Forest Carbon Credits

2024

White Paper

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Better understanding carbon credits



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France Valley offers investors, whether institutional or private, the opportunity to diversify their assets and wealth with shares in forestry funds. Thus, over 20,000 investors have trusted them. This investment provides several benefits. The benefit of a low correlation with other asset classes (e.g., stock market), the search for performance and attractive long-term risk-adjusted returns, inflation hedging properties, but not only that. All the investors we interviewed wanted to make an investment that, at a minimum, does not harm the environment, and if possible, makes it more livable. **Thus, a question often arises: "how much carbon emissions can I offset by investing in your funds?"** Our answer has always been the same: zero! Indeed, acquiring directly or indirectly a forest that already existed does not allow one to claim its negative carbon balance, in other words, to derive carbon credits from it, because this acquisition does not change the pre-existing reference situation. It does not increase the capture of carbon dioxide in the atmosphere.

The very nature of a carbon credit is complex: it can result from additional capture, or a reduction in emissions. It can be traded on a regulated or voluntary market. It can be ex-post or ex-ante. It cannot always be resold. Communicating about its use is not without consequences. Does it have a legal existence? Accounting? How is it estimated, certified, controlled? Who are the players in this market? All these questions are raised by our investors. As we introduced our Fund dedicated to pan-European afforestation—designed to create Carbon and Biodiversity sinks—we recognized the need for clear and thoughtful education to ensure the subject is properly understood. After all, no one invests in what they do not comprehend. Thus, we chose to begin here: by explaining."

Explain why there is sometimes controversy on this subject: some carbon credits are open to criticism. Explain also what, on the other hand, is good practice, particularly with regard to forests, the world's second largest carbon sink after the seas. Explain why this system of carbon credits, which enables capital to be channelled towards the climate, is not only useful but imperative: neutrality will not be achieved without increasing the capacity of ecosystems to absorb carbon in the long term. Finally, finance directors should also read this document: they will see that if carbon credits are part of their company's climate strategy, the cost could become particularly high, so they need to start thinking about it now.

This White Paper has an educational purpose on the general functioning of Carbon Credits.

It is intended for institutional investors who wonder if they have a role to play in this context, with potentially financial performance at stake, and how to best address their needs.

It is aimed at corporates that are already working on the reduction of their emissions across their entire value chain, but want to go further.

Finally, it is aimed at individual investors and engaged citizens who seek to understand these mechanisms and avoid getting caught in the greenwashing net that scrapes the bottom of portfolios!

For each, once defined what a carbon credit is, we will start by answering a simple question: **are carbon credits useful?**

1. General definition of carbon credit



29%

29% of the world's emissions are captured by forests. The presence of greenhouse gases (GHGs) in the Earth's atmosphere is quantifiable. Indeed, the presence of carbon dioxide exceeds 412 parts per million (ppm).⁽¹⁾, which is 0.0412% of the total atmosphere (this figure had not been reached for about 3 million years). Given a "weight" of the atmosphere of 5,291,000 billion tons, the weight of GHGs present in the atmosphere is approximately 2,180 billion tons of CO₂ equivalent (CO₂e).⁽²⁾. As an indication, the annual emissions from human activity in 2022 were 57 billion tons.⁽³⁾ (an increase of 1.2% compared to the previous year). They therefore represent 2.6% of the stock.

Yet, this does not mean that the stock of GHGs increases by as much each year, as nature absorbs part of these emissions. However, over the past 60 years, **50% of the emissions have indeed ended up in the atmosphere**⁽⁴⁾. At the current pace, it would take just 77 years to emit an amount of GHGs equivalent to what is already in the atmosphere—a strikingly short period, even by the modest timeline of human history, as it spans merely three generations. If this trajectory holds, the generation that would face such a scenario has already been born.

A carbon credit is a unit of measurement corresponding to one ton of carbon dioxide (or other GHG) that has not been emitted or has been removed from the atmosphere. A company, an individual, or a state that are all debtors, i.e., emitters, can thus (i) avoid emissions on one hand, and (ii) conduct carbon capture projects on the other, both adding up to eventually achieving a neutral balance ("Net Zero").

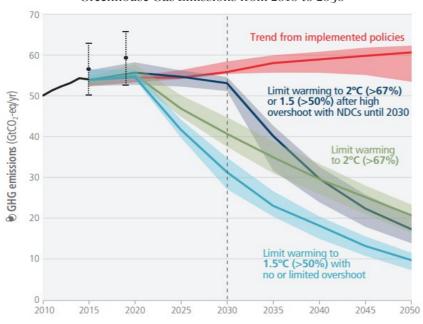
Reductions through avoided emissions can be achieved by investing in less energyconsuming production tools or by limiting their travel, for example. The carbon credit then allows calculating the amount of avoided emissions, called an "avoidance credit" (they are also found in the form of Energy Savings Certificates, ESCs).

Capture, on the other hand, can be done, for example, by leading the planting of a new forest, **as forests capture 29%**⁽⁴⁾ **of the world's emissions.** The amount of carbon credit then reflects the tons of CO_2 equivalent *absorbed* by the forestry project. The credits are thus called "removal credits".

Both types of credits can be traded based on the companies' needs: a company that exceeds its reduction targets could sell these "avoidance credits" to another company that lags behind. A company that does not have the skills to identify and lead a forest plantation can buy "removal credits" from those who have led these plantations. The purchase of a carbon credit therefore finances the necessary investment for a reduction or capture of GHGs and thus constitutes a financial contribution to global warming mitigation.



To address this question, let's project ourselves into 2050. 2050 is the target year set by the countries that signed the Paris Agreement to achieve "carbon neutrality." This neutrality is achieved by reducing emissions to a level that can be absorbed by nature (the oceans, forests, and soils). If this goal is met, there is a 66% chance that global warming will remain between 1.5°C and 2°C.



Greenhouse Gas Emissions from 2010 to 2050

The graph(5) shows the evolution of global warming based on reductions in greenhouse gas (GHG) emissions. Looking at the year 2050 on the navy blue curve, which corresponds to the upper range of the Paris Agreement targets in 2021 - i.e., 2°C, it can be observed that emissions remain at approximately 20 billion tons. These are the emissions that could potentially be absorbed by nature or other GHG capture mechanisms in the atmosphere.

Source : Intergovernmental Panel on Climate Change (IPCC / GIEC)

We make three observations:

1 The scenario corresponding to the commitments formally made today by countries and economic players, which corresponds to the red curve, would result in a warming of 3° C. In this scenario, not 20 billion tCO₂ would have to be absorbed to achieve carbon neutrality, but 60 billion tCO₂.

Even if the Paris agreements are honored, global warming is already having a negative impact on existing natural carbon sinks themselves, particularly as a result of drought. Not to mention the deforestation that is still taking place in the southern hemisphere. Part of the Amazon rainforest has already become a net emitter of greenhouse gases⁽⁶⁾. In France, between 2011 and 2021, the biological productivity of forests declined by 3%⁽⁸⁾, with particularly sharp impacts observed during the exceptionally dry years of 2019 to 2021. As a result, nature will fall short of absorbing the projected 20 billion tonnes of carbon emissions—let alone 60 billion tonnes.

On the technology side, technical solutions do exist to capture carbon dioxide from the atmosphere, but by 2050 they need to have been improved to capture more carbon than the emissions generated by their energy consumption, to have been industrialized for scale-up and to be economically viable by integrating their construction, operation, transport and burial or use of the CO_2 thus captured. These solutions could offset part of the residual emissions, of the order of 2 billion⁽⁹⁾ teqCO₂, representing about 10% of the 20 billion tonnes or 3% of the 60 billion tonnes.

2

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2. Are carbon credits useful?

Global warming impacts on life on Earth are incalculable⁽⁷⁾. Yet it seems certain that proactive emission reductions alone, although necessary, will not be enough to avoid this trend. **Mechanisms to increase the capture of carbon from the atmosphere are therefore essential**. This will require major investments.

In response to this challenge, **Europe has launched the LIFE programme**⁽¹⁰⁾ **allocating 5.4 billion euros for the period 2021-2027**, part of which is used to finance afforestation (the creation of a new forest) or reforestation (the creation of a previously destroyed forest). While this programme can be considered ambitious, it remains insufficient. To capture an additional 20 billion tonnes of carbon annually through new forests plantations alone, France Valley considers that a minimum investment of €10 trillion would be required. This is a rather theoretical exercise, as it would involve covering 10 million km² (the surface area of the French forest is 0.17 million km²(11)) in regions with high biological growth potential. It is evident that public funding, often constrained by national debt levels, will not be enough. Private sector mobilization is critical—and time is of the essence. We need to mobilize private sector. And this is a matter of urgency.

In this context, carbon credits are a tool that, while insufficient on their own, remain necessary. They are particularly compelling because they stem from a voluntary approach—i.e., a spontaneous initiative by companies. This voluntary action does not preclude the implementation of more stringent regulations, such as the European Union Emissions Trading System for certain industrial and transport⁽¹²⁾) or specific taxation. However, it would be a missed opportunity, to say the least, not to leverage this proactive willingness of companies to contribute financially to mitigating climate change.

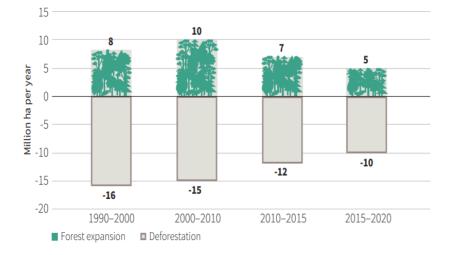
That said, the framework for this mechanism must be carefully structured to ensure:

- 1. It does not replace companies' efforts to reduce their emissions, as this would render the overall impact null.
- 2. The methodologies for calculating credit volumes are robust and do not negatively affect other environmental or social aspects (adhering to the "do no harm" principle).
- 3. Projects are thoroughly monitored to guarantee their quality and long-term viability.

Studies involving over 3,200 companies have shown that those using carbon credits to offset part of their emissions are also the ones investing the most in reducing their emissions, by a factor of more than three $\frac{(37)}{10}$. The takeaway is clear: it's not a matter of choosing one or the other but committing to both.

"Thus, not only are emission reductions a gargantuan task that allows no further delays but so too is the build-up of a carbon removal industry capable of delivering enough negative emissions at scale and on time. To be aligned to global climate goals, a company's climate strategy needs to address both sides of the challenge immediately." - World Economic Forum⁽³³⁾

The world has lost **178 million hectares of forests since 1990** (18), i.e. an area larger than the total forest cover of the European Union. While the rate of deforestation is slowing, it continues in regions such as Africa and Latin America. Conversely, forest cover is increasing in Asia, followed by Oceania and Europe, though the net gain remains modest in these regions.

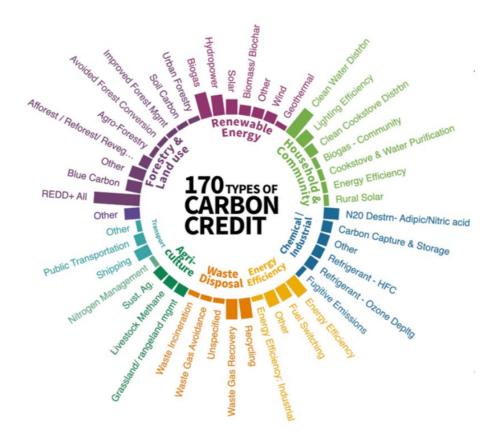


The Intergovernmental Panel on Climate Change (IPCC) estimates that Nature-Based Solutions, including reforestation, can contribute **up to a third of the reduction in carbon emissions needed to limit global warming to 1.5°C**⁽¹⁹⁾. Carbon credits can be used to finance these actions.

Source : Food and Agriculture Organization of the United Nations



There is a wide variety of carbon credits, each differing significantly in terms of impact, price, permanence, regulatory framework, or certification standards. By type alone, approximately 170 distinct categories can be identified.







Reduction in CO₂ emissions from the companies involved since the implementation of the "European Union **Emissions Trading** System."

Source : Ecosystem Marketplace

a. Compliance Markets

The United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992 at the Earth Summit in Rio and entering into force in 1994, aimed to stabilize greenhouse gas (GHG) concentrations to prevent dangerous climate disruptions. The Conference of Parties (CoP), established under this convention, has become the primary body for international climate negotiations.

The Kyoto Protocol (1997) marked a significant milestone by setting binding emission reduction targets for developed countries. It introduced mechanisms such as the cap-and-trade system, allowing countries and companies to trade CO₂ emission permits. The Kyoto Protocol's entry into force in 2005 enabled the creation of regional carbon markets, most notably the European Union Emissions Trading System (EU-ETS). The EU-ETS is the largest regulated carbon certificate market in the world. Its principle mirrors that of Energy Efficiency Certificates (EECs), establishing an annual emission cap for industrial sectors and aviation. This cap decreases each year, and companies unable to meet their targets can purchase allowances from those exceeding them. Each allowance corresponds to 1 tonne of CO₂ equivalent (1 tCO₂e). CO₂ emissions from the companies covered by the system have decreased by 47%⁽¹⁴⁾ since its implementation, equivalent to 942 million tCO₂e. The goal is to achieve a 62%⁽¹⁵⁾ reduction by 2030.

We previously mentioned Energy Savings Certificates. This system operates on a model similar to the EU-ETS, aiming to encourage energy producers and distributors (known as "obligated parties") to reduce their energy consumption and motivate their clients to do the same. Unlike carbon credits, an energy saving certificate is measured in cumulative discounted kilowatt-hours rather than tCO₂e. **The government sets energy consumption reduction targets**, and failure to meet these targets results in financial penalties. Alternatively, obligated parties can purchase certificates issued by those who exceed their targets. These certificates represent a regulated national market, with energy savings generated by this framework in 2023 totaling 37 TWh⁽¹³⁾—equivalent to the output of approximately four nuclear reactors.

Several other Cap-and-Trade schemes of this kind have been set up around the world, with a total of 25. Examples include the California Cap-and-Trade Program for the energy, aviation and industrial sectors, a federal programme in the United States covering power plants in certain Northeastern states, the New Zealand Trading Scheme, the Chinese National ETS and the Korean ETS. The economic players covered by these obligations account for 17%⁽¹⁶⁾ of GHG emissions, and could have contributed to reducing global CO₂ emissions by several billion tonnes since their inception (2005 for the EU ETS). This is far from negligible when considering the goal of reducing emissions by **50 billion tonnes** of **CO₂ equivalent by 2050**, as set out in the Paris Agreement (using 1990 as the reference year for calculating reductions).

Compliance Markets

Advantages	Disadvantages
Guaranteed emissions reductions: these markets operate with an emissions cap, guaranteeing that emissions do not exceed a certain level. This cap decreases over time, forcing companies to gradually reduce their emissions.	Price volatility: the price of allowances can fluctuate according to supply and demand, making it difficult for companies to plan their investments reliably. This can undermine the efficiency of the system.
Sophisticated financial instruments: emission permits (or allowances) become financial assets that can be traded, providing an incentive to innovate to reduce emissions.	Carbon leakage: some industries could relocate their activities to countries with less stringent climate regulations to avoid buying permits, thereby reducing the efficiency of the market.
Efficiency incentive: companies are motivated to reduce their emissions because of the financial costs associated with permits. If they are successful, they can sell their unused allowances, generating additional revenue.	Administrative complexity: managing these systems is complex and costly for companies, due to the need to monitor and verify emissions.
	Diaka
Opportunities	Risks
Investment in green technology: companies have an interest in investing in clean technologies to reduce their	Rising costs: the price of permits can increase rapidly,

interest in investing in clean technologies to reduce their permit requirements.

Economies of scale: companies that reduce their emissions can sell surplus allowances and thus generate revenue.

Changing regulations: climate policies may evolve, which could make costs unpredictable for businesses.

putting pressure on emitting companies.

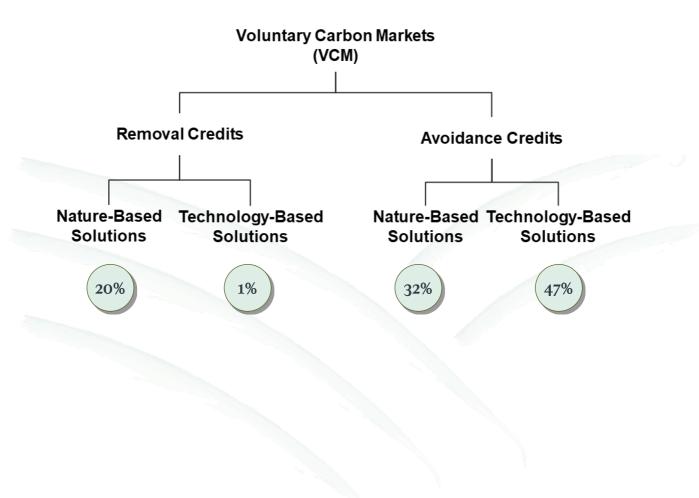
Regulated markets generally involve companies from the energy, aviation, and industrial sectors. These companies may wish to contribute to climate change mitigation beyond the targets set for them, alongside businesses not covered by these systems. They are presented with a wide range of opportunities. **These companies typically seek projects that finance additional CO₂ capture from the atmosphere compared to a baseline scenario**.

Such projects include the creation of mangroves, the installation of direct air capture technologies, reforestation or afforestation (recreating destroyed forests in the former case, and creating entirely new forests in the latter), agroforestry, and agricultural practices that maintain soil cover, as well as the preservation or creation of wetlands or hedgerows. **These investments contribute to the financing of "green infrastructure."** Other projects focus on avoiding emissions rather than capturing additional carbon. Companies participating in such financing need to calculate the impact of their contribution to ensure the effective use of their capital and to publicly claim the results of their actions.

b. Voluntary Markets

For carbon on Voluntary Markets, the same unit of measurement used in regulated markets is applied—i.e., GHG emissions avoided or sequestered in CO_2 equivalent (teq CO_2). For example, a program financing modern stoves to replace traditional stoves for certain communities helps avoid emissions and will generate "avoidance" credits. A cork oak plantation in a near-desert area of Spain would generate "sequestration" or "removal" credits through the carbon sequestered in the wood.

The credits available in the voluntary market are distributed as follows (percentages represent the share of credits supplied by each type)⁽¹⁷⁾:



Voluntary Markets

Advantages	Disadvantages			
Flexibility: companies can buy credit according to their needs or ambitions, without being subject to strict regulations.	Credibility problems: not all credits are equivalent in terms of environmental impact. Some offset projects can be accused of greenwashing, when emissions reductions are exaggerated or uncertain.			
Support for climate projects: voluntary credits finance green projects that might not otherwise have seen the light of day, creating additional environmental benefits, often in developing countries.	No direct reduction in emissions: buying credits does not necessarily motivate companies to reduce their own emissions. This can create a dependency on offsetting instead of actively reducing internal emissions.			
CSR and brand image: companies can use the purchase of credits to enhance their reputation and demonstrate their commitment to the fight against climate change.	Complexity and transparency: the certification and verification of projects can be complex, and the lack of common global standards makes it difficult to assess the quality of credits.			
Opportunities	Risks			
Carbon neutrality: companies can use these markets to achieve carbon neutrality or even become 'carbon negative'.	Greenwashing: companies could use carbon offsetting as a communication strategy, without actually committing to significant actions to reduce emissions.			
New income for green projects: farmers, forest owners and local communities can earn income from projects that sequester carbon, thereby contributing to sustainable development.	Non-additional projects: some projects do not reduce emissions as much as they claim, or the reductions would have occurred without the financing of the credits (problem of climate and economic additionality).			

c. Additionality

The most important point in the creation of a carbon credit is **the principle of additionality**. This concept is simple: it ensures that the credit is only issued if the financed action has changed the existing baseline situation in a sustainable way—meaning more carbon is actually captured, or emissions are avoided, compared to the status quo. As mentioned in the introduction, a forest owner whose forest already exists and is not at risk of disappearing cannot generate credits, even if the forest captures carbon—because it did so before and will continue to do so.

The degree of additionality, which can vary, directly influences the quality and reliability of the carbon credit. For example, a technical solution that reduces energy consumption by 20% represents a permanent avoidance. A farmer who maintains plant cover on their land prevents CO_2 from being released into the atmosphere, but this only holds true temporarily if they do not maintain the cover the following year. This is the principle of permanence. Another example is that creating a forest has stronger additionality than protecting an existing forest, as it must be demonstrated that the forest would have been destroyed without intervention.

There must also be economic additionality: if a more energy-efficient industrial process is already economically justified to improve margins, or if planting a forest is subsidized to cover most of the costs, the sale of carbon credits would not have been necessary for the project to happen. In this case, there is no economic additionality. **Carbon credits must finance projects that would not have been carried out without them.**

d. Ex-post and Ex-ante credits

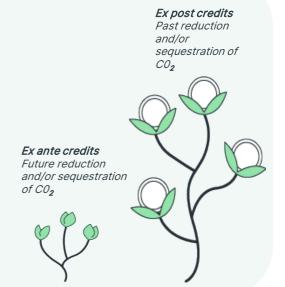
Imagine that you plant an oak tree in your garden in a place where there hasn't been one since at least 1990. You are thus creating a new small carbon sink. This sink could potentially last for 400 years.

How many credits have you created?

This oak tree will have a volume of $5m^3$ at maturity, or approximately 5 teqCO₂ captured during its lifetime. You would therefore no doubt want to generate and sell 5 credits, taking into account the full future impact of this change in situation.

These would be *ex-ante* credits, issued before the carbon is actually captured. If, for example, we look ahead to 2050, the key year in the Paris agreements for achieving carbon neutrality, your oak tree will still be very young and will only have captured 10% of the expected carbon. The most conservative approach would therefore be to issue credits as and when the capture is observed, year after year. These would be *ex-post* credits. This concept is important because some certifications provide for annual *ex-post* credits, others *ex-ante* but only for periods of 5 years, others over 30 years or more.

Ex-post credits are obviously more solid.



a. Regional strategies - European example (Green Deal)

The European Union has put in place an ambitious strategy to develop Voluntary Carbon Markets, as part of its goal of carbon neutrality by 2050, as set out in the Green Deal. This strategy is based on 6 key pillars:

1 Certifying carbon capture

In 2022, the EU proposed a Carbon Capture and Reduction Framework (CCRF) to ensure that the carbon credits used and traded on the voluntary market are of high quality, with verifiable projects such as reforestation or low-carbon agriculture. The European Parliament adopted this framework in April 2024, with the aim of establishing rigorous criteria for additional, measurable and permanent emissions reductions. All the 'operational' variants of the text ('delegated acts') are currently being discussed at European level.

Alignment with the Green Deal

The strategy of voluntary carbon markets is in line with the objectives of the **European Green Deal**, contributing to the reduction of greenhouse gases and providing environmental co-benefits, such as the protection of biodiversity.

Promoting high-quality local projects

The EU supports local projects such as those certified by the **Label Bas Carbone** in France, which guarantee carbon credits from nature-based solutions (forest restoration, soil management) while bringing benefits to local communities and ecosystems.

Harmonisation with international standards

The EU is working to align its practices with international standards such as the **Verified Carbon Standard** (VCS, Verra) and the Gold Standard. This effort aims to ensure the consistency of carbon markets worldwide and the quality of the carbon credits purchased.

Integration into sustainable finance

Voluntary carbon markets are part of wider initiatives such as the green taxonomy, the SFDR (which applies to the financial world) and the **CSRD** (which is gradually being applied to companies, see page 13). These regulations encourage investors to finance projects that are in line with climate objectives and increase the transparency of companies on their climate impact in their ESG reports.

The fight against greenwashing

The Green Claims Directive, proposed as part of the European Green Deal, helps to structure the voluntary carbon market by ensuring that the credits used for green claims are credible, verifiable and aligned with the EU's climate objectives. By imposing high EU the standards, is encouraging green innovation and boosting consumer confidence.

Focus CSRD

The CSRD (Corporate Sustainability Reporting Directive) aims to improve the transparency and quality of extra-financial reporting by companies within the European Union. Replacing the NFRD (Non-Financial Reporting Directive), the CSRD extends extra-financial reporting obligations to a wider range of companies, including listed small and medium-sized enterprises (SMEs). It requires companies to disclose detailed information on their environmental, social and governance (ESG) impacts, including greenhouse gas emissions, climate strategies and emission reduction efforts.

ESRS E1 relates to climate change, and several points are relevant to the development of carbon markets:

- Publication requirement E1-1 Climate change mitigation transition plan: "the company publishes information on its GHG emissions reduction targets, its climate change mitigation actions and its transition plan";
- Disclosure requirement E1-7 GHG absorption and mitigation projects financed by carbon credits: "the company publishes information concerning GHG absorptions and storage expressed in metric tons CO₂ equivalent resulting from projects it may have carried out as part of its own operations, or to which it may have contributed in its upstream and downstream value chain; the amount of GHG emission reductions or absorptions resulting from climate change mitigation projects outside its value chain that it has financed or plans to finance through the purchase of carbon credits." "The objective is to provide an understanding of the scale and quality of carbon credits that the company has purchased, or is considering purchasing, on the voluntary market, potentially to support its claims of GHG neutrality."

b. National strategies - French example (SNBC)

France's Stratégie Nationale Bas-Carbone (SNBC) plays a key role in the development of carbon markets, setting out an ambitious national framework for achieving carbon neutrality by 2050.

By setting GHG emission reduction targets as well as encouraging carbon capture initiatives, the SNBC supports both Compliance Markets (such as the EU-ETS) and Voluntary Carbon Markets.

- Emissions reduction targets: the SNBC sets ambitious GHG emissions reduction targets for all sectors, aiming for carbon neutrality by 2050. These targets create a growing demand for carbon credits from companies and sectors that cannot immediately reduce their emissions. This is driving them to buy credits on voluntary markets or to participate in initiatives such as the EU Emissions Trading Scheme (EU-ETS).
- Encouraging carbon sequestration: the SNBC also encourages the development of carbon sequestration projects in the agricultural and forestry sectors, which are essential to offset residual emissions. This includes initiatives such as reforestation, agroforestry and soil restoration, which capture and store CO₂. According to the SNBC, the forestry sector is one of the key physical levers to achieve carbon neutrality by 2050 in France, due to its dual role as a carbon sink and a provider of bio-based products. One of the primary objectives of this national strategy is to improve the "carbon pump" of forests by strengthening their upstream CO₂ sequestration potential and optimizing the use of wood in long-life products (target trajectory for the creation of a sectoral carbon sink of 46 Mt CO2eq by 2033).
- Support for voluntary carbon markets: the SNBC encourages companies to offset their residual emissions via certified projects, particularly those meeting strict criteria such as those of the Label Bas Carbone, the French National Voluntary Scheme. This helps structure a national market for carbon credits and stimulate demand for Nature-Based Solutions (reforestation, ecosystem restoration).
- **Harmonization with European initiatives**: the strategy is aligned with European policies, notably the EU-ETS, reinforcing France's integration in regulated carbon markets. It also encourages cooperation with international standards (VCS, Gold Standard), facilitating access to global carbon credits for French companies.

c. Spontaneous strategic initiatives stimulating demand

Spontaneous private initiatives play an essential role in the development of carbon credit markets. These initiatives help establish common practices and consistent standards for managing GHG emissions, enabling companies to define emission reduction trajectories and offset their residual emissions.

Alignment with science-based trajectories (SBTi) ⁽²⁰⁾ SBTi is a collaborative initiative designed to help companies set science-based emissions reduction targets in line with the objectives of the Paris Agreement (limiting warming to 1.5°C or 2°C). These targets are to be achieved primarily through internal emissions reductions, before considering carbon offsetting for residual emissions.	Creating clear standards: SBTi enables companies to follow a clear and consistent carbon trajectory. This lends credibility to climate commitments, as these reductions are based on robust scientific methods. Companies are obliged to reduce their emissions first, before resorting to offsetting, thus avoiding greenwashing.			
	Demand for high-quality carbon credits: once companies have reached their internal reduction limits, they use carbon credits to offset their residual emissions. SBTi targets, combined with strict requirements, create demand for additional, permanent and verifiable carbon credits, contributing to the growth of voluntary carbon markets.			
	Harmonization of practices: companies that follow SBTi adopt common methodologies to measure and manage their emissions, thus facilitating the emergence of standard practices in GHG management. This promotes greater transparency on carbon credit markets, where rules and certifications are sometimes fragmented.			
	Reliability of carbon offsets: by forcing companies to disclose their climate risk management, the TCFD improves the transparency and reliability of carbon markets. Companies that report their climate risks are more likely to adopt responsible carbon offsetting practices, reinforcing the credibility of the market.			
Transparency and Climate Risk Management (TCFD) ^[21] he TCFD, indirectly founded by G20 governments and central banks, encourages companies to publicly disclose how they identify, measure and manage the climate risks associated with their activities. This includes physical risks (linked to the impacts of climate thange) and transition risks (linked to climate policies, technological developments, etc.).	Incentives to offset residual emissions: by assessing the climate risks in their operations, companies are encouraged to think about how to offset the emissions they cannot immediately reduce. TCFD thus encourages the adoption of voluntary offsetting practices, while ensuring that internal emissions reductions are given priority.			
technological developments, etc.).	Consistent disclosures: by harmonizing climate risk disclosures, the TCFD enables investors and stakeholders to assess companies' climate performance in a consistent manner. This facilitates comparability between companies and helps carbon credit markets to rely on verifiable, standardized data.			

	Carbon neutrality: many companies that follow the SBTi or TCFD frameworks set themselves carbon-neutral or carbon-negative targets. This prompts them to invest in carbon credits to offset the residual emissions they cannot yet eliminate through internal reductions.			
Stimulating demand for carbon credits These initiatives increase demand for carbon credits by structuring corporate climate strategies in a way that is consistent with global climate objectives.	investments in low-carbon projects: companies adopting these frameworks are encouraged to finance Carbon Removals or Carbon Farming projects, creating increased demand for quality carbon credits. This stimulates investment in carbon capture technologies and nature-based solutions (e.g. reforestation, ecosystem restoration), contributing to the development of voluntary carbon markets.			
Establishing common practices and standards	Standardization of targets : with SBTi, companies follow consistent emissions reduction trajectories, creating a common language in the assessment and management of CO_2 emissions. This facilitates the integration of carbon credits as a complementary solution to internal efforts.			
Private initiatives such as SBTi and TCFD are also helping to structure corporate carbon management practices around common standards, thereby facilitating the development of carbon credit markets.	Harmonized carbon performance measures: thanks to the TCFD, companies are required to track standardized indicators on their emissions, climate risks and risk management. These harmonized practices facilitate the implementation of reliable and comparable offsetting strategies, which are essential for strengthening the credibility of carbon credit markets.			
	ICVCM (Integrity Council of the Volontary Carbon Market) ²² : The ICVCM's core principles introduce rigorous standards for carbon credits, ensuring that they are additional, permanent and verified by independent auditors. The aim is to create a robust framework where traded carbon credits are reliable, thereby increasing the credibility of the market.			
Confidence in market quality and integrity	VCMI (Volontary Carbon Markets Integrity Initiative) ²³ : The VCMI Claims Code provides a framework to ensure that companies using carbon credits to meet their carbon neutrality targets do so transparently and honestly. The code requires companies purchasing carbon credits to declare them correctly, explaining how these credits complement their internal emissions reduction efforts. It also ensures that claims made around carbon neutrality are credible and supported by evidence.			

Before detailing the methods for calculating the amount of carbon sequestered or avoided, it is important to note that methodologies generally rely on the same key principles:

- Environmental and Economic Additionality
- Baseline Measurement (the level of sequestration or emissions that existed before the project)
- **Estimation of "Leakage"** (additional emissions the project could cause, such as the potential increased exploitation of other forests due to the protection of one)
- Conservative Assumptions
- Quantifiable and Measurable Results
- **Permanence of Carbon Sequestration:** no future re-emission of the sequestered carbon. Buffer stocks of unused carbon credits (ranging from 10% to 40% depending on the project) are kept as a collective insurance to account for uncertainties. For instance, a 40% buffer stock may not cover the complete loss of a plantation destroyed by fire, but would be more than sufficient for a project that suffers no damage elsewhere.
- Transparency: methodologies, calculations, data, and sources of information must be accessible to verifiers
- Reliance on the most accurate scientific knowledge
- It is essential that third parties verify the consistency of the project throughout its lifespan.

a. Example of Carbon Credits generated from existing forests

There is a wide range of forest management strategies in existing forests to enhance the carbon sequestration i.e., to change the reference situation in terms of conservation or carbon capture. Some overlap, or even combine. These are the methodologies in the "IFM" (Improved Forest Management) family. Here are a few examples:

- **Restoration of partially or fully destroyed forests:** after a fire, storm or health issue, a forest requires investments to return to its previous carbon sequestration levels. These investments can be financed by carbon credits.
- **Timber quality improvement:** A forest managed to produce low-quality timber, used for energy or industrial wood (with short lifespans), captures carbon well. However, it is possible to selectively choose the best shoots (trees growing from stumps) for producing higher-quality timber that will sequester carbon for decades, even centuries. This conversion requires an initial economic sacrifice, which carbon credits can help finance. This approach is similar to selective logging in commercial forests, where the highest-quality trees are retained and lower-quality or slower-growing trees are removed, instead of cutting indiscriminately.
- **Extension of harvesting cycles:** Forest management is often legally regulated, especially concerning the maturity stage of the stands, determined by their age or diameter. By delaying the harvesting of mature stands, a forest can increase its average carbon storage "on-site." In some cases, logging may be prohibited entirely, causing the carbon stock to increase even further. Delaying or canceling harvesting represents an economic sacrifice that carbon credits can compensate for.

- Avoiding human destruction of existing forests: in some countries where regulations are lax or not respected, forests are threatened with logging, to free up agricultural land or areas needed for construction. When this risk can be demonstrated, the protection of these forests can lead to the generation of carbon credits.
- Avoiding the degradation of existing forests: the risk of forest degradation is not only of human origin, particularly in the context of global warming, which is leading to the weakening of forest stands, making them less resistant to sanitary attacks, or to decay due to insufficient rainfall. The transformation of these forests, by introducing species adapted to this situation, helps to preserve these carbon sinks. These investments can be financed by issuing credits.
- Creating more sustainable forest ecosystems: forest management that takes into account the need to enhance biodiversity can help build more balanced and sustainable forest ecosystems that are more resilient to climate change. From this point of view, this action secures the existence of long-term carbon sinks. Introducing a variety of species, some of which are not very productive, is one of many solutions, while leaving dead trees standing or on the ground are also short-term economic sacrifices.

These features of carbon credits generation are not all equal. Below, we have summarized some of the strengths and weaknesses of each, taken individually. The weaknesses are often offset by a margin of maneuver that is allowed: part of the credits generated will not be available for compensation but will be set aside as a "buffer," acting as insurance covering risks.

Method	Strengths	Weaknesses
Restoration of partially or fully destroyed forests	The methodologies for calculating the carbon capture of plantations, according to species, soil and climate, are sound, and the volume of wood created compared with the previous situation is significant.	If the owner had the financial means to invest in replanting his forest, if he had access to subsidies to help him do so, or if regulations forced him to do so, economic additionality would be fragile.
Wood quality improvement	This method makes it possible to satisfy the growing demand for timber, particularly in the construction industry, as a substitute for concrete or steel. This emission-avoidance effect is powerful and permanent.	The rotation in a forest producing wood for energy production or industry is rapid. Carbon capture in the forest is therefore high. The incremental improvement is not always easy to measure, and the longevity of wood products is sometimes theoretical. What's more, a property developer using these woods will be tempted to issue credits in turn, in which case the credit would be double- counted.
Extension of harvesting cycles	If all the world's forests were to extend their harvesting cycle, the standing carbon stock would be much higher. This method is independent of the use and lifespan of processed wood products.	The drop in volume put on the market for a time can potentially be offset by greater removals from other forests to satisfy demand, neutralizing all or part of the impact.
Avoid human destruction of existing forests	The world's forest carbon sink is threatened by deforestation, which is slowing but continuing in Africa, South America and Oceania. The creation of non-harvestable areas is slowing this process.	On a case-by-case basis, it is difficult to demonstrate that deforestation of a plot of land is imminent, so additionality may be fragile.

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Method	Strengths	Weaknesses
Avoid degradation of existing forests	It has been shown that global warming has begun to reduce the carbon uptake of forests, yet they must be able to capture residual GHG emissions for the next few hundred years. Forest adaptation is a matter of urgency in certain geographical areas.	We have little experience of the adaptation of new species to the affected environments in which they are implanted, with the risk that their growth will be limited or even that they will not adapt to their new environment.
Creating more sustainable forest ecosystems	Biodiversity is the source of all natural carbon capture: for example, without biodiversity, soils no longer fulfil their function of degrading organic elements into mineral elements that nourish trees. Furthermore, the diversity of species chosen makes it possible to dilute the health risk (each species often having its own enemies).	This very long-term strategy does not address the urgent need to increase the efficiency of carbon sinks. Moreover, the complexity of ecosystems makes it difficult to measure the impact of these actions.

b. Example of Afforestation and Reforestation

Afforestation (and to a lesser extent reforestation) is to date the most robust method in terms of additionality, a determining factor in the quality of the carbon credits generated.

Indeed, creating a forest where one has been cleared for agricultural land or construction (reforestation), or better yet, creating one on bare land where no forest has existed since at least 1990 (the global emissions reference year) (afforestation), offers the highest additionality among nature-based methods: carbon storage in trees and in the litter is substantial, and generally also in the soils, provided they are not overly disturbed and exposed to the sun during harvesting.

Furthermore, the methods for calculating the volume of carbon stored in trees are scientifically accepted and wellestablished. There are many factors that can influence tree growth: the type of species, the nature of the soils, rainfall, humidity, and sunlight exposure, among others. However, for many years, we have had reliable growth tables for trees, by species, by geography, and by main forestry type. In Ireland, for example, it is possible to rely on the Sitka Spruce growth model developed by the Ministry of Agriculture (the "GROWFOR model"⁽²⁴⁾). In Finland, where forest data has long been monitored with plots throughout the country, it is possible to rely on the MOTTI model⁽²⁵⁾ developed by the Natural Resource Institute of Finland. In France, for years forest managers have been using the growth tables of the "Chaudé Tariff"⁽²⁶⁾. Portugal has developed the pan-European Yield-Safe model⁽²⁷⁾ and in England the government provides the Forest Yield software⁽²⁸⁾.

From the volume of the log, it is possible to determine the total biomass of the tree (both aerial and root) in terms of dry matter. This is then converted into a quantity of carbon using a carbon-to-biomass ratio that varies according to tree species. In addition to the carbon present in the trees, there is also carbon in the soil and litter (dead leaves, fallen branches, decomposing organic matter). Furthermore, the management practices carried out will have a significant impact on the conservation of this carbon, ensuring that, for example, clear-cutting does not occur.

Method	Strengths	Weaknesses		
Reforestation	Additionality ++ Proven methodologies, potentially positive biodiversity impact.	Check the history of deforestation (may have been carried out to reforest and obtain credits) and the possible economic impact on local populations to be reclassified.		
Afforestation	Additionality +++ Proven methodologies, potentially positive biodiversity impact.	Possible economic impact on local populations to be reclassified.		

Apple conducted a study to determine its potential contributions to mitigating global warming, beyond its actions to drastically reduce its emissions. They compared carbon credits based on their stage of technical development, their industrialization, their durability, the robustness of their methodology and their potential co-benefits. This very comprehensive reading grid gives the following result:

	Development stage	Scalability	Durability	Carbon methodology	Cobenefits
Aforestation, reforestation, and revegetation (ARR)			\bigcirc		
Soil carbon sequestration			\bigcirc	\bigcirc	
Biochar		\bigcirc		\bigcirc	
Bioenergy with carbon capture and storage (BECCS)	\bigcirc	\bigcirc		\bigcirc	\bigcirc
Direct air capture (DAC)	\bigcirc	\bigcirc		\bigcirc	\bigcirc
Enhanced weathering / ocean alkalinity	\bigcirc			\bigcirc	\bigcirc
Ocean fertilization	\bigcirc			\bigcirc	\bigcirc

Covered
Partially covered
Not covered

Source : Apple Removal Strategy white paper



6. The main certification standards

Based on the general principles indicated above, several standards have been developed, proposed by NGOs, which then select companies or associations authorized to certify and audit projects.

The main standards are the first four presented below, which represent 90% of carbon credits recorded in the world. These organizations validate the underlying methodologies, which can cover many situations (forest protection, afforestation, improvement of management of existing forests, agriculture, agroforestry, energy savings, emission reductions, etc.). We will then mention some other national certification programs, on a smaller scale but recognized for their solidity and sometimes supported by the States themselves.

Verified Carbon Standard (VCS)

In 2005, the regulated markets that were created did not include forestry projects in the quota mechanism. In 2006, a few operators decided to create a private benchmark. Among the founders were the World Economic Forum in Davos and the Climate Group (an international alliance of multinationals). Verra, which supports this standard, is a non-profit organization and the VCS is one of the most widely used standards in the voluntary carbon market (83 million credits issued in 2023 but 255 million in 2022). It covers a wide range of projects, from reforestation projects to those related to renewable energy and energy efficiency. Verra was destabilized when an article was published in the British daily The Guardian(35) in 2023, which questioned the additionality of REDD+ projects⁽⁴⁴⁾ (UN mechanism for Reducing Emissions from Deforestation and Forest Degradation), but remains the reference most requested by buyers of carbon credits for forestry issues.

Gold Standard (GS)

Founded by WWF and other NGOs, this standard aims to guarantee climate and sustainable development impacts. It focuses on co-benefits for sustainable development (such as poverty reduction or access to drinking water) in addition to reducing carbon emissions. It is the second most used certificate in the world, with 93 million credits issued in 2023 (45 million in 2022). It covers many types of projects, such as renewable energy, reforestation, water management, access to clean energy, etc.

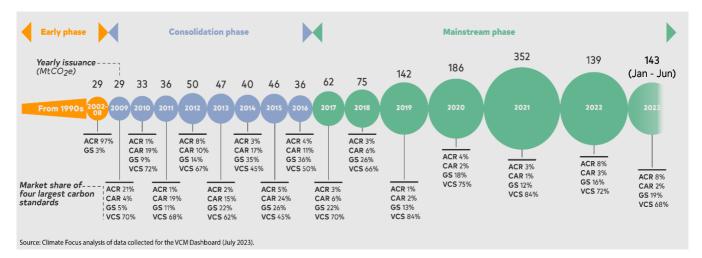
Climate Action Reserve (CAR)

This North American standard offers carbon credits from energy, forestry and agriculture projects in the United States and Mexico, and now in many other countries. CAR is particularly known for its methodological rigor. CAR has issued approximately 198 million carbon credits worldwide in 2023 for various types of projects, including waste management, methane destruction and industrial processes.

American Carbon Registry (ACR)

The ACR is a US initiative that provides a framework for emissions reduction projects in the United States and around the world. It is one of the first voluntary registries created. It is recognized in the United States in particular for a program for using methane as a fuel. The projects cover activities such as renewable energy, carbon sequestration in forests, agriculture, methanization, etc.

6. The main certification standards



Distribution of credit emissions by main standards (June 2023)

Source : Climate Focus

Label Bas Carbone

This certification framework was launched by the French government in 2019. Initially applying to forestry projects (afforestation, reforestation, improved forest management), it has since expanded to agriculture, transportation, and waste management. It is overseen by the Ministry of Ecological Transition. Since its creation, it has issued 14 million credits, including 4 million in 2023.

La Belle Forêt

Through private initiative, the company *La Belle Forêt* has developed a methodology verified by Ecocert and certified by Bureau Veritas. This methodology involves postponing the harvesting of mature trees, as outlined in the French guidelines of the Regional Forest Management Schemes, for a period of 20 years. This allows for the extended storage of carbon in healthy forest stands. *La Belle Forêt*'s approach incorporates co-benefits such as biodiversity protection and water conservation, which define the quality and value of its carbon credits. This system was implemented within the Chambord National Estate and sold to EDF for a 5-year period. France Valley has decided to adopt this methodology for a portion of its French forest assets.

Woodland Carbon Code

Managed by the Scottish Forestry government agency, it covers the United Kingdom and has seen significant local development. It applies exclusively to forestry projects but incorporates aspects related to biodiversity, water management, and social impacts. A total of 1.2 million credits have been issued since its inception in 2019.





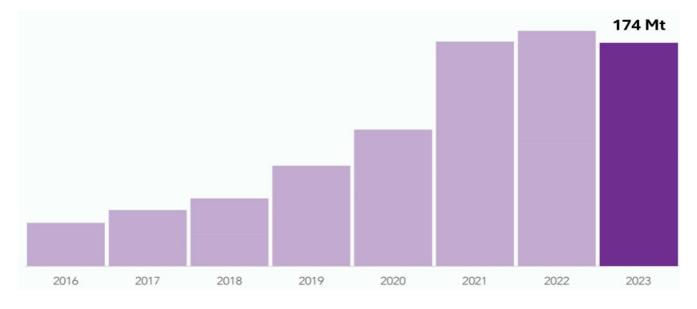
To date, ³/₄ of the market is captured by "certificate" type instruments on regulated markets. Carbon credits represent the last quarter, the majority of which is also concentrated on regulated markets. **The Voluntary Credit Market represents 2% of the total in 2022, for a value of 2 billion dollars, i.e. 4 times more than in 2020.** Over the same period, the Compliance Market has increased 2.5-fold⁽¹⁷⁾.

The Voluntary Credit Market declined sharply in 2023, reaching 111 million credits in volume (a decrease of 56%⁽³⁶⁾) and \$723 million in value, a decrease of 63%. This must be put into perspective since it represents a growth of 35% in value compared to 2020. We do not conclude that 2021 and 2022 were anomalies in the path of carbon credits, but it is likely that COVID, which has demonstrated the interconnectedness of humanity's problems across the planet, has occasionally fueled climate action.



Source : Ecosystem Marketplace

This decline is mainly explained by the desire of companies likely to use carbon credits to **focus on the most qualitative of them**, in particular those based on nature which have, in addition to carbon, environmental and social co-benefits. This attention paid to the nature and integrity of the credits generated was amplified by the publication of an article in the daily newspaper The Guardian⁽³⁵⁾ early 2023 revealing that in 90% of REDD+ projects⁽⁴⁴⁾⁽⁴⁵⁾ in tropical forests certified by Verra, additionality was zero. Even though the Verra association contested the conclusions of the journalists and because of other similar publications, notably on agroforestry projects in the southern hemisphere, this phenomenon has increased throughout 2023. The first part of 2024 shows a slight recovery of the market. The steps taken by project leaders, NGOs and sometimes States for better supervision of carbon credits that can be used are beginning to restore business confidence. On May 28, 2024, the Biden administration published the "Joint Policy Statement and Principles on Voluntary Carbon Markets". This is one of many recent international initiatives aimed at rebuilding confidence in voluntary carbon markets, in addition to the work of the SBTI, CVMi, ICVCM and the European Union (see above). Regarding the voluntary market, the supply of credits is currently greater than demand. Thus, in 2023, 174 million credits were withdrawn (i.e. used for compensation) for 308 million credits recorded on the certifiers' registers. However, the end of 2023 saw strong growth, with a 35% growth in December 2023 compared to the record month of December 2021⁽⁴⁷⁾.

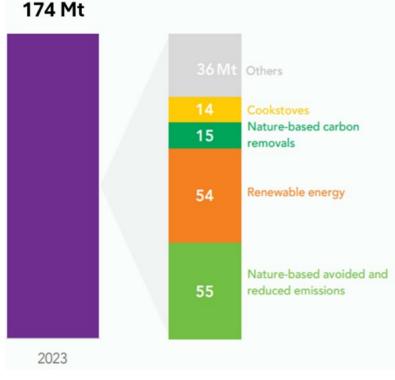


History of retired carbon credits (voluntary market)

Source : <u>Climate Focus</u>

Furthermore, the dynamics by credit type is very variable. The credits offered that come from nature-based projects now represent 122 million tonnes, compared to 73 million for renewable energies. Note that credits issued by the installation of more efficient cookstoves in developing countries have more than doubled in 2023 to reach 60 million tonnes⁽⁴⁷⁾.

Typology of withdrawn carbon credits (voluntary market)

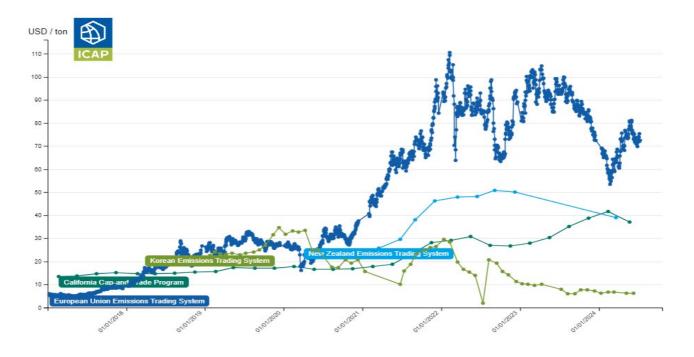


It is interesting to compare the credits issued with the credits actually retired. In 2023, out of 308 Mt issued, 174 Mt were used. As a result, the stock of old carbon credits is increasing, reaching 878 Mt in 2023. Of this, 180 Mt come from credits issued before 2016, and are less likely to find buyers at high prices due to the evolving standards, which are more stringent, and the growing demand from companies, which are increasingly concerned about the quality of the credits.

Source : <u>Climate Focus</u>

b. Credit prices

On the Compliance Market, carbon credit prices have risen significantly. However, they do not serve as a perfectly reliable indicator of trends in the voluntary carbon market, as the regulated market is driven by public policies that set emissions reduction targets for so-called "compliant" companies, which influences the demand and availability of credits. Indeed, a company facing increased emissions reduction obligations will have a harder time exceeding those limits and therefore will have fewer surplus credits available for others. The price range for carbon (regulated market) is very broad: as of August 1, 2023, prices ranged from 1 cent per ton in Baja California (Mexico) to \$154 in Uruguay. Currently, over 70% of covered GHG emissions are still priced at less than \$20 per tCO2e. The most reliable market is the EU-ETS, the largest carbon market in the world: prices in this market have more than doubled since 2021.



Source : ICAP Allowance Price Explorer

On the voluntary carbon offset market, the price of a carbon credit can vary between \in 5 and \in 200 per tonne of CO₂ equivalent⁽⁴⁸⁾. It depends on many factors (typology, geography, certification, co-benefits and above all quality).

Thus, despite the impacts of the publication of the Guardian article and the contraction in demand, the drop in prices of credits from forestry projects was limited to 4% in 2023. Within these forestry credits, the prices of REDD+ program credits (78% of credits) fell by 23% but those from improving forest management to capture more carbon increased by 11%.

Among these credits, some projects claim the avoidance of emissions ("avoidance credits") while others claim additional capture ("removal credits"): a significant part is issued on the claim of protection of existing forests, therefore on the limitation of emissions (those linked to the use of cut wood, fires, exposure of bare soils). The increase in the requirement of the actors led the price of "removal credits" to increase by 32% in 2023. That of "avoidance credits" fell by 21% that same year. The gap between the two was 152% in 2022, it rose to 245% in $2023^{(36)}$. Similarly, a credit offering, in addition to the carbon impact, social or environmental co-benefits, will have been traded with a premium of $35\%^{(36)}$ compared to a "simple" carbon credit.

In general, credits from projects on natural assets remain the most sought after with 35% market share, ahead of renewable energies which represent 28%⁽³⁶⁾. Prices are affected, since nature-based credits sell for twice as much on average as so-called technological credits (chemistry, cookers, renewable energies, waste treatment, etc.).

	2022			2023			Percent Change		
CATEGORY	Volume (MtCO ₂ e)	Value (USD)	Price (USD)	Volume (MtCO ₂ e)	Value (USD)	Price (USD)	Volume	Value	Price
Forestry & Land Use	113.0	\$1.1 B	\$10.14	36.2	\$351.3M	\$9.72	-68%	-69%	-4%
Renewable Energy	92.7	\$386.1 M	\$4.16	28.6	\$111.1 M	\$3.88	-69%	-71%	-7%
Chemical Processes/Industrial Manufacturing	13.3	\$68.5 M	\$5.14	12.2	\$50.2 M	\$4.10	-8%	-27%	-20%
Household/ Community Devices	9.1	\$77.6 M	\$8.55	9.9	\$76.6 M	\$7.70	+10%	-1%	-10%
Energy Efficiency/ Fuel Switching	6.6	\$35.6 M	\$5.39	9.4	\$34.4 M	\$3.65	+43%	-3%	-32%
Agriculture	3.8	\$41.7 M	\$11.02	4.7	\$30.6 M	\$6.51	+24%	-26%	-41%
Waste Disposal	6.2	\$44.9 M	\$7.23	1.5	\$10.9 M	\$7.48	-77%	-76%	-3%
Transportation	0.18	\$770 K	\$4.37	-	-	-	-	-	-

	2022			2023		
Project Cluster	Volume (MtCO ₂ e)	Value (USD)	Price (USD)	Volume (MtCO ₂ e)	Value (USD)	Price (USD)
REDD + (ALL)	57.4	\$584.2 M	\$10.19	28.2	\$222.3M	\$7.87
Afforestation, Reforestation and Revegetation (ARR)	10.8	\$129.8 M	\$12.05	4.1	\$64.8 M	\$15.74
Improved Forest Management (IFM)	4.5	\$66.2 M	\$14.67	2.4	\$38.9 M	\$16.21
Blue Carbon	3.4	\$39.3 M	\$11.58	0.38	\$3.2 M	\$8.33

Source : Ecosystem Marketplace Report I

Prices also differ greatly by geography. Credits issued in Asia are trading at an average price of \$5.6, \$5.7 in the United States, compared to an average of \$24.6 in Europe, where supply is much narrower. They reached £25 compared to £15 in $2021^{(46)}$ in the UK. Those certified by the Woodland Carbon Code were traded at a price of £37. Carbon credits from the Low Carbon Label in France are in the lead with an average of $\leq 33^{(49)}$. Finally, let us note the sale of carbon credits from the French La Belle Forêt program, by the Chambord estate, to EDF, for ≤ 100 per credit (18,000 credits on a first batch), "a far cry from the few cents paid for "ghost" credits in the Amazon"⁽⁵⁰⁾. Projects integrating a biodiversity protection dimension are the most sought after, like the Kalimantan Forest Carbon Project in Indonesia, providing for the preservation of multiple critical habitats, which generated credits acquired at a unit price of ≤ 158 .

c. Market outlook

The Shell BCG study⁽¹⁷⁾ of 2023 covering 2022 estimates that the voluntary credit market will be multiplied by 5 by 2030, for an average credit price of 25 euros. This estimate includes all types of credits, regardless of their quality.83% of the companies surveyed believe that their compensation needs will increase in the future. In their selection criteria, they place the quality of the credits first, i.e. the capacity to monitor projects, report and control. Price is the second criterion, ahead of permanence and additionality. Finally, the companies surveyed believe that their credit portfolio will consist of "removal credits", which represented less than 20% of the credits issued between 2015 and 2023. This share could reach 35% by 2030, i.e. an annual growth of 24%. According to the TSVCM study⁽³¹⁾ this share would reach 50 to 60% in 2030. Growth is even stronger in the segment of nature-based capture solutions, which represented 27% of credits in 2020 (for a volume of 54 million teqCO₂) and which could reach 43% market share in 2030 (for a volume of 430 million tonnes).

In any case, these elements argue for the generation of quality carbon credits and for appropriate use by purchasers. The framework that was drawn up this year by SBTi⁽⁴¹⁾ as well as the adoption of the European CRCF framework⁽⁴²⁾ defining and classifying carbon credits, the Green Claims directive project, which provides a framework for corporate communication, particularly with regard to climate claims, provides a framework that will provide security for businesses.

Concretely, corporate initiatives are increasingly numerous and significant. For example, Apple has achieved carbon neutrality in scope 2 of its "corporate" perimeter (all the emissions it controls and those induced by its energy consumption), thanks to the use of renewable energies that cover 100% of its consumption; the company plans to achieve neutrality across its entire value chain by 2030⁽³⁰⁾. It has already invested several hundred million dollars in nature restoration projects, after examining all existing solutions, including \$400 million in its Restore Fund. In addition, Apple has led some of its subcontractors, such as TSMC, to commit themselves.

"From our review of different available technologies, we determined that nature-based solutions - including afforestation, reforestation and revegetation (ARR) and soil carbon sequestration - currently offer the most comprehensive carbon removal approach today." - Apple (30)



This is the rate of the world's largest companies having announced a "net zero" strategy by 2023.

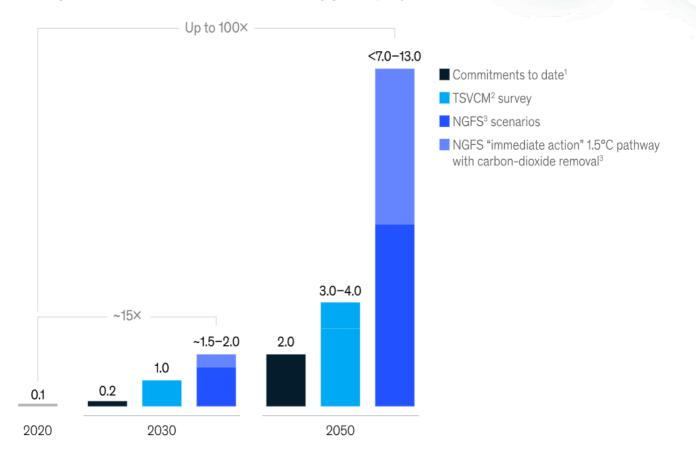
For its part, Microsoft has committed to erasing its historical carbon footprint generated since its creation in 1975 by 2050. In 2022, 85% of its portfolio consisted of forestry projects. The company has announced a billion-euro program for the reforestation of 135,000 hectares in Latin America.

In France, the Orange Group has set up its own decarbonisation fund, with \in 50 million, to offset all residual emissions. Companies such as Kering, Danone, Chanel, Hermès, Mars, Bel, to name a few, have financed projects to capture or reduce CO₂ emissions.

The potential remains considerable: in 2021, a boom year for carbon credits, their use represented only 2% of GHG emissions.

Thus, a BCG study considers that the demand for carbon credits on the voluntary market will exceed the supply between 2024 and 2038⁽²⁹⁾. The study conducted by McKinsey for the Institute of International Finance⁽³²⁾ considers that the market could reach 50 billion dollars by 2030, an increase of a factor of 15, then of a factor of 100 by 2050. For its part, the strategy firm Bain considered in 2022 that the market would reach 30 to 50 billion dollars by 2032⁽⁵¹⁾ (compared to around \$700 million in 2023).

This demand could also be driven by the difficulties companies are having in reducing their emissions in line with the plan they have announced. 37% of the world's largest companies have announced a "net zero" strategy by 2023, compared to 27% in 2021. However, only 18% are actually on this trajectory. 33% of these global companies, without being on the net zero trajectory, are actually reducing their emissions. The balance, or 49%, are still increasing them.

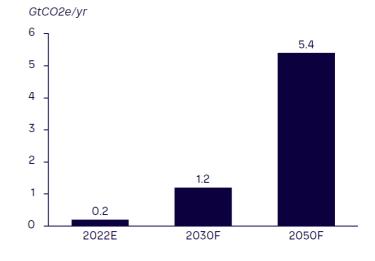


Voluntary demand scenarios for carbon credits, gigatons per year

Source McKinsey

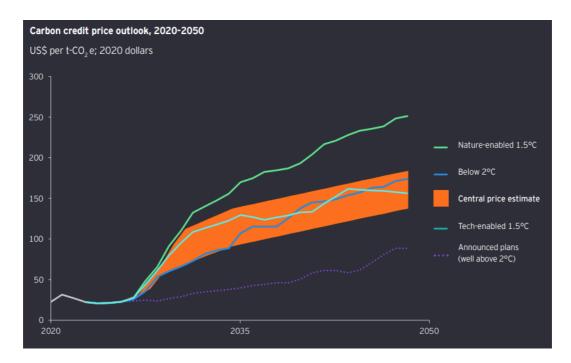
The same study considers that this demand for nature-based carbon credits may not be able to be satisfied, given several difficulties, including the concentration of projects in a limited number of host countries and the slow deployment to quickly generate these credits. After taking these risks into account, the volume of credits could be 1 to 1.5 billion tCO_2e in 2030 (compared to 408 million issued on the voluntary market in 2023), for a demand that could reach 8 to 12 billion tCO_2

Arthur D. Little and BloombergNEF estimate for their part that the demand for carbon credits on the voluntary market could increase by a factor of 8 by 2030 and by a factor of 27 by 2050.



Source : Arthur D.Little

The pressure from demand, technical and time limitations on supply, as well as the search for high-quality credits, are expected to have a significant impact on the prices of carbon credits with high integrity. Between 40% and 60% of the credits issued worldwide are expected to exceed the \$50 threshold by 2035, with 76% surpassing the \$100 threshold. The average price could reach \$115 by 2035 and \$175 by 2050. EY also envisions a scenario where the goals of the Paris Agreement are met by relying on nature-based solutions. In this case, the average price of carbon credits (across all qualities) could approach $$250^{(38)}$.



BloombergNEF predicts qualitative credits will reach \$238 in $2050^{(40)}$, with a price of $162^{(39)}$ in Europe from 2030.



Sources : EY, BloombergNEF

These are only averages, all credits combined, while **high-quality credits can now present a premium of 245%**⁽³⁶⁾. Our estimate is that carbon credits leading to carbon capture in the atmosphere, based on Nature-Based Solutions that provide environmental co-benefits, **could reach €300 by 2050**, **or even more, particularly in Europe.**



Since the implementation of the European regulated market (EU-ETS), CO_2 emissions from the companies affected have decreased by $47\%^{(14)}$, amounting to 942 million tCO₂eq. This represents 1.25% of the global reduction effort to be achieved over the next 26 years. While this is small compared to the overall target, it is significant in absolute terms and demonstrates the capacity of states to define and implement effective systems. Greenhouse gas emissions reductions are underway in Europe, so we cannot be pessimistic.

However, without relinquishing the absolute imperative to accelerate these emission reductions, the challenges of climate change demand that no solution be overlooked. Funding must support the development of technological alternatives to reduce emissions or capture carbon from the atmosphere before it is sequestered. Carbon credits must be promoted to finance afforestation projects in particular, all within a framework that leaves no room for doubt regarding their integrity.

This framework now exists, and many companies have recognized it by financing substantial projects. It is certain that the demand for credits will soon exceed supply, leading to a significant rise in their prices, particularly for the most integral ecosystem credits.

While limiting the rise in temperatures caused by human activity is imperative, there is another, even more complex challenge: limiting the effects of this warming on ecosystems. The issue at hand is the survival of many species around us, upon which we depend. Preserving and creating new natural habitats for biodiversity will be the next key issues to address. "Biodiversity credits" will likely be the focus of another White Paper!

While reading this report on a laptop screen, you emitted 15g of CO2. If using a desktop PC screen, you would have emitted 40g, or just 0.8g using a smartphone screen.

About the authors



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About France Valley :

A portfolio management company approved by the Autorité des marchés financiers since 2014, France Valley is a European leader and expert in investment and wealth solutions in natural assets, particularly forestry, winegrowing and agricultural assets. The leading private forestry investment company in France and with a team of 40 people, France Valley manages €4.5 billion in assets (SCPIs valued on a freehold basis). The company owns 48,000 hectares and 400 forests in Europe, from Ireland to Finland, via France, Romania, Germany, Sweden and the Baltic States. In the wine sector, the assets managed by France Valley are concentrated in a single region: Champagne, where the management company has 41 holdings. France Valley also offers a financial product for pooling temporary usufructs of SCPI units, available to both legal entities and individuals.As a catalyst for change, 20,000 private and institutional investors have access to France Valley investment solutions through partner financial advisers, family offices, private banks and institutional investors. <u>www.france-valley.com</u>

Prior to joining France Valley, Arnaud co-founded La Société d'Investissement Forestier, where he was Managing Director. A former auditor with Arthur Andersen before joining the Thalès group to take part in investment operations in technology companies, Arnaud then worked in private equity with Seventure (Natixis group) and then UFG Private Equity (La Française Asset Management group - €50 billion under management), where he became a Member of the Executive Board. In this capacity, he carried out venture capital, expansion capital and LBO transactions.

Arnaud is Managing Director and co-founder of France Valley.

Camille began her studies with a degree in Economics and Management at the University of Paris II Panthéon-Assas, followed by a Master 1 in Sustainable Development and Organisational Responsibility at the University of Paris Dauphine. During a gap year, she gained significant experience as an ESG analyst at Natixis TradEx Solutions and Natural Capital Officer at WWF France. Her end-of-studies internship at CDC Biodiversité deepened her understanding of biodiversity-related financial risks and extra-financial regulations in France and Europe. Today, as ESG Manager at France Valley, Camille is applying her expertise to meet environmental and social challenges.

After initial experience in capital markets at Morgan Stanley and then in strategy at the Ministry of the Economy and Finance, Marc joined Kearney as a strategy consultant in Paris. He then joined the Figana investment fund in Paris as Director of Strategy and right-hand man to the Chairman and CEO. Marc is a graduate of HEC Paris, Université Paris-Dauphine and Ecole Polytechnique. Marc is Director of Strategy at France Valley and participates in the roll-out of France Valley and the development of the company's strategy.

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