reduced deforestation and degradation, whereas afforestation had potential negative impacts on biodiversity, though reforestation had a positive effect. Taken together, these studies suggest that options to avoid emissions show at least as many, and potentially more, co-benefits across a range of land challenges and ecosystem services than options that create new sinks.

5 | COSTS, RISKS, AND OPPORTUNITIES FOR INVESTMENT IN AVOIDED EMISSIONS AND NEW SINKS

The central tenet of achieving net zero, whether globally, nationally, or at an organizational level, is that all avoidable emissions are stopped as quickly as possible, and that any unavoidable emissions—from analgesia in health care for instance—are then balanced by new sinks. However, the prominent role of long-term sinks in major reports like the IPCC's 1.5 assessment (Masson-Delmotte et al., 2018), the greater value attributed to removing emissions from the atmosphere compared to adding less to it (Joppa et al., 2021), and so-called "mitigation deterrence" (where emissions' cuts today are sidelined by hoped-for removals in the future) (Dooley et al., 2022), has arguably led to an overemphasis on market-based sinks to offset emissions (SP Global, 2022).

To date, carbon credits associated with new sinks have tended to attract a premium compared to those associated with avoided emissions (SP Global, 2021), with a large and expanding range of investment opportunities in both avoided emissions and new sink projects meaning that investors are faced with myriad locations, technologies, timeframes, and projected carbon and co-benefits to choose from. The prominence of new sinks, combined with this complex and evolving array of avoidance and sink projects, means that investors' view of what is most robust and cost-effective in terms of climate mitigation specifically may be obscured or greatly distorted.

6 | CHANGING INVESTOR PERCEPTION, INVESTMENT OPTIMIZATION TOOLS, RESOLVING MARKET CHALLENGES

The perception of greater impact via new sinks, as opposed to through avoided emissions, has already led some large investors to focus on sink-related projects (Bindman, 2021). This is a flawed perception when applied universally and carries a risk that effective routes to mitigation through avoiding emissions are side-lined. In reality, both emissions avoidance and emissions removal are needed, and both can be a cost-effective means of delivering mitigation.

Changing investor perception requires both improved understanding by investors of the relative merits of avoidance and removal projects and improved understanding by their shareholders, consumers, governments, and the wider public. Yes, reported "avoided emissions" have been hot air in some cases, but so too have some reported removals via new sinks—either approach is only as good as the science and safeguarding that underpin it.

What is needed are robust and transparent investment and regulatory frameworks across both the compliance carbon markets and the fast-evolving voluntary carbon markets (Ruseva et al., 2020). The tools available to properly assess investment opportunities and risks have improved greatly in recent years, with new standards and monitoring systems being developed in the voluntary carbon sectors that can give greater assurance around risks like additionality, leakage, and permanence (ICVCM, 2022).

7 | CREATING A PATHWAY FOR COUPLING SCIENTIFIC EVIDENCE TO INVESTMENT DECISIONS ON CLIMATE SOLUTIONS

Private investment globally favors sink creation over avoided emissions, for instance woodland planting over peatland restoration. This outcome stems from a bias in market perception of the relative

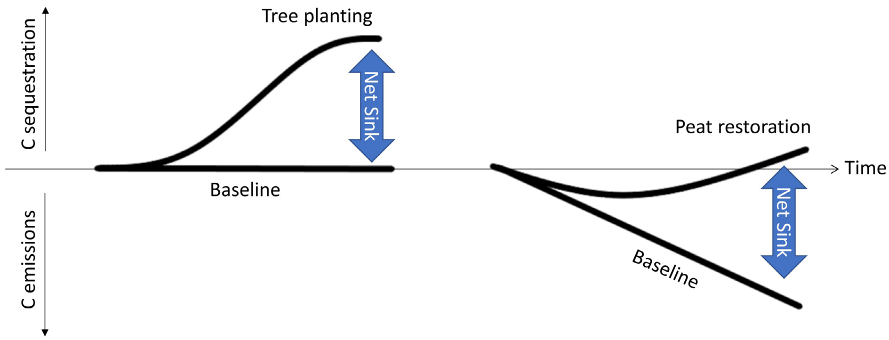

FIGURE 1 Net C emissions' reduction associated with creating a new sink (e.g., tree planting, left) and reducing emissions (e.g., peat restoration right) have similar potential net C benefits but are differentiated by the nature of their baselines and trajectories of their counterfactuals. In the left panel, the baseline assumes that the existing managed landscape has balanced C exchanges, for instance a pastoral system where production balances respiration. Tree planting results in an accumulation of woody C over time in stems, and this results in the generation of a net sink. In the right panel, the baseline assumes that a degraded peatland landscape is emitting C consistently over time. Peatland restoration slows, then stops emissions associated with degraded peat and ultimately converts the landscape into a sink over time through accumulation of peat. The net sink arises as the difference between baseline and counterfactual.

risks, rewards, and co-benefits of each approach, and most critically the public communication of the perceived "climate positive" outcomes. It is relatively easy to communicate C neutral outcomes arising through investment in natural sinks balancing out business emissions. It is harder to explain C neutrality by investment in projects that reduce emissions. However, the net effects are similar (Figure 1). Globally these two approaches have the same potential to deliver NCS at scale. Their costs and co-benefits are comparable. There is no clear difference in the potential for effective monitoring, reporting, and verification.

Both avoided emissions and new sink projects can therefore be effective ways to deliver climate change mitigation. But, with obfuscation or distortion of their relative merits in the eyes of investors, there is a risk that investment is inefficient and that prime opportunities are missed. Perceptions of investors and wider stakeholders need to better reflect the science and safeguards that underpin (or undermine) any particular project, with initiatives such as the Integrity Council for the Voluntary Carbon Market (ICVCM) having a crucial role to play in providing robust principles and frameworks for assessment that can be applied across the myriad removals (sink) and avoided emissions' projects that now exist.

CONFLICT OF INTEREST

The authors declare no known conflicts of interest.

DATA AVAILABILITY STATEMENT

There are no data presented in this Perspective article

ORCID

Pete Smith https://orcid.org/0000-0002-3784-1124

REFERENCES

Bindman, P. (2021). Who buys carbon offsets - and why? *Capital Monitor* https://capitalmonitor.ai/sector/tech/who-buys-carbon-offsets-and-why/

Dooley, K., Nicholls, Z., & Meinshausen, M. (2022). Carbon removals from nature restoration are no substitute for steep emission reductions. *One Earth*, *5*(7), 812–824.

Griscom, B. W., Adams, J., Ellis, P., Houghton, R. A., Lomax, G., Miteva, D. A., Schlesinger, W. H., Shoch, D., Siikamäki, J., Smith, P., Woodbury, P., Zganjar, C., Blackman, A., Campari, J., Conant, R. T., Delgado, C., Elias, P., Hamsik, M., Kiesecker, J., … Fargione, J. (2017). Natural climate solutions. *Proceedings of the National Academy of Sciences of the United States of America*, *114*, 11645–11650. https://doi.org/10.1073/pnas.1710465114

Griscom, B. W., Busch, J., Cook-Patton, S. C., Ellis, P. W., Funk, J., Leavitt, S. M., Lomax, G., Turner, W., Chapman, M., Engelmann, J., Gurwick, N. P., Landis, E., Lawrence, D., Malhi, Y., Schindler Murray, L., Navarrete, D., Roe, S., Scull, S., Smith, P., … Worthington, T. (2020). National mitigation potential from natural climate solutions in the tropics. *Philosophical Transactions of the Royal Society, B.*, *375*, 20190126. https://doi.org/10.1098/rstb.2019.0126

ICVCM. (2022). Core carbon principles, assessment framework and assessment procedure. https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-1.pdf

Joppa, L., Luers, A., Willmott, E., Friedmann, S. J., Hamburg, S. P., & Broze, R. (2021). Microsoft's million-tonne CO_2-removal purchase—Lessons for net zero. *Nature*, *597*, 629–632.

Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., Skea, J., Shukla, P. R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J. B. R., Chen, Y., Zhou, X., Gomis, M. I., Lonnoy, E., Maycock, T., Tignor, M., & Waterfield, T. (Eds.). (2018). *Global warming of 1.5°C. An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. Cambridge University Press.

McElwee, P., Calvin, K., Campbell, D., Cherubini, F., Grassi, G., Korotkov, V., Hoang, A. L., Lwasa, S., Nkem, J., Nkonya, E., Saigusa, N., Soussana, J.-F., Taboada, M. A., Manning, F., Nampanzira, D., & Smith, P. (2020). The impact of interventions in the global land and Agri-food sectors on Nature's contributions to people and the UN sustainable development goals. *Global Change Biology*, *26*, 4691–4721. https://doi.org/10.1111/GCB.15219

Roe, S., Streck, C., Obersteiner, M., Frank, S., Griscom, B., Drouet, L., Fricko, O., Gusti, M., Harris, N., Hasegawa, T., Hausfather, Z., Havlík, P., House, J., Nabuurs, G. J., Popp, A., Sanz Sánchez, M. J., Sanderman, J., Smith, P., Stehfest, E., & Lawrence, D. (2019). Contribution of the land sector to a 1.5°C world. *Nature Climate Change*, *9*, 817–828. https://doi.org/10.1038/s41558-019-0591-9

Ruseva, T., Hedrick, J., Marland, G., Tovar, H., Sabou, C., & Besombes, E. (2020). Rethinking standards of permanence for terrestrial and coastal carbon: Implications for governance and sustainability. *Current Opinion in Environmental Sustainability*, *45*, 69–77.

Smith, P., Arneth, A., Barnes, D. K. A., Ichii, K., Marquest, P. A., Popp, A., Pörtner, H. O., Rogers, A. D., Scholes, R. J., Strassburg, B., Wu, J., & Ngo, H. (2022). How do we best synergise climate mitigation actions to co-benefit biodiversity? *Global Change Biology*, *28*, 2555–2577. https://doi.org/10.1111/gcb.16056

Smith, P., Calvin, K., Nkem, J., Campbell, D., Cherubini, F., Grassi, G., Korotkov, V., Le Hoang, A., Lwasa, S., McElwee, P., Nkonya, E., Saigusa, N., Soussana, J.-F., Taboada, M. A., Manning, F., Nampanzira, D., Arias-Navarro, C., Vizzarri, M., House, J., ... Arneth, A. (2019). Which practices co-deliver food security, climate change mitigation and adaptation, and combat land-degradation and desertification? *Global Change Biology*, *26*, 1532–1575. https://doi.org/10.1111/GCB.14878

Smith, P., Soussana, J.-F., Angers, D., Schipper, L., Chenu, C., Rasse, D. P., Batjes, N. H., van Egmond, F., McNeill, S., Kuhnert, M., Arias-Navarro, C., Olesen, J. E., Chirinda, N., Fornara, D., Wollenberg, E., Álvaro-Fuentes, J., Sanz-Cobena, A., & Klumpp, K. (2020). How to measure, report and verify soil carbon change to realize the potential of soil carbon sequestration for atmospheric greenhouse gas removal. *Global Change Biology*, *26*, 219–241. https://doi.org/10.1111/gcb.14815

SP Global. (2021). Voluntary carbon markets: How they work, how they're priced and who's involved. https://www.spglobal.com/commodityinsights/en/market-insights/blogs/energy-transition/061021-voluntary-carbon-markets-pricing-participants-trading-corsia-credits

SP Global. (2022). Removal credits see high retirements despite low supply. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/040122-removals-credits-see-high-retirements-despite-low-supply-reflecting-buyer-preference-in-offsetting-carbon-emissions

World Economic Forum. (2021). Nature and Net Zero. Consultation: Nature and Net Zero.

How to cite this article: Williams, M., Reay, D., & Smith, P. (2023). Avoiding emissions versus creating sinks—Effectiveness and attractiveness to climate finance. *Global Change Biology*, *29*, 2046–2049. https://doi.org/10.1111/gcb.16598