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FORESTRY #AGRICULTURE
CARBON CERTIFICATION

I4CE INSTITUTE FOR CLIMATE ECONOMICS

Une initiative de la Caisse des Dépôts et de l'Agence Française de Développement

Six years of carbon certification in France: an assessment of the Label Bas-Carbone

Authors: **Simon Martel, Paul Mousset, Julia Grimault, Hadda Bourdareau** and **Clothilde Tronquet**

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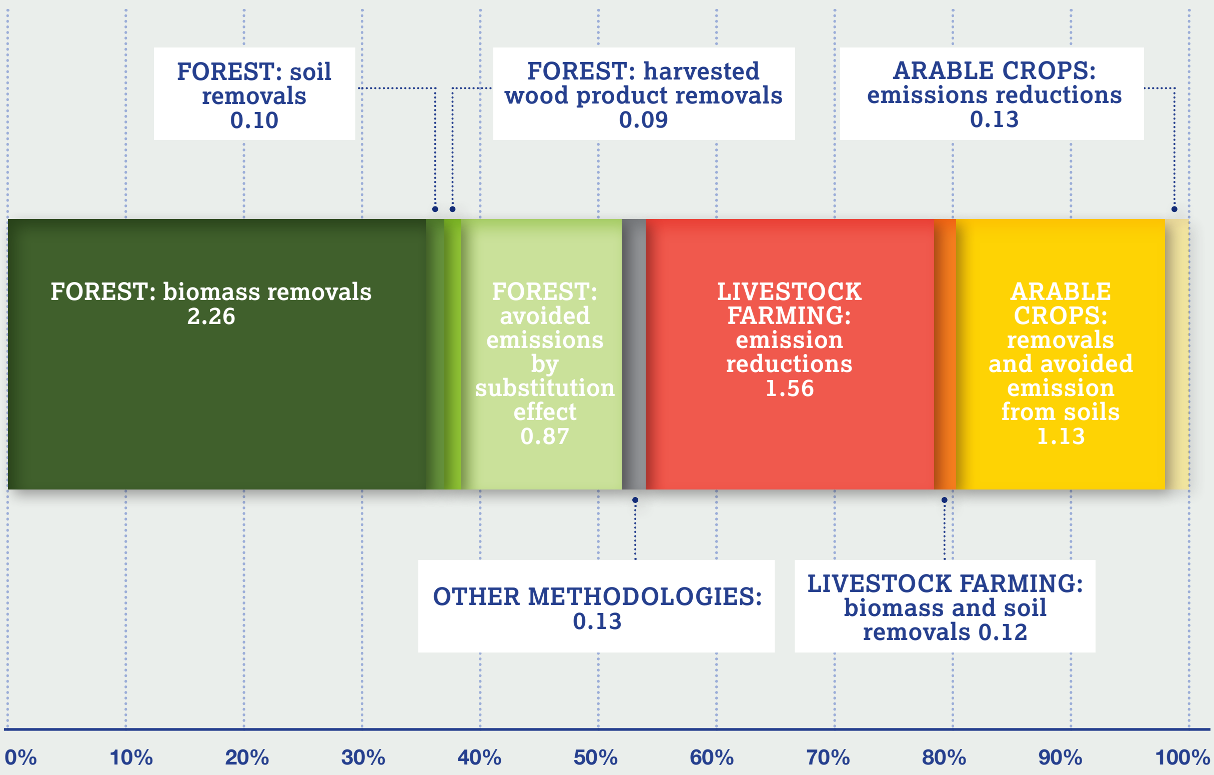
EXECUTIVE SUMMARY

Established in 2018 and held by the French Ministry for Ecological Transition, the Label Bas-Carbone (LBC) is a financing tool for "climate positive" projects, serving the French National Low-Carbon Strategy (SNBC). Based on a carbon impact measurement combined with the assessment of various quality criteria (additionality, environmental impact, etc.), it demonstrates and certifies the climate impact of activities in France, mainly in the agricultural and forestry sectors, with the aim of enabling their financing. The LBC mainly channels private funding from companies, often in the form of carbon offsetting or carbon contributions, which is an advantage given the constraints on public spending.

Six years after its inception, this study aims to review this mechanism and its projects: what activities are being implemented in the field, what impact are they having on the climate, with what robustness or, on the contrary, what limitations in terms of measurement, environmental integrity, accessibility, etc.? This exercise is also intended to feed into the process of continuous improvement of the scheme and to provide feedback for the current implementation of the European carbon certification framework *(Carbon removals and carbon farming: CRCF).*

REPARTITION OF THE GHG POTENTIAL IMPACT OF VALIDATED LBC PROJECTS

(AS OF 31 MARCH 2025 ; ABSOLUTE VALUES IN $MTCO_2EQ$)



Source: I4CE, based on Ministry data, April 2025

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A POTENTIAL IMPACT OF MORE THAN 6 $MTCO_2$, MOSTLY FROM THE AGRICULTURAL AND FORESTRY SECTORS

As of 31 March 2025, 1,685 LBC projects had been validated, representing a **potential impact of 6.41 $MtCO_2$eq,** which will be verified and adjusted 5 years after the launch of each project. Four out of a total of 15 methodologies dominate: **afforestation** and **restoration** of degraded forests for the forestry sector, and **low-carbon practices in livestock farming and arable-crops** for the agricultural sector. **The growth in LBC supply is following an exponential trend:** around 2.8 $MtCO_2$eq of potential certificates were validated in 2024, doubling the figure for 2023. **The projects cover the whole of mainland France,** with a planned extension to the overseas territories.

Unlike international carbon certification standards, the forestry LBC focuses on small individual projects (10.8 ha on average), whereas in agriculture, projects tend to be collective, on a larger-scale and mainly targeting large farms.

The agricultural and forestry sectors have been very active in developing projects, using the LBC as a lever to enhance their knowledge of climate issues. The LBC has also encouraged the emergence of new businesses that have built their economic model around this scheme. This dynamic, with its successes and limitations, provides valuable feedback for emerging initiatives on payment for ecosystem services or biodiversity credits.

FORESTS: REFORESTATION OF DEGRADED FORESTS FIRST AND FOREMOST

The 1,200 forestry projects studied cover more than 12,000 ha and will generate a potential 3.3 $MtCO_2$, including mainly:

- **3,800 ha of afforestation for a potential 1.26 $MtCO_2$,** 83% of it on former agricultural land.
- **5,000 ha of forest restoration** following a fire for a potential 1.02 $MtCO_2$, 93% of which is in the Nouvelle-Aquitaine region, primarily due to the fires that occurred in the summer of 2022.
- **3,300 ha of forest restoration following forest dieback** for a potential 0.71 $MtCO_2$, at least 72% of which is the result of the bark beetle epidemic affecting spruce trees in north-eastern France.

Overall, Low-Carbon Label plantations diversify the species planted, which is important for the resilience of the projects: around 5 species on average for afforestation and post-dieback restoration projects and 2.5 species for post-fire restoration projects. Apart from constrained soil and climate contexts such as the Landes de Gascogne, which restrict the possibilities, a minority of projects fail to take advantage of this diversification. The minimum mix thresholds imposed from April 2025 are therefore a step in the right direction.

Thanks to the continuous improvement process, carbon quantification is becoming increasingly well controlled. To avoid calculation errors observed in some projects, more and more parameters are set by the methodologies (growth and yield tables, rotation length), which also facilitates the work of the project developers and validators.

Substitution effects (i.e. indirect emission reduction due to the use of timber produced under the project) account for 26% of potential forestry certificates, and sometimes much more for certain projects. This particularity of the LBC among carbon standards can only be assumed if the quantification of substitution effects is realistic, with a projected decrease over time as the economy decarbonises. This is the path taken by the new version of the forestry methodologies. Greater transparency on the nature of the various carbon certificates would also strengthen the credibility of the LBC.

Between 10% and 39% of potential certificates are not generated (22% on average) due to various **discounts applied to account for climate risks, possible windfall effects or bias.** Further strengthening the robustness of the LBC would involve assessing these discounts as the risks increase.

AGRICULTURE: COLLECTIVE, MULTI-LEVER PROJECTS IN LIVESTOCK AND ARABLE CROP FARMING

The 3,500 farms involved in a Carbon'Agri or Arable Crops project are using an average of 4 levers (for example, optimising the age at first calving or introducing legumes into rotations), covering the main emission sources: **enteric fermentation, fertilisation and soil carbon.**

The average impact is around 1 tCO_2/ha/year, mainly achieved through emission reductions in livestock farming and sequestering carbon in arable soils. However, it should be noted that what is referred to as sequestration in the soil also corresponds to mitigating soil carbon loss (avoided emissions), even if this distinction is difficult to make because of the uncertainties involved.

There are ongoing debates about carbon quantification in the two agricultural methodologies, which could be improved in **two ways:**

1. **A change to the carbon metric for the Carbon'Agri methodology (livestock farming),** as the current metric encourages system optimisation, but hinders the structural changes that are essential to meet the agricultural sector's climate objectives.

2. **Improvements to the methodology for arable crops,** achieved through a stricter selection of eligible carbon levers and the correction of windfall effects linked to the use of modelling.

Finally, while all arable crop projects must, of course, have a positive net climate benefit, **an increase in gross emissions could be permitted if offset by greater carbon sequestration in the same project.** To account for the uncertainties associated with carbon sequestration in soils, a limit could be introduced to the amount by which emissions can increase.

VOLUNTARY AND COMPLIANCE DEMAND FOR A RELATIVELY HIGH CARBON PRICE

Historically, projects have been financed by French companies of various sizes and from a range of sectors, **as part of a voluntary carbon contribution scheme. These financiers pay an average of €35/tCO_2, which is over 4 times the international market price.** Despite the downturn in the global voluntary market, partly linked to a crisis of confidence, the LBC remains attractive because of its credibility and the possibility of financing very local projects.

At the same time, **compliance demand has emerged since 2022** due to the French Climate and Resilience Law which requires airlines to offset the climate impact of domestic flights. This demand accounts for 40%-80% of project pre-financing at **an average price of €30.7/tCO_2, thereby structuring the market.** This approach also encourages **the most effective projects in terms of biodiversity, even if the bonus mechanism** could be reviewed to avoid converting biodiversity into carbon and preserve LBC's role as a "carbon thermometer".

Although a minimum of 30% of projects are already pre-financed, **demand, particularly from voluntary sources, remains fragile for LBC projects, particularly agricultural projects.** These projects have a higher price **per tonne of CO_2 and a less attractive narrative** than forestry projects. **They also struggle to mobilise the downstream part of their value chain.**

To strengthen and sustain this voluntary demand, **we recommend enhancing transparency by better clarifying the different types of certificates validated within the registry,** but also the need to **specify the demands of funders, particularly those from downstream in the agricultural value chain.**

Finally, given the fragility of voluntary demand and the constraints on public finances, **it is also crucial to strengthen the compliance lever** in order to unlock the necessary funding for the transition in the agricultural and forestry sectors. This could be achieved by:

- **With current obligated parties, via an increase in the reference price o**f €40/tCO_2, which would also support improvements in project environmental integrity; or via **an upward revision of the share of the volume of emissions to be offset in Europe** (currently 50%).
- **By extending this obligation to new sectors.**

THE LBC: A TOOL FOR MEASURING CARBON IMPACT, WELL ESTABLISHED ACROSS THE WHOLE OF FRANCE

The LBC has established itself as an effective tool **for directing private climate funding towards the agricultural and forestry sectors in France.** Its **open governance and bottom-up approach have been widely praised,** as has its ability to engage a diverse ecosystem of stakeholders around climate issues. It has also produced benchmark tools for calculating the carbon impact of practices, which are now used far beyond the LBC. In a context where it has become essential to assess the effectiveness of the funding provided, these tools for exploring climate impact measurement are key.

The LBC is also experimenting with different ways of striking the right balance between the cost and accuracy of carbon measurement (using discount or framing methodologies, for example), with a view to ensuring both scientific rigour and accessibility for stakeholders of all sizes. This search for balance makes the **LBC more accessible to project developers than most international labels.** The LBC is therefore particularly well suited to small-scale projects, especially in the forestry sector.

Lastly, the LBC is also a **'pathfinding' tool,** providing data on the implementation of "carbon" practices, technical feasibility, costs, obstacles and facilitators. This data is invaluable for supporting the development of scalable climate public policies.

A PROCESS OF CONTINUOUS IMPROVEMENT TO BE PURSUED ON SEVERAL POINTS

In addition to its strengths, **the LBC also has limitations,** some of which have already been addressed through continuous improvement. It is therefore necessary **to ensure the technical development of the label and its methodologies in line with the latest scientific advances,** feed**back from the field and changes in the market.** Several methodological limitations have already been identified and are being or have been discussed as part of the review of the methodologies. This process is crucial, as it enables us to correct the loopholes observed and to continue to adapt to a changing context, while reinforcing environmental integrity wherever necessary. It is also to be expected that the process will increase the cost per tonne of CO_2, and measures might have to be taken to ensure demand continues to be met.

CONSOLIDATING GOVERNANCE AND TRANSPARENCY

The LBC is managed by the French Ministry for Ecological Transition, but governance is fairly open and bottom-up. Methodologies are proposed by stakeholders and different stakeholders participate in the Scientific and Technical Group (GST), which reviews technical developments. While this governance model has strengthened over time, there is still room for improvement: greater harmonisation of project validation processes by regional authorities, greater transparency around GST reports, the creation of a consultative 'users platform' and securing dedicated funding to ensure regular revision of methodologies. Finally, while some data can already be consulted for each project on the Ministry website (e.g. co-benefits, species and levers), more data should be made public to improve transparency (e.g. project discounts and carbon calculations).

NEW PROSPECTS AND NEW CHALLENGES

Finally, alongside internal technical and governance improvements, the LBC will be confronted with new challenges in the coming years, in line with the national and international context. Firstly, mandatory independent third-party audits, 5 years after project validation, should enable potential GHG impacts to be transformed and adjusted into verified impacts. Secondly, efforts to diversify the practices targeted by the methodologies should continue in order to better reflect the range of possible climate actions.

The LBC needs recognition beyond French borders, particularly to ensure its attractiveness to major groups, based in France. This could involve providing documentation in English or seeking accreditation by the meta-standards (ICROA, ICVCM) that label the quality of certification standards. Finally, the arrival of a carbon certification framework at European level (CRCF) represents both an opportunity and a challenge for LBC. There are two possible scenarios for the coming years: either LBC will be integrated into the CRCF, leading to significant changes such as abandonment of ex-ante credits and indirect emission reductions or the transition to temporary certificates; or the LBC will remain independent, which could result in a loss of attractiveness for companies operating on an international scale.

INTRODUCTION

In the mid-2010s, a collective dynamic emerged in France in response to two observations: first, the difficulty faced by agricultural and forestry stakeholders in securing remuneration for their efforts to mitigate climate change; and second, the desire expressed by certain French companies to "relocalize" part of their carbon financing. Researchers, technical institutes, field practitioners and certification experts, brought together through I4CE's Climate Clubs, mobilized to create a national certification framework: the Label Bas-Carbone (LBC, Low Carbon Standard).

This initiative, drawing on the experience of international carbon standards, scientific research and field pilot projects, has led to the development of a methodological framework tailored to the specificities of France. The Ministère de la Transition Écologique (MTE, French Ministry for Ecological Transition) subsequently adopted this framework in November 2018 as a tool to support the Stratégie nationale bas-carbone (SNBC, National Low-Carbon Strategy). At the time, this public endorsement was unprecedented, in a landscape largely dominated by the rise of major private international standards such as Verra-VCS and Gold Standard.

Six years after the launch of the LBC, the wealth of data now available makes it possible to conduct an initial assessment, focusing on the supply of projects. This study seeks to address several questions: what types of projects have been implemented? What ecosystem of actors has formed around the mechanism? Has a balance been struck between measurement accuracy and reasonable MRV[1] costs? And is the latest scientific knowledge being properly integrated?

The answers to these questions are all the more valuable as the LBC, as a pioneering initiative, can now inform European discussions at a time when a European certification framework is taking shape: Carbon Removals and Carbon Farming (CRCF). This feedback is also valuable in a context where approaches to ecosystem service payments and early biodiversity credit projects are beginning to emerge. Finally, at a time of constrained public resources, the experience gained through the LBC can help improve the efficiency of public spending by directing support towards projects with a proven climate impact.

The first part of this report provides an overview of certified projects, their types and the actors involved in their implementation. The second and third chapters provide a more detailed examination of the technical characteristics of the projects in the forestry and agricultural sectors, respectively. Chapter IV focuses on LBC funding, based on the partial data currently available. Finally, the main challenges and opportunities facing the LBC are discussed, followed by a concluding section that summarizes our analysis of its strengths and areas for improvement.

Some of the findings from this work also fed into discussions on revising the main forestry and agricultural methodologies used under the LBC: the Afforestation and Restoration of Degraded Forestsmethodologies, for which a new version was approved in February 2025 *(CNPF, 2025a, 2025b)*, and the Carbon'Agri and Arable Crops methodologies, which are currently being revised in 2025 *(MTE, 2025)*.

1. Monitoring, Reporting and Verification

This study was made possible through the analysis of several sources of information:

- **Data collected by the MTE for project validation and shared with I4CE under a non disclosure agreement.**
- **Data provided by a sample of LBC project developers.**
- **Interviews with key LBC actors, which complemented the data analysis.**

The various data sources are described in Appendix 1.

I. A TOOL TAILORED TO THE AGRICULTURAL AND FORESTRY SECTORS

The data used in this study are briefly described in Appendix 1.

1. Four methodologies are driving the growth of LBC supply

Under the LBC, a methodology is a technical document specific to a sector or to clearly identified sectoral practices. It sets out the carbon measurement tools and quality criteria applicable to projects. In this context, methodologies ensure that projects comply with the specific requirements of the LBC reference framework. Chapter II of the LBC reference framework describes the content of a methodology and its approval process (Decree of 11 February 2022 amending the decree of 28 November 2018 defining the reference framework for the "Low Carbon" standard, currently under review).

As of 31 March 2025, 15 LBC methodologies had been approved by the MTE. These 15 methodologies have enabled the validation[2] of 1,685 projects, with a total potential impact of 6.41 MtCO_2eq. It should be noted that a sixteenth methodology was approved at the end of April 2025. However, no projects have yet been validated under this methodology.

The methodologies have had varying degrees of success among project developers and can be classified based on the number of projects and the potential impact they generate:

- **Three methodologies have not generated any projects:** those targeting mangroves, Posidonia Seagrass Beds and Third Places. It should be noted that two of these are recent, having been approved in 2023.
- **Seven methodologies have seen relatively low use,** generating fewer than 15 projects each and a total impact of less than 20,000 tCO_2eq each. These are the Sobac'Eco-TMM, Hedgerows, Ecométhane, Conversion from coppice to high-stand , Building, Renovation and Urban Tree Planting methodologies.
- **One methodology has given rise to numerous projects** (124 individual projects and 8 collective projects) but generates a relatively low impact in terms of CO_2 reductions at the LBC level: the Orchard Planting methodology.
- **Four methodologies account for the lion's share, representing 98% of the total potential carbon impact:** Afforestation and Restoration of Degraded Forest in forestry, and Arable Crops and Carbon'Agri in agriculture.

Thus, 52% of the potential impact of LBC projects comes from the forestry sector, compared with 48% from the agricultural sector. The contribution of other sectors (transport, buildings, urban planning) is negligible in terms of the potential volume of certificates.

2. Once the authority has verified that a project complies with the method to which it refers, and that the application is complete, it can proceed with its validation, and the project receives the LBC Standard. Validation is distinct from the verification stage (typically five years after the project's implementation in the LBC), during which an independent auditor checks the effectiveness of the climate impact.

TABLE 1: LIST OF APPROVED LBC METHODOLOGIES

METHODOLOGY NAME	**YEAR OF FIRST** VERSION APPROVAL	**CURRENT VERSION** (DATE OF LATEST APPROVAL IN BRACKETS)	**TARGETED PRACTICES**
AFFORESTATION	**2019**	**V3** (February 2025)	**Forest planting on land not forested** during the previous 10 years.
RESTORATION OF DEGRADED FOREST STANDS	**2019**	**V3** (February 2025)	**Planting on forest plots** severely damaged by events such as fires, storms or important diebacks. This methodology is sometimes also referred to as "reforestation".
CONVERSION FROM COPPICE TO HIGH-STAND MANAGEMENT	**2019**	**V2** (July 2020)	**Conversion of deciduous coppice** to high-stand forest management through the selection and promotion of individual stems.
CARBON'AGRI	**2019**	**V1** (V2 in préparation)	**Multiple practices and levers** for cattle farms and crop production.
ORCHARD PLANTING	**2020**	**V1**	**Planting a perennial fruit crop** (orchard) on land not currently cultivated for this purpose.
HEDGEROWS	**2021**	**V1**	**Planting and sustainable management** of hedgerows.
SOBAC'ECO-TMM	**2021**	**V1**	**Reduction of inputs,** particularly nitrogen fertilizers, in crop production.
ECOMÉTHANE	**2021**		**Improvement of protein self-sufficiency** and optimization of feed self-sufficiency for dairy cattle.
ARABLE CROPS	**2021**	**V1** (V2 in préparation)	**Multiple practices and levers** for farms with arable crop production.
RENOVATION	**2021**	**V1**	**Reuse of materials or energy-saving** in building renovation operations.
THIRD PLACES	**2021**	**V1**	**Reduction in the distances travelled** by employees who regularly telework from a third place located in an area of medium or low density.
NEW BIO-BASED BUILDING	**2023**	**V1**	**Use of bio-based products and materials** in new construction.
POSIDONIA SEAGRASS BEDS	**2023**	**V1**	**Reducing the degradation of seagrass beds** caused by anchoring along the French Mediterranean coast.
RESTORATION OF MANGROVES AND SWAMP FORESTS	**2023**	**V1**	**Restoration actions for mangroves or swamp forests,** such as improving hydrological conditions and managing plant species.
URBAN TREE PLANTING	**2023**	**V1**	**Increasing tree cover in towns and cities** through tree and shrub planting projects.
EXTENSION OF ROTATION AGE THROUGH CONTINUOUS-COVER FOREST MANAGEMENT	***2025***	***V1***	***Maintaining harvestable and sustainable timber stocks in forests.*** *The scope include deciduous high forests, mixed deciduous/ coniferous forests, and mixed high forests/coppice forests.*

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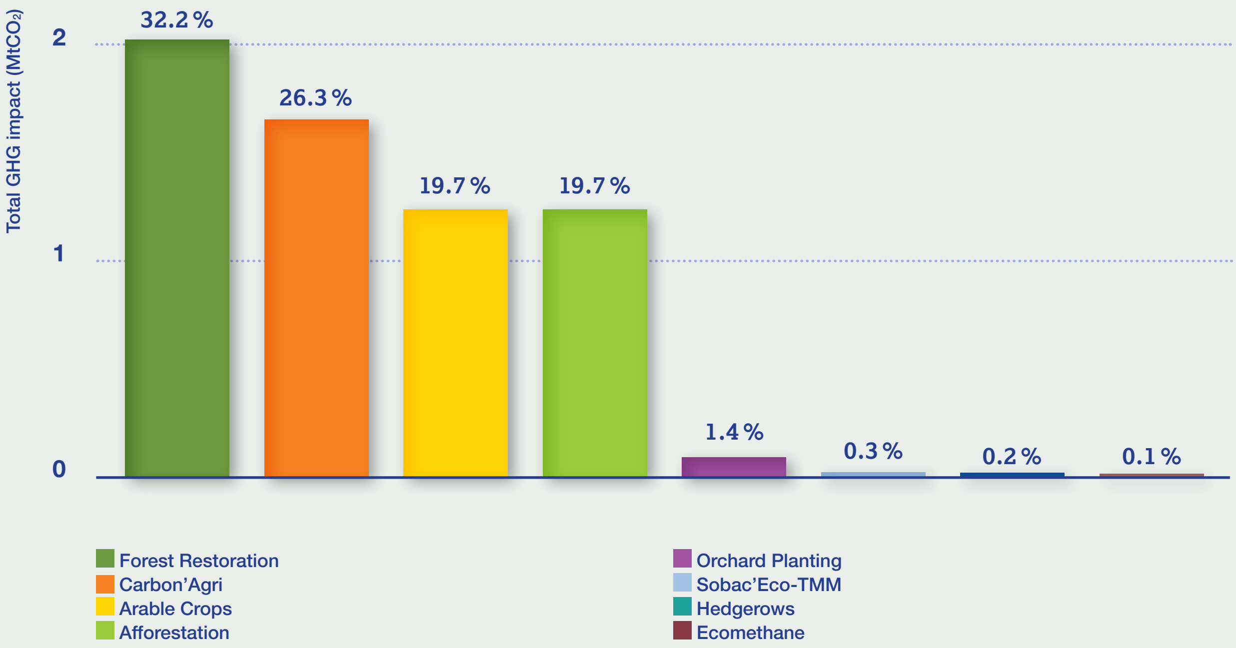
FIGURE 1: DISTRIBUTION OF POTENTIAL CERTIFICATES FOR VALIDATED LBC PROJECTS. ONLY THE EIGHT MAIN METHODOLOGIES ARE SHOWN. THE PERCENTAGE VALUES CORRESPOND TO EACH METHODOLOGY'S RELATIVE SHARE OF POTENTIAL CERTIFICATES.



Source: I4CE, based on the LBC public registry, MTE, 2025

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Some methodologies (Conversion from coppice to high-stand, Building, Renovation, Orchard Planting and Urban Tree Planting) generate a relatively low carbon impact per project, making it difficult to establish a business model that can offset the transaction costs involved in setting up the project. For other methodologies, the practices targeted may be too specific to be developed on a large scale; project developers often prefer to use multi-lever methodologies at the farm level. This is the case, for example, with the Ecométhane methodology, which shares key strategies with the Carbon'Agri methodology, among others.

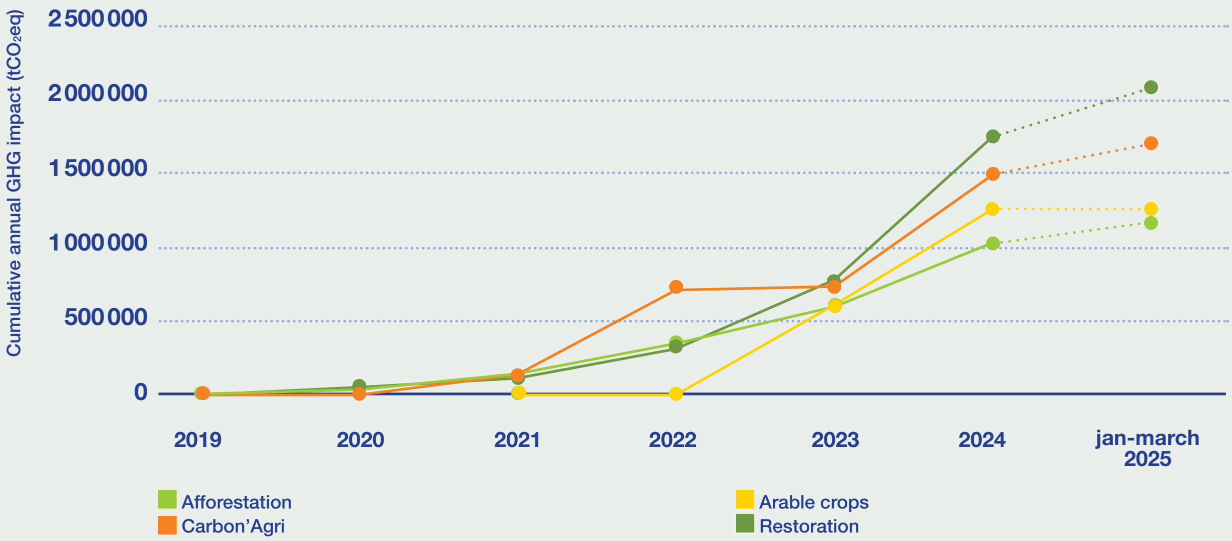
Methodologies may also compete with other national and regional funding schemes. This is the case for hedgerow planting, which is supported by government subsidies such as France Relance's Plantons des haies (Let's Plant Hedges) programme (2021) and the Pact for Hedges (2024), making LBC projects non-additional. Other technical and economic barriers help explain the low number of hedgerow projects: several representatives interviewed highlighted the difficulty and cost of implementing the sustainable hedgerow management plan (PGDH), which is mandatory for hedgerow projects.

Given that the creation of LBC methodologies represents a substantial cost[3], it is crucial to ensure the feasibility of practices, the viability of the economic model, and the attractiveness for stakeholders when developing a methodology. The four main methodologies have been tested against the technical and economic realities on the ground, for example through pilot projects, which may explain their relative success. It should be noted that the value of developing methodologies extends beyond simply establishing LBC projects for stakeholders: it includes advancements in R&D, raising awareness of climate issues, and use in other financing frameworks, etc. *(see section 6.1).*

The analysis of projects in the remainder of this study focuses on the four main methodologies.

3. The cost is primarily borne by the method developers, estimated at €75,000 – €150,000 based on feedback from the LBC. There is also a public cost (as method approval is mainly supported by the MTE), but this is limited, both in terms of private expenditure and the desire not to hinder the innovation brought about by new methods, which is one of the main benefits of the LBC.

FIGURE 2: ANNUAL CUMULATIVE POTENTIAL GHG IMPACT OF PROJECTS VALIDATED BY METHODOLOGY (IN TCO_2EQ)



Source: I4CE, based on the LBC public registry, MTE, 2025

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According to Figure 2, the Restoration and Afforestation methodologies, both approved in 2019, began gaining traction from 2021 onwards. Afforestation has shown steady growth, while the increase in Restoration projects became more noticeable in 2023, likely due to the fires in Gironde during the summer of 2022. The Arable Crops methodology, approved later in August 2021, saw many projects submitted in 2023 and 2024. Finally, Carbon'Agri has supported several large collective projects that, while fewer in number, have nonetheless contributed to incremental growth.

Project developers need time to familiarize themselves with the methodologies, which may explain the low number of projects in the years following the publication of a methodology *(2019 for Afforestation, Restoration and Carbon'Agri; 2021 for Arable Crops)*. It seems that approximately two years are needed for stakeholders to adopt a methodology and develop a large-scale project offering.

The growth in the supply of LBC projects is following an exponential trend, with the number of approved projects nearly doubling since the launch. For example, in 2024, approximately 2.8 $MtCO_2eq$ of potential certificates were validated, double the volume of the previous year. All four methodologies are growing strongly, but restoration projects are seeing the strongest growth in 2024 (108% increase compared to 2023), in line with the various crises that have affected French forests in recent years. However, an analysis of projects validated in the first quarter of 2025 shows a weaker growth trend in supply, with significant variation depending on the methodology used. The number of forestry projects submitted continues to rise compared to the previous year. However, there are currently far fewer arable crop projects: only one project was approved in the first quarter of 2025, compared to an average of 16 per quarter in 2023 and 2024. Pending confirmation of this trend for the rest of 2025, it can be assumed that the fragility of financing, partly linked to the need for clarification on the claims of agricultural projects *(see section 4.7)*, is contributing to the decline in supply.

2. An atypical standard geared towards small projects

A. MANY SMALL INDIVIDUAL FORESTRY PROJECTS

LBC forestry projects cover an average area of 10.8 ha, with 6.6 ha on average for afforestation and 15.0 ha on average for restoration.

FIGURE 3: DISTRIBUTION OF THE NUMBER OF PROJECTS (A) AND POTENTIAL IMPACT (B) BY AREA THRESHOLD
(AS A PERCENTAGE OF THE NUMBER OF PROJECTS AND TOTAL GHG IMPACT OF THE METHODOLOGY)

Source: I4CE, based on MTE, BDD3, april 2025

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These project areas are much smaller than those developed under international standards. An analysis based on 248 North American forestry projects under the Verra-VCS, ACR and CAR standards shows a median area of 3,500 ha *(Karnik et al., 2025)*. Compared to standards operating under similar conditions in Europe, LBC projects remain small in size. The average area of the 724 projects validated as of 31 December 2024 by the Woodland Carbon Code (UK standard) is 51 ha *(Forestry Commission, 2025).* Similarly, the 35 forestry projects validated by the German standard Wald-Klimastandard have an average size of 39 ha *(Ecosystem Value Alliance Foundation, 2025)*.

A detailed examination of projects covering less than 5 ha (53% of afforestation projects and 37% of restoration projects) shows that very few projects cover less than one hectare: only 20 of the 1,127 forestry projects validated. This is due to the minimum eligible area for LBC being 0.5 ha, and the impact of fixed transaction costs (such as auditing, project set-up, monitoring, etc.) discouraging project developers from taking on very small projects. Several developers report that they do not set up projects smaller than 2.5 ha as these are generally not economically viable.

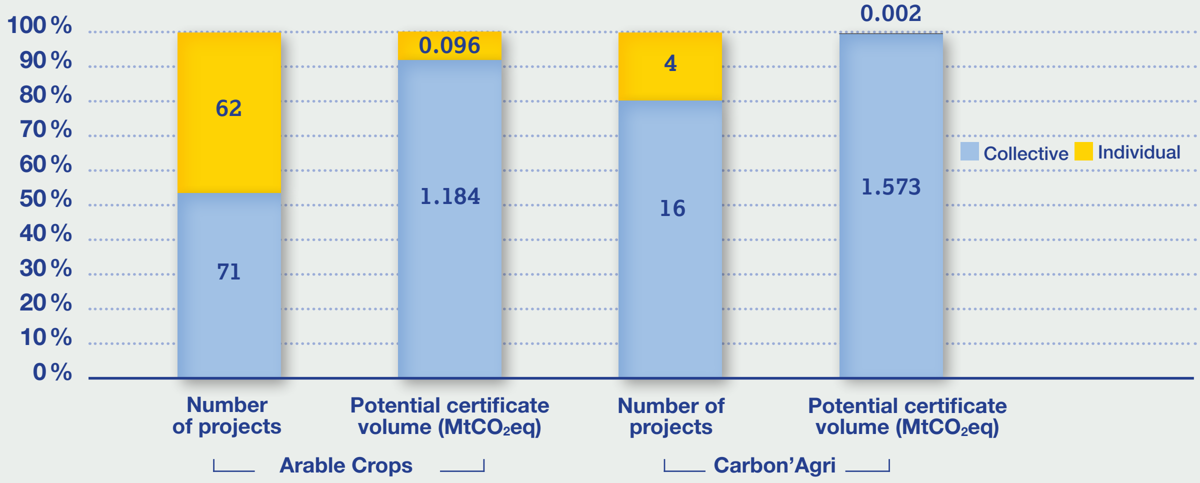
Some restoration projects are remarkably large compared to other forestry projects. While only 7% of potential carbon credits come from afforestation projects larger than 25 ha, 56% of the potential GHG impact of restoration comes from projects larger than 25 ha *(Figure 3)*. This includes 89 restoration projects, of which 53 followed fire, 34 followed dieback, and 2 followed storms. Seven projects exceed 100 ha, with the largest reaching 240 ha. These large projects are primarily associated with Groupement Forestier (French collective forest ownership structures) or state-owned forest properties. The French regulation to apply for afforestation on a case-by-case basis (an administrative rule independent of the LBC) probably explains the scarcity of large-scale afforestation projects. Projects exceeding a certain size are subject to environmental impact-assessment, a process considered prohibitive for most of the project developers surveyed due to the cost and time involved.

Unlike agricultural projects, all approved forestry projects are individual, meaning they are carried out by a single owner, whether a private individual or a legal entity. V2 forestry methodologies do not allow for collective projects. Bringing owners together within a grouping structure, such as the Association Syndicale Libre de Gestion Forestière (ASLGF, forest management association), theoretically enables the inclusion of small owners within the LBC. However, according to our analyses, the co-benefit that makes this option attractive is used in only 4% of afforestation projects and 3% of restoration projects *(see section 2.6)*, which is very low. The time required to establish such a grouping structure is considerable, which explains these low proportions. The challenges of consolidating forest ownership extend beyond the scope of the LBC (IGF et al., 2024). A genuine public policy on this issue is a prerequisite for private LBC financing to contribute to the consolidation of management. The possibility of carrying out collective projects in V3 of the forestry methodologies *(CNPF, 2025b)* should also facilitate the involvement of fragmented ownership in the scheme.

B. COLLECTIVE AGRICULTURAL PROJECTS FOCUSED ON LARGE FARMS

The Carbon'Agri projects involve 2,372 cattle farms covering 390,000 ha, while the Arable Crops projects involve 1,163 farms covering 219,000 ha. Unlike forestry projects, agricultural LBC is characterized by the prevalence of collective projects, which bring together multiple farmers without geographical restrictions. In fact, 16 of the 20 Carbon'Agri projects and 71 of the 133 arable crops projects are collective. The vast majority of potential certificates come from these collective projects: 99% for Carbon'Agri and 92% for arable crops, representing 97% for both methodologies combined.

FIGURE 4: DISTRIBUTION OF PROJECTS AND POTENTIAL CARBON CERTIFICATES ACCORDING TO THEIR INDIVIDUAL OR COLLECTIVE NATURE. THE VALUES SHOWN ARE ABSOLUTE (IN MTCO₂EQ FOR POTENTIAL CARBON CREDITS).



SOURCE: I4CE, based on data from MTE, BDD3, april 2025

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Setting up a collective project allows for economies of scale during the application process, as well as during the audit, since verification is limited to a sample of farms. Project developers play a central role in "recruiting" farmers for projects. There are also instances where the momentum comes from the grassroots, with farmers forming associations to set up projects *(see section 1.4).*

Regarding Carbon'Agri, of the twenty or so collective projects that have been approved, **two models** can be identified:

1. **A group of a few farmers** (between 3 and 20), typically within the same production area. This applies to the majority of projects.

2. **A large-scale initiative involving hundreds of farmers:** three projects, each with 1,004; 933; and 321 farmers. Farmers participate in these projects through national calls for proposals organized by France Carbon Agri, which are then implemented in the field by the agricultural advisory services.

The average farm participating in Carbon'Agri projects covers 157 ha. This is larger than the national average of 93 ha for cattle farming *(Agreste, 2020).* The area dedicated to cash crops across all these projects represents 24% of the total area, or 38 ha per farm on average. The distribution between dairy and meat production is fairly balanced among the farms involved in the LBC, with 41% of the livestock in Carbon'Agri projects dedicated to dairy farming[4], compared to 59% allocated to meat production. **Finally, more than 11% of farms in Carbon'Agri projects have organic certification,** which matches the national average for dairy cattle and is above the average for beef cattle *(6.5% of farms on average, according to INSEE, 2024).*

Collective arable crop projects, meanwhile, bring together between 2 and 214 farms, with an average of 15 farms. While farms of all sizes are involved, the average size of farms participating in arable crop projects is 188 ha. This is well above the average area of French farms specializing in arable crops, which is 83 ha *(Agreste, 2020).* This can be explained by the fact that larger farms generally have more room for improvement in their GHG balance than smaller ones, and that it is easier to amortize the fixed costs associated with the LBC approach over large areas.

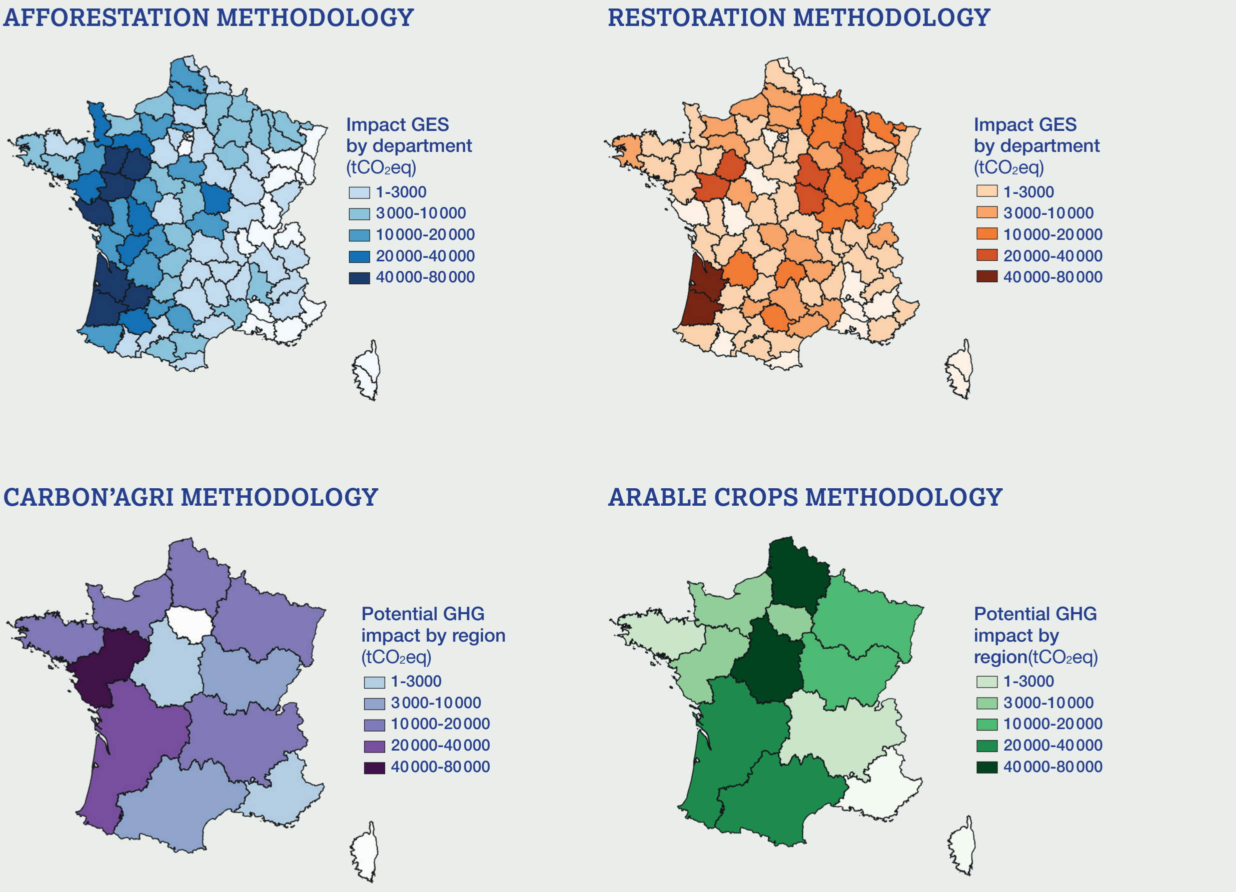
Other carbon certification standards in the European agricultural sector include Soil Capital, which operates in the arable crops sector and has a project bringing together nearly a thousand farms in France, Belgium and the UK, covering just over 200,000 ha *(Soil Capital, 2025).* This compares to the 218,000 ha committed to LBC arable crops. However, the approach is different, as only one project is assessed each year, with new farms joining the initial project annually.

4. Proportion calculated as the ratio between the live weight of diary cattle and beef cattle.

3. Projects in all territories

One of the ambitions of the LBC is to enable funders to contribute to the climate transition as close as possible to their own locations. An analysis of the distribution of projects shows that this territorial objective has been achieved, with projects present across all regions and in the vast majority of departments in mainland France *(Figure 5).*

FIGURE 5: GEOGRAPHICAL DISTRIBUTION OF LBC PROJECTS, BY POTENTIAL GHG IMPACT



Source: I4CE 2025, based on data from MTE, BDD3, april 2025

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Afforestation projects are more numerous in the western part of the country. This distribution can be explained by lower existing afforestation rates (12% in the Pays de la Loire region, for example, according to IGN, 2020) as well as favourable land, accessibility and site conditions. The decline of agriculture in the livestock farming areas of these regions is also likely to contribute to this trend. It should also be noted that certain local public policies influence the implementation of LBC projects. For example, in Brittany, the "Breizh Forêt Bois" scheme provides support covering up to 80% of the costs of afforestation for private landowners *(Région Bretagne, 2025)*, which makes LBC projects non-additional.

The Restoration methodology is mainly used in Nouvelle-Aquitaine and the north-east of France. More than half of the potential post-dieback carbon certificate volumes are located in the Bourgogne-Franche-Comté (33%) and Grand Est (29%) regions. In these regions, restoration is being carried out on stands affected by the bark beetle crisis, which has been devastating spruce trees since 2018. The recent spread of this crisis to other regions, such as Auvergne-Rhône-Alpes and Occitanie, could lead to the development of post-dieback restoration projects in those areas. Nouvelle-Aquitaine accounts for 93% of potential post-fire carbon certificates. The fires of summer 2022 destroyed large areas of forest, particularly in Gironde. To date, the LBC has supported the reforestation of 3,800 ha of the 30,000 ha affected by fires in Gironde in 2022, and 2,400 ha of the 110,000 ha affected by bark beetles between 2018 and 2024. In the case of restoration following fire damage in Gironde, LBC funding has been combined with public funding for forest renewal, which has supported the restoration of around 8,500 hectares *(Jobert, 2025 ; I4CE, 2025).*

For the agricultural LBC projects, Figure 5 shows the distribution of farms and their impact by administrative region. **In general, these maps reflect the territorial specializations of national agricultural production.** The large number of Carbon'Agri projects in the north-west corresponds to the concentration of dairy farms in that region. The same applies to projects in the Massif Central, which align with the presence of suckler cow farms. For projects using the Arable Crops methodology, the strong concentration along the north-east to south-west diagonal corresponds to areas where arable crops account for a large share of the utilized agricultural area (UAA).

It is noteworthy that no LBC projects have yet been implemented in France's overseas departments and regions (DROM-COM). The existence of the Mangroves methodology, which is dedicated to a specific overseas ecosystem, and the recent adaptation of two forestry methodologies for use in overseas territories should help foster the development of projects in these areas. Exploratory work has also been carried out on adapting the Arable Crops methodology *(Demenois et al., 2023)* and the Carbon'Agri methodology (through adaptation of the CAP2ER tool) for use in overseas territories.

4. A diverse ecosystem of stakeholders supporting the strengthening of climate expertise across sectors

The creation of the Label Bas-Carbone has fostered the emergence of new "professions" within the agricultural and forestry sectors. Economic actors delivering services linked to LBC projects are positioned at the centre of a tripartite relationship involving **three key players** :

- **Farmers and forest owners,** who own and manage the land and are responsible for implementing low-carbon practices.
- **Funders who support projects and expect guarantees** regarding project quality and the issuance of carbon "certificates" in return.
- **The public authority (MTE and its decentralized services),** which validates projects, oversees verification by independent auditors and issues carbon certificates.

The activities carried out by these economic actors can be broadly grouped as follows:

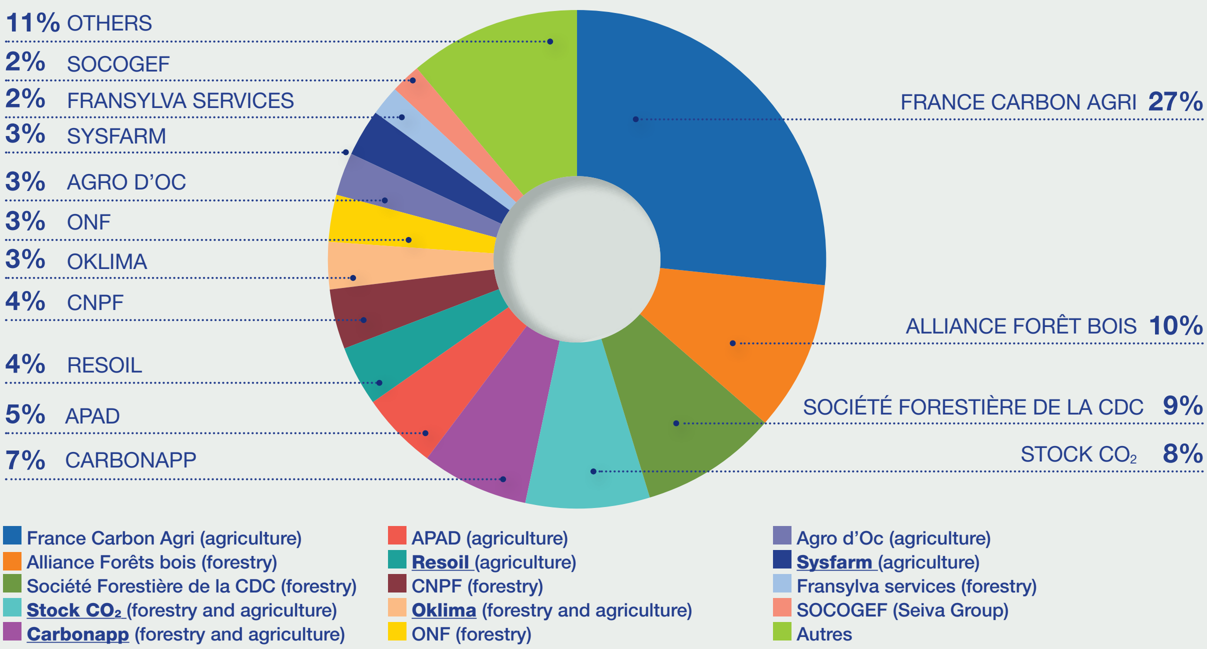
1. **Identifying projects and contacting forest** owners and farmers
2. **Conducting technical field assessments,** such as greenhouse gas assessments for farms, soil fertility assessments, and forest climate diagnosis
3. **Calculating carbon footprints,** preparing and compiling LBC project files, and managing administrative follow-up
4. **Securing project financing**
5. **Aggregating projects** to create portfolios for funders

Steps 1 and 2 involve fieldwork and require technical expertise. They are therefore primarily carried out by actors who already work closely with farmers and forest owners, such as technical advisors or forest managers. Step 3 is generally handled by specialized project officers, who develop in-depth knowledge of the methodological requirements and the data to be provided. Close coordination between field staff and those responsible for preparing project files is essential to ensure that both the qualitative and quantitative descriptions of the projects are accurate. Finally, steps 4 and 5 require commercial skills and access to CSR (Corporate Social Responsibility) managers, with whom financing agreements are negotiated. Based on a survey of project developers and extrapolation to the entire sector, **it is estimated that around 100 full-time equivalents (FTEs) are currently engaged in the development of LBC projects across these economic actors.**

The LBC public website lists contact points for project instructors, who carry out step 3 described above and referred to as "developers". Around 60 different actors are identified, of which **22 organizations account for 96% of the potential validated carbon certificates** *(see Appendix 2)*, with 14 organizations accounting for 89% of the potential GHG impact *(Figure 6)*. This distribution does not represent the market share, as it does not take into account the level of project funding, which varies greatly depending on the methodologies and developers involved. In addition, some projects may involve several intermediaries, although only one is classified as a developer in this analysis.

FIGURE 6: DISTRIBUTION OF LBC PROJECT SUPPLY AMONG "DEVELOPERS" FOR AGRICULTURAL AND FORESTRY METHODOLOGIES.

ONLY ORGANIZATIONS RESPONSIBLE FOR MORE THAN 100,000 TCO₂EQ OF POTENTIAL GHG IMPACT ARE SHOWN. START-UP ACTORS ARE IDENTIFIED IN BOLD AND UNDERLINED.



Source: I4CE, based on the LBC public website, MTE, 2025

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Most developers specialize in either agriculture or forestry, but five of them, representing 19% of total supply volume, carry out projects in both sectors.

Developers with a long-standing presence in the agricultural and forestry sectors typically carry out field operations up to and including step 3. Some also market the projects themselves, but most collaborate with aggregators, whose role is to group projects together to achieve significant scale and to diversify their sectoral and geographical profiles. **It is estimated that 68% of LBC project supply is delivered by these technical actors in the agricultural and forestry sectors** *(see classification in Appendix 2)*, as illustrated by the three main providers: France Carbon Agri, Alliance Forêts Bois, and Société Forestière de la CDC. In parallel, several start-ups have developed activities related to the Label Bas-Carbone, sometimes focusing exclusively on the LBC *(e.g. Stock CO_2, ReSoil and Sysfarm)* and sometimes working with other standards (e.g. CarbonApp). **These start-ups are estimated to account for 31% of the potential carbon certificates generated to date.** They generally partner with field-based actors for steps 1 and 2. These technical operators are often independent professionals or small organizations that cannot fully develop the specific skills required for LBC themselves. Such partnerships enable them to offer this type of financing opportunity to their farmer and forest owner clients.

The agricultural and forestry sectors as a whole have mobilized around the LBC to develop projects. Cattle farming stands out for its particularly structured organization, with most stakeholders in the sector brought together under the umbrella of France Carbon Agri. The forestry and arable crops sectors have also engaged actively, with numerous forest managers (cooperatives, forestry experts and independent managers) and many organismes stockeurs[5] (OS, storage organizations) acting as field-based intermediaries to support project development. The adoption of the LBC tool has contributed to building climate expertise within these sectors[6]. In particular, the LBC has played a major role in promoting the use and dissemination of GHG diagnostic tools on farms. Some start-ups, which have built their business models around the LBC, now play a key role in combining and channelling multiple sources of funding to farmers, such as sectoral subsidies and agri-environmental measures under the CAP.

5. Organizations acting as intermediaries between farmers and industry and responsible for collecting and storing agricultural produce. These are generally agricultural cooperatives and traders.
6. These issues have been discussed since 2010 and 2012 within the Forest and Wood Climate Club, and the Agriculture and Food Club. https://www.i4ce.org/en/projet/carbon-forest-and-wood-club/ and https://www.i4ce.org/en/projet/agriculture-climate-club/

5. Assessment and cross-cutting recommendations

PROJECT ASSESSMENT, 2019 - MARCH 2025	AREAS FOR IMPROVEMENT
• As of 31 March 2025, **15 Label Bas-Carbone methodologies** were approved by the MTE, enabling the validation of **1,685 projects with a total potential impact of 6.41 $MtCO_2eq$.** • The LBC has enabled the implementation of four main project types: **afforestation, restoration of degraded forests, emission reduction, and carbon storage in cattle farming and arable crops.** • The LBC also targets other sectors and practices, but **these other methodologies account for only 2% of the total carbon impact of the LBC.** Some methodologies are used only minimally or not at all. Another methodology (Orchard Planting) has generated many projects, but has a limited carbon impact. • Some methodologies (Conversion from coppice to high-stand management, Building, Renovation, Orchard Planting and Urban Tree Planting) generate a relatively low carbon impact per project: it **is therefore difficult to establish an economic model that offsets the transaction costs associated** with project development. • It appears to take approximately two years for stakeholders to adopt a methodology and begin launching projects at scale.	• At present, LBC forestry practices are focused mainly on planting. **A methodology targeting new forest management practices was approved in April 2025, and further approaches are expected to emerge,** including extension of rotation age and enrichment planting. • The scope of agricultural LBC is expected **to broaden in 2025 regarding livestock farming. Planned developments include extending the Carbon'Agri methodology to cover goat and sheep farming, and approving a pig farming methodology, which is currently under development.** In parallel, stakeholders also expect the approval of a methodology for intra-plot agroforestry.
• **The growth in project supply under the LBC is following an exponential trend:** a potential of approximately 2.8 $MtCO_2eq$ was validated in 2024, double the volume achieved for 2023. **Project development in arable crops has been less dynamic recently,** likely due to challenges in securing financing for agricultural projects.	
• Unlike most international carbon certification standards, **the LBC forestry standard is primarily geared towards small individual projects,** which average 10.8 ha in size, in line with the structure of land ownership in France. • Conversely, **agricultural projects** are collective and much larger in scale, **more geared towards large farms:** the average size of participating farms is 164 ha for cattle farming and 188 ha for arable crops.	• One of the reasons why LBC is more geared towards large farms is the fixed costs of GHG diagnostics. **Public support for GHG diagnostics is therefore important to help smaller farms get on board.**
• **Almost all departments in mainland France** are covered by LBC projects. • However, **no LBC projects have yet been implemented in the DROM-COM** (overseas departments, regions and communities).	• The approval in 2023 of a methodology for the restoration of mangroves and swamp forests, along with the recent adaptation of two forestry methodologies for use in overseas territories, should encourage the emergence of projects in these areas.
• The implementation of low-carbon projects requires technical support for farmers and forest owners, particularly for conducting field assessments, calculating GHG impacts, preparing administrative files and, where necessary, securing funding. • These support needs have led to **the emergence of new professions within existing operators and new organizations:** nearly 100 FTEs have been created within around 15 organizations in recent years to support the development of LBC projects.	• The momentum generated within sectors around the LBC (including both successes and lessons learned) should provide **valuable feedback for current initiatives aimed at rewarding ecosystem services, such as payments for ecosystem services (PES) and biodiversity or nature credits.**
• The agricultural and forestry sectors have been **highly active and have adopted the LBC tool** in recent years. The LBC has thus contributed to raising climate awareness in these sectors. For example, it has supported the development and dissemination of GHG assessment tools for farms. Some start-ups, which have built their business models around the LBC, also play a key role in combining and channelling various sources of funding to farmers, such as sectoral subsidies and agri-environmental measures under the CAP.	

Green: Key strengths
Marron: Limitations observed
Blue: I4CE recommendations

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II. FORESTRY PROJECTS: TOWARDS MORE ROBUST NEW VERSIONS OF THE METHODOLOGIES

The analyses presented in this section focus on LBC projects developed based on version 2 of the forestry Afforestation and Restoration methodologies *(CNPF, 2020a, 2020b)*. The presentation of the preliminary results from this study informed the discussions of the Groupe Scientifique et Technique (GST, Scientific and Technical Group) on version 3 of these methodologies. Approved in February 2025 and adjusted in September 2025, this new version introduces a number of adjustments intended to address certain limitations identified in this chapter *(CNPF, 2025b, 2025a)*. However, the main recommendations put forward by the INRAE rapporteurs have only been partially taken into account *(INRAE, 2024a, 2024b)*. In particular, the recommendation based on a review of existing literature to revise upwards the post-disturbance natural colonization dynamics used in the baseline scenario for restoration projects (and afforestation on fallow land) has only been partially incorporated. Following this recommendation, the ONF and the CNPF carried out an analysis of data from the post-storm observatory established after storms Lothar and Martin in 1999 *(Figueres, Deleuze, et al., 2025)*. The final values used in V3 of the forestry methodologies are based on this study and lie between the V2 values and those recommended by INRAE. This point remains the subject of debate between the methodology developers, the MTE, and several project developers who contest the changes.

1. Methodologies that take forests and wood products into account

The nature of GHG impacts on forests can be divided into three categories:

- **Carbon removals in biomass and soils,** currently referred to as "forest-related REA" (réduction d'émission anticipée, anticipated emission reduction). This is not strictly an emission reduction, but rather carbon sequestration or removal from the atmosphere. The current proposal to revise the LBC decree aims to correct and clarify this terminology, making clearer distinction between different carbon certificate types.
- **Carbon storage in harvested wood products, r**eferred to as "product-related REA".
- **Substitution effects linked to the use of additional harvested wood products.** If the project results in the production of wood-based materials that replace fossil fuels or more energy-intensive materials such as concrete or steel, then the GHG emissions associated with those substituted products are avoided. To have a complete picture of the project's carbon impact, and despite the uncertainty surrounding the actual future use of the products, the LBC has therefore chosen to account for the difference in GHG emissions between the wood materials and energy generated by the project and the mix of products they replace. This impact is referred to as "réduction d'émission indirecte" (REI, indirect emission reduction) in the LBC's methodological framework.

Despite the debate around substitution *(see section 2.4.2)*, the LBC has opted to include all direct and indirect carbon impacts associated with implementing a forestry project.

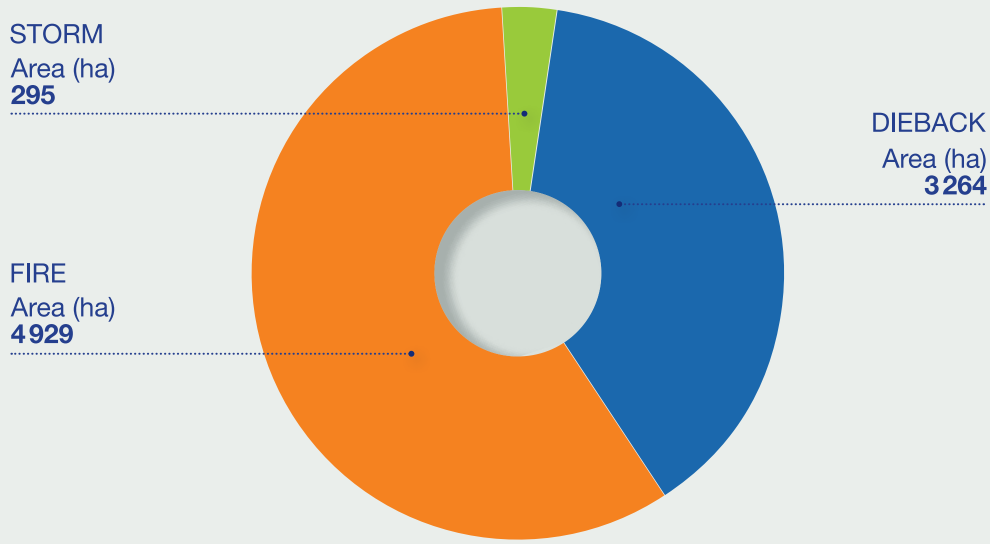
2. Restoring degraded forests and afforesting agricultural land

To demonstrate that a carbon project genuinely results in CO_2 savings, it must be compared to a baseline scenario. This scenario represents the most likely situation in the absence of the project, i.e. the carbon removals and emissions that would probably have occurred without the project. It takes into account existing regulations and, more broadly, current practices already in place.

A. DEGRADED STANDS: LBC MAINLY RESTORES FIRE-DAMAGED STANDS OR BARK-BEETLE INFESTED SPRUCE STANDS

Three types of damage make a project eligible under this version of the methodology *(CNPF, 2020a)*, which forms the basis for all projects analysed here: fire, storm damage and intense dieback. The new version of this methodology, which came into force in April 2025, also makes degradation caused by heavy snow and hail eligible *(CNPF, 2025b)*.

FIGURE 7: DISTRIBUTION OF AREAS BY CAUSE OF DEGRADATION IN RESTORATION PROJECTS.



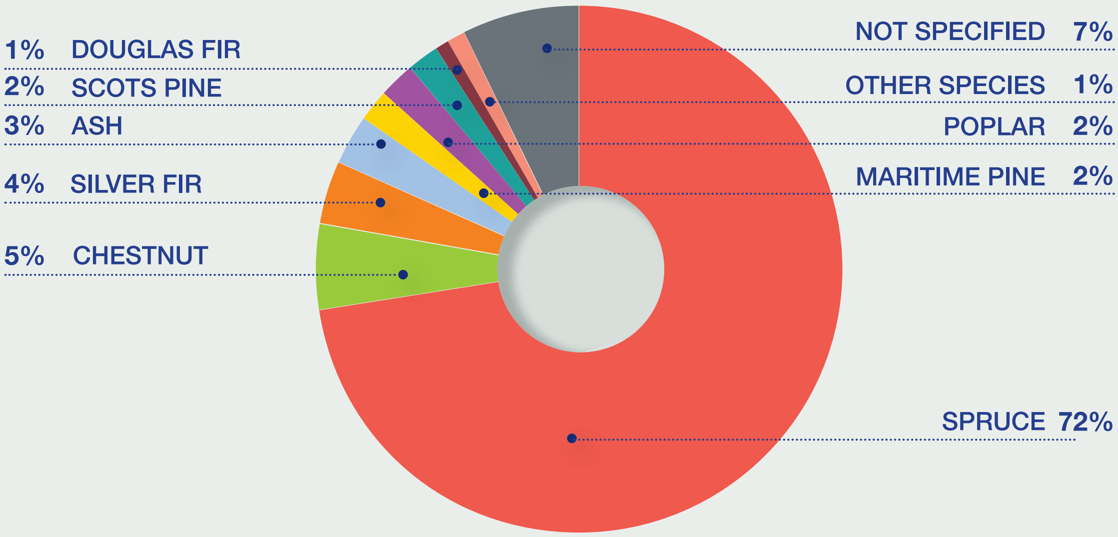
Source: I4CE, based on MTE, BDD3, April 2025 @I4CE_

Restoration projects mainly follow severe dieback or fires. Until 2023, most projects were carried out after episodes of dieback, but post-fire restoration has grown significantly since the 2022 wildfires, particularly in Gironde, where 30,000 ha were affected. As the sector mobilized, a large number of projects were submitted in 2024 and early 2025. Nearly three years after the fires, almost 5,000 ha have been restored through the LBC.

Post-storm restoration accounts for only a few hundred hectares and typically addresses localized damage, such as in the Tarn-et-Garonne and Saône-et-Loire departments. Since Storm Klaus in 2009, which damaged more than 690,000 ha (Indicateurs de Gestion Durable, 2023), there have been no major storms requiring LBC-financed restoration.

Regarding post-dieback restoration, analysis of project descriptions indicates that 72% of LBC projects were developed in spruce forests *(Figure 8)*. This is consistent with the geographical analysis *(Chapter 1.3)*, which shows the concentration of these projects in north-eastern France, where 110,000 ha of spruce were affected by bark beetles. **The LBC has enabled the restoration of at least 2,350 ha of these stands.** The fact that the LBC Restoration programme prioritizes severely degraded stands such as bark beetle-infested spruce stands in areas where forests are becoming a net source of carbon *(CITEPA, 2024)* reflects an interesting logic behind the prioritization of no-regret measures. The other main tree species experiencing mortality in France are chestnut, ash and silver fir *(IGN, 2024).*

FIGURE 8: DISTRIBUTION OF POST-DIEBACK RESTORATION PROJECT AREAS BY SPECIES REPLACED

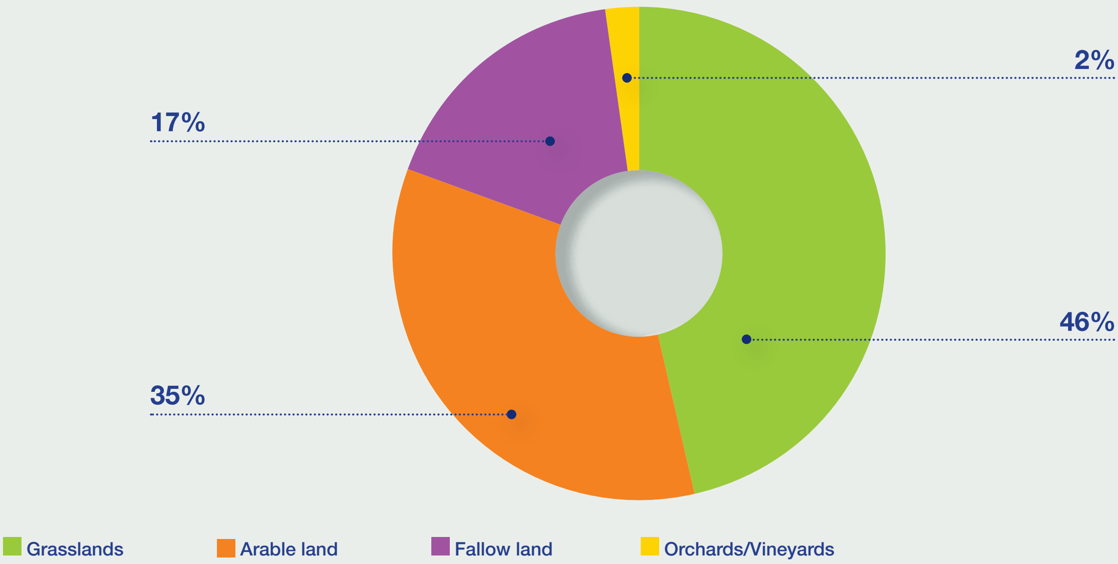


Source: I4CE, based on MTE and BDD3, April 2025. @I4CE_

B. AFFORESTATION: MAINLY ON AGRICULTURAL LAND

When submitting an LBC application, project developers are required to provide information and documentation on the prior use of the plots to be afforested. The chart shows how afforestation project areas are distributed according to previous land use:

FIGURE 9: AREA DISTRIBUTION OF BASELINE SCENARIOS FOR VALIDATED PROJECTS USING THE AFFORESTATION METHODOLOGY



Source: I4CE, based on data from MTE, BDD3, April 2025 @I4CE_

These data show that most projects are established on land previously used for agriculture (83% of the total area when combining grassland and arable land) and relatively few on fallow land. This breakdown of the origins of LBC afforestation reassures us about the additionality of the projects, which is more uncertain on fallow land *(INRAE 2024a)*. Afforestation on former vineyards remains rare (currently 2%), but further growth is expected following the plan to grub up more than 13,000 ha of vineyards in Bordeaux *(Nouvelle-Aquitaine Prefecture, 2023).*

Afforestation mainly takes place on grassland (46%), which represents the least favourable conversion in terms of soil carbon sequestration. Afforestation on former agricultural land is distinct in that it accounts for this carbon removal in the soil. **Given the distribution of land use prior to afforestation, it is estimated that approximately 96,000 tCO_2eq of potential carbon certificates come from soil carbon removal under LBC forestry.**

3. Traditional plantations that are becoming increasingly diverse

A. PREDOMINANCE OF MARITIME PINE, SESSILE OAK AND DOUGLAS FIR

To determine the area covered by each species under the LBC, the proportion of each species planted was combined with the total area of each project. This analysis includes species reported by project developers (even if they are not factored into the carbon calculations, often due to the lack of an appropriate yield table). For both methodologies, the total area represented by the 14 most commonly planted species was calculated accordingly.

TABLE 2: MOST COMMONLY PLANTED SPECIES IN LBC RESTORATION AND AFFORESTATION PROJECTS

RESTORATION	AREA (HA)	PROPORTION OF TOTAL AREA (%)	AFFORESTATION	AREA (HA)	PROPORTION OF TOTAL AREA (%)
MARITIME PINE	4698	55%	SESSILE OAK	628	16%
DOUGLAS FIR	602	7%	MARITIME PINE	534	14%
SESSILE OAK	464	6%	POPLAR	383	10%
ATLAS CEDAR	385	5%	PUBESCENT OAK	268	7%
LOBLOLLY PINE	312	4%	ATLAS CEDAR	254	7%
CORSICAN PINE	297	3%	CORSICAN PINE	253	7%
EUROPEAN LARCH	182	2%	LOBLOLLY PINE	187	5%
POPLAR	172	2%	DOUGLAS FIR	177	5%
RED OAK	152	2%	BLACK LOCUST	162	4%
PUBESCENT OAK	144	2%	HORNBEAM	103	3%
PEDUNCULATE OAK	58	1%	PEDUNCULATE OAK	62	2%
HYBRID LARCH	55	1%	TURKEY OAK	57	1%
TURKISH FIR	49	1%	SILVER BIRCH	54	1%
SYCAMORE MAPLE	48	1%	RED OAK	56	1%
OTHERS	834	10%	OTHERS	661	17%
TOTAL	8493	100%	TOTAL	3838	100%

Source: I4CE, based on data from MTE, BDD3, April 2025 @I4CE_

Maritime pine is by far the most widely planted species within the LBC, covering approximately 5,200 ha out of a total of 12,300 ha, representing 42% of the total area. **The trio of maritime pine, sessile oak and Douglas fir accounts for 58% of the species planted across all LBC projects** *(Table 2)*. These three species have been by far the top-selling forest seedlings in France in recent years, representing an even larger share of total sales: 70% *(Joyeau & Desgroux, 2024)*. The ten most planted species in LBC projects match the ten most sold species in France *(Ministry of Agriculture and Food, 2024)*, with the exception of Sitka spruce, the tenth best-selling species, which ranks only 28th in LBC projects. As this species is mainly planted in Brittany, its lower uptake likely reflects more limited use of the LBC in that region *(see section 1.3)*.

The use of tree species in the Restoration methodology clearly varies depending on the type of degradation *(Table 3)*. Maritime pine dominates post-fire restoration, accounting for 86% of the area. As seen in Part 1, 87% of post-fire projects are concentrated in the Gironde and Landes departments, where maritime pine remains the species best suited to the area's challenging soil and climate conditions *(CNPF-IDF & CNPF Nouvelle-Aquitaine, 2022)*. However, diversification efforts using locally adapted species, whether for production (loblolly pine) or as companion species (cork oak, Pyrenean oak, etc.), are also present in LBC projects in the Landes forest. These initiatives must be encouraged, as they are essential in the face of climate change and increased risks *(CNPF-IDF & CNPF Nouvelle-Aquitaine, 2022)*. The main phytosanitary threat to maritime pine forests is nematode infestation.

Post-dieback projects involve a much more diverse range of species, with Douglas fir (18%), sessile oak (14%) and Atlas cedar (11%). The same is true for afforestation, where sessile oak covers 580 ha, or 15% of the total area, followed by maritime pine (14%), poplar (10%) and Corsican pine (7%).

TABLE 3: MOST PLANTED SPECIES WITHIN LBC RESTORATION AND AFFORESTATION PROJECTS

POST-DIEBACK	AREA (HA)	PROPORTION OF TOTAL AREA (%)	POST-FIRE	SURFACE (HA)	PROPORTION OF TOTAL AREA (%)
DOUGLAS FIR	573	18%	MARITIME PINE	4264	86%
SESSILE OAK	534	14%	LOBLOLLY PINE	295	6%
ATLAS CEDAR	348	11%	CORK OAK	43	1%
MARITIME PINE	307	10%	HOLM OAK	37	1%
CORSICAN PINE	276	9%	SILVER BIRCH	33	1%
EUROPEAN LARCH	175	5%	VARIOUS DECIDUOUS TREES	30	1%
RED OAK	131	4%	ATLAS CEDAR	29	1%
POPLAR	129	4%	TURKEY OAK	22	0%
DOWNY OAK	112	2%	DOWNY OAK	22	0%
HYBRID LARCH	53	2%	EUCALYPTUS	19	0%
TURKISH FIR	49	1%	CORSICAN PINE	16	0%
SYCAMORE	46	1%	PYRENEAN OAK	16	0%
PEDUNCULATE OAK	44	1%	SESSILE OAK	15	0%
SCOTS PINE	44	1%	PEDUNCULATE OAK	14	0%
OTHERS	475	15%	OTHERS	85	2%
TOTAL	3195	100%	TOTAL	4939	100%

Source: I4CE, based on MTE, BDD3, April 2025

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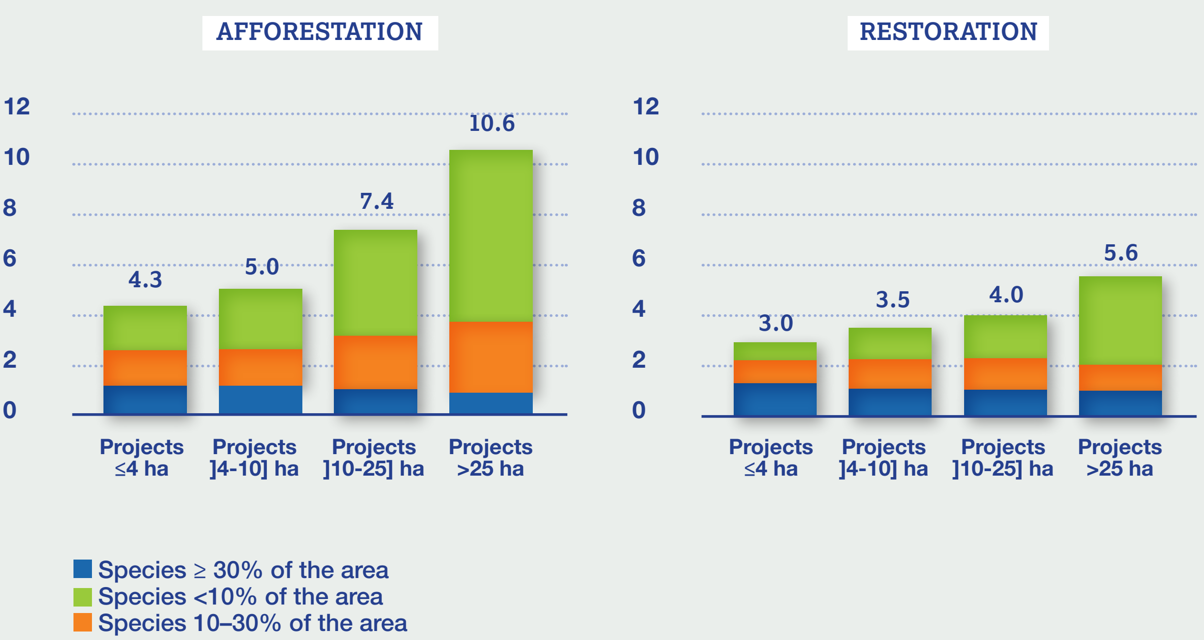
B. PROJECT DIVERSIFICATION

This chapter focuses on the diversity of tree species planted within individual projects. It is based on information provided by project developers when submitting their applications for project validation. No diversification requirement was included in the specifications of version 2 of the methodologies *(CNPF, 2020a, 2020a)*, which apply to the projects analysed here. However, species diversity within plantations was considered a co-benefit *(see section 2.6.2).* The obligation to mix tree species is introduced in the specifications for future LBC projects *(CNPF, 2025a, 2025b)*. What was previously valued as a co-benefit thus becomes a prerequisite. At the same time, new and more demanding criteria must now be met to qualify for this biodiversity co-benefit: mixed reforestation involving 3 to 5 species for projects under 4 ha, 4 to 8 species for projects between 4 ha and 25 ha, and 5 to 12 species for projects over 25 ha. The criteria for species diversification and native status remain combined.

FIGURE 10: AVERAGE AMOUNT OF SPECIES PER PROJECT, BY PROJECT SIZE CATEGORY



Source: I4CE, based on MTE, BDD3, april 2025

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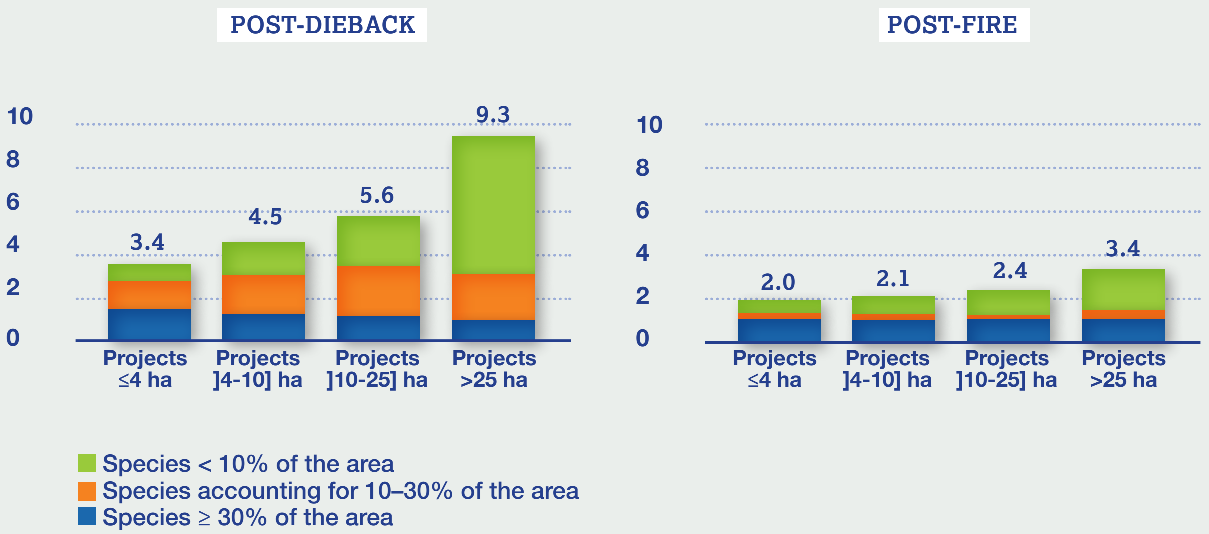
Promoting species mixing at the time of planting is essential, primarily to enhance ecosystem resilience *(Jourdan et al., 2021; Pardos et al., 2021)* and to reduce the financial risk for landowners in the event of timber price fluctuations or the dieback of a particular species. Recent research also points to a net advantage in terms of carbon capture for mixed-species plantations compared to monocultures *(Warner et al., 2023)*. Finally, mixed plantations support greater biodiversity than single-species stands *(Kremer et al., 2025).*

FIGURE 11: AVERAGE NUMBER OF TREE SPECIES PER PROJECT, BY AREA CATEGORY, FOR POST-DIEBACK AND POST-FIRE RESTORATION



Source: I4CE, based on MTE, BDD3, april 2025

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Figure 10 shows that the larger the project area, the greater the level of species diversification for both methodologies, although this is much more pronounced for afforestation. It also makes sense that the species covering less than 10% of the area are the most numerous in terms of species count, since projects typically include one or two dominant species along with several others in smaller proportions. Across all project size classes, the average number of tree species per project is 5.2 for afforestation and 3.8 for restoration. In post-dieback restoration (4.9 tree species on average), the level of diversification is fairly similar to that of afforestation. While 72% of these projects are carried out on former spruce stands *(Chapter 2.1.1)*, which are often monospecific *(Saintonge et al., 2021)*, there is a clear average trend towards greater diversification compared to the previous situation. Post-fire diversification is more limited (2.5 species on average), but these projects are also mainly located on former monospecific stands (maritime pine). The data clearly show that such projects typically include only a single main species (maritime pine), with a few minority species covering less than 10% of the area in some cases *(Figure 11).* Hardly any projects in the Landes forest opt for a main species other than maritime pine. The limited diversification here is largely due to the difficulty of establishing a productive alternative species other than maritime pine in the post-fire context of the Landes forest *(CNPF-IDF & CNPF Nouvelle-Aquitaine, 2022).*

The project developers surveyed all expressed interest in diversifying the tree species planted in LBC projects. A majority were also in favour of introducing a diversification requirement in the methodologies applied. However, case-by-case consideration is needed, particularly for sites where diversification is difficult due to soil and climate conditions, such as those in the Landes de Gascogne region, which is often cited as an example.

In general, the average figures do not reflect the diversity of situations: some projects are highly diversified, while others are not, due to clear soil and climate constraints; and finally, some projects do not include species mixing even though it would be possible. Efforts could be focused on this last group, for the reasons outlined above.

4. Quantifying carbon impact is becoming increasingly well regulated

A. A WELCOME FRAMEWORK FOR THE USE OF GROWTH AND YIELD TABLES

The GHG impact of LBC forestry projects ("carbon quantification") is mainly estimated using growth and yield tables[7], which are selected and justified by the project promoters. The LBC's decision to use these tables to project tree growth is pragmatic: they are available for many species and relatively easy for project developers to apply. A spreadsheet then automatically converts dendrometric data into carbon sequestration values. However, ensuring that these tables are properly selected and applied by project developers can be difficult. As a result, some projects – particularly in the early years of the LBC – reported inconsistent estimates of carbon gains *(Fournier, 2022; WWF France, 2021)*. Since the carbon certificates issued under the forestry LBC are ex-ante, i.e. they are assessed and sold before the actual climate impact occurs, quantification requirements must be very stringent to avoid overestimating carbon gains and issuing credits that are not backed by real removal. This is why the more detailed framing of the tables proposed in V3 of the methodologies, based on the work of the ONF and the CNPF *(Figueres, Gleizes, et al., 2025; Fournier et al., 2022)* is a welcome development. It will help guide project developers more efficiently and reduce the risk of error.

Analysing the information provided by project developers is challenging, as the growth and yield tables used are not standardized in the databases. Since a "carbon quantification" was carried out for each species in each project, nearly 6,000 carbon quantifications were available for analysis, with the tables used identifiable in 77% of cases. In the remaining 23%, the tables were correctly completed but presented in a format that prevented data aggregation. Our analysis shows that in 43% of identifiable cases, the British Forestry Commission tables were used *(Forestry Commission, 2016)*. Including tables from other countries, **an estimated 49% of carbon quantifications were based on non-French tables.** ONF forestry guides were used in 31% of identified cases, while the remaining 20% drew on other tables produced by French R&D. Using a non-French table to estimate the growth of a project is not necessarily problematic, provided it is applied in conditions similar to those for which it was developed. British tables cover a fairly wide range of fertility classes (up to 10), which can enable project developers to position themselves more accurately in relation to actual fertility. However, when French tables are available, they are generally more appropriate, given their closer alignment with domestic conditions. **As mentioned above, the improved guidance on table selection introduced in V3 of the forestry methodologies will help clarify these issues and enhance the robustness of carbon quantification.**

Furthermore, the choice of table and, above all, the fertility class, is a key issue during verification (audits). The number of potential carbon certificates may be revised downwards if, as noted in the above-mentioned studies, auditors consider that the fertility class has been overestimated.

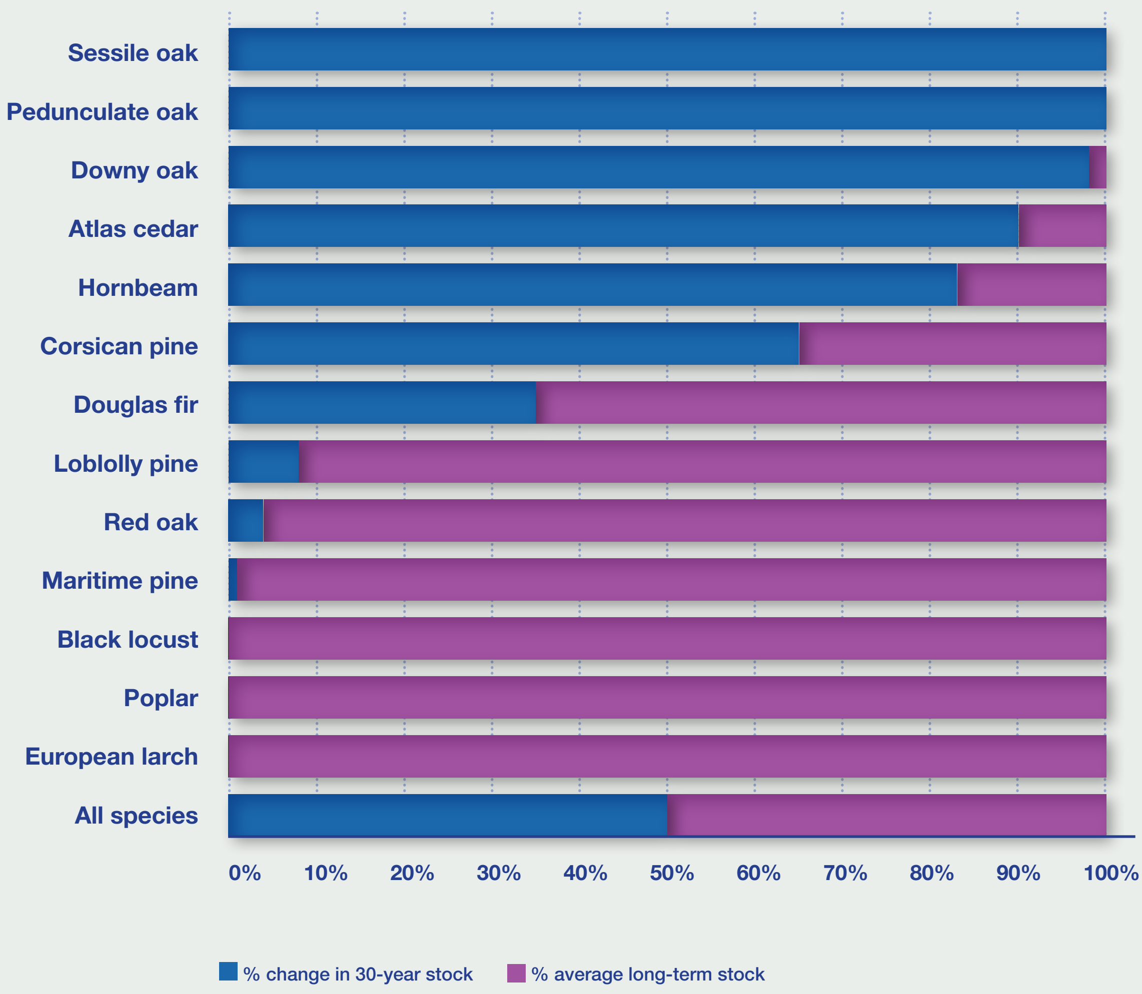
7. A forest growth and yield table describes the growth of even-aged forest stands of a given species, differentiated by fertility classes. Most tables are based on measurements from a specific geographical area and therefore have a limited range of applicability.

B. THE IMPORTANCE OF SETTING ROTATION PERIODS FOR GROWTH MODELLING

Carbon captured in biomass is quantified using the lower of two values: the difference in carbon stock at year 30, and the difference in stocks moyens de long terme (SMLT, long-term average carbon stocks) over the full rotation period, comparing the project scenario with the baseline scenario. This approach prevents a temporary increase in the 30-year stock from overstating the gain that would be achieved “over an infinite period”, which corresponds to the average stock maintained over the full rotation.

Based on the data shared by forest project developers, a summary is presented showing how these two possible carbon values are distributed according to the species planted *(Figure 12)*.

FIGURE 12: DISTRIBUTION OF THE BIOMASS CAPTURE CALCULATION METHOD (AS A PERCENTAGE OF PROJECTS USING THE AFFORESTATION AND RESTORATION METHODOLOGIES) FOR THE TEN MAIN SPECIES IN THE LBC.
EXAMPLE: FOR CORSICAN PINE, THE CARBON GAIN IS CALCULATED USING THE 30-YEAR STOCK DIFFERENCE IN OVER 60% OF PROJECTS, AND THE LONG-TERM AVERAGE STOCK IN JUST UNDER 40% OF PROJECTS.



Source: I4CE, based on data shared by forestry project developers, August 2024

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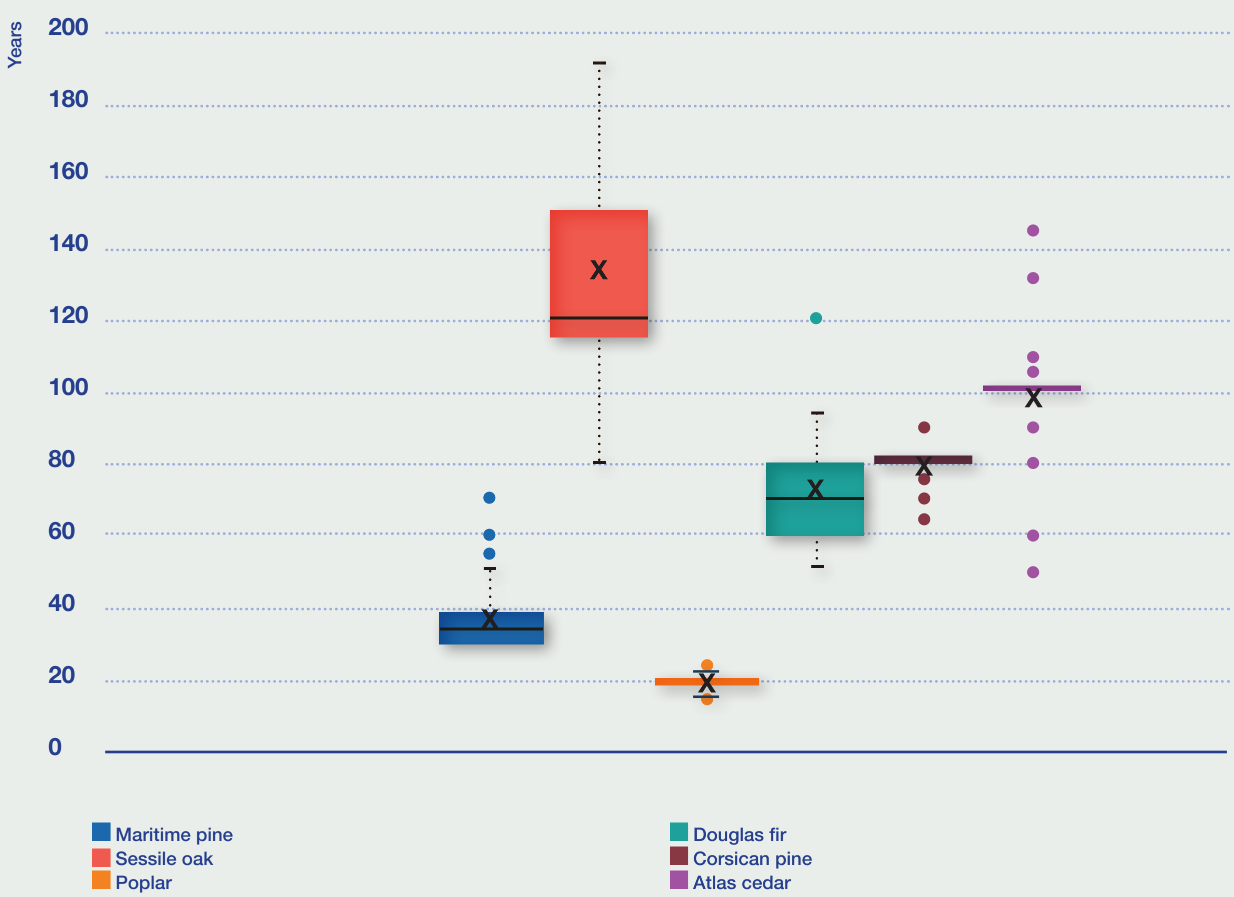
Logically, fast-growing species that accumulate a high stock difference after 30 years are assigned a biomass capture value based on the SMLT. Conversely, slower-growing species are assigned a biomass capture value equal to the stock difference estimated at 30 years. Among the sample of projects analysed, the two methodologies – the 30-year stock difference and the SMLT – are used in equal proportions.

However, the rotation period has a major influence on the calculation of the SMLT. The longer the rotation period, the higher the resulting SMLT. For example, in a hypothetical Douglas fir afforestation project, quantified using the ONF growth and yield table for fertility class 2, increasing the rotation length from 56 to 70 years raises the biomass stock difference (before discounting) between the project and baseline scenarios by 11%, from 248 tCO_2/ha to 275 tCO_2/ha. In theory, this means that carbon gains could be increased by adjusting the rotation length. However, this does not appear to be the case in practice: an analysis of the rotation lengths used for quantification *(Figure 13)* indicates that the values are generally realistic, given the varied growth conditions across France and diversity of silvicultural approaches.

FIGURE 13: ROTATION PERIODS USED FOR THE SIX MOST COMMONLY PLANTED SPECIES



Source: I4CE, based on data provided by forestry project developers in August 2024 @I4CE_

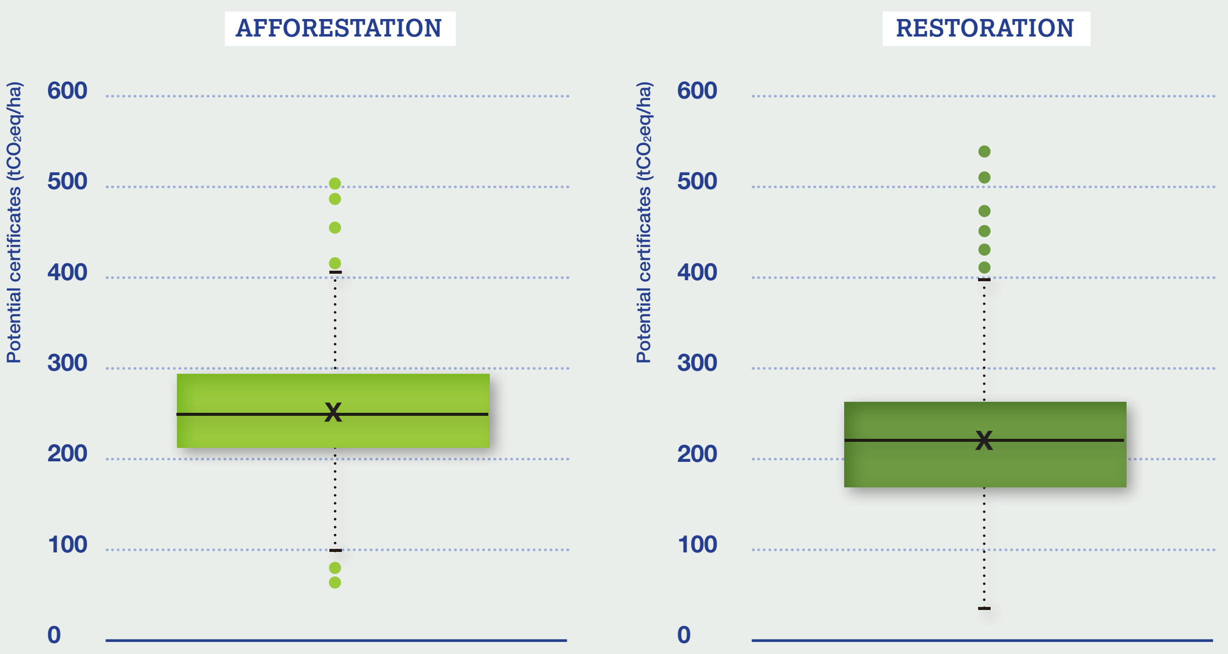
Nevertheless, to reduce information asymmetry and strengthen confidence in the quantification process, the new version of the forestry methodologies should ideally provide a framework for setting rotation lengths, potentially based on fertility class. In many cases, rotation lengths will therefore be determined by the ONF tables, which are generally longer than those used in managed private forests. Project developers operating in private forests should be allowed to request a shorter rotation period. Provided it remains longer than 30 years, this reduction could lead to a lower SMLT and, consequently, a lower carbon gain for the project, based on a conservative estimate.

5. Three-quarters of carbon gains are linked to forests, with the remainder attributable to wood product substitution

A. HIGHLY VARIABLE CARBON IMPACT PER HECTARE

An analysis of hundreds of approved projects enables us to examine how GHG impacts per hectare are distributed.

FIGURE 14: DISTRIBUTION OF GHG IMPACTS PER HECTARE FOR FORESTRY PROJECTS (AFTER DEDUCTIONS). BASED ON 561 AFFORESTATION PROJECTS AND 566 RESTORATION PROJECTS.



Source: I4CE, based on MTE, BDD3, April 2025 @I4CE_

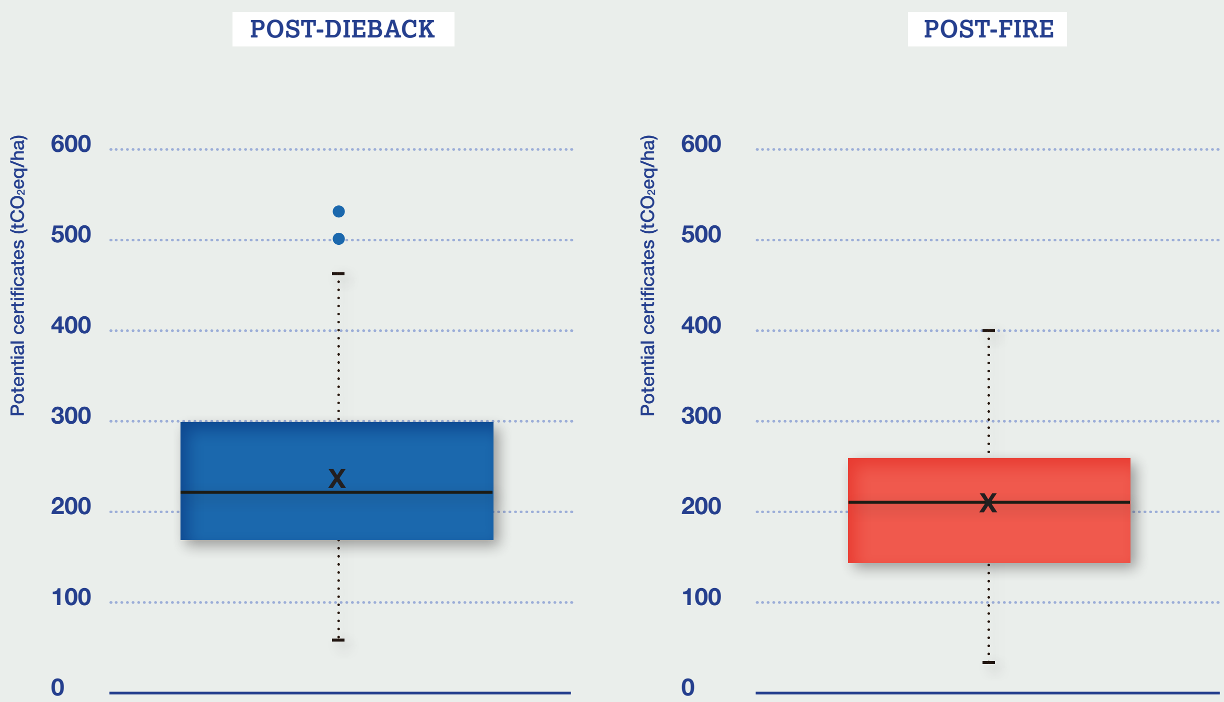
An afforestation project has an average impact of 252 tCO_2eq/ha, while a restoration project generates an average of 223 tCO_2eq/ha over 30 years. There is considerable variability between projects, which can largely be explained by differences in site conditions and the tree species planted. At the LBC level, however, it is not possible to isolate these factors from potential differences linked to the growth and yield tables and fertility classes chosen by project developers. However, the impact of these choices, which are difficult to verify during project validation, has been highlighted (*Canopée Forêts Vivantes, 2023; WWF France, 2021*), reinforcing the importance of a clear framework for quantification *(see section 2.4).*

Several factors help explain the difference in impact between afforestation and restoration projects. First, these two project types are generally located in different parts of France and involve different tree species. Second, the Afforestation methodology includes an additional component: changes in soil carbon stocks for projects whose baseline scenario is the continuation of agricultural cultivation *(35% of afforested areas, see Figure 9).*

A closer look at the average carbon impact of restoration projects by type of degradation also reveals a certain disparity *(Figure 15)*: post-dieback projects show an average impact of 238 tCO_2eq/ha, compared with 201 tCO_2eq/ha for post-fire projects. The lower carbon gains per unit area in the latter case can be attributed to several factors:

- **These projects are more likely to fall short of demonstrating economic additionality** and are therefore subject to discounts *(see section 2.6.2).*
- **The main species planted in post-fire projects is maritime pine** (86%, see section 2.2.1), which has lower basic wood density[8] than hardwoods, which are more common in post- restoration projects.

FIGURE 15: GHG IMPACT PER HECTARE FOR RESTORATION PROJECTS



Source: I4CE, based on MTE, BDD3, April 2025

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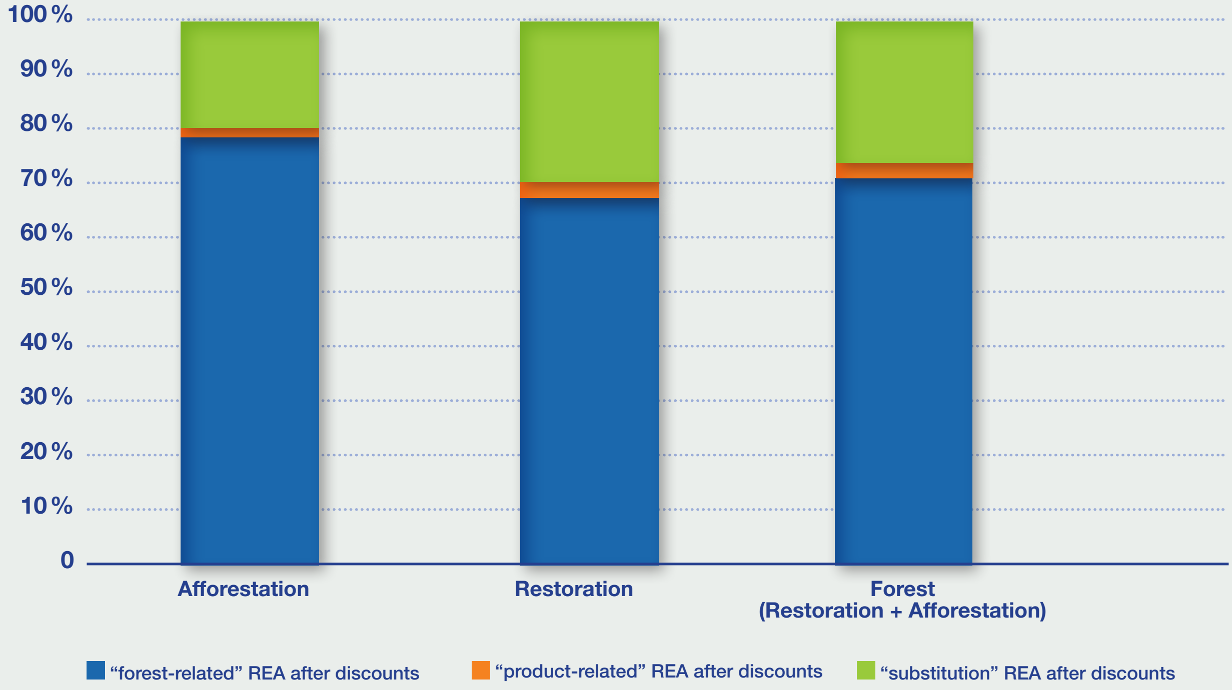
B. A SIGNIFICANT PROPORTION OF SUBSTITUTION IN POST-FIRE PROJECTS

Analysis of the nature of GHG impacts from LBC projects *(Figure 16)* show that around three-quarters of potential carbon certificates are linked to forest carbon sequestration, while more than a quarter (26%) correspond to substitution effects. “Product-related REA” account for just 3% of the total. This only refers to wood harvested during the 30 years after planting: at this stage, there are few or no long-lived products capable of storing carbon over time, which partly explains this low share. However, even in longer-term assessments, the contribution of the wood products carbon stock pool remains limited compared to that of the forest itself, mainly due to significant losses during processing stages *(Fortin et al., 2012).*

However, the share of certificates linked to substitution is relatively high: 26% on average across all forestry projects. This may seem surprising for a standard that only accounts for carbon gains over a 30-year period. Indeed, the substitution carbon benefits are primarily linked to material substitution, which is directly linked to timber production, and this is expected to be relatively low during the first 30 years of a plantation. A detailed analysis of the projects shows that the proportion of substitution is higher in restoration projects (29.7%) than in afforestation projects (19.7%) *(Figure 16)*. Within restoration projects, substitution accounts for an average of 38% of the impact in post-fire projects and 40% in post-storm projects, compared with only 17% in post-dieback projects. These

8. Basic wood density is the ratio between the mass of anhydrous wood and the volume of fresh wood. This species-specific coefficient is used to convert wood volume into dry biomass, which can then be converted into carbon. For example, the basic wood density of maritime pine is 444 kgMS/m³, compared with 650 kgMS/m³ for sessile oak *(Cuny et al., 2025)*.

FIGURE 16 : BREAKDOWN OF THE POTENTIAL GHG IMPACT OF FORESTRY PROJECTS BY TYPE

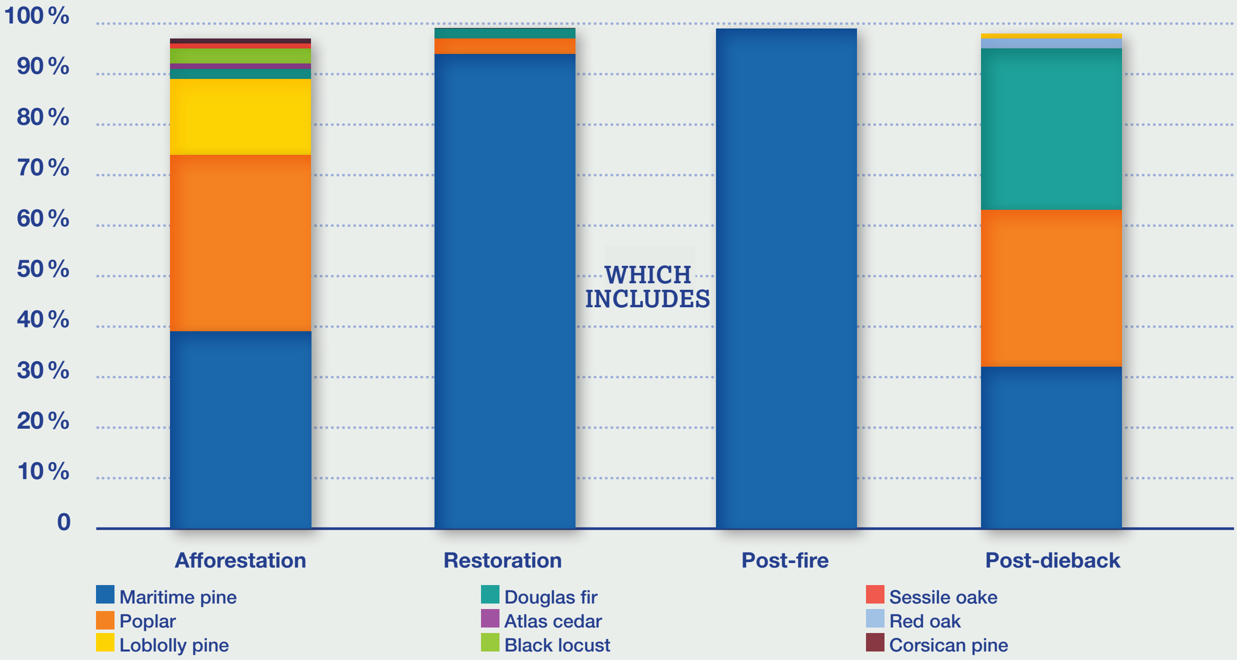


Source: I4CE, based on MTE, BDD3, April 2025 @I4CE_

differences are largely explained by the choice of replanted species and their growth rates. Fast-growing species (particularly maritime pine and poplar) generate greater substitution effects over the duration of the project *(Figure 17)*. For these species, it is possible to carry out thinning operations and sometimes even final felling (clearcut) for timber, and these silvicultural operations are modelled in the project scenario. These timber harvests, which take place during the 30 years following planting, generate these substitution effects.

While the key role of fast-growing species in short-term timber production is logical and expected, **questions remain over some of the rotation length choices for maritime pine.** Of the 274 projects involving this species for which rotation length data were available, 39% set the period at 30 years *(Figure 13)*, which appears shorter than is typical in forestry practices. Although the Schéma regional de gestion sylvicole (SRGS, regional management plan for private forest) for Nouvelle-Aquitaine sets a minimum harvest age of 20 years for maritime pine, it also states that "for timber production to meet the needs of all users in the sector, the harvest age is between 35 and 50 years" *(CNPF Nouvelle-Aquitaine, 2022)*. This suggests that some project developers may be seeking to "optimize carbon gains", thereby enabling them to account for the proceeds of final harvests. Regarding cultivated poplar, which is typically harvested at around 20 years and partially used for timber, the generation of substitution is consistent with the calculation method proposed in the V2 methodologies.

FIGURE 17: BREAKDOWN OF TREE SPECIES RESPONSIBLE FOR "SUBSTITUTION" CARBON CERTIFICATES. FOR EACH PROJECT, THE ENTIRE SUBSTITUTION IMPACT IS ATTRIBUTED TO THE TREE SPECIES THAT ACCOUNTS FOR MORE THAN 75% OF THE PLANTED AREA.



Source: I4CE, based on MTE, BDD3, April 2025 @I4CE_

These high levels of substitution in certain projects raise questions, especially given the recurring criticism of this approach *(Canopée Forêts Vivantes, 2023; WWF France, 2021)*. Several concerns have been raised:

- **The calculation of substitution is inherently uncertain,** as the methods applied depend not only on how the wood is used, but also on the mix of materials and energy sources it is assumed to replace, and their respective GHG footprints.

- **These potential substitution effects occur mainly at the end of the 30-year quantification period,** when trees have reached harvestable size. The planned use of coefficients, based on current and historical conditions, is questionable given that substitution effects are likely to decline as France and Europe decarbonize. Assuming France achieves carbon neutrality by 2050, these coefficients would approach zero by that time.

- **The funders of an LBC project are not always aware that they are purchasing carbon certificates linked to indirect emission reductions.** They often believe they are primarily supporting carbon sequestration in biomass and soils. However, some projects have particularly high proportions of "substitution" certificates – up to 75% in several cases.

- **The international carbon certification context is not conducive to the inclusion of substitution effects.** This is a distinctive feature of the Label Bas-Carbone, which is, to our knowledge, the only certification scheme that includes such effects. The forthcoming European certification framework *(Regulation (EU) 2024/3012 Establishing a Union Certification Framework for Permanent Carbon Removals, Carbon Farming and Carbon Storage in Products, 2024)* will not recognize these indirect impacts.

- **This is also a point of discussion and disagreement with agricultural methodologies, particularly for arable crops** *(Soenen et al., 2021)*. In the current version of the methodology, "downstream" emission reductions, which are considered as indirect, are not included. This remains a matter of debate, especially concerning rapeseed production as a substitute for imported soybeans used in animal feed.

The LBC's GST shared these findings, and the GST rapporteurs proposed a linear decrease in substitution coefficients to zero by 2050, in line with the SNBC *(INRAE, 2024a)*. This assumption is reflected in the new version of the methodologies, with one exception: the substitution coefficient for "sawing" decreases from 1.52 in 2024 to 1 in 2050. This relatively high value in 2050 raises questions about consistency with other coefficients that fall more sharply, particularly that for wooden panels. Clarifying the assumptions behind this choice could help facilitate discussion.

6. Discounts linked to risks of non-permanence and windfall effects

The LBC methodologies include several types of discounts that reduce the total potential impact of a project. These discounts correspond to the withdrawal of a portion of a project's calculated carbon benefits and, unlike buffers that exist in other standards, are never recredited. They are applied to account for risks such as non-permanence, uncertainties in quantification, or information asymmetry between the project developer and the validation authority. The forestry methodologies identify **4 distinct** types of discounts:

1. **A mandatory 10% discount accounts for general uncertainty about the project's actual climate impact,** including the overall risk of non-permanence.
2. **A variable discount (ranging from 0% to 15%)** is applied to account for fire risks.
3. **A 10% discount is applied** if the project developer does not justify the fertility classes used for the planted species, reflecting information asymmetry.
4. **A 20% discount** is applied when economic additionality is not demonstrated, to address the potential windfall effect.

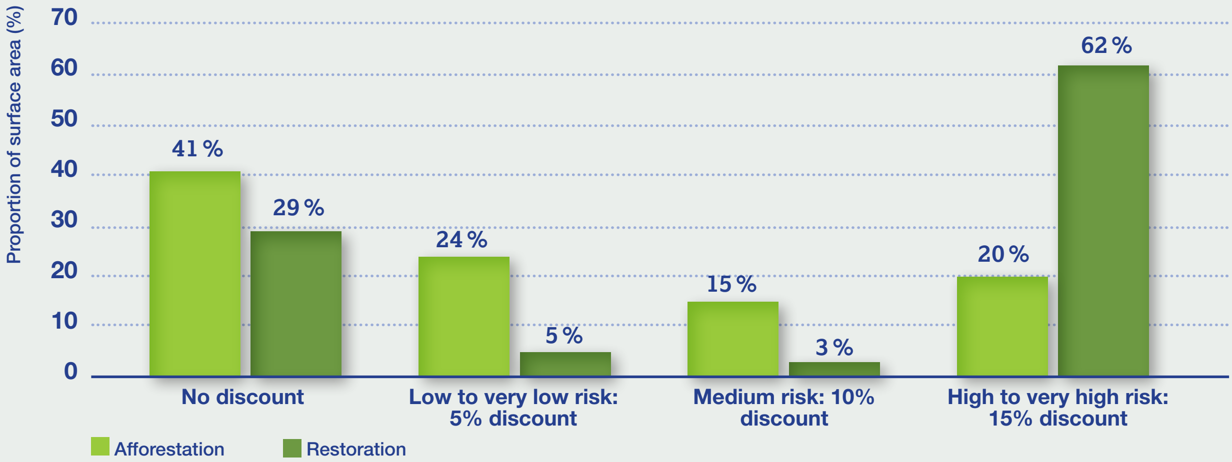
It should be noted that the methodologies also provide for a fifth discount, applied during the audit phase. If the measured stand density falls below the expected thresholds, the number of certificates is adjusted to reflect the gap between the planned density and the actual density. Strictly speaking, this is not a discount but rather an adjustment to the volume of carbon certificates issued, based on the estimates at project validation.

A. DISCOUNTS THAT VARY ACCORDING TO FIRE RISK

The LBC accounts for the possibility that fires may occur during the 30-year project period and release some of the captured carbon. To reflect this risk, project developers must provide information on the fire risk level in each municipality, through the Plans de Protection des Forêts Contre les Incendies (Forest Fire Protection Plans) at departmental or regional level, or the Dossier Départemental sur les Risques Majeurs (DDRM, Departmental Major Risk Register). A discount on a project's potential sequestration is applied for each risk level:

- **Negligible risk:** no discount
- **Low to very low risk:** 5% discount
- **Medium risk:** 10% discount
- **High to very high risk:** 15% discount

FIGURE 18: BREAKDOWN OF POTENTIAL FOREST CARBON CERTIFICATES BY FIRE RISK (IN %)



Source: I4CE, based on MTE, BDD3, April 2025 @I4CE_

For both forestry methodologies, around 40% of potential carbon certificates correspond to projects not subject to fire risk discounts *(Figure 18*). These projects are located in areas with low fire risk, primarily in the northern half of France. The application of fire discounts under the Restoration methodology is more pronounced: 62% of potential certificate volume comes from projects in high to very high risk areas. A close analysis of projects subject to the 15% fire risk discount reveals that 71% are in the Nouvelle-Aquitaine region. These are mostly restoration projects developed in response to the 2022 fires in Gironde, which occurred in areas classified as very high risk.

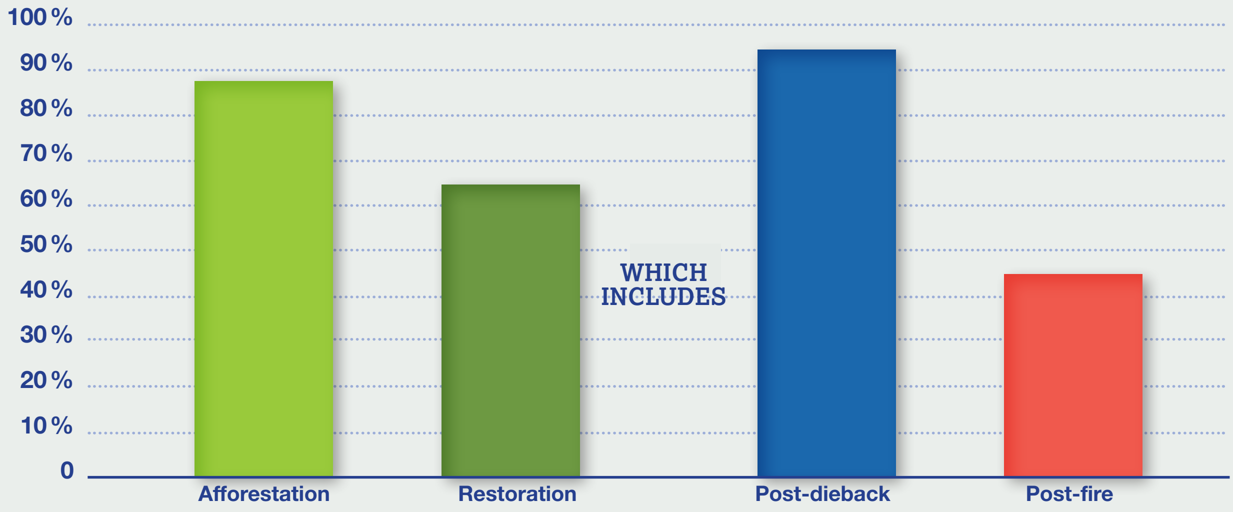
The adoption of a fire risk discount by 60% of LBC projects is consistent with current exposure levels: one third of heathland and forests in mainland France are already subject to high fire risk, a figure expected to affect 50% of forests by 2050 *(Chatry et al., 2010)*. It is therefore essential that fire risk assessments remain scalable. In July 2023, a new law was enacted to strengthen prevention and control of increasing fire risk. This legislation significantly expands the list of departments required to implement a plan de protection des forêts contre les Incendies (PPFCI, Forest Fire Protection Plan). The updated risk assessments will automatically apply to new projects, leading to higher discount levels in the future. However, some project developers have raised concerns about inconsistencies in fire risk zoning, with certain documents designating entire forest areas as high risk without sufficient differentiation.

B. FEWER THAN HALF OF POST-FIRE PROJECTS DEMONSTRATE ECONOMIC ADDITIONALITY

LBC projects must comply with the additionality principle, which is central to carbon certification. This means demonstrating that, without carbon funding, the project activities (and indirectly the associated GHG impact) would not have been carried out. The first part of the test concerns any public aid for which a project is eligible. If this exceeds 50% of the project cost, the project is not eligible, as the aid is considered a sufficient incentive. In the case of public support for forest renewal, however, the owner may refuse the funding, thereby making the project eligible for the LBC.

The second test verifies economic additionality to demonstrate that the project scenario is not more profitable than the baseline scenario. This requirement, common in carbon standards, is intended to avoid windfall effects – in other words, to prevent financing projects that would have gone ahead anyway. If the project is the most profitable option, it can reasonably be assumed that the promoter would have chosen it regardless of the carbon funding. The test is based on comparing the Net Present Value (NPV) of the project scenario with that of the baseline scenario. If the promoter chooses not to carry out this analysis, a 20% discount is applied to the potential emission reductions (ERs) generated by the project.

FIGURE 19: SHARE OF POTENTIAL CARBON IMPACTS OF PROJECTS THAT HAVE CARRIED OUT THE ECONOMIC ADDITIONALITY TEST



Source: I4CE, based on MTE, BDD3, April 2025

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In total, 73% of forestry projects pass the economic additionality test, thereby helping to ensure the effectiveness of the funding provided. As shown in Figure 19, the vast majority of afforestation projects (87%) and post-dieback restoration projects (96%) have carried out an economic analysis to demonstrate additionality. Conversely, only 45% of post-fire restoration projects involving maritime pine plantations meet this criterion, with some project promoters opting instead to accept the 20% discount. This discount accounts for 55% of the potential volume of post-fire carbon certificates. It appears that, at current timber prices, planting maritime pine without diversification may be more profitable than the baseline scenario, as shown by the NPV analysis. To strengthen the additionality requirement and thereby improve the climate impact of the funding, version 3 of the methodologies *(CNPF, 2025b)* introduces a more dissuasive discount – increased from 20% to 40%. This could help limit what appears to be a windfall effect. Nevertheless, it should be noted that economic profitability is not always the primary objective for forest owners *(IGF et al., 2024)* and that other obstacles can stand in the way of projects, including risk aversion and discouragement after experiencing a disaster.

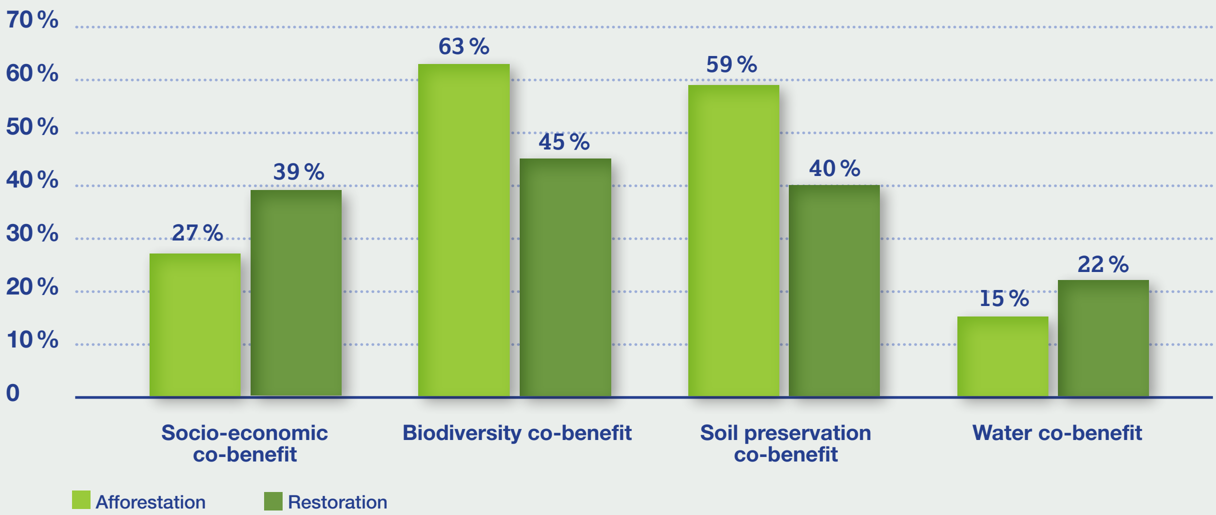
Finally, the discount for failure to justify the productivity class is rarely applied: only 1% of projects make use of it. Overall, across all restoration and afforestation projects, the weighted average discount by potential certificate volume is 22%. The total discount ranges from 10% to 39% in individual forestry projects. In addition to these discounts, other safeguards have been adopted to reduce the risks associated with carbon capture over 30-year projects – such as requiring a site and climate assessment to demonstrate the suitability of the chosen tree species. However, the impacts of climate change on tree mortality and stand growth are already evident in Europe *(Hertzog et al., 2025; Senf et al., 2020)*.The limited carbon credit buffer are sometimes criticized *(Anderegg et al., 2025),* as is the case in California *(Badgley et al., 2022).* A scientific assessment of the risks to plantation projects over the next 30 years could provide objective evidence as to whether current discount levels are sufficient.

7. Numerous co-benefits that are difficult to value

Although the LBC is primarily a carbon-focused approach, the methodologies include a framework for identifying and assessing a project's potential co-benefits and its impacts on other ecosystem services.

For forestry methodologies, the co-benefit assessment framework covers four categories: biodiversity, soil preservation, water, and socio-economic aspects. Each category is evaluated using several criteria, with co-benefits scored using a points-based system. The scores for the criteria in each of the four categories are summed and compared to the maximum achievable score, to give the percentage of co-benefits achieved for each category.

FIGURE 20: AVERAGE CO-BENEFIT SCORES FOR THE TWO FORESTRY METHODOLOGIES



Source: I4CE, based on MTE, BDD3, April 2025

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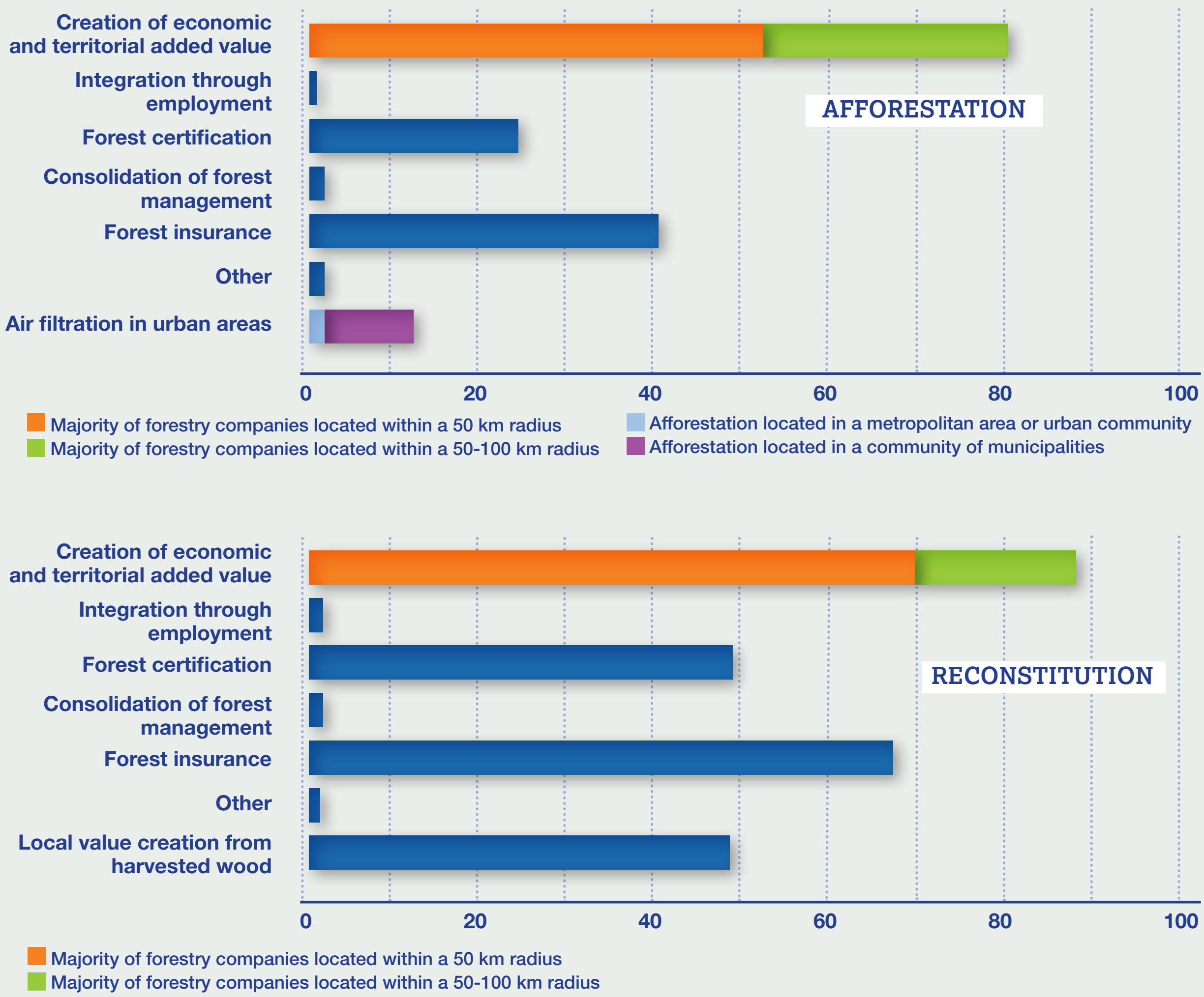
Figure 20 shows the average level of co-benefits for the two forestry methodologies, which have different assessment criteria (and associated points systems). For example, the criterion "air filtration in urban areas" applies only to the Afforestation methodology, as it involves the creation of new forests and is therefore not relevant to restoration. The biodiversity and soil preservation categories are the most widely used, especially in afforestation projects, with respective usage rates of 63% and 59%. The higher level of biodiversity co-benefits in afforestation is partly due to greater species diversification *(see section 2.3.2).*

The principle behind the co-benefits assessment framework is to highlight projects that have positive impacts on ecosystem services beyond carbon, ideally to help these projects attract better funding. However, the resulting percentage score is not intuitive for funders. As a result, most project developers do not use the tool in its current form to highlight co-benefits. Instead, they tend to identify the most relevant co-benefit(s) for each project and present them using a narrative they develop themselves.

Finally, some project developers reported that they choose not to declare certain co-benefits, even when implemented. Since co-benefits are audited at t+5 and the verification criteria can be unclear, they see a risk in declaring them. This is particularly true when it is difficult to guarantee that a co-benefit will be maintained for five years: for example, with the diversification/indigenous species criterion, which involves a risk if one or more species die during the first five years. années.

A. SOCIO-ECONOMIC CO-BENEFITS

FIGURE 21: AVERAGE SCORES FOR EACH SOCIO-ECONOMIC CO-BENEFIT CRITERION



Source: I4CE, based on data provided by forestry project developers in August 2024 @I4CE_

Socio-economic co-benefit scores are higher for restoration projects than for afforestation projects (33% compared with 19%, as shown in Figure 20). This difference is particularly marked for two criteria: forest insurance and certification *(Figure 21)*. Afforestation projects are often developed by new forest owners (e.g. former farmers) who do not yet have forest insurance or sustainable management certification. For some restoration projects, the location is higher risk (particularly in terms of fire), which weighs heavily on landowners, who prefer to protect themselves against potential future damage and therefore take out insurance.

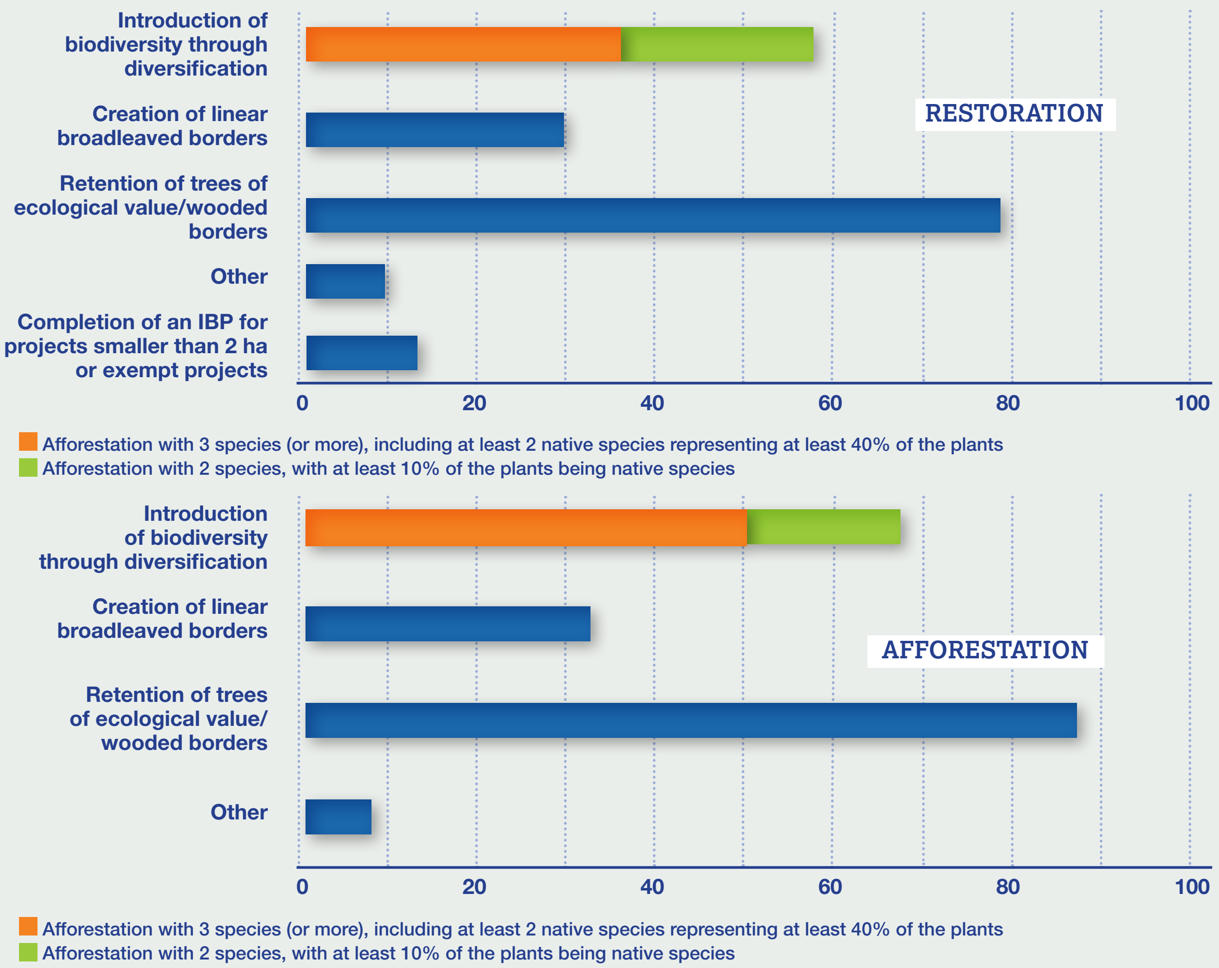
As noted in Part 1, restoration under the LBC scheme is concentrated in the Landes forest and in the north-eastern quarter of France. These regions, which have extensive forested areas, are home to many forestry companies operating across the territory *(1630 Conseil, 2021).* As a result, 70% of restoration projects are carried out by local companies (within a 50 km radius), compared with 55% for afforestation projects.

The employment integration criterion, requiring forestry work to be carried out by professional reintegration organizations or by employing people with disabilities, is rarely applied (only 8 projects out of the 630 analysed here). Some representatives highlight the complexity of implementing and justifying this measure during the audit process.

Finally, the "forest management grouping" co-benefit encourages landowners to join management structures such as ASLGF or GIEFF. It is used in only 1.5% of afforestation projects and 1.8% of restoration projects. Bringing landowners together through these structures requires significant coordination and therefore remains rare. Given that 89% of forest owners hold less than 4 ha *(Fransylva & CNPF, 2021)*, there is a clear value in encouraging them to work together to develop projects.

B. BIODIVERSITY CO-BENEFITS

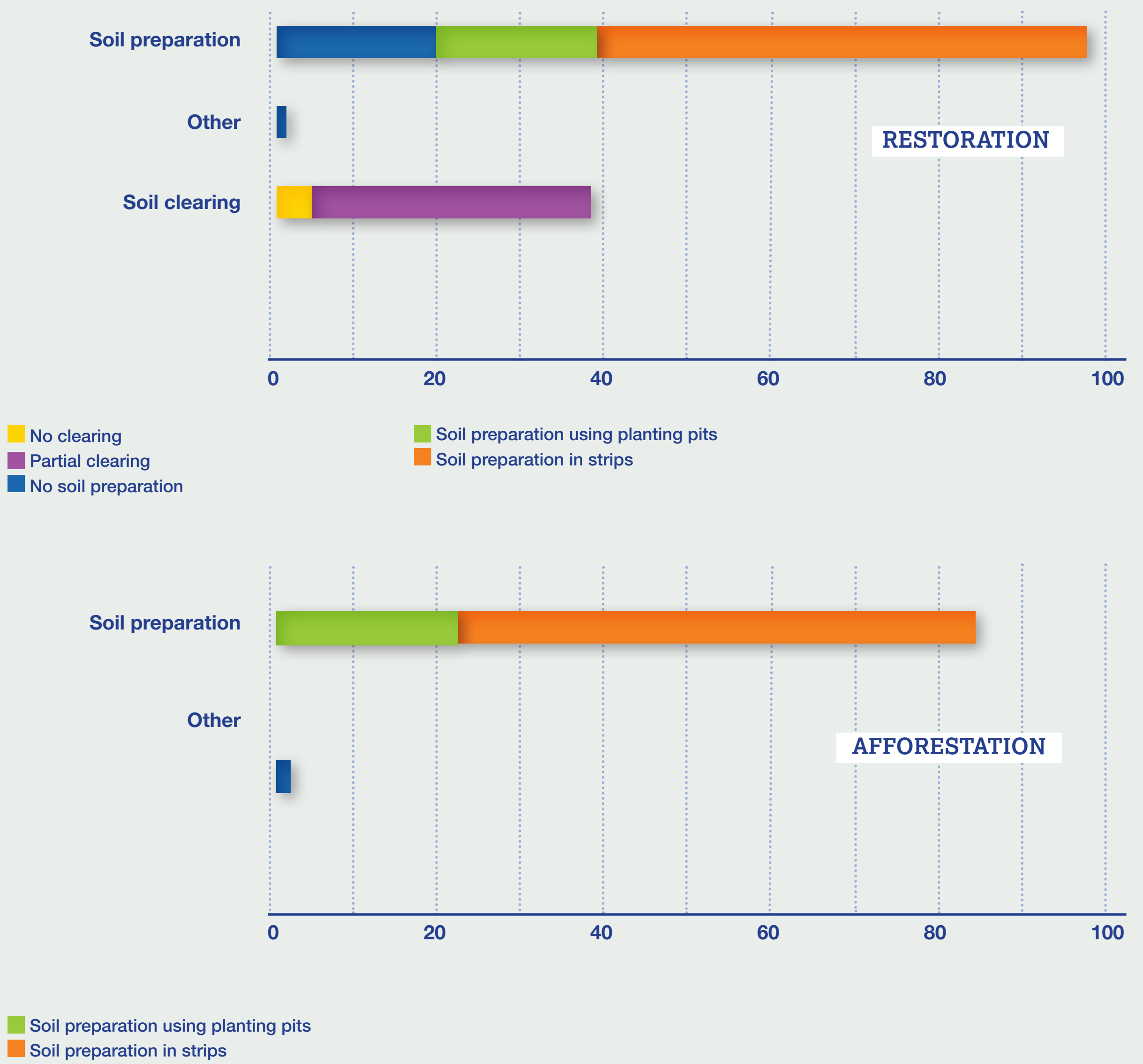
FIGURE 22: AVERAGE SCORES FOR EACH BIODIVERSITY CO-BENEFIT CRITERION



Source: I4CE, based on data provided by forestry project developers in August 2024 @I4CE_

C. SOIL PRESERVATION CO-BENEFITS

FIGURE 23: AVERAGE SCORES FOR EACH SOIL PRESERVATION CO-BENEFIT CRITERION



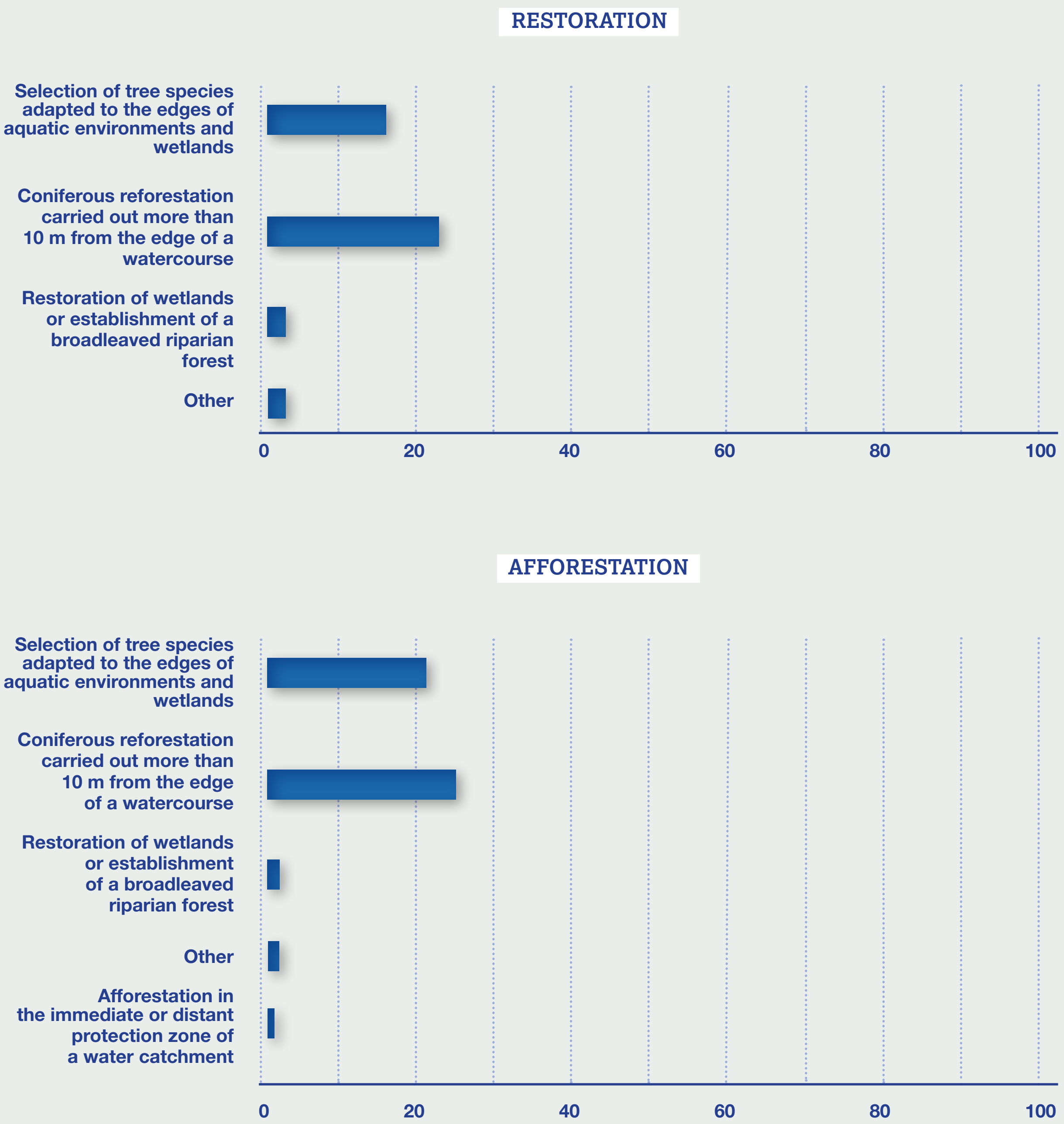
Source: I4CE, based on data shared by forestry project developers in August 2024 @I4CE_

This co-benefit aims to limit soil tillage, which tends to release carbon *(Augusto et al., 2019)*. The analysis shows that most projects avoid full soil preparation: 96% of restoration projects and 90% of afforestation projects favour strip or planting pit preparation, which has a lower impact. Planting forest trees on non-forest land requires preparatory work, whereas 20% of restoration projects are carried out without any soil preparation. The use of the worked planting pit technique is similar between afforestation (24%) and restoration (19%).

While some of these criteria aimed at limiting soil preparation are becoming mandatory in the V3 methodologies, the current situation suggests that most project promoters will be able to adapt to these new requirements.

D. WATER RESOURCES CO-BENEFITS

FIGURE 24: AVERAGE SCORES FOR EACH WATER RESOURCES CO-BENEFIT CRITERION



Source: I4CE, based on data provided by forestry project developers in August 2024 @I4CE_

As noted above, the average level of use of the "water" co-benefit remains relatively low compared with other categories (11% for restoration and 8% for afforestation). This co-benefit only applies to projects located near wetlands or aquatic environments. The fact that a score of 0% is still displayed on the LBC website for projects to which the water criterion does not apply has caused confusion among LBC funders. Some project developers suggest that this category should only be activated when relevant, which would make the information easier to interpret.

8. Assessment and recommendations for forestry projects

REGARDING THE FORESTRY COMPONENT: THE WEAKNESSES HAVE BEEN PARTIALLY CORRECTED IN THE UPDATED METHODOLOGIES

PROJECT ASSESSMENT 2019-MARCH 2025	AREAS FOR IMPROVEMENT
• Although diversification is optional, **afforestation and post-dieback restoration projects are already diversified:** between 3.7 and 5.3 species per project, although there are significant differences between projects. • However, **some projects remain relatively undiversified,** sometimes due to soil and climate constraints, but not always. Promoting species mixing at planting is essential to strengthen ecosystem resilience and support the economic resilience of project developers. • The latest public funding specifications for forest renewal are more ambitious than LBC V2 on diversification, showing that it is possible to set such criteria.	• For these reasons, **mandatory diversification criteria** were introduced into the LBC. These are now incorporated into **version 3 of the methodologies (2025)**, helping to improve diversification in projects where species mixing is feasible. • **Adding the option to quantify the carbon gain** (by analogy with other species, using a conservative approach) **from diversification species** (e.g. forest fruit trees) could increase the leverage effect of diversification.
• **A carbon calculator** has been integrated into the methodologies to support project developers and reduce errors. • **Some early projects included incorrect carbon quantifications with overestimated** values due to the incorrect use of growth and yield tables and fertility classes.	• The **provision by ONF of growth and yield tables adapted to the French context and the assessment of other tables (CNPF)** should greatly mitigate this risk in version 3 of the methodologies. • These are only errors in estimated carbon reductions, which auditors can correct during project verification.
• The calculation **method and the integration of the long-term** average stock make it possible to account for timber harvesting and help ensure that carbon gains are not overestimated. • When using the long-term average stock method, **the choice of rotation length can significantly affect the carbon outcome.**	• To reduce information asymmetry and build confidence in the quantification process, the new version of the forestry methodologies **requires the use of the rotation lengths specified in the selected table,** while allowing for justified exceptions where appropriate.
• Substitution, which is unique to LBC (not accounted for by other standards), represents **26% of total carbon gains from forestry projects, with the remaining three-quarters attributed to forest carbon removals.** • In post-fire projects, substitution accounts for nearly 40% of the total impact, and **can reach up to 75% in some cases.** However, substitution calculations remain **complex and subject to considerable uncertainty**. Although substitution effects from LBC plantations are expected by 2040-2050 (with harvesting occurring before year 30), this potential is likely to decline as the economy becomes increasingly decarbonized.	To enhance the credibility of these calculations and respond to concerns raised by several stakeholders, the following measures are needed: • **Gradually reduce coefficients over time to reflect the ongoing decarbonization of the economy** – this is **already implemented for wood energy** in version 3 of the methodologies, but only partially for timber. • **Clearly indicate the types of certificates generated in the registry, to ensure full transparency for funders** about what is being financed: indirect emission reductions. The new version of the decree (2025) is expected to formalize this distinction.
• **The risk of non-permanence is appropriately addressed based on current data:** discounts ranging from 10% to 25% for climate-related hazards, along with evidence that the species selected are suited to local conditions through site and climate assessments. Overall, 22% of modelled potential credits are removed through these discounts. • While these tools currently seem appropriate for the level of risk, **the low level of credit reserves under certain standards have been criticized internationally** (Anderegg et al. 2025) and a cautious approach is recommended.	• It will be **important to ensure that discounts are regularly reviewed as climate risks increase,** especially **the risk of fire: this risk has already been revised upwards following updates to risk assessment documents.** • **New diagnostics to ensure the adaptation of tree species to future climate conditions** (silvicultural climate tools) are also required in the new version of the methodologies and will support improved climate adaptation. • In addition, a **scientific assessment of the risks facing planting projects over the next 30 years** could provide objective evidence as to whether the current discount levels are sufficient.
• The majority of projects (over 73%) pass **the economic additionality test, thereby ensuring the effectiveness of the funding provided.** • However, **55% of post-fire restoration projects do not demonstrate this additionality** and are subject to a 20% discount on the certificates generated.	• To limit what could be considered a windfall effect, **the 20% discount could be increased.** Version 3 of the methodologies therefore **raises the discount to 40%**, which should help reduce this effect. However, there is concern that this may not be a sufficient deterrent for projects that are not additional at all, even though relying solely on the NPV test also has its limitations. **The use of this discount will need to be monitored to assess** how effectively the mechanism limits the windfall effect.
• A standard that goes beyond carbon by recognizing **qualitative benefits for biodiversity, soil, socio-economic activity and water.** The most significant co-benefits relate to biodiversity and soil. • The projects are **particularly effective in preserving soil,** meeting 90% of the criteria for afforestation and 96% for restoration. • **Restoration projects deliver fewer substantial co-benefits for biodiversity and soil than afforestation projects, due to lower levels of diversification.** • **The percentage-based display is considered difficult to interpret** by stakeholders, particularly funders. • Some stakeholders **choose not to report certain co-benefits** for fear of being unable to justify them during audits.	• **Diversification becomes mandatory** in the new version of the methodologies, with stricter co-benefit criteria on this point. • **The soil preservation criteria are clarified in version 3,** though this should not lead to major changes, as they were already largely met in existing projects. • To make co-benefits more transparent for stakeholders, **the percentage display could be replaced with a points-based system,** for example. • To support co-benefit audits and reassure stakeholders, **clear verification criteria must be included in the methodologies, which is one of the aims of V3.**

Green: Key strengths, **Marron:** Limitations observed, **Blue:** I4CE recommendations

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III. MULTIFACETED AGRICULTURAL PROJECTS WITH COSTS THAT REMAIN UNCERTAIN

Although six methodologies have been validated and are currently in use in the agricultural sector, this section focuses only on the two most successful: the Carbon'Agri methodology for cattle farming and the Arable Crops methodology.

1. Few levers mobilized by farmers

Unlike the forestry methodologies, the two agricultural methodologies examined here provide a multi-lever approach: farmers who engage in an LBC initiative can choose from a range of measures to implement, or not, on their farms.

Of the 18 to 29 levers offered by these methodologies *(see table in Appendix 3 for details),* farms tend to adopt around four – **slightly more in the Arable Crops methodology than in the Carbon'Agri methodology** *(Table 4).*

TABLE 4: SUMMARY OF LEVERS MOBILIZED IN THE ARABLE CROPS AND CARBON'AGRI METHODOLOGIES

	TOTAL NUMBER OF LEVERS AVAILABLE IN THE METHODOLOGIES	AVERAGE NUMBER OF LEVERS EFFECTIVELY MOBILIZED*	NUMBER OF FARMS COVERED
ARABLE CROPS	18 (3 categories)	4.7 [1-12]	817
CARBON'AGRI	29 (10 categories)	3.8 [1-14]	2042

The values in brackets indicate the minimum and maximum number of levers mobilized per project. Farms participating in collective projects may have mobilized more levers than the higher figure shown here.

Source: I4CE 2025, based on data from MTE, BDD3, April 2025

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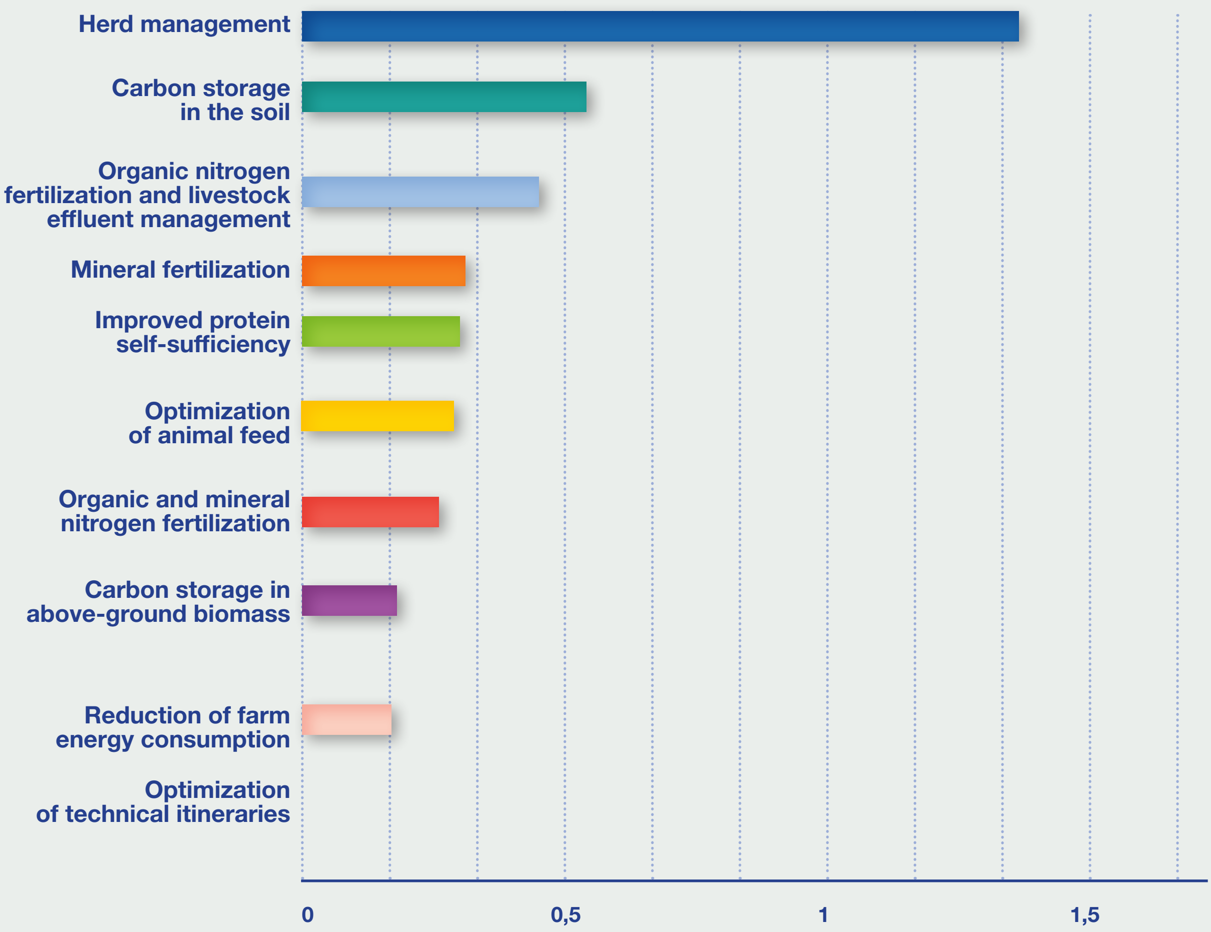
The data aggregated during project validation do not provide details on the individual levers used by farmers for each methodology; however, the number of levers used by category is available *(Figure 25 and Figure 26).*

For the Carbon'Agri methodology, the number of levers activated is low but covers most of the GHG mitigation potential: emission reductions linked to enteric fermentation and fertilization, and carbon removals in soils. These farming practices are widely supported by cattle farmers: on average, they plan to implement 1.4 practices in this category *(Figure 25).* These levers aim to optimize herd management by reducing the proportion of unproductive animals that contribute to farm emissions without contributing to production. They are the most recommended by agricultural advisors and the most widely adopted by farmers, as they align well with strategies to improve production profitability. Feedback from the field shows that optimizing the age at first calving is by far the most frequently selected practice. This involves bringing forward the age at which heifers calve for the first time, so they begin milk production as early as possible.

FIGURE 25: AVERAGE NUMBER OF PRACTICES IMPLEMENTED PER FARM, BY CARBON'AGRI LEVER CATEGORY



Source: I4CE 2025, based on data from MTE, BDD3, December 2024

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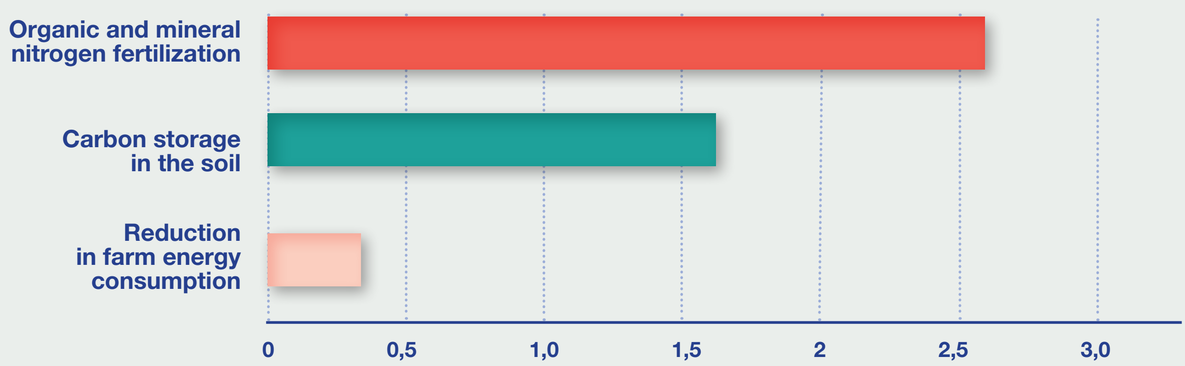
There has been considerable debate around the revision of the Carbon'Agri methodology, particularly concerning the emission reductions metric and the implications this has for farming practices. At present, Carbon'Agri expresses emission reductions in terms of CO_2 per unit of product, i.e. per kilogramme of meat or per litre of milk. **While this approach reflects certain on-the-ground realities (e.g. farm expansion), it has been criticized for primarily promoting optimization or even intensification, and for failing to recognize or support broader changes to farm systems.** Such systemic shifts may occur over a longer timeframe, but they are essential if the sector is to meet its emission reduction targets by 2050. Introducing a per-surface metric based on tCO_2eq/ha would help incentivize these changes. As part of the current discussions on revising the methodology, stricter requirements for co-benefits are being considered. These would make it possible to retain the per-unit-of-product metric while limiting the adverse effects of certain practices on biodiversity or water.

With regard to the Arable Crops methodology, the levers linked to fertilization and carbon storage in the soil are the most widely used by farmers *(Figure 26).*

FIGURE 26: AVERAGE NUMBER OF PRACTICES IMPLEMENTED PER FARM, BY ARABLE CROP METHODOLOGY LEVER CATEGORY



Source: I4CE 2025, based on data from MTE, BDD3, December 2024

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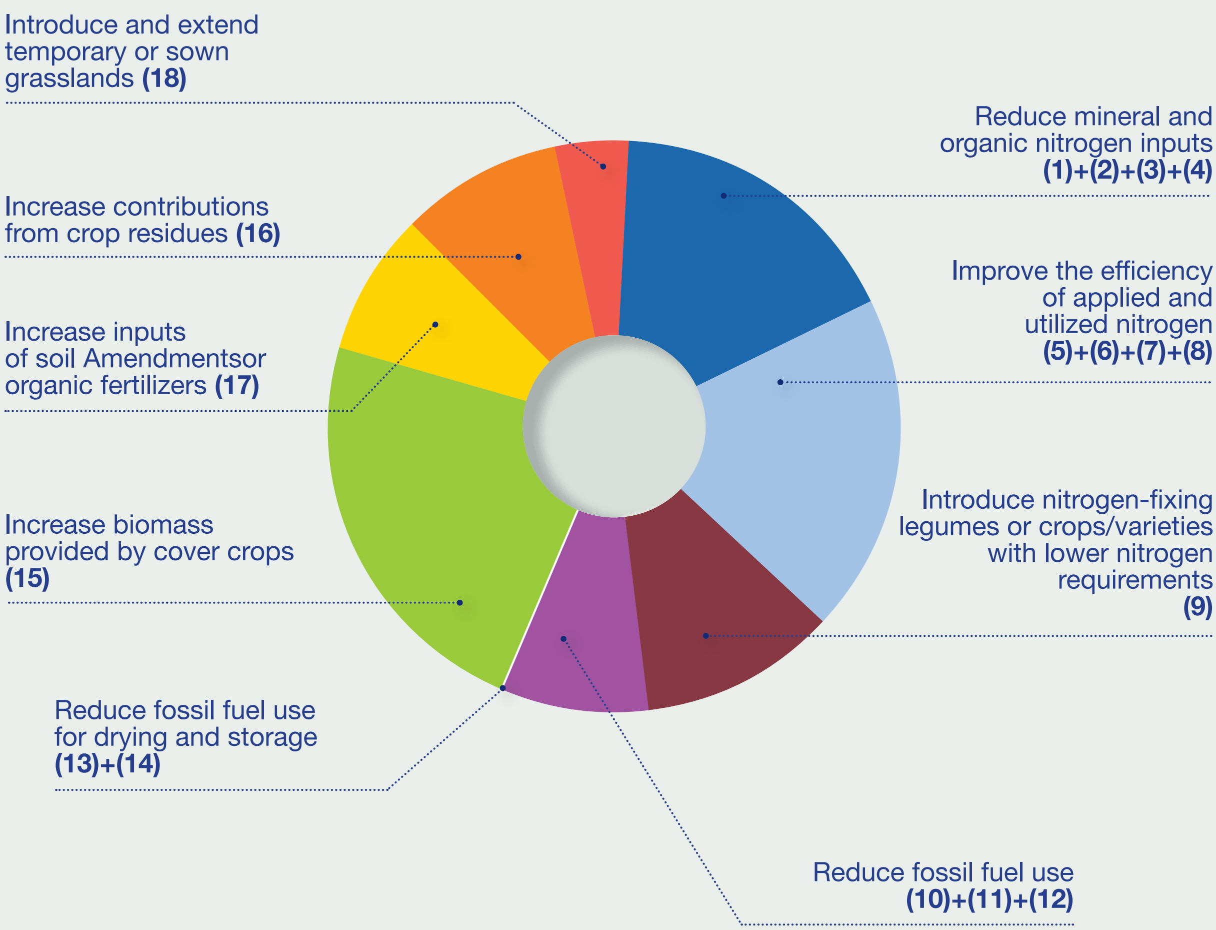
The analysis of the levers mobilized for Arable Crops is then refined using data provided by three project developers, which accounts for 37% of the methodology's potential carbon impact. This is based on a classification system that groups the 18 individual practices into nine categories *(Figure 27)*. The most widely implemented practice is the increase in biomass returns through the use of cover crops, which has a direct effect on soil carbon dynamics. The introduction of legumes (a nitrogen-fixing plant family) is also a commonly used lever to reduce the impact of fertilization. The adoption rates of these practices are consistent with the detailed assessments of 31 farms in the Grand-Est region *(Agrosolutions, 2023)* and extracts from the Carbon-Extract database *(Personal communication, Arvalis and Agrosolutions, 2024)*. In addition to their low-carbon nature, the main levers mobilized provide other benefits for farmers. They can support greater autonomy when they reduce the need for synthetic fertilizers, or have technical benefits. Most project developers provide agronomic support, which leads them, for example, to propose levers beyond purely carbon-focused ones (such as no-till farming for soil health) and to sequence the levers used within the LBC framework. Practices targeting soil carbon are prioritized in the early years to (re)build organic matter levels in the soil and thereby increase yields. Once soil fertility has been restored, mineral nitrogen fertilizer inputs can be reduced in a second phase. **Some levers (such as increasing returns through crop residues and increasing the application of Matériaux Améliorants et Fertilisants d'Origine Résiduelle (MAFOR, soil improvers and fertilizers from residual materials) are widely used by farmers, even though their impact mainly consists of shifting carbon storage from one field to another.** Pellerin et al. *(2019)* thus indicate that only inputs associated with exogenous carbon sources (sewage sludge, some composts and digestates) contribute to increasing carbon in agricultural soils without leakage. These elements are currently under review as part of the revision of the methodologies, and this could lead to restrictions on the use of these levers or to their association with carbon leakage.

It is clear that the levers affecting fossil fuel consumption for drying and storage are rarely used, as they require significant investment or do not depend directly on farmers (e.g. drying carried out downstream of the farm).

FIGURE 27 : PAVERAGE PROPORTION OF GROUPS OF PRACTICES IMPLEMENTED IN ARABLE CROPS (ANALYSIS BASED ON 37% OF POTENTIAL CARBON CERTIFICATES). SEE APPENDIX FOR NUMBERS OF INDIVIDUAL PRACTICES.



Source: I4CE 2025, based on MTE, BDD3, April 2025

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2. The costs of these practices are variable and often underestimated

Ce This chapter draws on data that, while not all specific to the LBC, helps shed light on an issue that is central to the LBC. There is no single cost of agricultural transition, but rather a range of costs that depend on the type of production, the farm's starting point, the local context, the ambition of the transition effort, energy prices, and other factors. Scientific research provides theoretical estimates of the cost of practices and shows that these costs can be either positive or negative. While some practices generate additional expenditure, others can ultimately lead to economic gains for farms. These are referred to as "negative costs". The development of the LBC and other financing mechanisms has also made it possible to gather field data on the actual cost of implementing practices. This chapter therefore reviews the available cost estimates for individual practices, examines different approaches to cost assessment in cattle and arable farming, and considers the role of non-economic barriers. It draws on both technical field data and economic evaluations from scientific literature. It is important to distinguish between the cost of implementing practices and transaction costs, the latter referring to expenses directly linked to the implementation of financing mechanisms, whatever form they may take. These transaction costs are addressed at the end of the chapter. Finally, this chapter also discusses "transition costs" *(Idele, 2024)*. This term refers to the full set of costs associated with implementing new practices. These include not only the direct costs of the practices themselves, but also indirect costs such as transaction costs and those related to risk-taking. This comprehensive approach is still under development, and no consolidated figures are currently available.

Feedback from LBC project developers and a recent study on the subject *(Lamerre et al., 2024)* indicate that carbon payments are far from being the main reason farmers choose to engage with the LBC. Other motivations are frequently cited *(Agrosolutions, 2023)*, including environmental values, the desire to set an example, and the agronomic benefits of the practices. Expected income is often seen as the "icing on the cake": current funding does not appear sufficient to cover the full cost of implementing the practices and the associated risk-taking.

A. HIGHLY VARIABLE COSTS

The various cost estimation methods identified in the literature are based on the partial budget method *(Soenen et al., 2021)*. The figures presented here reflect the net change in costs and revenues associated with the implementation of each low-carbon practice.

Costs are grouped into two broad categories:

> **Operating costs:**

- The operating costs of a low-carbon practice may take the form of a new and additional expense: for example, the purchase of legume seeds when they are introduced into the rotation.
- They may also involve a change in the structure of operating costs: optimizing replacement livestock numbers requires organizational changes for farmers, who may need to alter the calving cycle and possibly purchase equipment such as heat detection aids.
- Finally, the implementation of low-carbon practices may affect a farm's output, for example by changing the level or variability of crop yields, or by altering the volumes of different crops (e.g. fewer main crops and more grassland when it is added to the rotation).

> **Investment costs:** these may be tangible, such as the purchase of agricultural equipment, or intangible, such as costs related to training.

These low-carbon practices can therefore affect both farm costs and revenues, either negatively (representing a cost) or positively (representing a gain or negative cost). A review of recent studies shows that cost calculations have not been carried out consistently across all practices covered by the LBC. Firstly, practices that are less adopted by farmers have been the subject of fewer quantitative studies. In addition, methodological differences and the specific characteristics of each type of agricultural production contribute to heterogeneity in how results are presented. In other words, recent literature expresses costs using a variety of units (€/ha, €/tonne, etc.). To enable comparison, the summary table compiles results that are either originally expressed or recalculated in €/tCO_2eq. Given the considerable uncertainty and variability in cost estimates, the results are presented as "ranges" in the table.

TABLE 5: SUMMARY OF COSTS FOR SELECTED PRACTICES UNDER CARBON'AGRI AND ARABLE CROPS METHODOLOGIES, BASED ON RECENT LITERATURE

SECTOR	LEVER	PRACTICE (Carbon'Agri and Arable Crops methodologies)	TYPE OF COST	COST RANGE (€/tCO_2eq) (theoretical estimate)	COST RANGE (€/tCO_2eq) (theoretical estimate)	CONFIDENCE INDEX OF TECHNICAL ESTIMATES[1]
CATTLE FARMING	Livestock management	Optimize replacement heifer numbers	Operational (change in cost structure)	NC	[-10 ; 0] (Idele, 2020)	++
	Improving protein self-sufficiency	Increase protein self-sufficiency	Operational (change in cost structure)	NC	[0 ; 200] (CNIEL, 2023)	+
	Organic nitrogen fertilization and manure management	Improve manure spreading methods (trailing hose, injection equipment)	Investment	-74 (Pellerin et al, 2013)	[100 ; 300] (CNIEL, 2023)	+
	Mineral fertilization	Optimize fertilization to reduce the use of N, P, K mineral fertilizers	Operational (change in cost structure)	[-98 ; -39] (Pellerin et al, 2013)	[0 ; 50] (CNIEL, 2023)	+
	Carbon storage in above-ground biomass	Plant hedgerows on the farm	Investment and operational (new additional cost)	[59 ; 1171] (Pellerin et al, 2020 ; Bamière et al, 2023)	[10 ; 460] (CNIEL, 2023 ; Afac 2023)[3]	+++
ARABLE CROPS	Reduction in energy consumption on farm	Reduction in energy consumption on farm	Reduce machinery energy consumption	NC	[-130 ; -80] (Com Perso, Carbone Farmers, 2025[2]	++
	Organic and mineral nitrogen fertilization	Use nitrification inhibitors	Operational (new additional cost)	NC	[0 ; 250] (Terrasolis, 2022 ; Com Perso, Carbone Farmers, 2025[2]	++
		Incorporate organic and mineral inputs	Investment and operational (new additional cost)	-59 (Pellerin et al, 2013)	[40 ; 70] (Com Perso, Carbone Farmers, 2025[2]	+++
		Introduce nitrogen-fixing legumes into crop rotation	Operational (change in cost structure)	[-184 ; 4] (Pellerin et al, 2013 ; actualisation par l'IDDRI en 2024)	[-80 ; 170] (Com Perso,Carbone Farmers, 2025[2]	+++
	Carbon storage in the soil	Increase the use of MAFOR on the farm	Operational (change in cost structure)	70 (Pellerin et al, 2020)	[30 ; 80] (Com Perso, Carbone Farmers, 2025[2]	+++
		Introduce and extend temporary and sown grasslands in crop rotation	Operational (new additional cost)	[-183 ; 90] (Pellerin et al, 2013 ; Pellerin et al, 2020)	40 to 900 (Pers. Com, Carbone Farmers, 2025; Terrasolis, 2022) [2]	+++
		Increase the amount of biomass provided by cover crops	Operational (change in cost structure)	19 to 301 (Bamière et al., 2023)	-25 to 0 (Terrasolis, 2022) [2]	++
	N/A	Plant hedgerows on the farm	Investment and operational (new additional cost)	59 to 1,171 (Pellerin et al., 2020; Bamière et al., 2023)	150 to 460 (Terrasolis, 2022; Afac, 2023)[3]	+++

(1) Confidence index:
+ : only one source available, with little or no information on the method used.
++ : only one source available, but with an explicit estimation method.
+++ : several sources available, including at least one providing detailed methodological information.
(2) Data originally expressed in €/ha were converted to €/tCO_2eq using data from Pellerin et al. (2013)

(3) Data originally expressed in €/km/year were converted to €/tCO_2eq using data from the Hedgerows methodology and the Carbocage project (2024)

Source: I4CE 2025, based on data from MTE, BDD3, April 2025 @I4CE_

According to this summary, practices generating economic gains (negative costs) are observed mainly in cattle farming. While some practices in arable crops could also result in negative costs, average costs are generally higher than in livestock systems. The work carried out by the Institut de l'élevage (Idele, French livestock institute) *(Castellan, 2024)* is not systematically included in Table 5. The results of Idele's work, with the exception of the figure presented in the table, are expressed per unit produced or in relation to changes in GOS (Gross Operating Surplus), and are therefore not directly comparable with figures expressed in €/tCO_2eq. Nevertheless, this work highlights many negative costs, particularly for technical optimization levers. On average, taking all practices into account and including investmentcosts, Idele estimates the cost at €8/tCO_2eq in livestock farming *(Castellan, 2025).* These findings illustrate the gap between theoretical assessment and the actual adoption of practices in the field. Despite the relatively low estimated costs, the adoption of practices remains limited in some cases due to indirect costs and non-economic barriers that are not captured in these calculations *(see 3.2.3).* Most practices in arable farming are associated with positive costs, even those that do not require investment. On average, for all practices combined, the cost ranges from €7/tCO_2eq to €314/tCO_2eq *(Agrosolutions, 2023)* for arable crops. However, these averages mask wide variability depending on crop type and the soil and climate conditions of individual farms.

B. METHODOLOGICAL DIFFERENCES

The figures presented in the summary are drawn from three main sources: a study by Idele (based on actual data from 325 French farms); a Carbon Think study (involving 88 farms in the Grand Est region, including a sub-sample of 18 farms for cost estimates); and provisional data from Carbone Farmers (covering 80 French farms).

One of the main limitations in comparing the costs of practices lies in the methodological differences between sources. For example, Idele's calculations take into account interactions between different practices implemented on the same farm, whereas this is not the case in the work of Terrasolis and Carbone Farmers. Idele adopts a statistical and microeconomic approach, which in some cases allows the results to be broken down by sub-practice. The work carried out by Terrasolis follows a more holistic approach. Finally, in some cases, calculations have been conducted at an even broader scale, covering multiple practices *(IEEP, 2024).* In addition, the tools used to collect technical data are not based on the same parameters. For instance, the CAP'2ER tool used in livestock farming does not provide detailed quantification of changes in farmers' working time when a new practice is introduced.

There are also temporal differences between the calculation methodologies. Idele's calculations are based on a comparison between the situation at year 0 and year 5 of the project, assuming linear implementation of the levers from the start until full adoption. In contrast, Terrasolis calculates costs on an annual basis, taking into account year-to-year variations.

C. COSTS NOT INCLUDED

Not all costs are included in the calculations presented in the summary.

Transaction costs refer to the expenses associated with setting up the monitoring, reporting and verification (MRV) process required for implementing a low-carbon project, as well as the administrative work involved in securing financing. These costs arise regardless of the financing method. While they are not included in the costs associated for individual practices, they are assessed at the overall project level by Terrasolis.

However, transaction costs are not the only barrier. An analysis of around ten agricultural practices with negative costs, based on the work of Bamière et al., 2017a and Pellerin et al., 2013, also identifies two other major obstacles: the need to acquire new skills and risk aversion. Finally, the costs associated with the risk of changing practices are not included in the results presented here. This topic is currently being studied by Idele, with work already completed for five practices.

3. In agriculture, different types of carbon impacts must be clearly identified

When action plans are developed for each farm participating in an LBC project, GHG impact modelling is conducted. However, actual impacts may differ if practices are not implemented as intended, or if climatic conditions over the five-year project period prevent the expected objectives from being achieved. This section outlines the types of impacts modelled in the validated Carbon'Agri and arable crops projects.

The carbon farming practices defined in the two methodologies affect several GHG cycles and fall into three categories: emission reductions, carbon removals and avoided emissions. Accordingly, the following types of impact are distinguished:

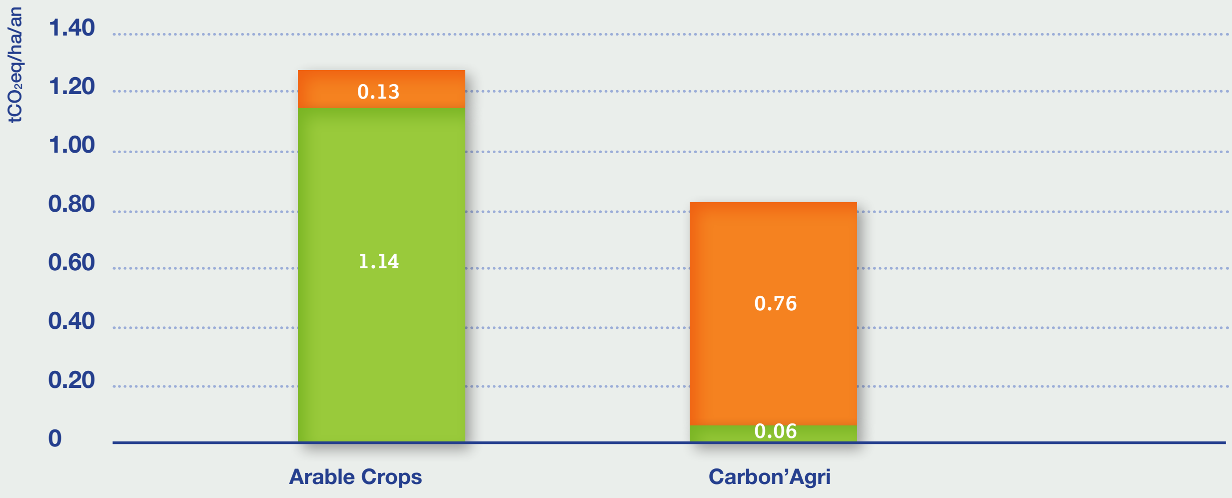
- **reductions in CO_2 emissions** (for example, from fossil fuel use);
- **reductions in CH4 emissions** from enteric fermentation and manure management;
- **reductions in N2O emissions resulting** from fertilizer production and application, and from effluent management;
- **CO_2 removals in biomass** (e.g. through hedgerow planting);
- **CO_2 removals or avoided emissions** in soils.

For the latter category, removals and avoided emissions are grouped under the single heading of "soil carbon storage" within the LBC. They correspond to the same practices and can only be distinguished based on the chosen baseline scenario *(see chapter 3.B.)*. The LBC decree also differentiates between direct emission reductions, which occur on the farm, and indirect reductions, which occur either upstream (e.g. input manufacture and transport) or downstream (e.g. product drying). From 2025 onwards, these different types of carbon units are expected to be clearly identified in the registry, following the amendment of the decree that defines the LBC framework *(Decree amending the decree of 28 November 2018, 2025)*.

With the data now available, it has been possible to distinguish between emission reductions and carbon removals for projects carried out between 2021-2024, which is essential for several reasons. First, emission reductions are permanent, whereas carbon removals in ecosystems are temporary, even when measures are in place to manage the risk of non-permanence. Second, the voluntary carbon market requires a clear distinction between carbon removal and emission reduction certificates. Demand for removal credits could increase as the economy decarbonizes and actors seek to offset their residual emissions with equivalent removals *(Johnstone et al., 2025)*. Finally, because some practices have simultaneous effects across the categories mentioned below, it is not possible to isolate their specific impact on each individual GHG.

On average, the projects are expected to generate 1.27 tCO_2eq/ha/year for arable crops and 0.83 tCO_2eq/ha/year for Carbon'Agri over the five-year project period. For livestock farming, surface area is not the most appropriate metric for reporting emissions, and it was not possible to calculate impacts per unit of milk or meat produced. The average impact per farm over five years is 664 tCO_2eq for livestock farming and 1,101 tCO_2eq for arable crops.

FIGURE 28: DISTRIBUTION OF IMPACT TYPES IN PROJECTS USING THE TWO MAIN AGRICULTURAL METHODOLOGIES



Source: I4CE 2025, based on data from MTE, BDD3, April 2025

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A. EMISSION REDUCTIONS AND CARBON STORAGE: DISTINCT STRATEGIES IN ARABLE CROPS

Although emission reduction levers account for 57% of those mobilized by farmers *(Figure 27)*, they represent only 10% of the total GHG impact of arable crop projects, with an average of 0.13 tCO_2eq/ha/year. Reducing nitrogen fertilization is the most impactful measure for lowering reductions *(see Table 6).*

By contrast, the average contribution of storage levers exceeds what would be expected relative to their representation among the levers mobilized. Since this storage is estimated through modelling, the most likely explanation is that projects have been concentrated in areas where the model predicts the highest potential gains. The more accurate the model, the more effective the scheme will be. However, if the model has a high margin of error, as suggested by Clivot et al., 2019, the discrepancy could reflect a windfall effect *(e.g. Bellassen & Shishlov, 2017).*

TABLE 6: AVERAGE EMISSION REDUCTIONS IN ARABLE CROPS

BREAKDOWN OF ARABLE CROP EMISSION REDUCTIONS (en tCO_2eq/ha/year)	
Fertilization	0.10
Combustion	0.02
Storage/Drying	0.003
Drying by storage operators	0.001

Source: I4CE 2025, based on data from MTE, BDD3, April 2025

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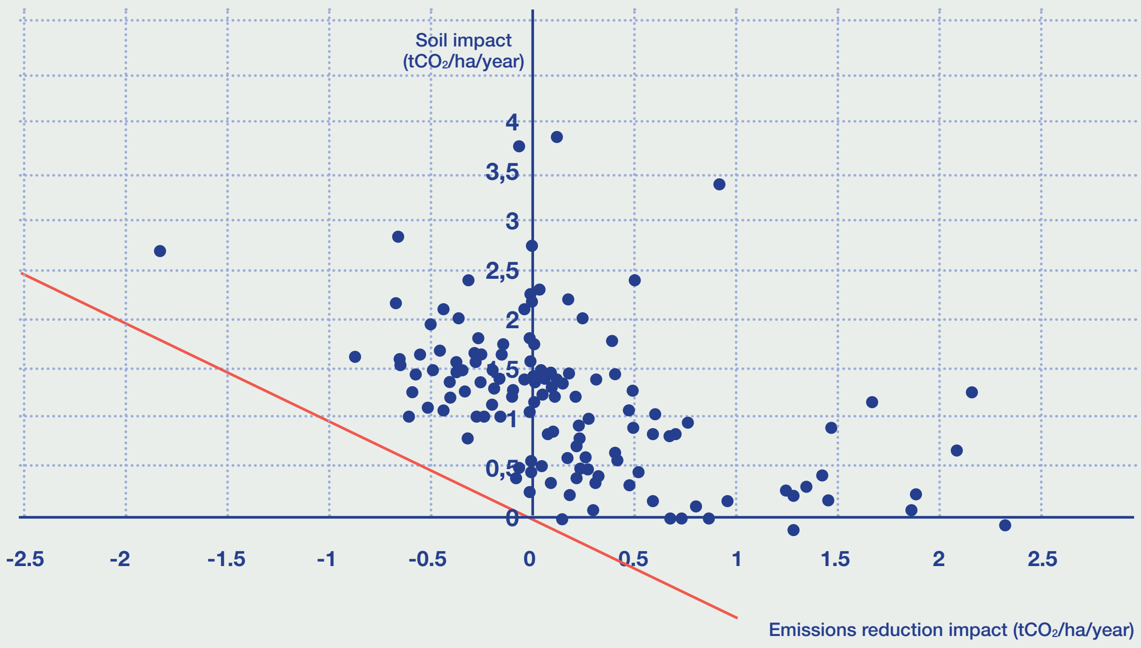
However, the average figures conceal surprising variability *(Figure 29).* There is significant variation in surface carbon gains, both for soils (from slightly negative to over 3.5 tCO_2/ha/year) and for emission reductions.

For emission reductions, it is difficult to account for this wide range of results, particularly values above 0.5 tCO_2eq. In reality, one hectare of arable land typically emits around 1 to 2 (ranging from 0.5 to 5) tCO_2eq/ha *(Bellassen et al., 2021; Meier et al., 2015; Odegard et al., 2015; Poore & Nemecek, 2018).* These variations can be explained by several factors, including differences in soil and climate conditions across project sites, the initial situation of the farms, and the capacity of farmers to adopt transformative practices. At the project level, developer strategies also differ: some choose to work only with farms where the potential carbon gain per hectare is high, to maximize the return on transaction costs.

Furthermore, an arable crop project is only eligible if the overall climate impact is positive. However, it is possible to improve soil carbon levels while simultaneously increasing GHG emissions, or vice versa. **Figure 29 shows that emissions are rising on 29% of the areas covered by the methodology, despite an overall positive GHG balance.** In practice, promoting soil carbon sequestration through greater biomass return may require additional fertilizer inputs and mechanical operations, which can increase emissions. It is precisely to account for such negative effects that carbon credits must consider not only soil carbon removals but also GHG emissions *(I4CE, 2022b).* This also reinforces the concern raised above regarding the reliability of soil storage estimates: sharp increases in emissions are sometimes offset by storage values that are significantly higher than those reported in the literature for the levers used by this methodology.

FIGURE 29: BREAKDOWN BETWEEN "SOIL IMPACT" (REMOVALS AND MITIGATION OF CARBON LOSS) AND EMISSION REDUCTIONS FOR EACH ARABLE CROPS PROJECT.

ON BOTH AXES, POSITIVE VALUES INDICATE A BENEFICIAL CLIMATE IMPACT. NO PROJECT APPEARS BELOW THE RED LINE, AS THIS WOULD INDICATE AN OVERALL NEGATIVE CLIMATE IMPACT.



Source: I4CE 2025, based on data from MTE, BDD3, April 2025

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B. SEQUESTRATION OR MITIGATION OF CARBON LOSS?

In 2023, cultivated land in France experienced an average reduction in carbon loss of 170 kgC/ha/year *(Pellerin et al., 2019).* However, most of this average carbon loss probably comes from the conversion of permanent grassland or forests into arable land *(Ay et al., 2024; CITEPA, 2024; De Rosa et al., 2024),* which is not included in the arable crop projects or their baseline scenarios. Excluding the rare cases where a project's impact on soil carbon is negative but offset by larger emission reductions, **three scenarios** are possible:

1. **the baseline scenario results in carbon removals**: the project must therefore capture more than this baseline.

If the baseline scenario results in carbon loss from soils, two possibilities arise:

- 2 **the project scenario** also emits carbon, but less than the baseline;
- 3 **the project scenario** results in carbon removals.

Our study analysed a large project (representing 17% of the total arable crops impact) for which such data are available. While soil-related levers are listed as "carbon storage", 46% of the land area actually falls under case 2 and 29% under case 3. Although this analysis may be biased as it covers only a single project, these figures appear to be representative of national trends: a summary of the Carbon Extract database, covering 160 farms in seven French regions, shows that 43% of farms fall under case 2 and 26% under case 3 *(Personal Communication, Arvalis and Agrosolutions, 2024)*. Similar trends were observed in the Carbon Think study *(Agrosolutions, 2023)*. While many LBC stakeholders refer to "carbon sequestration" when certificates are derived from practices targeting agricultural soil carbon, it is likely that more than half of the volumes concerned actually reflect avoided emissions. In a context where soils are losing carbon, preserving existing stocks involves avoiding emissions, which clearly has a positive climate impact and should be supported. However, it is also essential to clearly differentiate and transparently label the impacts of "carbon sequestration in soils" and "mitigation of soil carbon loss", the latter corresponding to "avoided emissions", as proposed by research *(Don et al., 2023).*

4. Assessment and recommendations for agricultural projects

PROJECT ASSESSMENT FOR 2019–MARCH 2025	AREAS FOR IMPROVEMENT
• In theory, the LBC allows farmers to activate **numerous levers (20 to 30) to reduce emissions and capture carbon.** • On average, only four levers are activated per farm, but they target key emissions sources: soil carbon, enteric fermentation and fertilization.	
• The LBC allows **reductions in different GHGs** (CO_2, N2O, CH4) and **carbon sequestration** in biomass and soils to be distinguished, **but this distinction is not reflected in the public information displayed.** • For arable crops, most of the impact comes from carbon removals, but **a significant share of "carbon sequestration in agricultural soils" actually corresponds to avoided emissions (mitigation of soil carbon loss).**	• From 2025 onwards, **the different types of carbon units should also be distinguished in the registry.** • In a context where soils are losing carbon, avoided emissions must also be supported. However, it may be useful to distinguish more **clearly between avoided emissions and changes in stocks (and within the latter, between absolute removals and avoided carbon loss).** This recommendation is, however, tempered by the limited predictive accuracy of the models used, which underpin the distinction between absolute sequestration and avoided carbon loss.
• In arable crops, **the GHG impact of carbon storage is greater than would be expected based on the average results for these levers reported in the literature.** This may indicate a **possible windfall effect**, with projects targeting situations where modelling provides more favourable outcomes. • Certain practices (residue return and MAFOR) may not result in net carbon storage, but instead represent a shift in storage from one field to another. These aspects are currently under review as part of the revision of the methodologies.	
• An arable crops project is only eligible if **its total net climate impact is positive.** However, a project may **increase GHG emissions** as long as these are offset by a beneficial impact on soil carbon, a situation observed in 29% of the areas concerned. This can be problematic, as soil carbon sequestration is inherently non-permanent and subject to uncertainty.	• This scenario reinforces the importance **of accounting for all mitigation levers,** not just carbon sequestration. • The LBC could consider limiting the extent to which increased emissions are permitted, even when offset by sequestration, given that carbon storage is not permanent and is estimated with greater uncertainty. **We propose requiring that projects do not increase their emissions by more than 0.5 tCO_2/ha/year.**
• The synthesis carried out jointly on technical and scientific data shows that the costs of low-carbon agricultural practices remain poorly understood and vary widely depending on the practices, soil and climate conditions, socio-economic contexts, and calculation methodologies: from -184 to 250 €/tCO_2 (excluding hedgerow planting).	• Further work is needed to assess the cost of risk-taking and non-economic barriers.
• Unlike the Arable Crops methodology, which uses carbon impact per unit area (in tCO_2eq/ha), the **Carbon'Agri methodology evaluates projects based on carbon intensity per unit of product** (tCO_2eq/kg meat or tCO_2eq/litre milk). While this approach encourages system optimization and even intensification, it limits systemic change. Moreover, since absolute results (tCO_2eq) are not published, the direct climate impact cannot be assessed, which raises a transparency issue, regardless of the debate on the best metric.	• While optimization practices are a necessary first step, Carbon'Agri could go further in supporting farm transitions. The revision of the Carbon'Agri methodology offers **an opportunity to reconsider the product intensity approach,** possibly by combining it with an area-based metric, or at least by introducing safeguards to prevent adverse effects. This would also ensure greater consistency with the Arable Crops methodology.

Green: Key strengths, **Marron:** Limitations observed, **Blue:** I4CE recommendations

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IV. LBC PROJECTS ARE FUNDED BY BOTH COMPLIANCE OFFSETTING AND VOLUNTARY CONTRIBUTIONS

A comprehensive analysis of how LBC projects are funded is currently impossible, as the standard does not systematically collect this information. The financing results from a private contract between a project developer and a funder. While project funders may declare themselves to the Ministry during the project validation stage or in subsequent years, this is not standard practice. Until now, there has been no requirement to declare such information, but upcoming changes to the decree defining the "Label Bas-Carbone" are expected to introduce a transparency obligation for carbon certificate transfers. This chapter draws on partial data published on the LBC website, market observatory reports, and discussions with project developers.

1. Variable prices which are much higher than the international market

The average price of an LBC carbon certificate is €35/tCO_2, compared to an average of €8/tCO_2 across all standards, according to French operators in the voluntary market, who purchase credits both in France and internationally *(Info Contribution Neutralité Carbone, 2024).* The average price on the global voluntary carbon market was estimated at \$6.5/tCO_2 in 2023 *(Ecosystem Marketplace, 2024).*

Contrary to what is observed in international markets, LBC forest credits are priced primarily based on the cost of practices rather than prevailing voluntary carbon market prices. This is due to the nature of the two main forestry methodologies, which require substantial upfront investment that is relatively easy to quantify. These costs range between €20 and €70/tCO_2, except in exceptional cases. The main drivers of this cost include the tree species planted and species mix ratio, game pressure – which may require protective measures -, soil preparation techniques, availability of local contractors to carry out the work, and the number of maintenance operations required during the first five years. In most cases, the forest owner contributes to the cost, with self-financing generally covering 20% to 40%, based on our discussions with project developers.

Agricultural projects involve a mix of practices with varying costs, which are more complex to determine. Theoretical abatement costs are generally higher, ranging from €55 to €250/tCO_2 according to the literature *(Bamière et al., 2023, see Chapter 3.2).* Unlike forests, the sale prices of agricultural LBC carbon certificates are less closely tied to the actual costs of practices. For arable crops and Carbon'Agri methodologies, prices typically range between €40 and €60/tCO_2, according to the project developers interviewed.

2. Large, medium and small businesses are getting involved

As of 31 March 2025, the list of funders declared in the LBC register includes 205 entities, covering 622 projects and approximately 892,000 tCO_2 that are potentially pre-financed, i.e. representing around 14% of the validated volume. **The analysis reveals a wide range of funders, both in terms of size *(Figure 30)* and activity sector *(Figure 31).*** Although large companies and their subsidiaries (with more than 5,000 employees) purchase the largest share of LBC volumes (43%), intermediate-sized companies (250 to 4,999 employees) and small to medium-sized enterprises (SMEs) (10 to 250 employees) are also involved. **Among projects for which funders have been declared, SMEs and intermediate-sized enterprises account for 58% of the projects and pre-finance 43% of the potential certificate volume.** A broad range of sectors is represented. Unsurprisingly, transport is the largest, as it includes airlines subject to compliance offsetting obligations *(see section 4.4),* even though this requirement has only been in effect since 2022.

FIGURE 30: NUMBER OF PROJECTS (ABOVE) AND VOLUME OF POTENTIAL CARBON CERTIFICATES (BELOW) REPORTED AS FUNDED, BY ORGANIZATION SIZE.
A MICRO-ENTERPRISE HAS FEWER THAN 10 EMPLOYEES, AN SME HAS BETWEEN 10 AND 250, AN INTERMEDIATE-SIZED ENTERPRISE HAS BETWEEN 250 AND 5,000, AND A LARGE ENTERPRISE HAS MORE THAN 5,000 EMPLOYEES.

Source: I4CE, based on the LBC registry and the MTE financing database, April 2025

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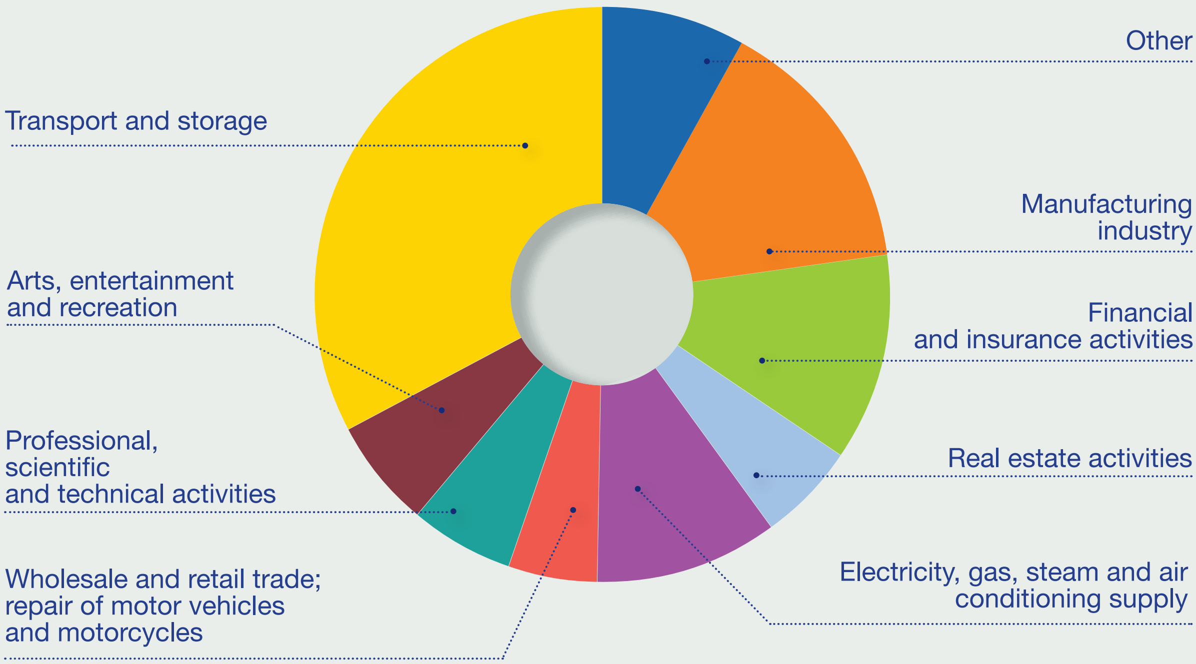
FIGURE 31: SECTORS OF ACTIVITY OF FUNDERS DECLARED IN THE LBC REGISTRY.
THE CATEGORIES CORRESPOND TO SECTIONS OF THE 'NOMENCLATURE DES ACTIVITÉS FRANÇAISES'. (NAF, FRENCH CLASSIFICATION OF ECONOMIC ACTIVITIES).



Source: I4CE, based on the LBC public registry, MTE, April 2025

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3. The historic demand for voluntary contributions is holding up despite market fluctuations

The Label Bas-Carbone was created in 2018 to redirect some of the voluntary offsetting demand from national actors towards projects on French soil, whereas this demand had previously focused exclusively on international initiatives *(I4CE, 2017).*

The concept of offsetting is gradually giving way to the contribution paradigm, but in both cases it involves private, voluntary funding for projects with a measurable carbon impact. These funders typically act as part of a Corporate Social Responsibility (CSR) strategy. Most have carried out a carbon footprint assessment (mandatory or voluntary) and seek to go further by financing climate projects beyond their own value chain. Discussions with stakeholders suggest that funders choose LBC projects for the scheme's credibility and its local dimension. Larger companies are also investing in other voluntary standards, assembling portfolios of projects across sectors and regions. **Since LBC certificates cost more than four times the average price of other standards *(Info Contribution Neutralité Carbone, 2024)*, LBC funders tend to prioritize high-quality projects.** Key selection criteria include location, the existence of co-benefits, and the absence of reputational risk. Funders prefer projects that have "a nice story to tell", ideally located near their operational sites. The matching of project demand and supply occurs through commercial relationships between project developers or intermediaries and funders, but also through public or private tenders designed to foster competition between project developers.

Demand for voluntary carbon credits has fallen sharply worldwide since 2022, across all project sectors but particularly forestry. In 2023, the volume and value of forestry credits traded globally declined by 68% and 69% respectively compared to 2022 *(Ecosystem Marketplace, 2024).* Agricultural projects have been expanding for several years (up 24% between 2022 and 2023), but their share of the global market remains very small *(Ecosystem Marketplace, 2024).*

The market is also contracting for French operators in the sector, though to a lesser extent: from approximately 40 to 26 $MtCO_2$ between 2022 and 2023 *(Info Contribution Neutralité Carbone, 2024).* The main reason for the global decline in demand appears to be a loss of confidence following the REDD+ credit scandals[9], along with a gradual withdrawal by major buyers[10] that began several years ago. **LBC financing has been less affected than other types of standards, with market participants emphasizing the credibility of the scheme, which is backed by public authorities, providing reassurance to funders.**

4. Compliance offsetting creates substantial demand

The French government has introduced offsetting obligations for the aviation and coal-fired power plant sectors *(see Box 1 for further details),* which has helped boost demand for LBC project financing. In aviation, the regulation applies to around 25 airlines, with just five of them responsible for 90% of the emissions covered *(Ministry for Ecological Transition, Energy, Climate and Risk Prevention, 2023).* Airlines met 99.9% of their EU offsetting obligations in 2022 and 2023 using LBC projects, partly due to the limited availability of alternative European projects outside the LBC. However, as competing standards within the EU emerge to meet French demand, the share of this demand met by the LBC could decline. This compliance mechanism generated demand for 0.4 $MtCO_2$ in 2023, and the provisional demand for 2024 was 0.73 $MtCO_2$. **At an observed average price of €30.7/tCO_2 *(MTE, 2024a)*, this corresponds to around €12 million in LBC project financing, and potentially €22.5 million for 2024 (assuming stable prices and emissions volumes).** For "coal" compliance offsetting, €10 million in project financing is allocated over several years *(see box).* This offsetting obligation is transitional, as France has committed to permanently ending coal-fired electricity production by 2027.

Of the 3.2 $MtCO_2$ of potential certificates validated under the LBC as of 1 June 2024[11] (not all of which are financed), 0.57 $MtCO_2$ have been pre-financed by airlines (for 2022 and 2023) and 0.25 $MtCO_2$ by energy companies *(MTE, 2024)*, together accounting for 26% of the total LBC project supply. For 2023 alone, the 0.4 $MtCO_2$ financed by airlines made up the bulk of the total financed volume of 0.5 $MtCO_2$ *(Info Contribution Neutralité Carbone, 2024).* However, this total, based on publicly declared funders, is likely to be a significant underestimate. Compliance demand from aviation is therefore estimated to account for between 40% and 80% of total annual demand.

This certificate requirement imposed by the public authorities is therefore a key factor in shaping the LBC. As emissions from domestic flights are expected to decline due to climate commitments or forthcoming regulatory measures, this compliance demand is only temporary. However, it plays an important role in structuring the emerging LBC market.

It is also worth noting that only a few thousand carbon certificates have been validated to date. Offsetting in the aviation sector is therefore currently being achieved through potential certificates, rather than verified ones. During the verifications conducted five years after project launch, the pre-financed volumes are likely to be adjusted. **As significant volumes of verified certificates will become available in the coming years *(see section 5.1)*, the MTE may need to assess airline compliance using verified carbon credits**. This would avoid such adjustments and be more consistent with the principle of environmental integrity, which requires that actual emissions be offset by real emission reductions or removals.

9. An investigation by The Guardian, Die Zeit and SourceMaterial in 2023, based on a scientific publication (West et al., 2023), found that 90% of REDD+ carbon credits certified under Verra-VCS did not correspond to any actual reduction in emissions, primarily due to overly optimistic baseline scenarios.
10. Companies such as Delta Airlines, Google, EasyJet and Shell have stopped purchasing carbon credits following criticism of their poor quality.
11. Reporting deadline for 2023 declarations.

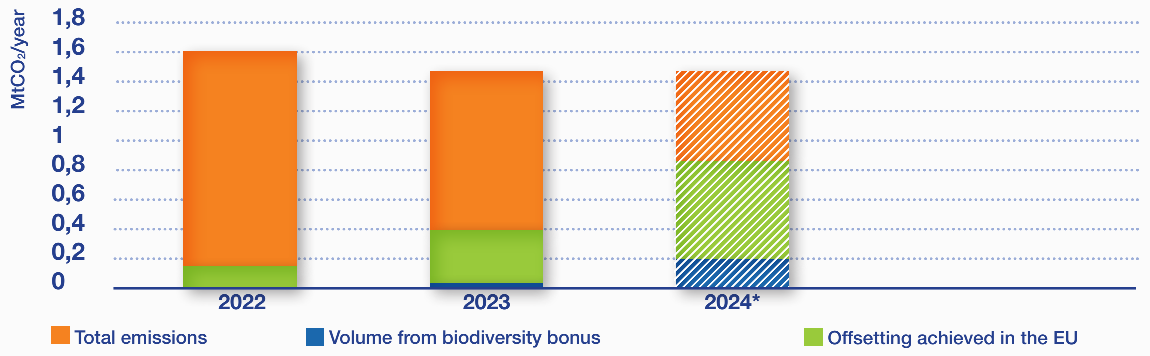
BOX 1: COMPLIANCE OFFSETTING DEMAND

In its early years, the LBC mainly responded to voluntary demand. However, the French government has since introduced measures requiring economic actors to finance carbon certificates from European projects, thereby creating “compliance demand” for Label Bas-Carbone projects.

1. COMPLIANCE OFFSETTING IN THE AVIATION SECTOR

Article 147 of the 2021 Climate and Resilience Law introduced a requirement for greenhouse gas (GHG) emissions to be offset for domestic flights. French aircraft operators exceeding a certain annual emissions threshold must offset the GHG emissions of their domestic flights within mainland France (i.e. excluding overseas departments and regions). The share of emissions subject to offsetting increased gradually from 2022 and 2024, reaching 100%. The law also stipulates that an increasing proportion of these offsets must come from projects located within the European Union, rising to 50% by 2024 (see graph below). Operators may deviate from this EU project quota if they can demonstrate that no suitable EU-based projects are available below a price of €40/tCO_2. Operators must report the credits they have financed by 1 June of the following year. Finally, a biodiversity bonus was introduced by decree in 2023. Projects that meet sector-specific criteria (in forestry, agriculture or nature conservation) receive a 50% bonus in credits per year, up to a maximum of 15% per aircraft operator annually.

FIGURE 32: EVOLUTION OF COMPLIANCE OFFSETTING IN THE AVIATION SECTOR



* Values for 2022 and 2023 correspond to actual observed data, while the 2024 value is a forecast based on emissions in that year being assumed equal to those of 2023.

2. COMPLIANCE OFFSETTING FOR COAL-FIRED POWER PLANTS

The 2017 decision to phase out coal-fired power generation established gradually decreasing annual emissions thresholds for coal-fired power plants. However, due to pressure on the electricity supply, the government temporarily eased these thresholds in 2022. Thus, the Law of 16 August 2022 on Emergency Measures to Protect Purchasing Power allows coal-fired power plants to exceed the 0.7ktCO_2e/MW ceiling, but energy companies must pay compensation for emissions above this threshold: a lump-sum payment of €40/tCO_2 for excess emissions in 2022 and 2023; rising to €50/tCO_2 from 1 January 2024. Half of these sums must be spent within four years, and the full amount within eight years.

The power plants in Cordemais (Loire-Atlantique), operated by EDF, and Saint-Avold (Moselle), operated by GazelEnergie, are affected by this decree. In the winter of 2022-2023, 254,000 tCO_2 were subject to offsetting, with two-thirds of this total from Saint Avold, and the remaining third from Cordemais. The two operators have adopted different strategies to meet this requirement: GazelEnergie is primarily financing projects located near the Moselle plant, while EDF is supporting LBC projects distributed across the country, along with a smaller share of R&D activities related to LBC that will not necessarily result in the issuance of carbon certificates.

The thresholds were not exceeded during the milder winters of 2023-2024 and 2024-2025. This compliance offsetting is difficult to predict as it depends on annual energy production conditions. It could theoretically apply again to energy producers during a cold winter or a period of pressure on electricity production, potentially requiring the use of coal-fired power stations. However, this source of funding is set to disappear with the permanent closure of these power stations in 2027.

5. Compliance demand focused on volumes and low prices

Unlike voluntary schemes, which primarily target high-quality projects, companies subject to offsetting obligations tend to seek the cheapest possible carbon certificates, in large volumes. While some companies are making efforts to diversify the projects they support, the agents surveyed indicated that price remains the dominant selection criterion and that this demand tends to favour lower-quality projects, particularly in the forestry sector. The rise of projects covering large areas, featuring productive species and maximized substitution *(see section 2.4.2)* has coincided with increased demand from the aviation sector. The 2023 offsetting report thus shows substantial volumes generated through the reforestation of areas affected by the 2022 summer wildfires in Gironde *(MTE, 2024a).* However, some of these projects have been criticized for their high proportion of substitution certificates and widespread use of discounts due to insufficient demonstration of additionality. That said, this observation should not be generalized to all post-fire reforestation projects in Gironde. Most of the project developed surveyed expressed concern about the low quality of some projects and pointed to the associated reputational risk for the LBC as a whole. The latest version of the forestry methodologies introduces corrective measures intended to improve the overall quality of LBC projects *(CNPF, 2025a, 2025b).* Furthermore, it is worth noting that the €40/tCO_2 threshold, above which airlines are permitted to finance international projects, is not a strict ceiling, although many project developers perceive it as such. In 2023, two LBC projects were voluntarily financed by an airline at prices above this threshold. To date, no airline has used the option to bypass the EU project requirement by demonstrating that no offer below this price was available.

6. A biodiversity bonus affects the carbon metric

The 4 June 2023 decree allows for an increase in the volume of carbon certificates issued to projects that deliver significant benefits for the preservation and restoration of natural ecosystems and their functions. Projects recognized under these criteria are granted a 50% annual bonus in certificates per eligible project, enabling aircraft operators to reduce their offsetting obligations by the same proportion, up to a limit of 15% per aircraft operator.

While the aim of creating incentives for the most biodiversity-friendly projects is commendable, the current implementation causes confusion. The bonus artificially and arbitrarily inflates the carbon impact of projects: one tonne of certified emission reductions is treated as 1.5 tonnes, even though the actual carbon impact remains unchanged. In effect, biodiversity gains are being converted into carbon impacts, which is problematic for a mechanism specifically designed to quantify carbon impact. To maintain the incentive to fund biodiversity-friendly projects, it could be required that a minimum share (e.g. 10%) of an airline's obligation be met through carbon certificates from projects that meet the "biodiversity" criteria. Alternatively, each tonne of CO_2 reduced or removed by a project meeting the "biodiversity" criteria and funded by an airline could count as 0.5 tCO_2 towards its offsetting obligation, up to a limit of 15% of the emissions covered by the obligation.

The requirements for a project to qualify for the "biodiversity" bonus are summarized in Table 7. For each sector, the project must meet all the criteria simultaneously to be eligible.

TABLE 7: ELIGIBILITY CRITERIA FOR PROJECTS TO RECEIVE THE "BIODIVERSITY BONUS" UNDER THE AIRLINE CARBON OFFSETTING SCHEME.

FORESTRY SECTOR	1. **Existence of an approved sustainable management document,** or one currently being drafted 2. **Projects must take place within timeframes compatible with the national low-carbon strategy** and generate permanent carbon credits, i.e. through a method of accounting for emission reductions and carbon capture that goes beyond a one-year timescale by applying measures to manage the risk of non-permanence. 3. **Presence of PEFC or FSC** certification **For projects involving planting (afforestation and restoration):** 4. **Projects involving planting** must comply with regional forest reproductive material regulations, and any exemptions must be justified for the establishment of an arboretum or for adaptation to climate change 5. **Diversification criteria:** • **At least three species, with the main species covering** no more than 80% of the area for single-site projects between 4 and 10 hectares • **At least 4 species, with the main species covering** no more than 70% of the area for single-site projects larger than 10 hectares. **For reforestation projects:** 6. **Preservation of patches of old-growth stands** covering at least 3% of the project's forest area;
AGRICULTURAL SECTOR	1. **Projects must be carried out** on land that is currently in conversion to organic farming or is already certified as such; 2. **Ensure restoration or maintenance of permanent grasslands without ploughing,** sowing or the use of plant protection products; 3. **Ensure creation or maintenance of agroecological infrastructure** (hedgerows, copses, isolated or aligned trees, ponds) in their ecological functionality to achieve and maintain a level of at least 5% of arable land as agroecological infrastructure. 4. **For projects involving only hedgerow management and planting,** sustainable management must be planned based on a sustainable hedgerow management plan.
CONSERVATION OF NATURAL AREAS	**Projects implemented as part of the management of terrestrial and marine** protected areas must comply with the protection guidelines set out as priorities in a management document.

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One difficulty in implementation is the lack of consistency between the criteria defined and the co-benefits set out in the methodologies. This leads to additional costs, both for project developers, who have to assess and monitor new criteria, and for the authority responsible for verifying compliance. Better synergy with the co-benefit assessment framework defined in the methodologies could be considered, with adjustments where these co-benefits cannot be adopted as they stand. Furthermore, some stakeholders have expressed doubts about the authority's ability to verify compliance with certain criteria retrospectively, five years after the project's implementation, such as the criterion on species diversification, given that species may experience different mortality rates during the first five years.

Finally, the criteria for obtaining the biodiversity bonus are generally easier to meet for forestry projects than for agricultural ones. According to our estimates, for example, only one in ten agricultural projects meets the certification or organic conversion criterion required in that sector. In forests, several criteria are effectively met by default in LBC projects (*criteria 1, 2 and 4 in the table),* while others are relatively easy to satisfy: among the validated forestry projects, 72% already meet the diversification criterion and 37% meet the sustainable management certification requirement. The legislator's intention was probably to impose stricter conditions in more human-altered environments, while making the criteria more accessible for natural environments. However, since forestry carbon certificates are already widely accepted by airlines, the current bonus system risks further reinforcing the imbalance between the two sectors.

7. The challenge of financing agricultural projects

The narrative surrounding tree planting and forests tends to resonate more strongly with voluntary contributors, while the cost per tonne of CO_2 is generally lower for forestry projects. As a result, funders are more inclined to support forestry than agricultural initiatives. This imbalance in demand was identified in the study on the potential voluntary market that preceded the creation of the LBC *(I4CE, 2017)*. Compliance demand, however, has not succeeded in generating meaningful support for the agricultural sector. For example, of the 150 projects financed by aircraft operators in 2023, only 20 involved agriculture, compared with 130 forestry projects *(MTE, 2024a).*

The funding gap for LBC agricultural projects is a concern shared by all stakeholders. This diagnosis also appears to apply to other European carbon standards beyond the LBC *(Climate Agriculture Alliance & Greenflex, 2025).* The project developers surveyed reported funding rates ranging from 5% to 40% for approved agricultural projects. By comparison, approved forestry projects are estimated to be financed at levels between 60% and 100%. Many actors involved in agricultural LBC projects have expressed concern about their inability to secure sufficient funding, and some are already observing greater difficulty in attracting new farmers to participate.

A. THE LBC HAS NOT BEEN AS SUCCESSFUL AS EXPECTED AMONG AGRICULTURAL VALUE CHAINS

When the LBC was launched, and during its early years, project financing by downstream actors in the agri-food value chain appeared promising. For example, 34% of respondents to a survey of potential contributors cited offsetting GHG emissions upstream in their production chain as a reason for providing funding *(I4CE, 2017).* Often referred to as "insetting", the financing of carbon credits within a value chain is a way of establishing contracts aimed at reducing an agri-food company's Scope 3 impact, while also securing its supply and providing additional financing to producers. **However, insetting funding has yet to develop significantly under the LBC. Instead, agri-food industries have increasingly turned to "supply chain premiums",** which have expanded rapidly since 2023 *(Lamerre et al., 2024).* Supply chain premiums involve an industrial buyer paying a preferential price for an agricultural product in exchange for the adoption of low-carbon practices, enabling the product to benefit from a reduced GHG emission factor. Agri-food industries have promoted this approach in particular to meet the mitigation requirements of the Science Based Target Initiative (SBTi), which commits companies to a decarbonization pathway towards carbon neutrality. The SBTi Forest, Land Use and Agriculture (FLAG) framework, which applies to the land sector, is based on the rules of the GHG Protocol. However, these frameworks require precise allocation of carbon benefits between actors both within and outside the value chain to avoid "double counting". The current difficulty in assessing these allocations complicated the funding of low-carbon projects and contributes to the funding shortfall for agricultural projects.

B. TOWARDS CLARIFICATION OF THE RULES ON CLAIMS?

While the growing variety of funding sources for carbon farming is a positive development, supply chain premiums alone are clearly not sufficient to support widespread changes in agricultural practices. These subsidies, which remain concentrated in specific sectors or production areas, often fail to reach all farmers, and are generally not available for export-oriented production. I**n many cases, therefore, different sources of funding, both from within and outside the value chain, need to be combined to provide effective incentives and trigger the adoption of low-carbon practices.** It is essential to seek complementarity between the existing types of financing for low-carbon agriculture (particularly carbon credits, supply chain premiums and the CAP's agri-environment-climate measures AECM) *(I4CE, 2022a)*, especially where abatement costs are high. This complementarity can be achieved in two ways: by combining funding sources to make the overall offer sufficiently attractive, or by tailoring the type of support to the stage the farmer is at. Some tools, such as the LBC, support changes in practice, while others can be used for upstream analysis or, conversely, to consolidate a practice that is already in place.

At present, the interpretation of rules promoted by the SBTi and the GHG Protocol is limiting the ability of actors in the agricultural value chain to provide financing, and complicating the combination of such financing with other sources. Under this interpretation, companies may be prevented from claiming credit for their actions if an LBC project has already been financed on the farm, despite the fact that environmental integrity is not necessarily compromised, provided that the principles of pragmatism and transparency are respected *(I4CE, 2022a).* The SBTi and the GHG Protocol also allow companies that finance sectoral premiums on farms to make claims, even if those farms also benefit from contribution carbon credits *(Carbone Farmers, 2023).* The ongoing revision of the LBC standard clarifies that it generates contribution carbon certificates by default, which should help facilitate financing. In cases where certificates are used for voluntary or compliance offsetting (i.e. outside of default contribution cases), their use must be declared in the registry *(MTE, 2025).*

Furthermore, for co-financing to become viable, clear rules are needed for allocating carbon impacts for practices implemented within the same farm. Such rules are currently being developed within the LBC framework to meet the expectations of funders engaged with the SBTi or the GHG Protocol. LBC methodologies, which bring together a wide range of technical and institutional stakeholders, are the right tool for establishing rules that are accepted by all and that can facilitate the coordination of financing at the farm level.

To attract financing from outside the value chain, improving environmental integrity and developing simple and compelling narratives around carbon farming remain key challenges to be addressed.

8. Assessment and recommendations regarding demand

PROJECT ASSESSMENT 2019-MARCH 2025	AREAS FOR IMPROVEMENT
• **LBC prices are significantly higher than international market prices,** allowing for better coverage of project costs: €35/tCO_2 compared to $6.5/t$CO_2$ internationally.	
• Unlike international markets, **the price of LBC forest credits (between €20/tCO_2 and €70/tCO_2) are mainly based on the cost of practices,** rather than on global voluntary carbon market prices. • Conversely, **the selling prices of agricultural LBC credits are more disconnected from the actual costs of practices:** €40/tCO_2 to €60/tCO_2. According to the literature, theoretical abatement costs are generally higher, ranging from €55/tCO_2 to €250/tCO_2.	• There is no single method for dealing with the various technical issues, and there are sometimes differences between sectors (co-benefits, carbon certificates types, etc.), which can make the LBC less readable for funders: efforts to standardize could be continued to make it even more consistent.
• The LBC **diversifies funding sources,** drawing on both voluntary demand (offsetting and contributions) and compliance **demand arising** from obligations on airlines and coal-fired power plants.	
• Although large companies and their subsidiaries purchase most of the LBC volume, **mid-sized companies and SMEs are also present and finance 43% of the volume.**	
• **Demand for voluntary carbon credits has been declining sharply worldwide since 2022, particularly for forestry projects,** which lost nearly 70% in volume and value between 2022 and 2023. **The LBC has been less affected overall than other international standards, with market players highlighting the credibility of this standard and the support of public authorities, which reassures funders.**	• Additional efforts could be made to improve transparency and clarify LBC nomenclature: the term "emission reductions (ER)" used interchangeably for reductions and removals should be reviewed when referring to the LBC (we propose using the term "carbon certificates") and specified as much as possible: direct or indirect emission reductions, soil or biomass sequestration.
• Airlines are required to finance European carbon projects if there is an offer available below €40/tCO_2. **The LBC captures almost all of this demand, and some projects are even financed above this threshold.** • With an average price of €30.7/tCO_2, **compliance demand from aviation represented €12 million in financing in 2023 and could reach €22.5 million in 2024 (0.73 MtCO_2). Added to this is €10 million from coal-fired power plants, spread over several years.** • Compliance demand has a substantial impact and could cover **40% to 80% of total annual demand for LBC projects.** This is **a transitional source of financing, but one that helps to structure the market**. • However, unlike voluntary schemes, companies that are obliged to participate are primarily looking for **the cheapest credits available, in large volumes,** which may **increase interest in the cheapest and therefore sometimes lowest quality projects.** • The 2023 compensation report thus shows significant volumes resulting from the reforestation of forests burned in the summer of 2022 in Gironde. **Some of these projects have been criticized due to a high proportion of substitution certificates and the widespread use of discounts for failure to demonstrate additionality.**	• The latest version of the forestry methodologies introduces corrections that should improve the overall quality of LBC projects. • The latest version of the forestry methodologies introduces corrections that should improve the overall quality of LBC projects. • With the rollout of European offers similar to the LBC, some of the demand for air travel could be captured by lower-cost projects in countries other than France. As environmental integrity requirements for forest-based LBC projects become more stringent, **it is important that the eligibility criteria for airline-financed credits "keep pace" to avoid a shift in funding towards lower-quality projects.** • To date, compensation in the aviation sector has been based on potential certificates rather than verified ones. As the volume of verified certificates available gradually increases in the coming years, **it may become necessary for the government to assess airline compliance using verified certificates** to avoid both post-verification adjustments and to uphold the principle that actual emissions must be offset by actual emission reductions (or removals). • The €40/tCO_2 benchmark for financing European projects is generally lower than the average cost of implementing agricultural practices. Furthermore, strengthening environmental integrity through the revision of key forestry methodologies is likely to increase costs. To support this shift and maintain financing for high-quality projects in France, **an upward revision of this reference price would be beneficial.** • While LBC was one of the first carbon labels to operate in Europe, others have since emerged or gained ground. The CRCF, due to become operational in a few years, should also significantly boost project supply. To align funding with the expansion of the European offer, **it may be worth considering an upward revision of the share of emissions that airlines are required to offset on European soil (currently 50%).**
• There is **an incentive to promote the financing of the most virtuous projects that offer benefits in terms of biodiversity.** • However, **the form of this incentive raises questions,** as it "converts" a biodiversity impact into a carbon impact, **thereby artificially and arbitrarily increasing the carbon impact of projects.** • **The criteria for this "biodiversity bonus" are not consistent with the co-benefits promoted by the LBC,** which leads to a lack of clarity. • The criteria for achieving the biodiversity bonus are generally easier to meet for forestry projects than for agricultural projects, which tends to further **reinforce the funding imbalance between the two sectors.**	• To avoid confusion and ensure clear communication while maintaining the same incentive, **one option could be to require that a minimum share (e.g. 10%) of an airline's obligation be met using certificates from projects eligible under the "biodiversity" criteria.** • Alternatively, the wording could at least be revised as follows: **each tonne of CO_2 from a project eligible under the biodiversity criteria and financed by an airline allows a derogation from its compensation obligation of 0.5 tCO_2, up to a limit of 15% of the emissions submitted.** • The **biodiversity bonus criteria could be aligned more closely** with the co-benefit criteria of the LBC.

Green: Key strengths, **Marron:** Limitations observed, **Blue:** I4CE recommendations

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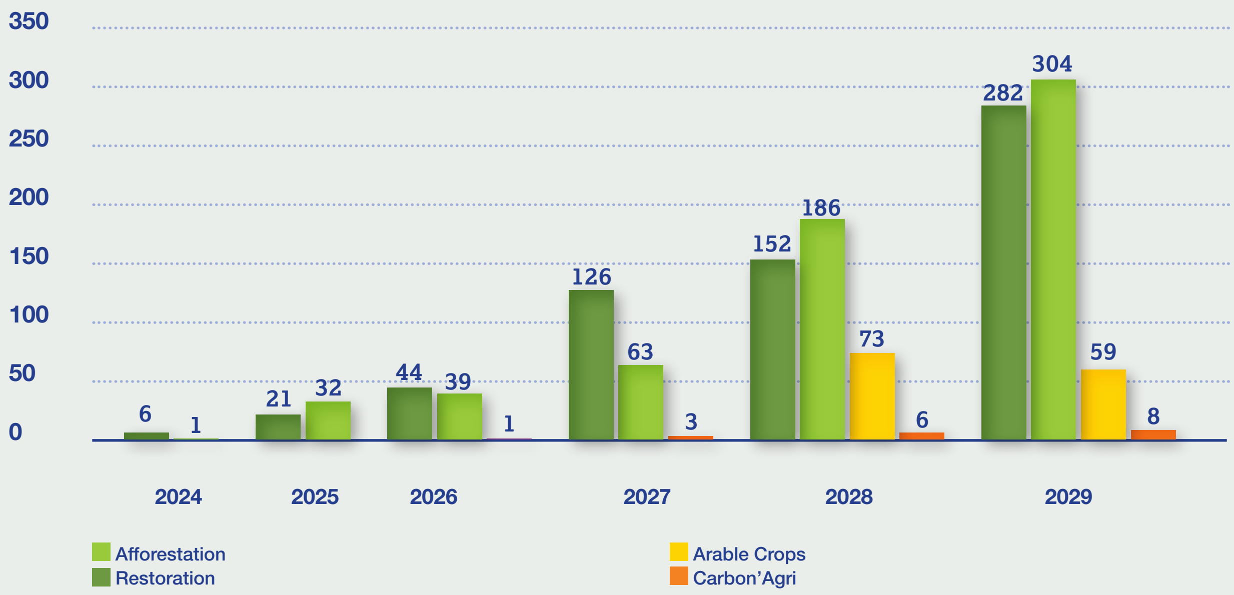
V. WHAT ARE THE CHALLENGES AHEAD FOR THE LBC?

1. Upcoming audits will need to build on this momentum

Beyond the pilot projects, the first LBC projects were validated in 2020 and are due to be audited after five years: 2025 is therefore the first year in which audits should be conducted for forestry methodologies and for the Carbon'Agri methodology. The pace of audits will then accelerate, making auditing of LBC projects a new and growing activity from 2026-2027.

FIGURE 33: PROJECTED NUMBER OF PROJECTS TO BE AUDITED PER YEAR FOR THE FOUR MAIN LBC METHODOLOGIES



Source: I4CE, based on data from MTE, 2025

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The lack of a framework for LBC audits has been the subject of criticism *(Canopée Forêts Vivantes, 2023; Climate Action Network et al., 2023).* One of the challenges of the audits is the need for clear and structured protocols for auditors. The first audits conducted on forest pilot projects have already helped clarify the protocols in the V3 methodologies *(CNPF, 2025b).* Further adjustments may still be needed, including to the agricultural methodologies. This process of responsive adjustment is key to ensuring audit quality, given that it is difficult to anticipate all possible scenarios in advance. Regular exchanges between auditors, project developers, methodology designers and the Ministry will therefore be essential to refine the audit protocols in line with on-the-ground realities.

Feedback from the audits will also be highly valuable. It will make it possible to assess the actual verification rate of certificates modelled at the outset. On the agricultural side, it will help evaluate the extent to which emission reduction efforts have truly been implemented at the farm level.

2. Diversify methodologies and manage their evolution

The four main LBC methodologies currently in use are sometimes criticized for covering only a limited range of climate actions. Forestry methodologies, in particular, are seen as overly focused on planting *(Canopée Forêts Vivantes, 2023).* The project developers we interviewed unanimously highlighted the need to expand the scope of practices eligible for certification under the LBC. In response to these expectations, new methodologies are being developed, helping to broaden and diversify the range of practices covered.

A methodology certifying continuous cover forest management projects, mainly for broadleaved species, has been proposed *(La Belle Forêt, 2025),* and a similar one for conifers could follow (MTE, 2024b). As this type of methodology focuses on avoided emissions, it is essential that baseline scenarios are established as robustly and credibly as possible. The same applies to any "leakage" effects caused by the postponement of logging. Strict control of windfall effects will also be necessary to ensure that carbon certificates genuinely reward additional changes in practices.

On the agricultural side, new livestock sectors are expected to be covered through the revision of the Carbon'Agri methodology, which will be extended to sheep and goat farms, and the forthcoming approval of a methodology for pig farming *(MTE, 2025).*

3. A need for international recognition?

Figure 30 shows that a significant share of the potential LBC certificate volume is financed by large French companies. These entities operate in an international context and are sometimes subsidiaries of international groups that develop CSR policies for the group as a whole. Even when they are French companies, they must report on their CSR activities to their business partners, who may be foreign. **However, the LBC remains relatively unknown outside France.** Some potential LBC funders are calling for it to be recognized by the meta-standards that have been created to label the quality of certification systems, such as the ICVCM (Integrity Council for the Voluntary Carbon Market) and the ICROA (International Carbon Reduction and Offset Alliance). The British Woodland Carbon Code, which is similar in size and operation to the LBC, is recognized by the ICROA, but to achieve this it had to adopt an ex-post credit system. **At the very least, documentation in English would enable better international communication about the LBC.**

4. Will the CRCF sideline the LBC?

Since December 2024, a European regulation has provided a certification framework for carbon removal and carbon farming activities taking place on EU soil: the Carbon Removals and Carbon Farming (CRCF) Regulation *(Regulation [EU] 2024/3012 Establishing a Union Certification Framework for Permanent Carbon Removals, Carbon Farming and Carbon Storage in Products, 2024)*. By establishing quality criteria and defining monitoring and reporting processes, the CRCF aims to facilitate investment in innovative carbon removal technologies, as well as in agricultural and forestry activities that sequester carbon or reduce GHG emissions from soils. Emissions reductions from livestock farming could be included in its scope from 2027. Although the CRCF Regulation entered into force at the end of 2024, it is not yet fully operational but should be by 2026. The CRCF certification processes must still be specified in implementing acts, and the first methodologies are expected to be published as delegated acts by 2026. These first methodologies are likely to focus on peatland restoration, afforestation of non-forest land, as well as carbon storage and emission reductions in agricultural soils and agroforestry.

With nearly six years of experience operating the LBC, France holds a unique position within the EU. Most Member States do not yet have a certification framework and are awaiting the system to be introduced by the European Commission. Conversely, France is now focusing on ensuring that the future CRCF is compatible with the LBC. Although the scope and details of the CRCF have not yet been fully defined, several key differences between this framework and the LBC can already be identified:

- **Different scopes, currently excluding livestock farming and substitution:** emission reductions linked to livestock farming are excluded from the CRCF, although they could be included from 2027 onwards. However, indirect emissions linked to substitution effects are not covered by the CRCF.

- **Temporary certificates for the agricultural and forestry sectors:** unlike the LBC, the CRCF distinguishes between temporary and permanent certificates. Permanent certificates apply to CO_2 removals stored in deep geological formations (using DACCS and BECCS technologies). Land-sector activities generate "temporary" removals, due to the reversible nature of biological sequestration. As a result, the certificates are considered reissued after a monitoring period specific to each methodology.

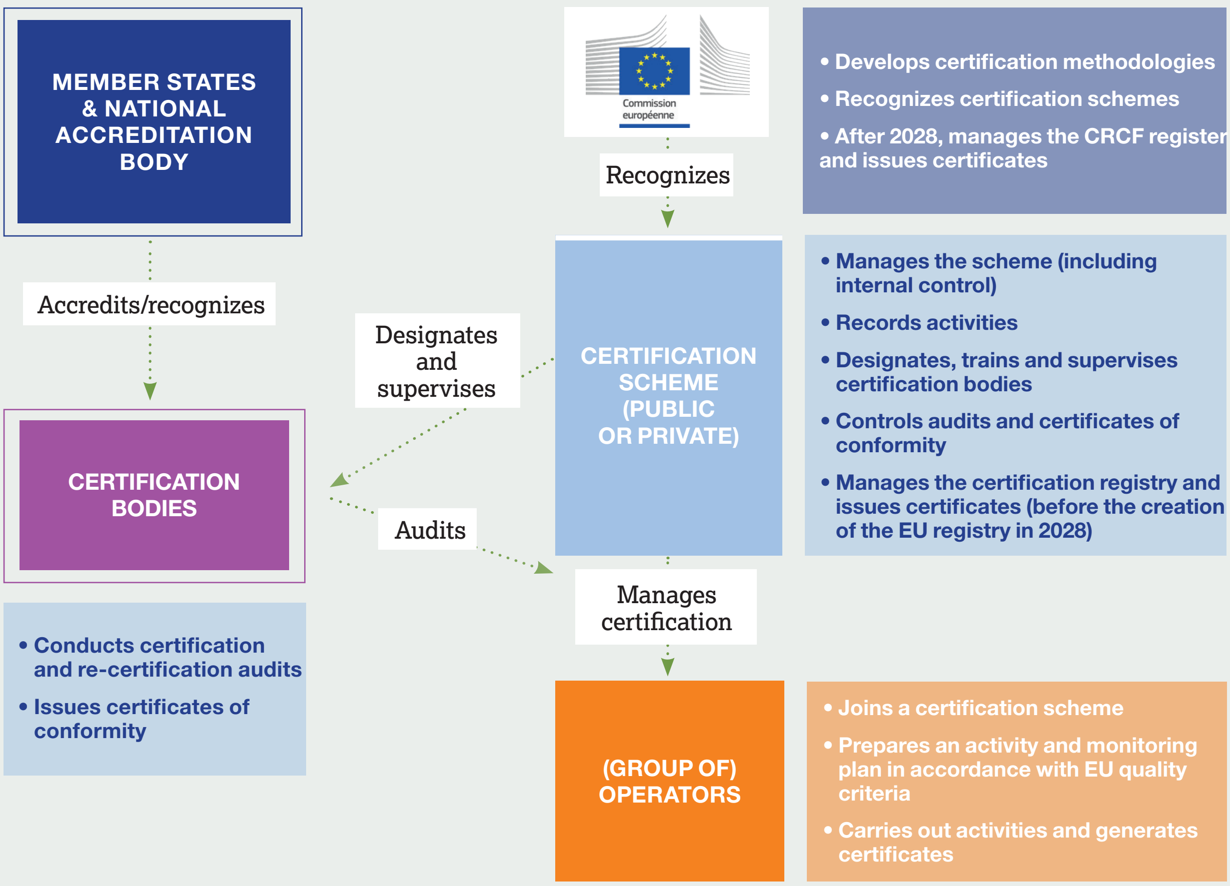
- **Ex-post certificates only:** the CRCF regulation requires that carbon removals be verified before certificates are issued. In practical terms, this means that ex-ante certificates are excluded. This is a major difference from the forestry LBC, which raises the question of pre-financing afforestation and reforestation projects, which take decades to store significant volumes of carbon.

- **A preference for generic reference scenarios that favour pioneers:** the CRCF plans to develop "highly representative standardized" baseline scenarios, which are likely to result in fairly general reference values, allowing good practices already implemented to be remunerated. Depending on how these scenarios are operationalized in the methodologies, they could differ significantly from the LBC scenarios, which can be described as "specific and regulated".

- **Validation by external auditors, potentially subject to a fee:** whereas public authorities validate LBC projects at no cost to project developers, the CRCF will require independent auditors for validation and periodic re-certification. A monitoring obligation (with reporting) also applies. These requirements are likely to increase transaction costs for project developers.

Finally, the CRCF Regulation provides that "certification schemes" will serve as intermediaries between the Commission, the operators implementing the activities, and the auditors responsible for validating the projects and verifying their compliance.

FIGURE 34: CERTIFICATION PROCESS PLANNED FOR THE CRCF



Source: European Commission, 2024

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One possible scenario is that the Label Bas-Carbone could become a CRCF certification scheme. In this case, LBC methodologies would become obsolete (as only methodologies drafted and published by the Commission would be eligible) and the Ministry for Ecological Transition would rely on independent auditors to validate projects. While the MTE would lose direct control over carbon certification, the pooling of methodologies could in theory lead to economies of scale by sharing development and validation costs with other European countries. The existing LBC methodologies could also serve as a source of inspiration for the CRCF's European methodologies.

The other possible scenario is that the LBC continues to operate alongside the CRCF, without seeking integration. The CRCF Regulation clearly states that it is a voluntary framework and, given the fundamental differences in approach, full compatibility between the two systems would require very significant changes to the LBC. It is therefore conceivable that the LBC could coexist with European certification. The CRCF could then be applied in France in parallel with the LBC, via private certification schemes. For this scenario to be viable in the long term, it is essential that economic actors purchasing LBC certificates are recognized within European public policies that influence demand, such as the CSRD or the Green Claims Directive, currently under negotiation. If such demand-side policies were to require companies to rely exclusively on CRCF certificates for their climate claims, demand for the LBC from major companies would likely decline. The creation of a regulated market mechanism (such as an Emissions Trading Scheme, ETS) for agriculture *(Bognar et al., 2024)* would also significantly change the landscape for the LBC. However, this issue does not currently appear on the European Commission's agenda for the coming years *(European Commission, 2025).*

Intermediate scenarios between the two described above could, of course, be envisaged. For example, a phased approach: the LBC's activities could be gradually transferred to the CRCF. Alternatively, partial integration could be considered, with the LBC becoming a CRCF certification scheme for only some of the activities it currently certifies, while the rest would remain solely under the "LBC" framework.

VI. ASSESSING THE LABEL BAS-CARBONE

1. The strengths on which the LBC can build

A TOOL WIDELY ADOPTED BY ACTORS IN REGIONS

The Label Bas-Carbone has successfully established itself as a multi-stakeholder public policy tool that channels private funding into agricultural and forestry projects at the local level. With open governance and methodologies developed by the stakeholders themselves, the LBC engages a wide range of economic actors from the sectors concerned. In this respect, it serves as a genuine testing ground for implementing climate transition in these sectors. Over the past six years, it has enabled stakeholders in these sectors to take ownership of climate and ecological transition challenges, while supporting the implementation of practical actions on the ground and the development of tools to measure impact.

A KEY DATA SOURCE FOR PUBLIC POLICY

In the process, the LBC has also made it possible to gather valuable data on the implementation of emission reduction practices. For example, information collected on projects, such as technical feasibility, cost, barriers and enabling factors can be invaluable in implementing the public policies needed for climate transition. Feedback from the LBC is now also proving useful at the European level, where the CRCF is being set up.

WIDELY USED REFERENCE TOOLS FOR CARBON ACCOUNTING

Some LBC methodologies are recognized as technical and economic benchmarks for low-carbon practices. The tools developed alongside these methodologies are sometimes used far beyond the scope of the LBC itself. For example, the Cap2er tool developed by Idele, the main tool for the Carbon'Agri methodology, has now been deployed on more than 45,000 farms in France and Europe to carry out carbon audits *(Idele, 2025)*. It is also used as a Monitoring, Reporting and Verification (MRV) tool for funding mechanisms, such as "supply chain premiums" and for the CAP's "Transition in Practices" AECM.

THE SEARCH FOR A BALANCE BETWEEN COST AND MEASUREMENT ACCURACY, BETWEEN RIGOUR AND ACCESSIBILITY

The LBC also strives to strike the difficult balance between the robustness of the MRV system and reasonable transaction costs. Several tools and features help achieve this, including the use of discounts and the highly structured nature of the methodologies. For many aspects (such as defining reference scenarios, setting discount amounts, and designing calculators or growth and yield tables, etc.), the methodologies concentrate the background research and demonstration effort. They also provide a framework for justifying choices, which no longer falls to the project proponent. This is particularly true for forest baseline scenarios for example, which are described and quantified according to several approaches within the methodologies. This structure both limits the complexity and time required from project developers, since most parameters are often pre-defined by the methodology, reducing the risk of bias and information asymmetry.

10. Équivalent de Monitoring, Reporting et Vérification (MRV) en français.

Integrity is thereby strengthened, even if the data are not specific to a particular project. Lastly, verification costs remain reasonable, even though they can theoretically account for up to half the total MRV costs *(I4CE, 2018)*. Together, these factors make the LBC more accessible to project developers than most international standards.

A TOOL SUITABLE FOR SMALL PROJECTS, PARTICULARLY IN FORESTRY

Unlike what is often seen internationally or in other European countries, LBC forestry projects tend to be small in scale. The tool is therefore well suited to small areas, and consequently to the fragmented structure of forest ownership in France, even though certification generally requires technical support. Several features make the scheme accessible to small projects:

- **Lower certification costs compared to international standards:** validation is covered by the public authorities and audits are expected to be inexpensive (due to standardized methodologies and a growing pool of auditors).
- **Highly standardized methodologies that reduce the workload for project developers:** a baseline scenario and carbon calculator are provided, relevant growth and yield tables are identified, and the demonstration of additionality is clearly framed. By contrast, international standards often require project developers to justify all of these elements themselves, making the process more complex and costly.

2. Areas for improvement to be pursued

Despite its successes and clear strengths, the Label Bas-Carbone remains a work in progress and will need to continue evolving. A number of limitations and areas for improvement have already been identified:

A. CONSOLIDATION OF GOVERNANCE NEEDS TO BE FURTHER DEVELOPED

- **Continue efforts to harmonize project appraisal processes**

Stakeholders continue to emphasize the need for greater consistency in how the Directions Régionales de l'Environnement, de l'Aménagement et du Logement (DREAL, Regional Directorate for Environment, Planning and Housing) assess processes. While significant progress has already been made, disparities remain between regions and between assessors, which can be confusing for project developers working across multiple areas. To address this, new methodologies and revisions increasingly include criteria and tools aimed at improving consistency, such as document templates and assessment frameworks. Ongoing training for DREAL teams is another important lever for improving the appraisal processes.

- **Ensuring the credibility of the "LBC" as a benchmark through transparency**

The GST supports the MTE in approving and revising the various methodologies. It is composed of researchers (notably from INRAE), as well as technical experts and representatives from civil society.

Currently, the GST meets for each methodology approval or revision after all participants have reviewed the documents and two rapporteurs from the research community have produced a report. This report is now published on the LBC website. Publishing it promptly, within a few weeks of the GST meeting, would help economic actors anticipate any significant methodological changes without prejudging the authority's final decisions. Furthermore, if the authority were to publish a short document explaining its final choices, especially where they differ from the GST's most significant recommendations, this would enhance transparency around technical decisions and help strengthen the credibility of the label.

- **Generalize consultative "user committees" to complement the GST**

To strengthen the involvement of those actors implementing LBC on the ground, the promoters of the Arable Crops methodology have established a "user **committee"** to gather feedback from project developers, some of whom are represented in the GST. For methodologies where project developers are clearly identified, creating such a committee ahead of methodology approval or revision would help better integrate field experience and anticipate potential obstacles.

The timetables for implementing methodological changes could be discussed, so that representatives have visibility and can adapt their economic models.

- **Secure funding for methodology reviews**

At present, methodology reviews are generally carried out by the original methodology developers, without any dedicated funding. This model does not appear sustainable, as it depends on the goodwill and financial capacity of methodology developers, who are not all public bodies. To ensure the quality of each review, specific funding should be made available either to the methodology developers or to other qualified technical actors. It is worth noting that methodology review projects are, in principle, eligible for several existing research and development support schemes (ADEME, CASDAR, etc.).

In addition, the Authority could take the initiative to revise methodologies itself, in consultation with stakeholders, or encourage stakeholders to propose revisions, even if they were not the authors of the previous version.

- **Improving transparency in project documents**

Transparency is essential for the credibility of the voluntary carbon market *(Delacote et al. 2024)* and for enabling continuous improvement. Internationally, most certification standards publish Project Description Documents (PDDs) public, which detail the projects and their technical specifications. For instance, the ICVCM's Core Carbon Principles require technical project information to be publicly available. This was initially the case with the LBC, which means it is rated favourably compared to other international standards on transparency *(Delacote et al., 2024)*. However, due to European personal data protection rules, PDDs were removed from the LBC website, leading to a significant decline in transparency. The latest version of the public LBC website has since made notable improvements, with information on co-benefits, tree species and implementation levers once again available for each project. Nevertheless, the LBC needs to improve its transparency further by making public certain technical project data, such as the discounts applied, carbon calculations, and the associated calculators used (or at least their input and output data).

- **Improving data collection for research purposes**

The data collected by the LBC is invaluable for evaluating the scheme's effectiveness and supporting its future development. While data collection has been automated in recent years, further standardization would facilitate expert analysis and research. For example, project developers currently enter information into Excel spreadsheets that often contain confidential data, making them difficult to share. However, the content of these files is often essential for project evaluation. Separating confidential information from other data would help improve ongoing assessment.

B. ENSURE THAT THE LABEL AND ITS METHODOLOGIES EVOLVE IN LINE WITH SCIENTIFIC ADVANCES, FIELD FEEDBACK, AND THE EUROPEAN CONTEXT

- **Continue improving methodologies**

The LBC has always been committed to continuous improvement, with regular reviews and evaluations of core components (methodologies, regulations). One of its key strengths is that it is sufficiently well documented to enable such revisions, much like other established standards that preceded it (e.g. Clean Development Mechanism, Verra-VCS Standard, etc.).

This study also highlights certain limitations in the calculation methods, such as the estimation of emission reductions for some agricultural projects, which in some cases appear to involve significant biases or windfall effects. Examples include leakage caused by certain "soil carbon" levers or how uncertainties are treated in soil carbon modelling *(see section III.3.)*. These issues are currently being examined by INRAE as part of the revision process for the Carbon'Agri and arable crops methodologies. Finally, methodology reviews also offer an opportunity to revisit methodological choices that may limit environmental integrity. For instance, the Carbon'Agri methodology currently does not allow for system changes. Revising the metrics used in this methodology could help address such limitations.

On the forestry side, similar limitations were raised in this study, including the choice of substitution coefficients and INRAE's work on growth dynamics or expanded forest areas *(INRAE, 2024a: INRAE, 2024b)*. The new version of the forestry methodologies, approved in February 2025, therefore strengthens the calculation approaches, although it does not adopt several of INRAE's prioritized recommendations.

Such ongoing revisions are essential in sectors like agriculture and forestry, where uncertainty remains high and where it is vital to incorporate the latest scientific findings. They also help improve the attractiveness of both the projects and the scheme as a whole, whose legitimacy depends on staying aligned with the most up-to-date scientific knowledge.

- **Anticipating the future of ex-ante credits and exploring alternatives**

Under the CRCF, ex-ante certificates, which validate projected future climate benefits, will not be permitted. Only ex-post certificates (which verify benefits already achieved) will be eligible. International labels such as ICROA and ICVCM, which aim to qualify credits and are increasingly required by funders, also certify only ex-post credits. This presents a challenge for the LBC, as its main forestry methodologies are currently based on ex-ante certification and would not be compatible with the CRCF. However, despite the uncertainties it entails, ex-ante certification is still considered necessary for projects that require significant upfront investment for carbon benefits that are spread over a long period, such as forestry projects, which must take into account tree growth time.

Therefore, if compatibility of the LBC with the CRCF is a goal for France, a solution will need to be found to enable the issuance of ex-post certificates under these forestry methodologies, something that will be challenging for projects involving growing stands. Work will be needed, drawing on international benchmarks, to assess the implications of such a change.

C. ENSURE THAT DEMAND IS STRENGTHENED AND SUSTAINED

- **Clarifying the different types of carbon units within the registry**

Although project developers generally document the different types of carbon gains (such as direct and indirect emission reductions, capture, etc.), these distinctions have not been clearly reflected in the registry so far. However, funders and other stakeholders need to be able to understand the nature of each unit and the associated implications. The registry should therefore allow for the clear identification and reporting of these different unit types.

- **Continuing to structure the market through compliance demand**

Compliance demand plays a key role in supporting LBC projects and has been instrumental in their expansion, as well as in the implementation of low-carbon practices. In a context of constrained public finances, strengthening this regulatory lever, either by expanding obligations for current actors or introducing them into new sectors, would help mobilize the funding needed to support the transition of the agriculture and forestry sectors.

- **Voluntary demand remains fragile**

Although LBC projects are funded through both compliance and voluntary funding, compliance demand has increased significantly over the past two years, now accounting for between 40% and 80% of known funding. It has become a structural pillar of the scheme, providing more predictable and stable financing for the transition of the agricultural and forestry sectors.

This recent growth in compliance financing reflects the relative decline in voluntary demand, which had previously played a larger role. Although still significant, voluntary demand has been falling internationally since 2022, notably due to scandals involving REDD+ projects. Moreover, financing through the LBC represents only small share of the volumes sold by French carbon operators (Info Contribution Neutralité Carbone, 2024). The price gap between French and international projects remains substantial: LBC projects are not designed to compete on carbon price.

Finally, demand remains limited for agricultural projects, which struggle to secure funding for all certified initiatives and are generally less well financed than forestry projects. Of the “stock” of approved projects, agricultural project developers report a funding level of between 5% and 40%, compared with 60% to 100% for forestry. Stakeholders cite several reasons for this disparity, though their relative importance remains unclear:

- **Higher certificate prices for agricultural projects (around €45/tCO_2)** compared with forestry projects (around €30/tCO_2). This makes them less attractive to voluntary funders and places them outside the scope of mandatory schemes.
- **Less compelling narrative that is more difficult to communicate to the general public compared to forestry projects** (planting trees). This is a key factor in financing on the voluntary carbon market *(I4CE, 2017).* Low certificate prices also encourage agricultural project developers to favour system optimization projects rather than more comprehensive changes, which may further reduce appeal for private funders.
- **Uncertainties around claims associated with purchasing certificates, particularly by downstream actors.** Internationally recognized carbon neutrality standards (GHG Protocol and SBTi in particular) require clear allocation of carbon benefits between different actors within and outside the value chain to avoid “double counting”. This currently complicates the financing of low-carbon projects and prevents farmers from combining different sources of financing, even when justified by the cost of implementing low-carbon practices.

These funding difficulties are currently hindering the development of new projects and limiting farmer engagement. **Two short-term options** could help stimulate demand:

1. **Greater compliance demand from the aviation sector,** either by raising the reference price or increasing volumes to be offset.
2. **Clearer rules on permissible claims by funders, particularly for those downstream in the agricultural value chain.** Public authorities could support this by clarifying the rules for voluntary claims and positioning LBC units in relation to international reference standards such as the SBTi and GHG Protocol.

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APPENDIX

APPENDIX 1 - Description of the data used in this report

Most of the data presented in this report comes from the Label Bas-Carbone databases. Some of this information is publicly available and can be viewed and downloaded from the Label Bas-Carbone website. Additional data was provided for the study by the MTE under a specific agreement. This includes methodology-specific information entered by project developers on the "Démarches Simplifiées" portal.

Finally, in parallel with qualitative interviews conducted with forestry project developers, spreadsheets detailing co-benefits ("Document 6") and carbon impact calculations submitted during project validation ("Document 8") were shared by project developers. Similar data was provided by agricultural project developers but was used only to a limited extent due to its heterogeneous nature.

The table below summarizes the various data sources used for this study.

CHARACTERISTICS OF THE DATA USED FOR THIS STUDY

DATABASE NAME	NUMBER OF PROJECTS	POTENTIAL VOLUME OF CERTIFICATES (tCO_2eq)	START DATE	END DATE	METHODOLOGIES	SOURCE
Extrait général registre (General registry extract)	1685	6 408 426	04-dec.-19	31-mar-25	All methodologies	MTE, DGEC, public data
BDD demandeurs (applicants database)	1519	6 389 991	04-dec.-19	31-mar-25	All agriculture and forestry methodologies	MTE, DGEC, public data
BDD financeurs (funders database)	622	892 039	04-dec.-19	31-mar-25	All agriculture and forestry methodologies	MTE, DGEC, public data
BDD3 méthode Boisement (Afforestation methodology database)	561	939 272	01-mar-22	31-mar-25	Afforestation	MTE, DGEC, non-public data
BDD3 méthode Reconstitution (Restoration methodology database)	566	1 814 314	01-mar-22	31-mar-25	Restoration	MTE, DGEC, non-public data
BDD3 méthode Carbon'Agri (Carbon'Agri methodology database)	20	1 575 686	09-nov.-22	31-mar-25	Carbon'Agri	MTE, DGEC, non-public data
BDD3 Grandes Cultures (Arable Crops methodology database)	133	1 280 647	06-jan.-23	31-mar-25	Arable Crops	MTE, DGEC, non-public data
BDD mandataires forêt (forest project developers database)	630	1 081 024	04-dec.-19	01-oct.-24	Afforestation and restoration	Data shared by 9 developers

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APPENDIX 2 - List of LBC developers according to the public LBC registry as of 31 March 2025

APPLICANT NAME	SECTOR	ACTOR TYPE	NUMBER OF PROJECTS	POTENTIAL VOLUME (tCO_2eq)	SHARE OF TOTAL SUPPLY (%)
France Carbon Agri*	Agriculture	Established sector actor	7	1 704 307	27
Alliance Forêts Bois*	Forestry	Established sector actor	396	647 070	10
Société Forestière de la CDC *	Forestry	Established sector actor	92	569 965	9
Stock CO_2*	Agriculture and Forestry	Start-up	192	513 731	8
Carbonapp*	Agriculture and Forestry	Start-up	231	467 097	7
APAD*	Agriculture	Established sector actor	1	309 174	5
ReSoil*	Agriculture	Start-up	53	229 681	4
CNPF*	Forestry	Established sector actor	183	229 673	4
Oklima	Agriculture and Forestry	Start-up	69	216 766	3
ONF*	Forestry	Established sector actor	70	205 944	3
Agro d'Oc*	Agriculture	Established sector actor	2	201 606	3
Sysfarm*	Agriculture	Start-up	21	169 426	3
Fransylva services*	Forestry	Established sector actor	70	151 599	2
Socogef (Selva Group)	Forestry	Established sector actor	29	101 181	2
Carbone Farmers*	Agriculture	Start-up	8	82 795	1
REFOREST'ACTION*	Forestry	Start-up	34	81 455	1
Actiforest - Maforêt	Forestry	Start-up	19	63 609	1
Pierre Aussedat SARL	Forestry	Established sector actor	8	56 569	1
Le Printemps des Terres S.A.S	Agriculture and Forestry	Start-up	13	48 298	1
Invivo Alpha 32	Agriculture	Established sector actor	26	46 324	1
CFBL Coopérative Forestière*	Forestry	Established sector actor	36	36 841	1
Neosylva investissement forestier	Forestry	Start-up	22	35 020	1
Coopérative Carbone*	Agriculture and Forestry	Regional actor	13	29 291	0
Selarl cabinet lorne	Forestry	Established sector actor	11	18 287	0
Atmosylva	Forestry	Start-up	16	17 645	0
Co_2responsables	Agriculture	Start-up	3	15 893	0
Carbon&Co (filiale InVivo) ATMOSYLVA	Agriculture	Established sector actor	8	10 163	0
Groupements forestiers de Cimes et des combes	Forestry	Established sector actor	2	9 796	0
Forestry France	Forestry	Established sector actor	1	9 670	0
Cooperative agricole AGORA	Agriculture	Established sector actor	2	9561	0
Chambre d'agriculture du Rhône	Agriculture	Established sector actor	1	9478	0
Forêts & Bois de l'Est	Forestry	Established sector actor	6	9424	0
Coforet	Forestry	Established sector actor	7	8 443	0
The pure project	Forestry	Start-up	4	6 168	0
Symbiose Normandie, Paiements pour Services Environnementaux	Agriculture	Regional actor	2	6 110	0
Kloros	Forestry	Established sector actor	4	5 370	0
EMC2	Agriculture	Established sector actor	1	5 194	0
Ecotree	Forestry	Start-up	1	5 013	0
Autres	Agriculture and Forestry		41	46 354	1

* Project developers marked with an asterisk were interviewed by I4CE. These were the 15 main developers at the launch of the project in April 2024.

APPENDIX 3 - **Levers proposed in the arable crops and Carbon'Agri Label Bas-Carbone methodologies**

LEVERS PROPOSED IN THE CARBON'AGRI METHODOLOGY

CARBON'AGRI METHODOLOGY	
Livestock management	> 1 **Improve** health management
	> 2 **Improve** animal housing and ventilation to optimize production per cow
	> 3 **Optimize age** at first calving and cow longevity
	> 4 **Improve genetic performance** (productivity, enteric methane reduction)
	> 5 **Optimize** time on farm for sale animals
	> 6 **Optimize** number of replacement heifers
Optimization of animal feed	> 7 **Optimization** of concentrate feed
	> 8 **Add lipids** to the ration
	> 9 **Improve forage** quality
Improvement of protein self-sufficiency	> 10 **Optimize** nitrogen content in feed
	> 11 **Replace** soybean meal with rapeseed meal
	> 12 **Increase** protein self-sufficiency
Fertilisation azotée organique et gestion des effluents d'éle-vage	> 13 **Increase** grazing time
	> 14 **Increase** frequency of manure removal
	> 15 **Improve manure** spreading (trailing hose, injection equipment)
	> 16 **Cover manure** storage pits
	> 17 **Anaerobic** digestion of animal manure
	> 18 **Manure** composting

CARBON'AGRI METHODOLOGY	
Mineral fertilization	> 19 **Optimize** fertilization to reduce the use of mineral fertilizers N, P, K
Organic and mineral nitrogen fertilization	> 20 **Establish** legumes in mixtures or as pure crops
Reduction in energy consumption on the farm	> 21 **Reduce** electricity use in milking parlour
	> 22 **Reduce** fuel consumption
Carbon storage in soils	> 23 **Establish** cover crops
	> 24 **Establish** temporary or permanent grassland
	> 25 **Extend** temporary grassland duration
Optimization of technical itineraries	> 26 **Optimize** crop rotation
Carbon storage in above-ground biomass	> 27 **Establish** hedgerows on farms
	> 28 **Improve** hedgerow management
	> 29 **Develop** agroforestry

LEVERS PROPOSED IN THE ARABLE CROPS METHODOLOGY

ARABLE CROPS METHODOLOGY	
Organic and mineral nitrogen fertilization	> 1 **Adjust dose estimates** based on realistic yield targets and input data
	> 2 **Take climatic conditions** into account when scheduling fertilization
	> 3 **Use** of management tools
	> 4 **Intra-plot** modulation
	> 5 **Use** of nitrification inhibitors
	> 6 **Lime acidic soils**
	> 7 **Use** lower-emission fertilizers (reduce use of urea-based fertilizers and apply urease inhibitors)
	> 8 **Incorporate** organic and mineral inputs
	> 9 **Introduce** nitrogen-fixing legumes in crop rotation
Reduction in energy consumption on the farm	> 10 **Reduce** machinery passes over fields
	> 11 **Reduce** energy consumption of machinery
	> 12 **Reduce** energy consumption of the irrigation system
	> 13 **Reduce** energy consumption of drying/storage systems
	> 14 **Implement** a technical itinerary that enables harvesting at a lower moisture content
Carbon storage in soils	> 15 **Increase** returns from crop residues
	> 16 **Increase** use of soil improvers and fertilizers from residual materials (MAFOR)
	> 17 **Introduce** or expand temporary/sown grassland in crop rotations
	> 18 **Increase** biomass returned via cover crops

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www.i4ce.org

INSTITUTE FOR CLIMATE ECONOMICS
30 rue de Fleurus - 75006 Paris

www.i4ce.org
Contact : contact@i4ce.org

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Création-réalisation : Laëtitia Colas