

EXECUTIVE SUMMARY

Contracted Durability

A Framework for
Performance-Based
Carbon Removal



Executive Summary



Policymakers designing carbon removal markets today have an opportunity to lay the groundwork for **contracted durability** — enabling the full range of CDR pathways to participate while ensuring that every credit delivers the climate impact it promises.

The durability challenge

Carbon dioxide removal (CDR) is not optional. Alongside rapid emissions reductions, CDR is essential to meeting global climate goals, including limiting near-term warming, achieving net-zero emissions, and ultimately drawing down the accumulated stock of carbon dioxide already in the atmosphere (IPCC, 2022). There are many pathways for removing and storing carbon, spanning biogenic (e.g., afforestation, bioenergy with carbon capture and storage), geochemical (e.g., enhanced weathering, ocean alkalinity enhancement) and synthetic (e.g., direct air capture). No single pathway is sufficient to meet the volumes of CDR required for net-zero or net-negative emissions; policymakers must therefore establish policies to support the full range of CDR pathways while ensuring verified climate impact.

Durability is one key determinant of that impact. ‘Durability’ refers to the length of time that a tonne of carbon dioxide (CO₂) represented by a CDR credit remains out of the atmosphere. However, durability is variable; not all credits represent CO₂ stored for the same duration. Durability is also uncertain, meaning the duration of storage is often unknown until a reversal (a net loss of carbon storage) occurs. This is particularly true for nature-based pathways, which rely on naturally occurring biogenic carbon fixation to capture and store CO₂ and face reversal risks such as wildfires, pests and disease, and human intervention.

The climate impact of carbon removal therefore depends on durability: i.e., how long the CO₂ stays out of the atmosphere. Much of the policy debate around carbon removal has necessarily centered on durability. Establishing an appropriate durability threshold (i.e., the time period over which carbon must remain out of the atmosphere as defined by the policy, standard, use case, or claim being made) is a central concern, alongside defining how projects can reliably meet that threshold. Effective policy must support the full range of removal pathways while credibly managing variability and uncertainty in durability. Current approaches, however, have typically failed for one of two reasons:

1. Locking out necessary pathways: some policies and policy proposals restrict CDR credits to those with 1,000-year durability or geologic storage, excluding nature-based pathways that have a higher risk of reversal but are economically feasible today, essential to near-term climate goals, and capable of delivering significant social and environmental benefits.

2. Undermining environmental integrity: other approaches that are inclusive of nature-based credits have failed to ensure storage over sufficient timescales because the durability threshold set in policy often exceeds the monitoring and liability commitments of underlying projects, leaving a gap over which reversals go unmonitored and uncompensated.

What is needed instead is an approach that neither locks out nature-based pathways nor leaves gaps in monitoring and liability for reversals, ensuring that credits represent carbon dioxide that remains out of the atmosphere over timescales relevant to both near- and long-term climate objectives. We call this approach ‘contracted durability’.

Contracted durability as a solution

Contracted durability offers a way forward by using legal and financial mechanisms to ensure carbon removal over a defined duration. This paper introduces ‘contracted durability’ as a new concept that centers durability as an explicit, enforceable obligation at the credit level, fulfilling two core functions across the durability threshold: 1. assigning contractually enforceable liability for reversals, and 2. providing the resources and tools to compensate for any reversals that occur. Together, these functions ensure that one credit continues to represent one tonne of carbon removed from the atmosphere for the entirety of the required storage period — regardless of whether the original credit’s storage persists.

Contracted durability introduces a new way of thinking about durability — one that relies on contracted mechanisms to achieve desired durability performance as opposed to assuming durability based on pathway. In practice, contracted durability may operate through a combination of the following mechanisms:

- **Buffer pools**, which provide first-loss protection by withholding a portion of issued credits to compensate for reversals during the crediting and monitoring period;
- **Insurance**, which provides coverage for specific reversal events, particularly correlated losses that could overwhelm a buffer pool;
- **Horizontal stacking**, which replaces an original credit with a new one at the end of the monitoring period or following a reversal, carrying the storage obligation forward; and
- **A permanence trust**, which is an endowed institution that assumes ongoing liability for reversals, funded through a per-credit fee at issuance and actively managing risk through monitoring, reversal prevention, and

replacement.

Together these mechanisms form a financial and legal toolkit that can enable high integrity removal pathways to meet the durability threshold that the policymaker or standard-setter sets. Contracted durability draws on established practices in insurance, finance, and institutional design, but combining these mechanisms into integrated approaches for carbon markets is new ground.

Buffer pools or insurance alone, however, cannot deliver contracted durability. These mechanisms, designed to compensate for reversals during the crediting and post-crediting monitoring period, require either a permanence trust or horizontal stacking to assign liability for the duration of the durability threshold. Critically, credits with a negligible risk of reversal over the durability threshold can release the liability for ongoing monitoring and compensation, whereas those with non-negligible risk of reversal require either horizontal stacking or a permanence trust to ensure ongoing monitoring and compensation. **Exhibit ES1 on the next page illustrates how contracted durability could work in practice.**

Contracted durability in policy and standards

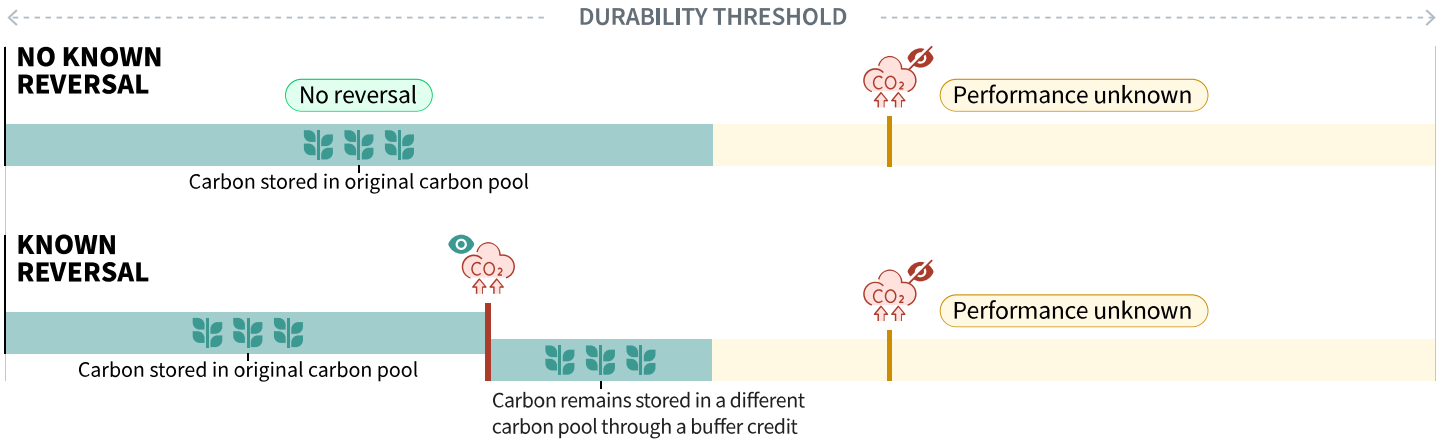
A number of active policy and standard-setting processes are determining how to regulate, incentivize, and set quality benchmarks for carbon removal, each grappling with shared questions around durability standards, reversal risk management, and long-term liability. We argue that contracted durability can be integrated into these existing policy and standard-setting processes, as follows:

- **California** is developing overlapping regulatory instruments under SB 905 and Cap-and-Invest that include durability requirements. Contracted durability can satisfy this standard across a diversity of pathways while resolving gaps in liability after project agreements expire.
- As the **European Union** assesses how removals certified by the Carbon Removals and Carbon Farming (CRCF) Framework might be integrated into the EU ETS and defines quality requirements for international credits toward its 2040 target, contracted durability could enable a broader set of removal pathways to qualify. This would ensure credits deliver the impact EU climate policy is designed to achieve.
- The **Paris Agreement Crediting Mechanism** (Article 6.4) has already embedded contracted durability concepts in its design, requiring monitoring and remediation of reversals after the crediting period and actively developing reversal risk assessment tools, insurance mechanisms, and guidance on negligible risk of reversal.
- The **Science Based Targets initiative's** Corporate Net-Zero Standard V2 requires companies to source an increasing share of “long-lived” removals over time to compensate for “long-lived greenhouse gases (GHGs).” Contracted durability offers a practical path forward: a performance-based durability threshold that credits can meet regardless of pathway.
- The **Integrity Council for the Voluntary Carbon Market** sets quality benchmarks, with Core Carbon Principle-eligible programs covering approximately 98% of the voluntary carbon market. Its second Continuous Improvement Work Program on Permanence is actively exploring mechanisms aligned with contracted durability.

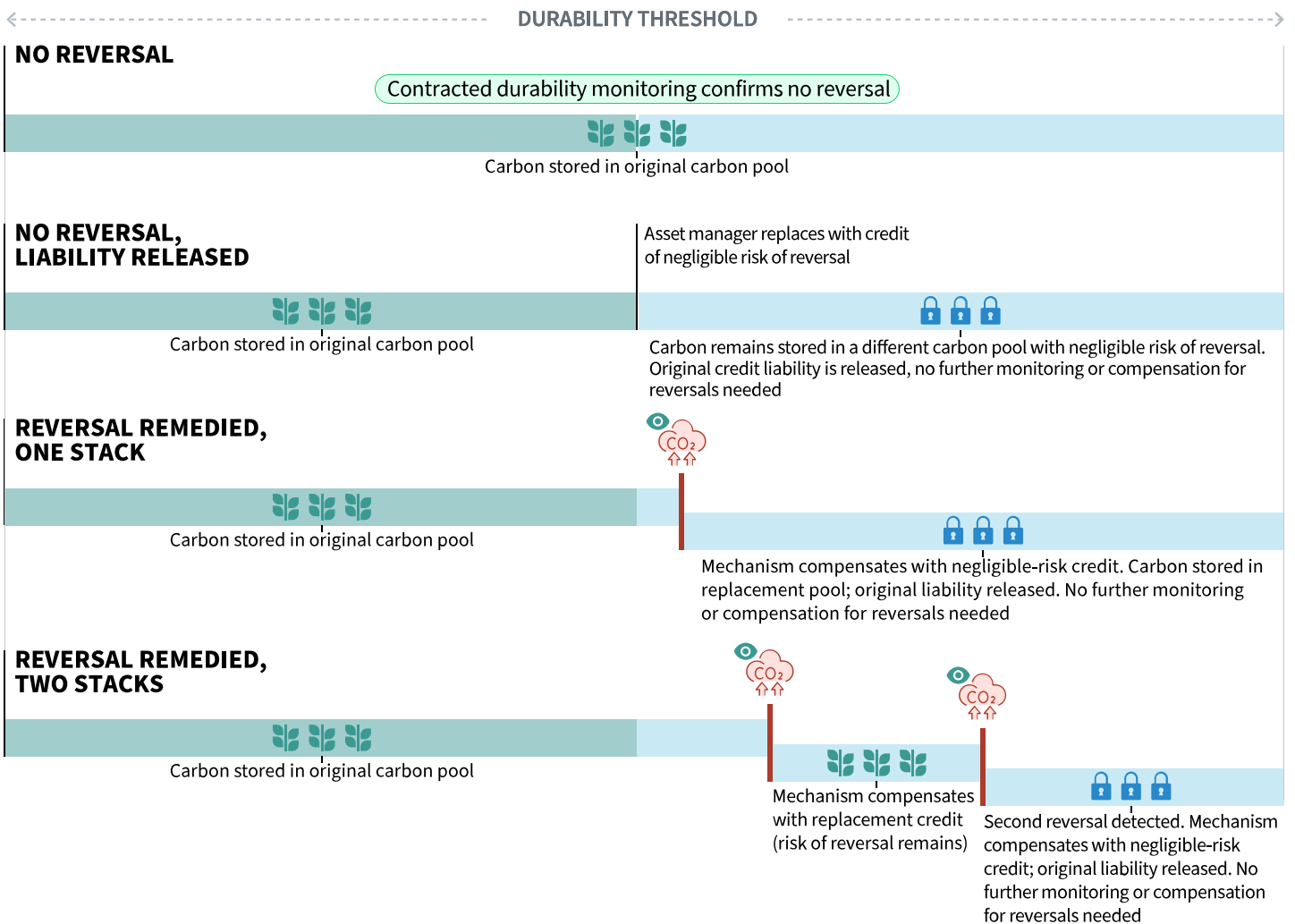
Exhibit ES1: Contracted durability in practice

- Crediting + post-crediting monitoring periods
- No contracted durability monitoring
- Contracted durability monitoring
- Non-negligible risk of reversal credit
- Negligible risk of reversal credit
- Possible undetected reversal
- Detected reversal occurs

NO CONTRACTED DURABILITY SCENARIOS (STATUS QUO)



CONTRACTED DURABILITY SCENARIOS



Limits of contracted durability

Contracted durability addresses one specific challenge: ensuring that a credit represents carbon stored for an established duration. It does not address cost parity between nature-based CDR and novel engineered pathways. Contracted durability is likely to raise the price of credits with higher reversal risk, but the gap in costs between pathway types will likely persist and require dedicated policy measures to address that, including subsidies, public procurement, and R&D funding for novel CDR. Contracted durability carries an additional risk: if implemented with a durability threshold that is too low, it could slow investment in novel CDR by enabling markets to be satisfied with more affordable, shorter-duration credits in the near term. Contracted durability should therefore be understood as part of a broader policy portfolio, addressing the integrity of the credits traded in markets today while complementary measures accelerate the cost-down and scale-up of novel pathways.

What's next?

Contracted durability is not a silver bullet, nor is it yet a proven solution. Moving contracted durability from concept to implementation requires near-term progress across three areas:

- **Policy engagement.** Key near-term priorities include adopting performance-based durability language in active standard-setting processes and defining what constitutes negligible risk of reversal — a concept introduced in the Article 6.4 standards but not yet operationalized.
- **Research and development.** Translating contracted durability into operational tools requires risk assessment frameworks, models for pricing reversal risk, institutional designs for permanence trusts that can outlast the organizations that create them, and legal frameworks for binding obligations across decades.
- **Piloting.** Real-world testing is essential to build the evidence base that policymakers and standard-setters require before broader adoption. Several vehicles are already available, including the ICVCM's Innovation Sandbox, the American Forest Foundation's Permanence Trust Feasibility Study, and Verra's Durability Pilot.

Policymakers designing carbon removal markets today have an opportunity to lay the groundwork for contracted durability — enabling the full range of CDR pathways to participate while ensuring that every credit delivers the climate impact it promises.

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