

ENVIRONMENTAL RESEARCH
LETTERS

PERSPECTIVE

The revised oxford principles for net zero aligned carbon offsetting

OPEN ACCESS

RECEIVED
3 March 2025REVISED
7 July 2025ACCEPTED FOR PUBLICATION
21 July 2025PUBLISHED
7 August 2025

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Keywords: climate change, carbon markets, offsetting, climate policy

1. Introduction

Market mechanisms have long been recognised as tools for climate change mitigation. However, since their introduction carbon offsetting (baseline-and-credit) schemes have suffered from a number of integrity challenges, in both compliance (Calel *et al* 2021) and voluntary settings (Fuss *et al* 2024). The growth in pledges to meet net zero emissions (Net Zero Tracker 2024) has prompted fresh calls to revise the integrity of both the supply and demand sides of these carbon markets (Fuss *et al* 2024). These general considerations, and the particular challenge of offsetting given the need to sharply reduce emissions to stabilise temperatures, inspired the release of the original Oxford Principles for Net Zero Aligned Carbon Offsetting (ONZOPs) in September 2020, and a revised version in February 2024 (Axelsson *et al* 2024).

The revised ONZOPs outline how organisations can credibly deploy an offsetting strategy in line with the science of net zero, which requires all residual emissions (i.e. those that cannot be feasibly reduced) to be durably counterbalanced. More specifically, the four principles set out the need to: (1) cut emissions, ensure the environmental integrity of credits, and regularly revise offsetting strategies as best practice evolves; (2) begin a transition now to carbon removals in the portfolio to cover all residual emissions by the global net zero target date; (3) shift to removals with

durable storage (low risk of reversal) to compensate these residual emissions by the global net zero target date; and (4) support the development of innovative and integrated approaches to achieving net zero (Axelsson *et al* 2024).

The ONZOPs use scientific principles to align current best practices with the highest chance of achieving net zero globally. In doing so they make global net zero the central focus of the framework, such that following the ONZOPs can put participating organisations on track to alignment with the global net zero goal. Unlike other integrity initiatives, the ONZOPs do not purport to verify net zero claims. Rather, they provide a framework that requires adaptation to a given organisational context, whether this be service providers or governments setting guidance and policies for climate claims (White House 2024) or organisations looking to make such claims themselves. They do not take a stance as to whether credit-based offsetting is required for a net zero world but outline what any organisation ought to do when incorporating offsetting—through the purchase of third-party credits or other means—into its net zero strategy.

Since their inception, the ONZOPs have sparked questions in relation to the design and execution of net zero aligned offsetting strategies, including related to the composition and quality of carbon project portfolios. In this perspective we contextualise the ONZOPs in the light of contemporary

debates, challenges, and trends in climate and offsetting policy. However, the original ONZOPs should be consulted for further depth on the concepts contained therein (Axelsson *et al* 2024).

2. Designing a high-integrity strategy that prioritises reducing emissions

Before offsetting is considered, the first priority for all organisations is to cut their own direct and indirect emissions as far as possible, especially where technology is readily available (such as emission from electricity generation which can be reduced via renewables). In most net zero pathways, emissions resulting from electricity, heating and land transport will need to be reduced to near-zero well before the date of global net zero (Pathak *et al* 2022). Credits can be an interim measure to complement ongoing value chain decarbonisation, but relying on credits instead of directly reducing emissions can be harmful for several reasons (Caney and Hepburn 2011). Low-carbon technologies and business models require time and early investment to scale and achieve cost-competitiveness. Through investing in direct decarbonisation now, stakeholders contribute to lowering costs in the research- and capital-intensive pathways required to reach net zero (Way *et al* 2022). Finally, a reliance on offsetting does little to shift political economic factors that entrench carbon-intensive interest groups' significant political power (Colgan *et al* 2021), including those which oppose the deep and swift structural decarbonisation that the IPCC indicates we need (Pathak *et al* 2022).

Credit quality and additionality also remains an ongoing issue. Many credits issued to date in major project categories on the voluntary carbon market have been found not to represent real emissions reductions (Probst *et al* 2024) as poor regulatory oversight persists across the market. High-quality crediting projects can face scalability challenges due to technological, financial and resource limitations, particularly for geological carbon removals, and finite land area places limits on land-based removals. Poorly designed carbon crediting projects can also have harmful impacts—including on human rights and biodiversity—which can undermine project success and legitimacy (Seddon *et al* 2021).

For these reasons, the ONZOPs recommend prioritising an organisation's own emissions reductions, using only high-integrity credits that follow good-practice guidelines, being transparent on when and why credits are used and how any offsetting strategy evolves over time in line with best practice.

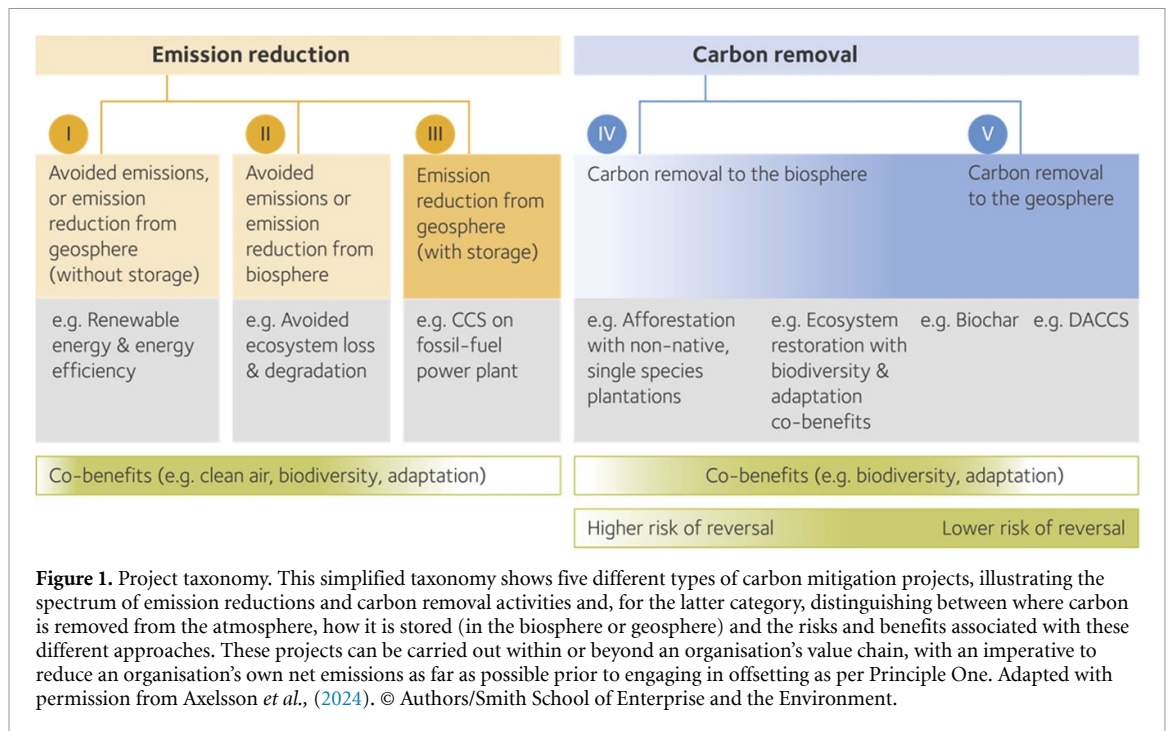
3. Counterbalancing residual emissions with removals

The 'emissions-removals gap' needs to be completely bridged to reach a state of net zero. Physically, many combinations of emissions reductions and removals could result net zero emissions. However, there are limits to the resources and inputs available to permanently remove emissions at scale, particularly in the context of a Paris-aligned mitigation timeline. In absolute terms, the IPCC scenarios project that the initial 'bridging' effort comes mainly from emissions reductions, but substantial interventions and investments will be needed across both emissions reductions and removals to deliver global net zero (see figure 1).

By definition, emissions and removals need to be in balance by the date of net zero (Fankhauser *et al* 2022). The net greenhouse gas transfer to the atmosphere of high-quality reductions and removals projects is similar both before and after the date of net zero, meaning there is no basis from the standpoint of carbon accounting to opt for one over the other (Möllersten *et al* 2024). Actors claiming to be net zero aligned by using credits therefore need, at minimum, to ensure their activities, including credits, result in no net greenhouse gas transfer to the atmosphere. However, there is no unique correct definition of 'organisational net zero', as net zero is a collective action problem, requiring an array of reductions and removals activities across a wide range of public and private actors.

Emissions reduction credits can play a vital role in the transition, for instance, accelerating the transition from fossil fuels and protecting the carbon stored and carbon sinks in potentially vulnerable ecosystems. In addition, emission reductions often deliver co-benefits such as improved air quality, biodiversity conservation, and resilience and adaptation to climate change. Emission reduction credits will therefore need to play a significant role in net zero offsetting strategies. However, as Paris-aligned public policy and private sector investment increasingly drives emissions reductions down towards only hard-to-abate categories, and innovation continues to reduce the number of those categories, we expect to see a decline in emission reduction credits that can be considered 'additional' as we approach net zero, underpinning principle Two of the ONZOPs which calls for a shift towards removals.

In addition to shifting to removal-based offsetting strategies, it is vital to protect existing natural carbon sinks in order to stabilise global temperatures, and the strength of natural carbon sinks required to



maintain a stable temperature after net zero is proportional to historical emissions. To stabilise global temperatures, collective action towards net zero must therefore both shift towards offsetting based on durable removals and fulfil the additional responsibility to maintain passive carbon uptake by protecting existing natural carbon sinks.

4. Ensuring the durability of removals

Unabated carbon dioxide emissions result in a near-permanent increase in global temperature (Cullenward 2023). While a range of physical and economic equivalencies can be drawn between carbon stored on differing timescales (Cullenward 2023), carbon removals need to reflect this permanence. To ensure that the net zero balance is maintained, residual emissions must be counterbalanced with sufficiently durable removals over time as in figure 2 (Fankhauser *et al* 2022). Currently human activity achieves approximately 2 GtCO₂ per year of CO₂ removal, almost all to the biosphere with a high risk of reversal (Smith *et al* 2024). Central estimates from scenarios with an emphasis on sustainability indicate 7–9 GtCO₂ of removal by 2050 with a lower risk of reversal (Smith *et al* 2024).

5. Creating an integrated policy environment conducive to net-zero alignment

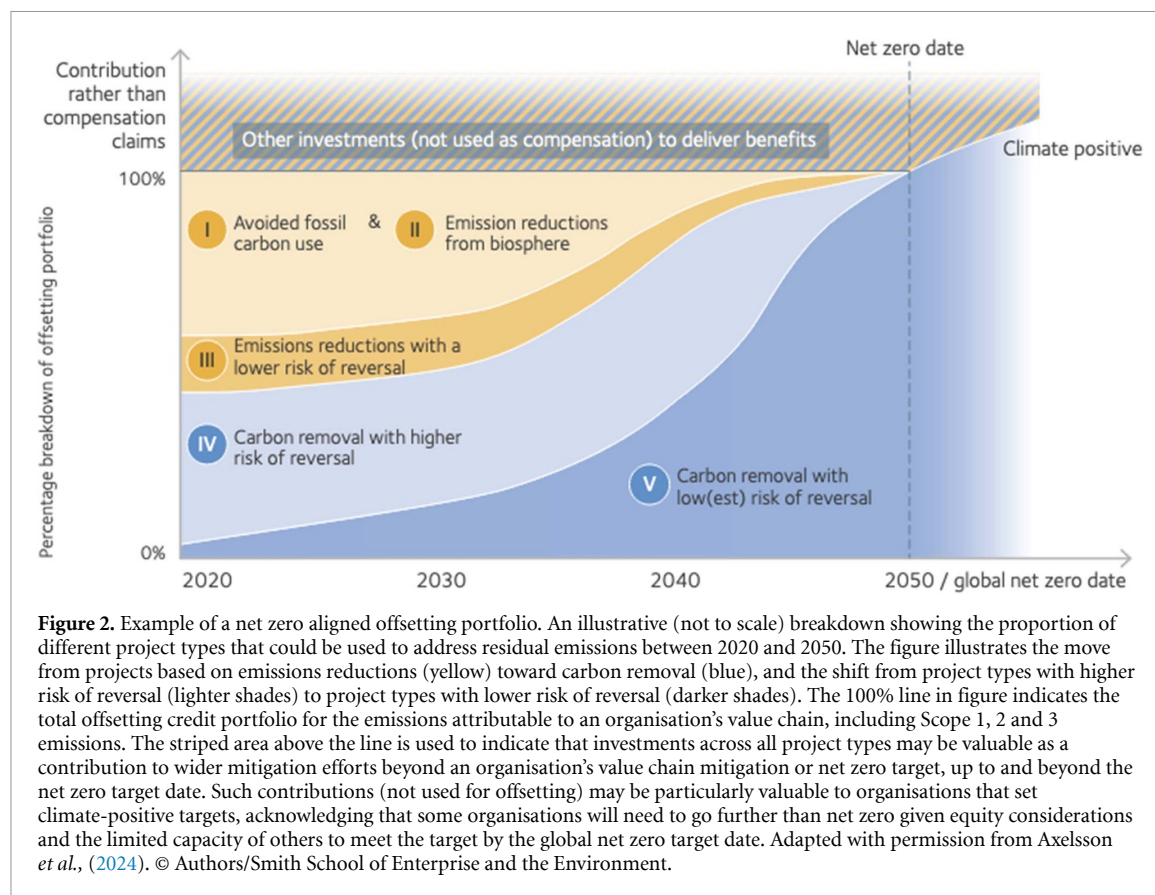
Delivering net zero aligned offsetting portfolios requires the right policy and practice-based signals to

ensure robust supply and demand in future. Central to climate mitigation will be policy support for investment in the zero-carbon energy transition. A range of catalytic levers exist for both the public sector (Hickey *et al* 2023) and the private sector (Johnstone 2024) that can *inter-alia* derisk project finance, provide demand pull, and corral sector-led innovations across mitigation outcomes (Grubb *et al* 2021). Moving from voluntary to compliance-based carbon markets forms part of this (Fuss *et al* 2024) as does broader regulation and oversight of voluntary claims (European Commission 2024).

The ONZOPs also recognise the crucial role of nature in delivering net zero alongside other goals. High quality nature-based approaches that restore and protect the carbon stored in well-managed resilient ecosystems play a vital role in both climate change mitigation and adaptation, provided they are developed in line with best practice principles, supporting local communities (Seddon *et al* 2021). An integrated approach to climate and nature that maximises synergies and minimises trade-offs is essential to deliver net zero on a habitable planet.

6. Summary

Environmental integrity issues related to the additionality, durability and over-issuance of credits have undermined market credibility and revealed the need to anchor offsetting strategies in climate science. In the ONZOP we hope to provide a rigorous framework to align organisational offsetting strategies with credible pathways to global net zero. Such strategies can



and should continue to evolve over time, informed by the latest developments in both climate science and mitigation practice.

Data availability statement

No new data was created or analysed in this study.

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