

Carbon market integrity: How to move beyond the limitations and uncertainties?

While the Paris Agreement put carbon markets back into focus, they remain fragile. Indeed, their integrity tends to be subjected to binary frameworks that obscure the fact that the value of carbon credits is based on uncertain and interdependent attributes, that shape a convention and rule-based market. The information asymmetry and misaligned incentives of market players undermine their effectiveness and result in an adverse selection. Restoring confidence thus requires institutions able to establish a clear legal framework, robust and transparent infrastructure, and a systemic approach that integrates both supply and demand. In addition, carbon markets can only contribute meaningfully to climate objectives if their governance is anchored in national emission reduction pathways, as articulated in the Nationally Determined Contributions (NDCs).

Carbon credits and carbon markets: understanding a structural complexity

The climate emergency and the Paris Agreement have put carbon credits back into focus, but they are experiencing a further crisis of confidence (Swinfield, Shrikanth, Bull and zu Ermgassen 2024). Their environmental integrity is often reduced to a binary interpretation, masking a much more complex reality. Indeed, this integrity depends on a set of uncertain attributes, such as additionality, permanence, over-crediting, leakage, double counting, which are particularly fragile for nature-based projects (see Box 1).

When carbon credits are traded on a market, they are exposed to significant information asymmetries and misaligned incentives, as the pursuit of volume prevails over quality, while purchasers have little incentive to demand high-integrity credits. Such dynamics fall outside the neoclassical assumption of the self-regulated market and serve as a reminder that carbon credits are “credence goods,” whose value is tied to the credibility of institutions (Baron 2011; Gottschalk 2018).

A major institutional overhaul is therefore required for the effective design of carbon markets, especially as the implementation of Article 6 of the Paris Agreement and the CORSIA mechanism^[1] accelerates, alongside the growing integration of carbon credits into regulated markets (quotas, taxes).

[1] Adopted in 2016, CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) is a mechanism designed to offset the CO₂ emissions of international flights by obliging operators to purchase carbon credits.

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Box 1 – Environmental integrity risks of carbon credits

The integrity of a carbon credit hinges on several complex and interdependent technical attributes:

- **Additionality:** The project must only exist through credit revenues, based on theoretical counterfactual scenarios (“business-as-usual” situation). **Regulatory additionality** also requires that the project is not already compulsory or provided for through a climate commitment, such as a conditional NDC, for example.

- **Permanence (or irreversibility):** To ensure that carbon credits have a lasting impact on emission reductions, they must provide environmental benefits for a minimum of seven years. Permanence is a major challenge, especially for nature-based projects, as the carbon stored may be released (through forest fires and logging, for example). “Buffer pools” are established to manage this risk. They consist in setting aside a percentage of credits which may be used as insurance: in the event of reversal, credits from this reserve are canceled to cover the loss.

- **Over-crediting:** This risk consists in issuing more credits than the actual reductions. It often arises when the baseline scenarios are overly optimistic or overestimate the threat (inflated deforestation rate, for example) and therefore the “avoided” reductions.

- **Leakage:** It is defined as an unintentional displacement of emissions. The emissions reduction at a given location (the protection of a forest, for example) results in an increase elsewhere (deforestation displaced to the neighboring plot, for example).

- **Double counting:** The risk that several actors claim the same reduction (the developer and the host country in its NDC, for example) or that it is sold several times, for lack of reliable registries.

Carbon credits: simplicity belies complexity

Carbon credits are denominated in a single unit, ton of equivalent CO₂ (tCO₂e), which would, at first sight, appears simple and universal. This standardization offers a clear advantage, allowing diverse climate actions to be measured and compared. Yet beneath this apparent simplicity lies a far more complex reality.

Carbon credits are more than mere accounting figures; they embody the ambition of transforming a wide array of diverse climate actions into standardized, market-tradable assets. There is a wide variety of actions, including emissions avoided by forest protection (REDD+ projects, for example),^[2] carbon sequestration through reforestation, the restoration of coastal ecosystems, called “blue carbon” (mangroves, seagrass meadows and salt marshes, for example), and reductions from industrial technologies. They differ not only in nature, but also in temporality, reversibility risk, and their degree of certainty. Carbon credits are quantified through baselines which determine how many tCO₂e have been avoided, sequestered or reduced by the action taken, all within the broader context of the climate system. Assigning the

same value to a ton avoided today and a ton sequestered over several decades is pure guesswork. This is also the case for a ton from fossil fuel combustion offset through natural ecosystems. Furthermore, the calculation assumes that there is a biophysical equivalence between the various greenhouse gases and their radiative effects, which is extremely reductive. Behind these technical aspects lies an even greater challenge: establishing equivalence between actual emissions and the assumed reductions. While industrial emissions can be measured with precision, the emissions associated with a carbon credit remain inherently uncertain.

Entering carbon credit markets, which are inherently hybrid, requires a theoretical approach at the junction of **input from the sociology of markets and institutionalism** (White, Callon, Polanyi),^[3] legislation and climate science. Their legitimacy depends as much on the robustness of the underlying methodological assumptions as on the credibility of the institutions that govern them.

Carbon Market Integrity: From Credit-Level to Systemic Environmental Trust

When a carbon credit is traded to meet offsetting requirements, the complexity goes far beyond the credit itself: it is ultimately a matter of the environmental integrity of carbon markets. Trading such a complex product requires robust institutional arrangements, while keeping them simple enough to contain transaction costs. Striking this balance remains a significant challenge.

The integrity of carbon markets goes beyond the quality of individual credits. It also depends on demand, governance, and alignment with climate targets. In this respect, the OECD identifies three key pillars (Wetterberg, Ellis and Schneider 2024):

- **Supply:** Additional, verifiable and sustainable projects, supported by transparent governance and registries;
- **Demand:** Responsible use of credits, as a complement to internal reductions, with no misleading declarations;
- **Infrastructure:** Reliable and interoperable systems for the monitoring, registration and retirement of carbon credits.

In addition to these three pillars, there are cross-cutting issues, first and foremost, it requires respect for human rights, with particular attention to the rights of Indigenous Peoples and Local Communities. These issues are increasingly recognized as central to the integrity of the supply of credits, shifting the debate from mere offsetting to a broader concept of “carbon finance for sustainable development”. This focus is reflected in the capitalization efforts of actors such as the French Facility for Global Environment (*Fonds Français pour l’Environnement Mondial – FFEM*) (Levallois, Boyer, de Liedekerke and Mazarrasa Elósegui 2025).

[2] REDD+ (Reducing Emissions from Deforestation and Degradation) is a mechanism launched in 2008. It aims to tackle the global warming caused by greenhouse gas emissions due to the degradation, destruction and fragmentation of forests. It consists in compensating emerging and developing countries through contributions from industrialized countries.

[3] See Callon 1998; Beckert and François 2012–2013.

Restoring carbon market integrity: numerous initiatives with mixed results

Over the last 30 years, carbon markets have strived to enhance their credibility, yet scandals and criticisms have fueled mistrust and led to oversupply of lower-quality credits. For example, studies have shown that many forest protection projects (REDD+) significantly over-estimated the threats of deforestation, resulting in credits for emission reductions that never actually occurred— (a clear case of over-crediting). Similarly, the issue of permanence has been challenged when forests underlying sold credits were destroyed by fires, casting doubts on the effectiveness of the “buffer pools” intended to cover such losses. In response, a proliferation of new private initiatives has emerged: the ICVCM (Integrity Council for the Voluntary Carbon Market) sets supply-side quality standards, agencies such as the CCQI (Carbon Credit Quality Initiative) and Sylvera rate the credits, the VCMI (Voluntary Carbon Markets Integrity Initiative) regulates their use by companies on the demand side, the SBTi (Science-based Target Initiative) specifies their role in net-zero trajectories, and Oxford University proposes principles for a credible use. These efforts are fostering gradual harmonization, yet their voluntary nature limits their reach and cannot substitute for a clear and universal regulatory framework.

In this context, the lack of legal rules clearly defining the responsibilities of market participants prevents effective self-regulation. Economic theory suggests that mechanisms such **labels, standards, certifications and reporting mechanisms**, can mitigate the effects of adverse selection, but only if they are credible, grounded in robust methodologies, particularly sound baselines, and supervised by independent institutions. Failing this, carbon credits remain exposed to a spiral of mistrust in which the short-term approach (maximizing volumes and minimizing costs) outweighs environmental integrity.

Another key point remains the clarification of the legal aspects of carbon credits and carbon markets, which has only truly progressed very recently (see Box 2).

Box 2 – The legal nature of carbon credits is still unclear

Should carbon credits be considered as contractual rights, debts, or intangible assets? This ambiguity undermines the **legal security of transactions** and complicates **dispute resolution**. In 2025, an important breakthrough was made with the publication of a joint study by UNCITRAL/UNIDROIT (2025). It clarifies the status of Verified carbon credits and sets out to provide a basis for an international harmonization by focusing on their nature, irrespective of their use as an offset.

Recommendations for carbon markets that work for climate action

Carbon credits cannot be reduced simply to a homogeneous unit of tCO₂e. Their value lies in uncertain attributes whose robustness determines their integrity. Restoring confidence requires acknowledging this complexity and establishing transparency mechanisms tailored to these uncertainties.

Several adjustments are needed, the foremost being the establishment of a clear **legal framework** that defines the rights and responsibilities of market participants, as well as the rules for the use, retirement, and transfer of credits, including their transboundary aspects. This framework must provide **regulatory clarity**, which is essential for markets with a long-term investment horizon: ensuring that baseline scenarios are aligned with national emission reduction trajectories (NDCs) and paired with explicit re-irement mechanisms in the event of non-additionality or reversibility.

At the same time, **transparency and oversight** must to be reinforced. The establishment of independent audits, as well as whistleblowing and reporting mechanisms, along with open access to data, and the possibility of legal recourse for certain NGOs (Battocletti, Enriques and Romano 2023) could help combat fraud and greenwashing. Clarifying demand is also essential: defining eligible uses for the credits and prioritizing demand would prevent an inflation of “neutrality claims”.

The third priority lies in strengthening **market infrastructure**. There is a need for interoperable and transparent registries, with unique identifiers, to ensure the traceability of transactions, while providing the information required for the legal implementation and oversight mechanisms. Host (or emitting) countries must establish robust monitoring, reporting and verification systems (following the example of the MRV mechanism)^[4] to guarantee the quality of carbon credits and equitable distribution of benefits. Rating agencies and insurers should be involved to help assess and price the associated quality and uncertainty, provided that the pitfall of excessive transaction costs is avoided. Failing this, there is a risk that actors will give priority to over-the-counter off-market trading.

At international level, **Article 6 of the Paris Agreement** crystallizes high expectations, but it also carries the risk of a dilution of ambitions if integrity is not ensured. Europe’s experience with the Clean Development Mechanism (CDM)^[5] has shown that a poorly regulated integration can lead to a fall in carbon prices.

In conclusion, the future of carbon markets will depend on their ability to move beyond a binary view of integrity. Carbon credits can only meaningfully contribute to the Paris Agreement targets through a systemic approach that considers supply, demand, and market infrastructure, while ensuring alignment with national emission reduction commitments (NDCs).

[4] MRV (Measuring, Reporting and Verification) is a monitoring-capitalization mechanism that evaluates the adaptation and mitigation actions of each country in terms of reducing greenhouse gas emissions.

[5] It is a project financing mechanism based on the principle of carbon offsetting.

References

Baron, David P. 2011. "Credence Attributes, Voluntary Organizations, and Social Pressure". *Journal of Public Economics* 95 (11): 1331–38. <https://doi.org/10.1016/j.jpubeco.2011.07.005>.

Battocletti, Vittoria, Luca Enriques and Alessandro Romano. 2023. *The Voluntary Carbon Market: Market Failures and Policy Implications*. Law Working Paper 688/2023. n. l.: European Corporate Governance Institute. <http://dx.doi.org/10.2139/ssrn.4380899>.

Beckert, Jens and Pierre François. (2012–2013). "Sociology of Markets". Doctoral seminar, Sciences Po Paris, October 1, 2012 – June 30, 2013.

Callon, Michel. 1998. "Introduction: The embeddedness of economic markets in economics". In *The Laws of the Markets*, edited by Michel Callon, 1–57. Oxford: Blackwell.

Gottschalk, Felix C.H. 2018. "What Characterizes Credence Goods? A Critical Look at the Literature". *SSRN*. <https://ssrn.com/abstract=3114257>.

Levallois, Olivier, Christophe Boyer, Tatiana de Liedekerke and Inés Mazarrasa Elósegui. 2025. *Cap' Sur La finance carbone : un levier pour un avenir durable*. Paris : Fonds français pour l'environnement mondial. https://www.ffem.fr/sites/ffem/files/2025-01-11-51-25/250109_FFEM_capitalisation_Finance_carbone_PaP.pdf.

Swinfield, Tom, Siddarth Shrikanth, Joseph W. Bull and Sophus O.S.E zu Ermgassen. 2024. "Nature-based credit markets at a crossroads". *Nature Sustainability* 7 (2024): 1217–20. <https://doi.org/10.1038/s41893-024-01403-w>.

Unidroit. n.d. « Nature juridique des crédits carbone vérifiés ». *Unidroit.org*. <https://www.unidroit.org/fr/travaux-en-cours/nature-juridique-des-credits-carbone-verifies/>.

Unidroit. 2025. *Draft Unidroit. Principles on the legal nature of verified carbon credits*. Study LXXXVI. Unidroit Working Group on the Legal Nature of Verified Carbon Credits, Rome, April 2–4, 2025. <https://www.unidroit.org/wp-content/uploads/2025/04/Study-LXXXVI-W.G.5-Doc.-2-rev.-Draft-Principles.pdf>.

Wetterberg, Klas, Jane Ellis and Lambert Schneider. 2024. *The interplay between voluntary and compliance carbon markets: Implications for environmental integrity*. OECD Environment Working Papers 244. Paris: OECD Publishing. <https://doi.org/10.1787/500198e1-en>.