CHAPTER 6

FOREST CDM IN BRAZIL: FUNDAMENTALS, LEGACY AND ELEMENTS FOR THE FUTURE[1]

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1 INTRODUCTION

This chapter aims at assessing the legacy of the forestry scope of the Clean Development Mechanism (CDM) in Brazil, as well as the main obstacles and opportunities that shape its potential future use.

Two main arguments are discussed. The first is that the most relevant impact of the forestry CDM in Brazil seems to be more associated with the institutional legacy than with the scale of net removals of greenhouse gases (GHG), although they were relevant when considering market limitations. Much of this sub-optimized mitigation potential may be related to international constraints on demand for forest credits, due to technical, economic and political factors, as well as the inherent complexity of the mechanism. The second is that, despite the various barriers, there may be a substantive potential for future use of the forest CDM, albeit in different forms. Nevertheless, this possibility tends to be quite conditioned to the proactive and cross-cutting insertion of the mechanism into broader public policies capable of increasing its mitigation efficiency through a combination of instruments, which corroborates several references in literature.

In order to develop the analysis, this chapter was divided into five sections, including this brief introduction. In the next section, the characteristics that differentiate the forestry scope of the CDM from the other scopes of the mechanism are presented, as the understanding of these specificities greatly influences the analytical effort. Section 3 discusses the experience in Brazil, considering cases of projects and broader aspects, in light of the main barriers related to supply and demand. Section 4 seeks to identify and analyze the main elements that may

1. The present chapter was based on author's personal capacity and it does not necessarily represent the views of the organization for which he works, partners or consultancy clients. The author is especially thankful to the following Plantar Carbon members for comments and support: Rodrigo Ferreira, Diego Toledo, Cristiana Oliveira and Gabriela Marzano.
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influence the potential for the future use of the forestry CDM, considering the current moment of transition in the international climate change regime, domestic policies and instruments. Section 5 presents the final considerations.

It should be noted that, in addition to the bibliography, the chapter is based on the author's practical experience in the development of CDM methodologies and projects, including in one of the cases addressed, as well as in the engagement in national policies and multilateral negotiations over the last fifteen years.

2 FUNDAMENTAL CHARACTERISTICS AND SPECIFICITIES

The insertion of forestry activities in the CDM was marked by a significant degree of complexity throughout the negotiating process of the Kyoto Protocol (UNFCCCa, 1997). On one hand, the international community recognized the important role of forests in mitigating climate change and in promoting sustainable development. By removing or "sequestering" CO_2 from the atmosphere, based on photosynthesis, forests can create and maintain carbon stocks in terrestrial ecosystems, which results in the reduction of the GHG concentration in the atmosphere.[3] Art. 3.3 of the Protocol requires countries to compute GHG removals from certain forestry activities to meet national commitments. The effect can be analogous to that of a carbon sink, according to the management practices adopted. On the other hand, there was a need to reconcile these potential climate benefits with the emissions compensation rationale that is inherent to a market-based mechanism such as the CDM.

This conciliation involved two main challenges: *i)* to create methodological tools to meet the *additionality criteria*[4] of the potential climate benefits generated by forestry activities; and *ii)* to create an appropriate form of accounting in which the risk of *non-permanence* of forests and their respective carbon stocks would be adequately addressed. That is, the key issue was how to ensure the integrity of a mechanism in which CO_2 removals (*negative flows*) generated by new forest stocks were used to offset emissions (*positive flows*) in Annex 1 countries, in light of the risk of loss of forest stocks and the subsequent return of carbon to the atmosphere.

The answer to this question is quite complex and will be dealt with later. To this day, it is the subject of more in-depth reflections than those developed in this chapter. Nevertheless, the parties to the Kyoto Protocol have been able to reach a consensus, albeit under various limitations, by means of Decision 19, adopted at

3. Hereinafter, "emissions" will be used as reference to "greenhouse gas emissions"; "removals" will be used as a reference to "net removals of greenhouse gases from the atmosphere by increasing forest stocks".

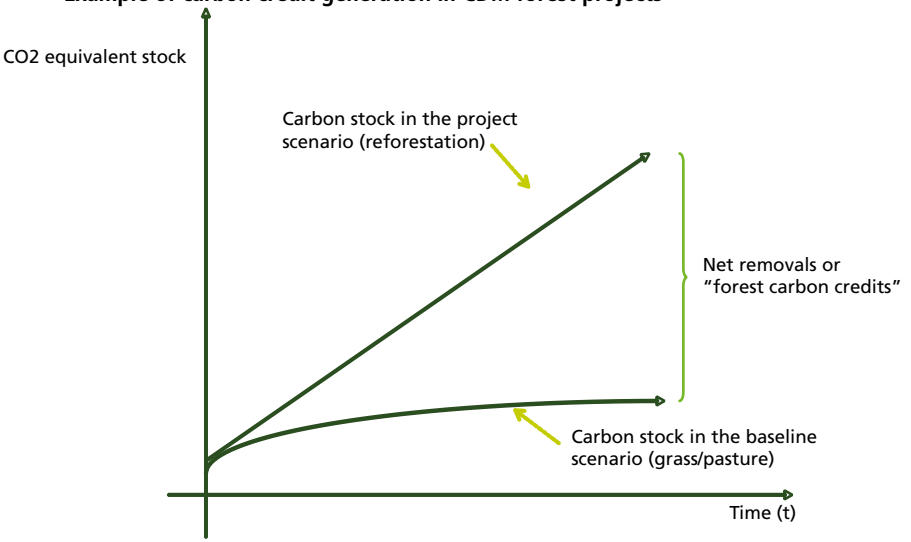
4. The concept of additionality is provided in annex A.

the 9th Conference of the Parties (COP-9) held in Milan in the end of 2003.[5] In practice, the Decision adapted the mechanism rationale to the specificities of the forest scope, based on Decision 17 of COP-7 (Marrakesh), which had regulated all other scopes of the CDM.[6] Most adaptations were made to key concepts such as baseline, additionality, definition of project boundaries, leakage and the characterization of units representing forest carbon credits.

While in other CDM scopes carbon credit is defined as the additional emission reduction in relation to the baseline scenario, in the forest scope the carbon credit generally corresponds to the net removal of 1t of CO_2 from the atmosphere, through the establishment of additional forest stocks in relation to a baseline scenario where such removals would not occur.[7]

Graph 1 shows the generation of forest carbon credits, by means of a symbolic example of a reforestation project, implemented in an area previously covered with grasses or pasture.

GRAPH 1
Example of carbon credit generation in CDM forest projects



Author's elaboration.

5. See UNFCCC (2003), which is a version of Decision 19/CP.9, translated into Portuguese by the Ministry of Science, Technology and Innovation (MCTI).

6. As a result of the entry into force of the Kyoto Protocol in 2005, Decisions 19/CP.9 and 17/CP.7 and 11/CP.7 (containing the definitions on land use and forests) have now been referenced, respectively, as Decision 5/CMP.1 (UNFCCC 2005c) Decision 3/CMP.1 (UNFCCC 2006a) and Decision 16/CMP (UNFCCC, 2006c), during the formal meeting of the I Meeting of the Parties to the Kyoto Protocol. Available at: https://bit.ly/2KiuMnK.

7. For a full concept, see the definition of actual net GHG removals in Annex A of this chapter, which also contains the main specific definitions of forestry CDM.

As for the adaptation of the main definitions of the CDM to the forestry scope, three groups of concepts deserve special attention, since they represent structural differences in relation to the other scopes: *i)* the concepts of afforestation and reforestation, which specify eligible activities for the scheme; *ii)* the risk of non-permanence of forest carbon, a crucial aspect to ensure fungibility between forest credits and other units under the Kyoto Protocol, including the units representing the emission limits for Annex 1 countries; and *iii)* the potential contribution to sustainable development. Each of these groups will be explained in detail below.

2.1 CDM Eligible forestry activities: afforestation and reforestation

The inclusion of forestry activities in the CDM was limited to afforestation and reforestation (A/R) activities, characterized by the anthropic establishment of new forests in areas that previously did not contain forests. After much controversy, conservation activities or management of existing forest stocks were excluded, for reasons that go beyond the scope of this chapter.[8] In order to understand the A/R definitions, first it is important to know the applicable forest definition:

> "Forest" is a *minimum area of land of 0.05-1.0 hectares* with tree crown cover (or equivalent stocking level) of *more than 10-30 per cent with trees* with the potential to reach a *minimum height of 2-5 metres* at maturity in situ. A forest may consist either of closed forest formations (where trees of various storeys and undergrowth cover a high proportion of the ground) or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes" (UNFCCC, 2006c p.3, author highlights in italics).

The general concept of forest is based on three ranges of values and parameters, which are highlighted in italics above. In order to accommodate the different realities and national perceptions about the term forests, each country was responsible for choosing the values among the ranges highlighted in the citation, generating the specific forest concept applicable to its jurisdiction.

In Brazil, the Interministerial Commission on Global Climate Change (CIMGC), through Resolution No. 2 of August 10th, 2005, adopted the highest values out of the three ranges. Therefore, in Brazil, forests are areas with at least 1 ha, with tree crown cover or equivalent stocking level with more than 30% of trees with potential to reach a minimum height of 5m, according to the other parameters of general definition of forests presented in the citation above. From this concept, A/R activities were defined as the only forest activities eligible for the CDM.

8. One of the causes for the exclusion of these activities was the fear that a perverse incentive would be created for the deforestation of existing forests, that is, the concern that there would be a kind of threat to clear an area if there were no additional resources coming from credits. Also contributing to the decision were fears regarding the verification of additionality and monitoring and the risks of leakage, along with broader political issues.

> "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed source (UNFCCC, 2006c, p. 5).
>
> "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on December 31st, 1989(UNFCCC, 2006c, p. 5).

The main difference between the definitions of afforestation and reforestation is the period in which the project area did not contain any forest before its implementation: fifty years before the project, in the case of afforestation; and in the case of reforestation areas can not contain forests on December 31st, 1989. In practical terms, this conceptual difference has little relevance, since the type of climate benefit generated by A/R projects is the same (removals generated by the planting of new forests).

One of the factors of greater influence in the negotiation of these concepts was the concern to avoid a perverse incentive for deforestation. There could be room for it, if regulation allowed for the reforestation of areas that had been deforested shortly before the implementation of a project, which helps to partially explain the choice of specific cut-off dates for the non-existence of forest cover in the project area.

The definitions have succeeded in leaving no room for perverse incentives for deforestation. However, in the case of the definition of reforestation, combining a very old cut-off date with the physical definition of what is a reforestation activity has generated a relevant restriction. All areas of developing countries that contained planted forests (production florests) in 1989 and which, by definition, would be *harvested* regardless of the CDM, which differs from *deforestation* of native forests, were excluded. The lack of differentiation between harvesting and deforestation for CDM purposes is also one of the reasons that contribute to this inadequacy. There also appears to be some regulatory contradiction, since Annex 1 countries can differentiate deforestation from harvesting in the accounting under national GHG inventories, which, in turn, influence on the compliance with mitigation commitments.[9] There is an attempt to improve this matter under the CDM, proposed by Brazil, which has not been approved so far.[10]

9. For an example of differentiation between harvesting and deforestation, refer to New Zealand's Greenhouse Gases Inventory (2015). Available at: https://bit.ly/1WoEu5R. Accessed on: May 27th, 2017.
10. Refer to box 1 for a more detailed discussion.

The accounting for changes in carbon stocks in A/R activities should be made based on changes in inventories in the different carbon pools, project boundaries, the baseline scenario, and the project scenario. Five carbon reservoirs are eligible and can be considered, either alone or in combination, according to project developers: *i)* above-ground biomass (carbon in tree trunks, branches and leaves); *ii)* below-ground biomass (carbon in roots); *iii)* litter (for example, leaves on the ground); *iv)* dead wood; and *v)* soil organic carbon.[11]

BOX 1
Possible eligibility of areas that had planted forests[12]

Although there is room for differentiation between harvesting and deforestation for the purposes of Annex 1 country inventories, the same logic has not been adopted in the eligibility criteria for A/R CDM project areas. Even areas that contained only planted forests in their last cycle, in 1989 or before a project, were excluded. That is, the current rules have made ineligible those areas that would be harvested anyway ("forests in exhaustion") and, as such, do not represent the deforestation of native forests.

Eligibility of a certain area means the possibility or permission to attempt to develop an A/R project for various purposes in that area. The fact that an area has already been covered with planted forests in the past does not necessarily mean that new A/R activities would occur automatically after the final harvest in the same area. By definition, planting new trees (reforestation) for production or conservation purposes depends on new investment decisions. Therefore, assessing the extent to which new A/R activities would occur in an area that contained planted forests is a matter of additionality rather than eligibility. Of course, for the correction of this gap to be effective, the additionality of A/R projects in those areas would have to be assessed, as in any CDM project.

The theme is relevant for developing countries, especially Brazil. In the past, the country had a fiscal incentive program for the establishment of planted forests, created in 1967 (the Sector Investment Fund – Fiset), through which large areas of land were reforested.To a great extent, these areas have been harvested and reverted to non-forested areas. According to data from the Food and Agriculture Organization of the United Nations (FAO), in Brazil there were 5 million hectares of planted forests in 1989, and 52.7 million hectares in Latin America, Asia and Africa (FAO, 2005 *apud* UNFCCC, 2011a). Under current rules, these areas cannot be used for new A/R CDM projects. Hence, new projects are forced to look for new areas, which makes the sustainable reuse of the same portion of land unfeasible.

Aware of this potential, the Brazilian delegation, with the support of Ethiopia, has been presented proposals to solve the problem since COP-14/MOP-4 held in Poznan, Poland in 2008. The COP requested the CDM Executive Board to evaluate the measure in 2009 and to make a recommendation to COP-15/MOP-5 in Copenhagen in 2010. The Executive Board has come to a favorable conclusion, informing that the term would be consistent with the modalities and procedures of A/R projects, if the reforestation definition were adjusted. (UNFCCC, 2009b). However, the measure was not approved by the COP. In an apparent asymmetry, New Zealand has put forward a proposal in Copenhagen to differentiate the harvesting of planted forests from deforestation, for the purposes of national inventories, by introducing the new terms "planted production forests" and "equivalent forests" (UNFCCC, 2009a). In 2012, Brazil hosted a technical workshop at its Ministry of Foreign Affairs, with representatives of governments and experts involved in the negotiation, followed by a field visit to areas in eastern Minas Gerais. The results of the workshop were reported to the Subsidiary Body for Scientific and Technological Advice (SBSTA) (UNFCCC, 2012a). However, some developed countries, especially the European Union, have opposed the idea, alleging, basically, inconsistency with current definitions and that this would be a new type of activity (UNFCCC, 2011a). The topic is on the agenda of negotiations. There has been technical evolution, but there is stagnation at the political level. The discussion will be resumed at the SBSTA intersessional meeting of 2019.

Author's elaboration.

11. As per Paragraph 1.a of the Annex to Decision 5/CMP.1.

12. Background of the discussions on the theme, referred to as *inclusion of lands with forests in exhaustion*. Available at: https://bit.ly/2KvtuoQ.

2.2 Approaches to the matter of non-permanence

The matter of non-permanence was one of the main challenges faced in drafting the regulatory framework of the forestry CDM. The solution adopted was to transform the removals generated by A/R projects into temporary carbon credits, through two types of units of measurement: tCER (Temporary Certified Emission Reduction) and lCER (Certified *Long-Term* Emission Reduction). According to the definitions presented below, these two units reflect, differently over time, the amount of credits that can be issued by a project, that is, *the actual net removals of greenhouse gases generated by A/R activities, through the additional amounts of carbon temporarily stored in project areas*. Each tCER or lCER is equal to 1t CO_2, defining what is informally known as the "forest carbon credits".

> A "Temporary CER" or "tCER" is a CER issued for an A/R CDM project activity, as per the provisions of Section K.…, which expires at the end of the commitment period following the one during which it was issued (UNFCCC, 2003, p. 5).

> A "Certified Long-Term Emission Reduction" or "lCER" is a CER issued for an A/R CDM project activity, as per the provisions of Section K.…, which expires at the end of the crediting period of the A/R CDM project activity or A/R PoA for which it was issued (UNFCCC, 2003, p. 6).

A central element in understanding these definitions is acknowledging the differentiation between the *period for obtaining credits* (henceforth referred to as crediting period) and the *commitment period*. While the crediting period is one in which a project can generate credits, the commitment period is the interval during which the Kyoto Protocol signatory countries must meet their emission reduction targets. The first commitment period of the Kyoto Protocol was from 2008 to 2012 and the second from 2012 to 2020.

In the case of A/R projects, the *crediting period* is different from other types of CDM projects. According to Decision 19/CP.9, project participants should choose between a period of up to thirty years or a period of twenty years, which can be renewed up to two times and can therefore last up to sixty years. In the latter case, renewal of the crediting period can only be granted upon revalidation of the project, i.e. only if a Designated Operational Entity (DOE) determines and informs the Executive Board that the baseline adopted at the beginning of the project remains valid or that has been updated, according to new data and analysis. Project participants are free to choose when to conduct the first verification audit. However, other audits should be carried out every five years from the date of first verification, but only once in each commitment period.

There is also freedom to choose the non-permanence approach to be adopted (tCER or lCER). But the choice must be made at the time of project validation, and cannot be changed over time.

2.2.1 The dynamics of tCERs

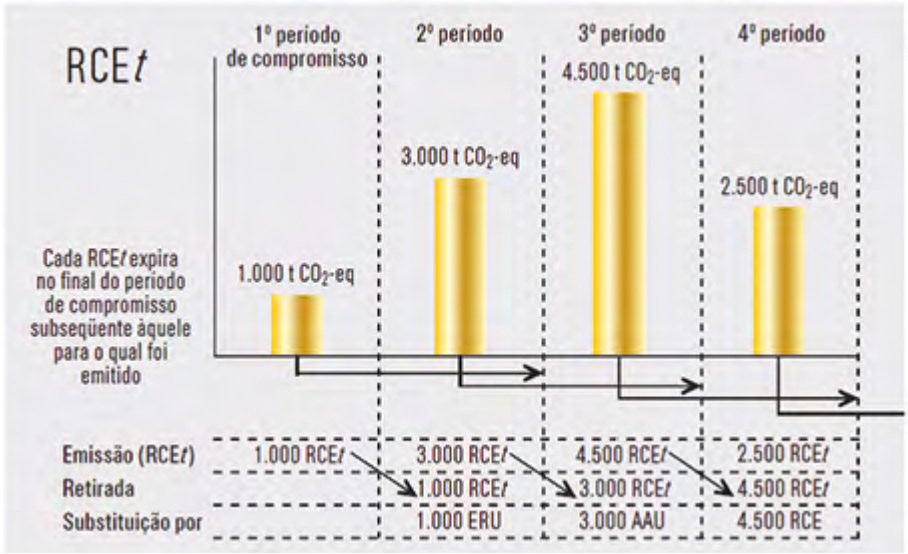
In general, tCERs are equivalent to *real net removals* (net removals, discounting leakage and emissions) or additional net carbon stock in the areas of an A/R project, on the date on which the project was verified by a DOE.

tCERs can be used by Annex 1 countries to meet their emission reduction targets. However, they expire at the end of the commitment period that is subsequent to the period in which they were generated. They must be replaced by the organization that used them to fulfill commitments (UNFCCC, 2005c). The replacement of tCERs can be done with other tCERs and with CERs (unit of all other types of CDM projects). It can also be done with AAUs (Assigned Amount Units), which represent the quotas or emission permits of Annex 1 countries,[13] and with ERUs (Emission Reduction Units) and ERMs (Emission Removal Units), which are units used to account for emission reductions and removals generated in Annex 1 countries. An lCER cannot be used to replace a tCER, although it is also a forest carbon credit.

Despite expiration, new tCERs can be generated (issued) by the same A/R project in the subsequent commitment period. As in the previous period, the tCERs will be equivalent to the net difference between the carbon stocks on the project verification date and the carbon stock equivalent to the project baseline. graph 2 illustrates the dynamics of generation and replacement of tCERs, demonstrating when tCERs are issued, withdrawn (expired) and replaced by other acceptable units.

13. For an explanation about each of these units, see Decision 13/CMP.1 (UNFCCC, 2005b).

GRAPH 2
The dynamics of tCERs



Source: Frondizi (2009, p. 77).
Obs.: 1. AAUs (*Assigned Amount Units*) and ERUs (*Emission Reduction Units*).
2. Replacements can be made with AAUs, CERs, ERUs, and/or tCERs.
3. Figure displayed in low resolution and whose layout and texts could not be formatted and proofread due to the technical characteristics of the original files (Publisher's note).

2.2.2 The dynamics of lCERs

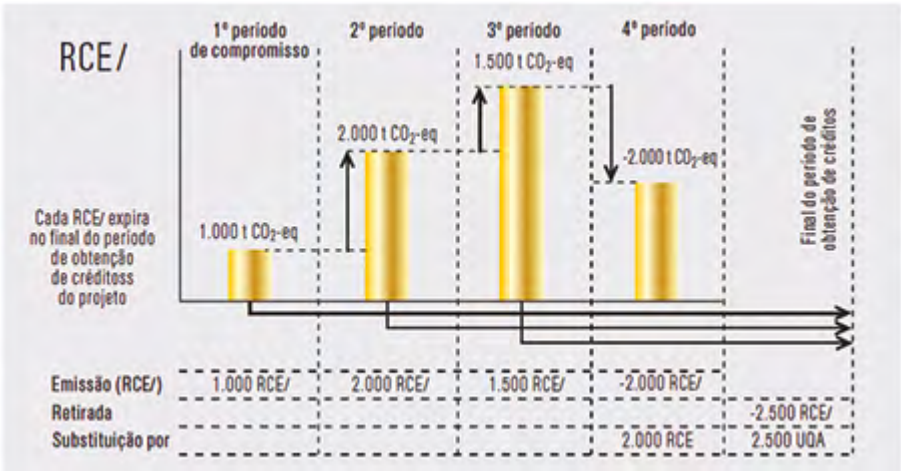
Unlike tCERs, which expire at the end of the commitment period following the one during which it was issued, lCERs are monitored and may last throughout the project's crediting period. They only expire at the end of the crediting period, which may include more than one commitment period, as adopted by the Parties to the Kyoto Protocol.[14] Thus, lCERs will also always represent the project's net carbon stocks at the time of verification, but are subject to adjustments (additions or subtractions) in relation to the carbon stocks determined in the previous verification.

As per graph 3, if the net stock of a given project is equivalent to 1,000 tCO_2e at the time of first verification,[15] project participants will be entitled to the issuance of 1,000 lCERs. If, on the second verification, in the next commitment period, the stock has increased by 2,000 tCO_2e, adding up to 3,000 tCO_2e, the project participants are entitled to the additional issuance of 2,000 lCERs. However, if

14. With the Paris Agreement and the possible discontinuity of the Kyoto Protocol in the post-2020 period, there is regulatory uncertainty over the treatment of these credits, which will require some measure that enables a fair transition.
15. In order to facilitate reasoning, only one verification was carried out in each commitment period. Initially, it was envisaged that the next commitment periods would be five years, but the second period of the Kyoto Protocol ended up being eight years. Either way, the rationale is the same.

there is a decrease in the carbon stock over the previous period, the organization using the lCERs of the project in question should complete the difference, as shown in the 4th period of graph 3 (UNFCCC, 2005c). Thus, unlike the dynamics of tCERs, lCER replacements do not necessarily occur at the end of each commitment period, but only if there is a negative difference in relation to the previous period. If there is no difference, the replacement will only occur at the end of the project crediting period.

GRAPH 3
The dynamics of lCERs



Source: Frondizi (2009, p. 78).
Obs.: Figure displayed in low resolution and whose layout and texts could not be formatted and proofread due to the technical characteristics of the original files (Publisher's note).

Given that an lCER may last longer than a tCER, its market value could be higher than that of a tCER. Conversely, the transaction costs of generating an lCER would tend to be higher due to the risk of reversals in carbon stocks and the need for a monitoring system for periods well beyond five years, in addition to contractual provisions appropriate to the constant adjustment of carbon stocks. However, the low liquidity of the forest credit market does not seem to have allowed confirmation of this premise. Most registered A/R projects opted for tCERs (61 out of the 66 projects).[16] Most likely, this was due to the greater simplicity in management, since in the case of tCERs the project manager need not worry about the variation of carbon stocks in relation to the last verification. At the same time, the buyer has predictability, by knowing that the purchased units will have to be replaced and that the replacement burden falls on the buyer.

16. According to research done in the documentation of each of the registered projects, available at the UNFCCC website by 6/30/2017. Available at: https://bit.ly/2KyxFQL.

It can be argued that the creation of a specific category for forest credits, based on the non-permanence/temporality of the assets, ended up generating a different type of flexibility to meet the targets of Annex 1 countries. Since tCERs and lCERs have an expiration date, and new units may be issued, the purchase of these assets is equivalent to: *i)* an incentive to maintain the generated carbon stocks; and *ii)* more time for the organization that has an emission reduction commitment to decide which type of permanent unit it will use to meet its commitment when the forest credit has expired.

In theory, such additional flexibility could result in "win-win" situations in the relationship between Annex 1 and non-Annex 1 countries, or simply between buyers and sellers. For example, a firm may have the option to purchase CERs or lCERs to meet its mitigation target up to term *x* and use the money saved (represented by the price difference between tCERs or lCERs and CERs – more valued for not being temporary) on definitive technological improvements, whose maturation process would not be feasible by term *x*. This would allow the same company to reduce emissions autonomously after term *x*. There would be time for the development of new technologies, and with a cheaper price of forest credit, there would be no trade-off between using resources to purchase a more expensive credit or investing in long-term research for a new technology.

BOX 2
Alternative approaches for the non-permanence of forest credits

For post-2012 negotiations, an agenda item was included on alternative approaches for the treatment of non-permanence of forest credits in A/R projects under the SBSTA. Proposals were submitted by different countries (UNFCCC, 2012b; 2013a; 2013b), but the discussion is also stagnant. Some suggestions mention approaches that have already been adopted in the voluntary carbon market, such as the use of insurance mechanisms and the creation of *buffers. Buffers* are usually a reserve consisting of part of the forest credits – not issued/sold in the market – attributable to a project, which can be used to cover the cases of losses in carbon stocks.. The proportions of this reserve vary according to the risk of loss of carbon stocks in each project (VCS, 2017).

One approach that seems to make sense is based on the contribution of Dr. Luiz Gylvan Meira Filho, fBrazilian negotiator who co-chaired the negotiating working group of the Kyoto Protocol (Meira Filho, 2016). In general, the approach is based on the natural decay time of the CO_2 in the atmosphere. According to the IPCC (2006), 47% of a certain amount of emitted CO_2 is naturally eliminated from the atmosphere in approximately thirty years and the remaining 53% is eliminated in hundreds and thousands of years. Thus, there may be room for a correlation between the duration of a reforestation activity and the permanence of its respective carbon credit. For example, while a certain reforested area reaches a longevity of 30 years, almost half of the credits generated in that area (47%) can be considered permanent, since during that period an equivalent amount of CO_2 will have already decayed, that its, will no longer be affecting the atmosphere.

Finally, another relevant aspect, defended by the author, may be consider as permanent the carbon stored in the roots of planted trees, in combination with other approaches for the other reservoirs of forest biomass. Very rarely, there is risk of root withdrawal, and even when the tree is harvested or destroyed, much of the carbon in its roots is fixed to the ground. Studies based on destructive samples may serve as the basis for the proportion of permanence factors. The literature indicates that the volume is significant, and may represent up to 27% of the total carbon stored in the live biomass of the trees (Scolforo, Oliveira and Acerbi Júnior, 2008; Brazil, 2016; IPCC, 2006).

Author's elaboration.

For sellers, forest credits represented an opportunity to stimulate mitigation and sustainable development actions associated with the land-use and forest sector. This sector often deals with structural factors that hinder access to capital, including long term investment maturity periods for reforestation or restoration.[17] However, a potential win-win relationship has not been fully exploited due to several supply-side barriers and, especially, demand-side barriers, which will be dealt with in the next sections, together with the possibilities for future use of the mechanism.

2.3 Contribution to sustainable development

It is important to recall that in addition to the mitigation objective (to help Annex 1 countries achieve their emission reduction targets), the CDM was also created with the objective of contributing to sustainable development in developing countries, according to Art. 12 of the Kyoto Protocol. The regulatory process of this double objective was quite asymmetric. The regulation of the mitigation objective is subordinated to a complex multilateral regulatory process by consensus, as shown in previous items. However, due to the difficulty of giving up national sovereignty to define what is a "contribution to sustainable development", the regulation of the second objective of the CDM was left to each country and was subject to the most diverse interpretations, with different levels of rigor (Cosbey et al., 2006; Olhoff et al., 2005; Olsen and Fenhann, 2006; UNDP, 2006).[18] According to Resolution No. 1 of the CIMGC (Brazil, 2003), Brazil has adopted the following criteria to evaluate the contribution of CDM projects to sustainable development:

- local environmental sustainability;
- development of work conditions and net job generation;
- income distribution;
- training and technological development; and
- regional integration and liaison with other countries.

17. As the CDM regulation makes no distinction about the purpose of the reforestation activity, within the scope of this chapter, the term "restoration" is used to characterize the *reforestation with the main objective of restoring the various types of conservation areas*. That is, the term falls within the CDM definition of reforestation, but is used only to denote a specific type of activity.

18. It is easier to understand this discrepancy in the light of the main objective of the Climate Convention: the stabilization of the GHG concentration in the atmosphere. The fact that a project does not generate other benefits besides emission reduction does not represent demerit per se, as long as its potential negative impacts are adequately addressed. It is very common to hear in multilateral negotiations that the CDM cannot be required to carry with it the obligation to solve other environmental or socioeconomic problems, despite the recognition that the solution of the problem involves the restructuring of a new economy.

The criteria apply to any type of project. However, it can be said that there is a relatively greater sensitivity regarding the contribution of A/R projects to sustainable development, since there is a direct relationship with the following themes: land aspects and rural development, deforestation processes and forest policies, biodiversity, water resources, etc. A simplified comparison between an A/R project and a project aimed only at burning industrial gases illustrates the difference in terms of impact on sustainable development, since the second case may not generate significant changes beyond the destruction of gas. Several authors confirm this perception in works that evaluate the potential contribution to the sustainable development of forestry projects in relation to other types of projects (Olsen and Fenhann, 2006; UNDP, 2006; Olhof et al., 2005; Cosbey et al., 2006). This can also be considered one of the aspects that differentiate the forest scope in relation to the other CDM projects.

3 THE BRAZILIAN EXPERIENCE: CONDITIONS AND IMPACTS

Due to the diverse specificities applicable to the forestry scope, an analysis of Brazil's experience is likely to be more relevant if it also deals with qualitative aspects, which go beyond the implicit quantitative impact – number of projects or quantities of GHG removals. This section addresses the Brazilian experience, based on a broader context and weighted by the main aspects that have conditioned the *demand* for forestry credits and the capacity to *supply* A/R projects.

3.1 The demand side

According to the UNFCCC[19] over 7.7 thousand CDM projects had been approved worldwide by June 2017. Out of these, only 66 projects, or less than 1% of the total, are forestry projects, three of which are Brazilian. Although forestry CDM, may include specificities that do not exist in other types of projects, e.g. area eligibility restrictions and non-permanence treatment, the complexity level of the other CDM scopes is also quite high. Such a significant difference in relation to other CDM projects (66 out of 7.7 thousand) does not seem to be attributable only to the marginal operational complexity of the forestry scope in relation to other types of projects.

One of the hypothesis that seems to make more sense to explain this discrepancy is related to the existence of barriers on the demand side for forestry credits. These barriers appear to be predominant in relation to barriers on the supply side, herein defined as those barriers to the operational capacity of the projects.

19. Data available at: www.cdm.unfccc.int by June 19th, 2017.

It is worth highlighting four major barriers on the demand side that have strongly restricted the role of forest CDM in Brazil and other countries.

The first came with the creation of the forest CDM. An overly strict limit was set for the use of forest credits (tCERs or lCERs) to meet Annex 1 countries' reduction targets under the Kyoto Protocol: 1% per year during each commitment period, i.e., in the first commitment period, from 2008 to 2012, the total limit would be restricted to 1% multiplied by five years.

The second, and certainly the most impacting, since these limits were not even reached, was the exclusion of the use of forestry credits in some domestic markets for carbon credits (cap and trade systems), especially in Europe. Forest credits were banned from the European Emissions Trading Scheme (EU-ETS),[20] which regulated emissions from private organizations and was linked to the CDM carbon market. Without the United States in the Kyoto Protocol, Europe was the main driver for CDM credits, followed by Japan and Canada (Kossoy et al., 2015). Therefore, forest credits were excluded from the largest source of demand, although some European governments used modest amounts of forest credits.

The third barrier is exogenous, unpredictable and only affected the market later: the general effects of the 2008 global economic crisis. Together with regulatory uncertainty over the post-2012 Kyoto Protocol negotiations, the crisis has impacted the carbon market, reducing overall demand (Niblock and Harrison, 2011; Harvey, 2012; Climate..., 2011). This effect, coupled with the modest targets of Annex 1 countries during the first commitment period (averaging 5.2% below 1990 levels), contributed to the plunge in CDM credit prices and other types of credits under the Kyoto Protocol (graph 4).

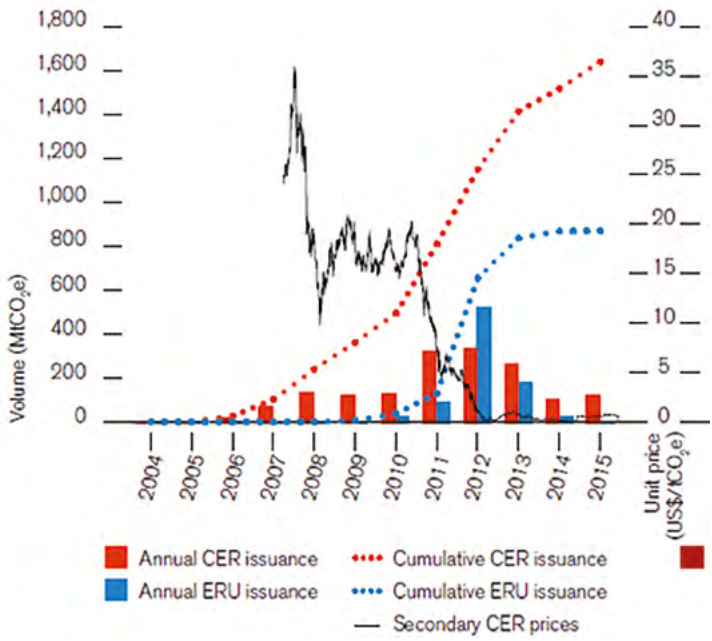
In the second commitment period of the Kyoto Protocol (2012-2020), Europe would still place a fourth barrier to the CDM, which would restrict the use of credits only to those generated in the least developed countries, hence excluding all emerging economies, like China, India, Brazil, South Africa and others. Even before this barrier, demand for credits had declined sharply, and prices were already low, falling from EUR10/CER to below EUR1/CER between 2010 and 2012.[21] The marginal contribution of this barrier to market collapse

20. European Union – Emissions Trading Scheme. Available at: https://bit.ly/2Myu5Dy. Although there are few formal justifications for such a restriction, the main arguments used in international negotiations are generally related to the timing of claims and who are responsible for the repayment of claims (governments, buying and selling companies).

21. Refer to the *secondary CER prices* curve in graph 4.

may be questionable, since the market was already falling. But its qualitative impact may have been significant, having conveyed a strong political message that, irrespective of market dynamics, Europe would not accept credits from emerging economies. It is a measure that structurally affects the formation of expectations by market players and incentives for mitigation in developing countries. There is also a certain "moral hazard," because entrepreneurs who backed investment decisions in multilateral rules agreed upon by all countries – including those that later banned credits from emerging countries and forest credits from their private systems – did not count on second thoughts on something that had already been agreed . If aspects such as these are not addressed in negotiations on future mechanisms, they may become aa relevant element of uncertainty and a discouraging factor.

GRAPH 4
Volumes issued and prices variation of CDM and JI projects



Source: World Bank, Ecofys e Vivid Economics (2016, p. 38).
Obs.: Figure displayed in low resolution and whose layout and texts could not be formatted and proofread due to the technical characteristics of the original files (Publisher's note).

To date, CDM credit supply has been at levels well above the regulatory demand determined by the modest Kyoto target (World Bank, Ecofys e Vivid Economics, 2016; Kossoy et al., 2015; Warnecke, Day e Tewari, 2015)[22] which, in turn, was further significantly decreased by the other barriers presented above. The term "over-supply" has been widely used. However, "sub-dmeand is likely to be the most appropriate term,, since the constraints seem to have come from the demand side. If this effect is highly impacting for CDM projects as a whole, the chances of a possible improvement in short-term demand for forest credits would be lower. For a recovery, there is a need for new sources of demand, which could come from more ambitious targets or an end to unilateral restrictions on forest credits. "Developed countries committed to reducing GHG emissions should stop banning CDM A/R project credits in their bilateral/multilateral emissions trading systems" (World Bank, 2011, p. 15).

In addition to the end of unilateral barriers, an alternative with a potential immediate effect on demand would be the explicit permission, by a formal decision of the Conference of the Parties of the UNFCCC or at the domestic level, by Brazil itself, that credits generated in the pre-2020 period be accepted for compliance in the post-2020 period. Under the Paris Agreement, the level of ambition for mitigation is substantially higher than it was in Kyoto, although it is more heterogeneous.

Another possibility, which could be developed as part of the regulation of the new market-based mechanism provided for in Art. 6.4 of the Agreement, is the creation of a system to absorb exogenous shocks, such as the effect of economic crises on the market, or even endogenous shocks, as potential errors in the allocation of emission quotas in carbon markets. The European Union, for example, has created a relevant system, namely the Market Stability Reserve (MSR), which will take effect from January 2019, to manage possible excesses in the amount of credits available in its cap and trade system.[23] A similar rationale could be applied to the CDM market or to its successor mechanism, interconnected or not with domestic carbon pricing schemes (see section 4).

22. Warnecke, Day and Tewari (2015) make an interesting analysis of the recovery potential of the market with prices at EUR2, EUR5 and above EUR5 / CER, indicating that for the band above EUR5 there could be a substantial chance of decreasing the deficit between demand and offer. The authors also highlight the role of the price crisis in the project's ability to generate credits, suggesting that current analyzes may be overestimating the potential for effective credit generation by 2020.

23. In general, the MSR allows for the creation of a credit reserve, which is supplied by credit withdrawals from the market, when it reaches a maximum level established by the regulator, and by the injection of credits in the market, when it reaches an established minimum level by the regulator. This dynamic, similar to that of a regulatory stock, enables price adjustments in the event of external shocks or possible internal failures. For more information on MSR, go to: https://goo.gl/i47waV.

Finally, there is also an initiative proposed by Brazil, already under implementation under the framework of the UNFCCC, which aims to promote the voluntary cancellation of credits generated in the CDM for several purposes, besides the fulfillment of official commitments – for example, offsetting of emissions of major events and economic activities in general. For now, the level of demand is still at very low levels to generate any immediate impact in prices on a significant scale. Nonetheless, the initiative has created a relevant official link between the multilateral CDM market and the voluntary market for emission reductions. It can open the door to innovative practices of private agents seeking multilateral legitimacy for their actions.

BOX 3
Forestry credits: different technical criteria or climate protectionism?

In World Trade Organization (WTO) negotiations, disputes between countries, regarding potentially protectionist practices, are very common. Commercial disputes often clash developed and developing countries. A classic example is the criticism posed by Brazil and other developing countries about restrictions on agricultural markets. On the other hand, developed countries often question restrictions on service markets or certain types of industrial policy in developing countries, even though developed countries have resorted to similar instruments in other times (Chang, 2003).

Practical and regulatory experience with the forestry CDM suggests that there may be a similar situation with regard to the multilateral regulation of carbon markets under the UNFCCC. The CDM's forestry scope has been subject to strong demand constraints, although: *i)* The Kyoto Protocol requires countries to account for the removals generated by reforestation, including for compliance with emission reduction commitments; and *ii)* the CDM has been approved by all countries. On the basis of the risk of "non-permanence" of forest credits and the difficulty of dealing with responsibility for the replacement of (temporary) credits, its use has already been restricted by a strict quota – 1% per year multiplied by the number of years in the commitment period. Even after the adoption of such a stringent multilateral regulation, some countries, especially in Europe, have banned forest credits from their domestic carbon markets (EU-ETS), which have been linked to the Kyoto Protocol Market.

Later in the regime's history, regulations for the inclusion of carbon capture and storage (CCS) activities in the CDM began, which may allow the generation of credits by injecting CO_2 into former oil reservoirs. Indeed, the referred carbon storage occurs through processes other than forest photosynthesis. Nonetheless, there is a risk of non-permanence, albeit in a different way. For the time being, there is no indication that such credits will be temporary or banned from other carbon trading systems. Although technically distinct processes, these measures represent, in some way, asymmetries to the treatment of different mitigation technologies. Coincidentally or not, the potential of using forestry practices as a tool for mitigation and sustainable development is much more relevant for developing countries, in light of their soil and climatic characteristics.

In fact, the biogenic nature of forest carbon demands additional precautions, considering several factors, including the risk of non-permanence. But these issues were dealt with in the regime, and there seem to be important alternatives. In this context, the extent to which differences in technical treatment do not result from a kind of "climate protectionism" to technologies and mitigation practices, which are more applicable to certain groups of countries, seems to deserve additional research efforts.

Author's elaboration.

3.2 The supply side

In general, the CDM has always been criticized for regulatory complexity and other aspects that go beyond this chapter.[24] As mentioned earlier, to a certain extent, it is normal for trade-offs to exist between the regulatory rigor, the scope, and the effectiveness of the mechanism. Much of the complexity is attributable to the need to ensure environmental integrity, i.e. the need for emissions reductions or removals to be real enough, so that they can be fungible with quantitative mitigation targets.

In fact, the logic of the mechanism is based on the attempt to "prove" *additionality* in relation to what would occur *in the absence of the project*. For the sake of logic, achieving the so-called "absolute certainty" about something that will occur in the future is not possible. There will always be room for discussion about how far regulatory rigor should go, especially regarding additionality. However, the fact that there are difficulties and scope for imperfections does not mean that relevant results cannot be achieved. Some authors, such as Trextler (2007), offer interesting perspectives for understanding this challenge and the usefulness of market-based mechanisms such as CDM.

> There is a well-understood axiom in the statistics that one cannot simultaneously minimize false positives and false negatives. However, false positives and false negatives can be handled in a manner that is conducive to the advancement of the main public policy objectives associated with the market (Trextler, 2007, p. 83).

In addition, the process of generating certified emission reductions is also known as a having a significant level of sophistication, which aims to ensure the accountability of the system as a whole. This is done through public consultations for each project, at local and global level, various independent audits, from the validation to verification phase, as well as several internal checks, within the CDM Executive Board and its various subsidiary bodies and panels.

The complexity of regulation is therefore a natural constraint on the ability to supply credit, provided there is a continuous improvement effort. There are specific challenges that have a direct impact on the CDM's forestry scope. One of the most structural aspects refers to the long-term nature of A/R projects compared to other types. Even in the case of using fast growing species under optimized edaphoclimatic conditions, such as the case of eucalyptus in Brazil, the first harvest takes approximately seven years, a short period for world standards, but a significant one for developing countries with less favorable financing conditions. In forest restoration activities, the maturity time is even longer, and may exceed twenty years.

24. Caney and Hepburnb (2011) make a counterpoint between criticism of ethics and the functioning of carbon markets. Repetto (2001) criticizes institutional complexity early in the mechanism.

The long-term nature that is inherent to forestry activity magnifies the CDM regulatory challenge for project developers, as it makes projects relatively more impacted by fluctuations in the carbon market, the difficulty in obtaining financing, and especially the risks of institutional and regulatory instability of a mechanism such as the CDM. For example, A/R projects that may have credit periods of twenty to sixty years have to cope with changes in rules and with the transition between broader frameworks, such as the process that will begin to occur in the transition from the Kyoto Protocol to the Paris Agreement, even if they had the right to generate credits in the long-term, as previously approved.[25]

The World Bank, via its BioCarbon Fund, commissioned what may be the most -comprehensive study on the experience of CDM forestry projects (World Bank, 2011). The analysis encompassed sixteen countries and almost one-third (21) of all 66 projects already registered. In addition to highlighting the demand-side barriers, especially the impacts of non-permanence treatment as a structural obstacle (discussed in the previous section), the study identified several barriers that have contributed to the underutilization of the mechanism. Some of the main obstacles raised in the study are highlighted and summarized below, with supplements applicable to Brazil, based on the author's practical experience.

- Land eligibility criteria: as explained in section 2, only those lands that did not contain forest fifty years ago or on December 31st, 1989 can be used for A/R projects. According to the study, many areas in developing countries were deforested in the 1990s, which limits the applicability of the forest CDM with direct impacts in Brazil (box 1).
- Difficulties in meeting project boundary criteria: even with advances in remote sensing techniques, project developers have difficulty meeting requirements for setting project boundaries. There is some regulatory flexibility, which allows project participants to demonstrate control over only two-thirds of the area at the beginning of the project. But the total limit of the project must be defined in the validation phase, which still results in a short period of time to find all of the required area.. This point may have been partially resolved by the program of activities (PoA) approach, in which specific areas can be incorporated over time. There are still few concrete cases to be asessed.
- Rigor in the accounting rules of carbon flows versus field reality: the operationalization of accounting rules and monitoring of carbon flows

25. The European Union, for example, mentioned in a position paper submitted recently in the negotiating process that the CDM should not continue beyond 2020, but that there should be significant discussions on transitional arrangements under Art. 6.4, while pointing out that concepts such as "additionality" and "environmental integrity" should be part of the key elements. For more information, access: https://bit.ly/2tEBBWq.

goes beyond the routine of forest operations. Even with the support of external consultants, it is not easy to implement. The study also points out difficulties in complying with specific rules to estimate the emissions of activity displacement of an A/R project (leakage). Finally, the lack of specific scientific data for developing countries often results in the suboptimization of a project´s mitigation potential. For example, in the absence of local data, projects should be based on factors of the Intergovernmental Panel on Climate Change (IPCC), which, by conservatism, end up representing lesser amounts of carbon stocks. In the case of Brazil, none of the three registered projects computes the potential gains from additional carbon stocks in pools such as soil or litter, which illustrates the challenge.

- Transaction and financing costs: the various barriers and elements of uncertainty associated with the forest scope make it the scope with higher transaction costs compared to the others (greater than USD1/ tCO_2e and according to the study). The difficulty in accessing adequate funding for the long-term reality of the forestry sector is also part of this context. Another aggravating factor is that the current CDM regulation allows only one verification and therefore a single issuance of credits during each commitment period (in the case of the Kyoto Protocol, the first was five years, from 2008 to 2012, and the second, from eight years, from 2012 to 2020). This restricts the ability to periodically generate revenue for a cash flow that is already heavily affected by the long term nature of the investment.
- Excessive rigor for framing small-scale cases: even under the special rules for small-scale cases, the study indicates that the maximum value (removals of 16,000 tCO_2e/year – UNFCCC, 2005a) is still too low to allow the engagement of smaller-scale producers. This aspect also seems to affect the specific potential in Brazil, since the current CIMGC rules for small-scale projects have determined a stricter maximum income criterion than the conditions defined in the National Program for Strengthening Family Farming (Pronaf) (Brazil, 2006). There are proposals to improve this criterion.[26]

In the same study (World Bank, 2011), there are a number of recommendations for adjustments to the mechanism in terms of regulation, financing, capacity building, and demand restraint. Suggestions include measures such as: standardization of baselines (which was later allowed) and consideration of broader national

26. Personal exchange with the Ministry of Science, Technology, Innovations and Communications, and the Ministry of the Environment in 2017.

and sectoral contexts to facilitate the demonstration of additionality, alternative approaches to the treatment of non-permanence to improve credit fungibility (in addition to the end of demand constraints by developed countries), monetization of the co-benefits of sustainable development as a means of improving access to financial resources, allowing more than one verification per commitment period, increasing the process of simplification and consolidation methodologies, promoting interfaces with other land use activities such as REDD+ and the agriculture sector, improving the capacity of DOEs and national organizations responsible for managing the mechanism at the domestic level (Nationally Designated Authority), improving communication with the Executive Board, etc.

In such a broad regulatory and political universe, it should be recognized that the system has also been able to improve itself in some significant aspects. These improvements can serve as a basis for a fair transition and a potential extension of the mechanism in the post-2020 context, marked by the Paris Agreement. In addition to the possibility of standardization of baselines, the process of consolidation and simplification of forest project methodologies deserves to be highlighted. The CDM Executive Board has succeeded in approving more than 15 A/R project methodologies, applicable to different realities around the world, and then consolidating them into four, two large-scale and two small-scale (UNFCCC, 2013c; 2013d; 2013e; 2013f). Another important aspect, and perhaps the one with the greatest impact, was the creation of the PoA system (UNFCCC, 2005d), analogous to an umbrella approach, in which each project component (in the case of forestry, different areas) can be incorporated in a single management structure and under specific methodologies, over time, with the possibility of sampling verification procedures. The logic of the PoA, although incipient in the forest scope, may represent a bridge in the transition from the CDM to the new mechanism, provided for in Art. 6.4 of the Paris Agreement, and to interface with wider instruments (section 4).

3.3 Impacts on Brazil

Brazil has generated significant amounts of emission reductions certified by the CDM during the first commitment period of the Kyoto Protocol (2008 to 2012). In all project scopes, more than 88.6 million tCO_2e have been reduced in this period, of which 4.2 million came from forestry projects (Brazil, 2014), or 4.8% of the total. Considering the various constraints of demand and the fact that only three projects have been registered in the country, this is a relevant value. It shows the mitigation potencial of A/R activities and also the potential for future use by Brazil as a forestry country.

It was from two forestry projects developed in Brazil that a good part of the main elements of the four forest methodologies currently in force in the CDM (UNFCCC, 2013c; 2013d; 2013e; 2013f) was generated. In the first case (The Plantar Project– box 4), the methodological elements associated to reforestation for multiple economic purposes were created and the first forest credits (tCERs) in the world were issued. The other case (AES Tietê – box 5) generated the methodological elements associated with reforestation activities for the restoration of of conservation areas (for example, permanent preservation or legal reserve areas). The third A/R project in Brazil was developed by Vale, already based on previous methodologies, with relevant mitigation potential in northern Brazil (Vale Florestar, 2012).[27]

In the cases of Plantar and AES Tietê, pioneers in reforestation and for production and restoration purposes, respectively, the development of projects was based on different levels of partnership with Carbon Funds managed by the World Bank, which were also innovative in the world. In addition to the development of methodologies by the diverse teams and the first contracts in the world for the transaction of official forest credits, the projects made possible the application of socio-environmental parameters, often more stringent than Brazilian regulations – for example, in the Plantar case, the FSC (Forest Stewarship Council) certification and, in the case of AES Tietê, the acceleration of the process of restoration of permanent preservation areas (APPs). That is, the monetization of carbon allowed the incorporation of other important variables for sustainable development, including the level of accountability of the activities.

Throughout the process, both projects were approved, despite numerous barriers and difficulties inherent to innovation at various levels (operational, management and multilateral regulation). In practice, both transactions also represented the overcoming of the demand constraints in the market, since the commercial conditions with the funds, including the price of the credit, were set at the beginning of the process.

In the case of Plantar, the arrangement with the World Bank allowed the company to be partially free of the CDM regulatory risk in the initial moments. Since the project was a pioneer in the country and the CDM rules were developed in parallel to its implementation, the funds managed by the bank would honor the commercial commitment to purchase the credits even if they were not approved by the UNFCCC. The guarantee against regulatory risk, beyond the control of the project managers, has generated sufficient confidence in the developers to create and maintain a long-term commitment.

27. This project is under a process of change of control, which is why it was not included in the analysis.

The operation with the World Bank also created an innovative institutional arrangement in the world financial market: the securitization of receivables, based on carbon trading. This operation made it possible to anticipate future revenue from credits, the main part of which would only be generated after seven years (harvest of the first plantations). Rabobank, a Dutch financial institution, anticipated, through a loan agreement, the proceeds that would be generated from the sale of the credits, and accepted the contract with the World Bank as part of the collaterals of the operation. As a result, credit risk was also associated with the World Bank-managed fund and not only with Plantar (a family-owned company). As a result, the financial spread has decreased, being a decisive factor to enable lower interest rates.

BOX 4
The case of the Plantar Group

The Plantar Group's CDM projects were pioneer in the country and began to be implemented in 2000 in partnership with the World Bank Carbon Prototype Fund. The initiative illustrates an example of vertical synergy along the forest production chain, with three mitigation drivers: *i)* generation of net removals or additional carbon stocks through reforestation of non-forested areas (Plantar, 2009); *ii)* reduction of methane (CH_4) emissions in the charcoal production process (Plantar, 2007); and *iii)* emission reductions in blast furnaces with the additional use of renewable charcoal instead of coal coke (Plantar, 2016, Sampaio et al 1999). Approximately 23,000 hectares of planted forests (eucalyptus) have been established, capable of supplying renewable charcoal for the annual production of approximately 240,000 tons of pig iron. The project also includes the conservation of approximately 9,000 hectares of native vegetation, through permanent preservation areas (APPs) and legal reserves associated with plantations. The carbon stocks in these areas are not part of the project's generation of credits. Through the CDM, the company became the first in its industry to base all of its pig iron production on renewable charcoal.

The projects were created on an integrated basis, but due to the evolution of the CDM regulatory framework, they had to be split into three – one for each mitigation activity. One of the important elements of this separation was precisely the differentiation of forest credits – attributable to the reforestation activities of the project – whose modalities and procedures were only ready at COP 9 in Milan, 2003. Over ten years, the project team developed three methodologies approved by the UNFCCC - methodologies A/R AM0005, AM0041 and AM0082 - which allowed for the incorporation of the three abovementioned mitigation vectors into the CDM..

Despite several barriers and elements of complexity, there was significant technological progress, which resulted from the project. For example, due to the possibility of generating carbon credits, the company developed customized research for the improvement of renewable charcoal production technology. The result of the work established, for the first time in the world, a negative correlation between methane emissions and the gravimetric yield of the carbonization process. Through process control, especially of temperature and new furnaces, it was possible to develop a method to reduce emissions. In addition to being transformed into a globally applicable methodology, there were important impacts for the elaboration and diffusion of public policies associated with charcoal in Brazil (see section 4 for an example: sustainable iron & steel program).

The project also generated a pioneering financial arrangement in the world, through the securitization of receivables backed by carbon credits, in partnership with Rabobank. Under the CDM and the partnership with the World Bank, a number of sustainable development criteria have been incorporated into production, anchored in the bank's safeguards and in the a globally recognized forest certification systems, consisting of hundreds of civil society organizations (FSCs). It was also the first case of forest certification in the independent pig iron sector. These criteria include: identification and monitoring of fauna and flora to conserve and increase local biodiversity; implementation of native forest ecological corridors between eucalyptus plantations, monitoring of physical, chemical and biological aspects of water resources; and social variables, in order to improve local impacts and interaction with communities. In fact, Plantar is, until today, the only company in the independent pig iron producer in Brazil and in the world that counts on this certification. Although not a requirement of the CDM, it was enabled by the mechanism, as it was incorporated into the arrangement with the World Bank.

There is good potential for replication in Brazil and the world, not only in terms of mitigation, but also in terms of sustainability criteria. In general, despite the advanced Brazilian forestry technology, the use of renewable charcoal is more complex than fossil-based alternatives, which increases the importance of monetary recognition for the climate benefit.

After 28 years, the projects are expected to contribute to reducing the GHG concentration in the atmosphere by approximately 12.8 million tCO_2e. By 2017, approximately 5 million credits related to removals in the forestry component and to emission reductions in the blast furnace had already been successfully generated.

Author's elaboration.

In the case of AES Tietê, an Emission Reduction Purchase Agreement was signed with the World Bank Fund, providing for the purchase of carbon credits as a consequence of the first verification carried out by the DOE, which was partially subsidized by the bank. The value of each tCER was kept even after a revision of the Project Design Document had to be conducted as part of the monitoring process under thefirst verification period. The costs of this process were originally borne by the bank. At the time of the settlement of the tCERs, the values referring to the issuance fees, charged by the UNFCCC, as well as the costs with the DOE were discounted.

One of the highlights of the project was the dissemination of scientific knowledge. Due to pioneer generation or carbon credits, through forest restoration with a high variety of species, the project mobilized researchers internally and externally. Different academic organizations have been involved, with the purpose of subsidizing the process of generation, monitoring and verification of net GHG removals.[28] The AES Tietê case also illustrated the potential for synergies between the CDM and legal provisions, since the mechanism served as an instrument to facilitate and accelerate the implementation of legislation applicable to the restoration of PPAs at the time.[29]

28. Personal communication with AES Tietê (2017).

29. See Manfrinato et al. (2005) for further discussion on the CDM interface, including additionality criteria, with legal instruments related to Permanent Preservation Areas and legal reserve areas. The discussion may also be applicable to the current context, under the new Brazilian Forest Code, which already provides for the possibility of using market-based mechanisms. Section 4 of this chapter explores the basis for an expanded CDM potential in the future, considering several aspects.

BOX 5
The AES Tietê case

The AES Tietê project aims at restoring, via reforestation, some 5.6 mil hectares of Permanent Preservation Areas, distributed along the banks of ten hydroelectric reservoirs located in the Tietê, Grande and Pardo rivers in the states of São Paulo and Minas Gerais. It is also a pioneer effort in the CDM, especially in relation to the use of native species to recover and accelerate the rate of reforestation of Permanent Preservation Areas.

Project implementation began in 2004. In twenty years, the project is expected to restore riparian forests similar to the previously existing native forests along the riverbanks of the regions, removing approximately 4 million tons of CO_2 from the atmosphere. The project includes the planting of 11 million seedlings of over 80 different species, treated in the company's seed bank. By the end of 2016, over 2,000 hectares had already been reforested under the CDM and approximately 167,000 tCERs issued and transacted with the World Bank's BioCarbon Fund.

In addition to the generation of net CO_2 removals, the project created biodiversity corridors to interconnect remaining habitat areas of the original fauna. Another possible additional benefit is the reduction of the risks of silting rivers and subsequent loading of toxic substances into the waters. The project was also developed in an integrated way to the company's strategy to mitigate the risks of irregular occupations of reservoir banks areas, and generated new parameters of interaction with local riverside communities.

As in the case of the Plantar Group, AES Tietê also had to develop an A/R methodology applicable to the case (AR/AM 0010), generating an innovative regulatory base. The potential for replication in Brazil is significant. In addition to the possibility of adding value to an already renewable energy source, such as hydroelectricity, AES Tietê has opened up the possibility of using the CDM for the recovery of Permanent Preservation Areas and legal reserve areas in several production chains. All this becomes even more relevant in the current context of implementation of the new Forest Code and the Brazilian NDC.

Author's elaboration, based on AES Tietê (2009) and AES Tietê (2012).

In practical terms, these innovative Brazilian initiatives contributed for pricing the climate variable in the forest scope,for the first time, , under the global legitimacy of the UNFCCC multilateral system, a central element for fair solutions to a major collective action problem such as climate change (see Ostrom, 1990).

Although an in-depth analysis of the performance of each project goes beyond the scope of this work, it can be said that in both cases the experience was broader than the technical aspects of the creation of methodologies and regulation of forest carbon credits. New parameters were generated for the interface with global funds, under the seal of international organizations, as well as new economic, financial and contractual arrangements, and the incorporation of other socio-environmental variables in the production process.

Even in the context of strong restrictions on the demand side, the cases illustrate the main legacy of the forest CDM in Brazil: the *lato sensu* institutional development (methodological, technological, economic and diverse co-benefits) capable of generating incentives for cooperation in mitigation actions, as well as for the internalization of the carbon value in forest investment decisions, despite all the complexity involved (North, 1990; Laffont and Martmort, 2002).

4 BASIS FOR AN ENCHANCED POTENTIAL

Since the adoption of the Paris Agreement in 2015, the multilateral climate change regime has been going through a transitional period that tends to have profound implications at the international and national levels and, of course, for the CDM.

One of the most relevant aspects was the change in the rationale of national mitigation commitments. Unlike the Kyoto Protocol, where a common metric – a percentage of specific emissions reduction in relation to the base year 1990 – was established in the text of the agreement for each Annex 1 country – top-down approach – the Paris Agreement was based on a bottom-up rationale, in which all countries committed themselves to establishing their own commitment through Nationally Determined Contributions (NDCs). This opens up scope for greater heterogeneity and therefore for more flexible interaction between the Paris Agreement regulation and the various national mitigation policies/instruments.

In this context, it is possible to identify three structural elements that seem to strongly influence the potential for future use of the forest CDM experience in Brazil and even in other countries: *i)* the interface with carbon pricing instruments, whether through the transition to a new mechanism in the Paris Agreement, or the relationship with national systems; *ii)* interface with national policies and other instruments; and *iii)* the interface with other sustainable development topics.

4.1 Interface with new carbon pricing instruments

The Paris Agreement provides for the creation of a new market mechanism under Art. 6.4, which may assist in the implementation of NDCs. It was determined that existing mechanisms should be taken as the basis – defined by the CDM. The Brazilian delegation has called this new mechanism Sustainable Development Mechanism (SDM). In the transition from the CDM to the SDM, there may be scope to address the constraining factors of the forest CDM, at the level of supply/operationalization of the mechanism, and especially at the level of demand, which has been strongly influenced by political factors, as explored in the previous section. Outside the scope of the Paris Agreement, but still at the multilateral level, the recently approved market mechanism for the civil aviation sector provides for the possibility of using the CDM.[30] Depending on further regulations, this could generate some type of demand.

30. Carbon Offsetting and Reduction Scheme for International Aviation (Corsia) within the framework of the Inter-American Civil Aviation Organization.

In this context, several countries are already developing or studying – in the case of Brazil – domestic carbon pricing systems, which include carbon markets (cap and trade schemes)and/or carbon taxation.[31] The methodological and institutional experience of the CDM can contribute through the following possibilities:

1) The direct incorporation of net removals in an eventual national carbon pricing system. In the case of a direct link between the generation of removals and the regulated sectors, the removals can be recorded in the net balance – emissions minus removals – of the participating organizations.

2) The indirect incorporation, since net removals, generated by reforestation and restoration activities outside the scope eventually covered by the pricing system, can also be treated as offsets – fungible credits with system units, which could be used to offset emissions of its participants.

In addition to providing several institutional elements for a potential Brazilian carbon pricing system, the transition from the CDM to the SDM can also be an opportunity for direct or indirect interconnections between the various pricing systems in other countries, under the multilateral legitimacy of the United Nations (UN).

Today, domestic pricing systems already cover nearly 25% of global emissions if considered developing systems in China (World Bank, Ecofys and Vivid Economics, 2016). Each domestic system can have different characteristics. But because the SDM will have multilaterally accepted rules and can be interconnected to domestic systems, depending on the interest of each country, the mechanism could also represent a global link, albeit partial or indirect. A very recent example of this possibility is the new carbon tax decree in Colombia, which allows for the use of CDM credits to meet tax obligations (Colombia, 2017). In China and South Africa, there are ongoing experiences using the CDM experience in carbon pricing systems, including forestry sector (South Africa, 2016; Hamrick and Gallant, 2017).

31. In general, in the case of taxation, the government determines the price of carbon – the value of the tax – and the volume of emission reductions results from the dynamics of regulated organizations. In cap and trade systems, the government determines the amount of emission reduction through an emissions cap, and price is determined by market dynamics (Goulder and Schein, 2013; Icap and PMR, 2016).

4.2 Interface with mitigation instruments and policies

It is common knowledge that there is no single instrument capable of solving the problem of climate change, probably the greatest problem demanding collective action ever faced by mankind. While the CDM represents a significant incentive to reduce emissions, via carbon pricing, there are also natural limitations, in addition to complexity. The literature indicates that the integration of pricing instruments with public policies and broader instruments is a determining factor for the greater mitigation potentials (Prahl, [s.d.]; Mehling et al., 2013; Cecilia2050, 2015; Boasson and Wettestad, 2013).

While the CDM market operated more vigorously in the world and in Brazil until 2011,[32] there have been important cases for which the mechanism contributed to the achievement of national policies. A good example was the consideration of the CDM as one of the instruments for implementing the program to promote alternative sources in the Brazilian electricity sector (Proinfa: Incentive Program for Alternative Energy Sources) and the new electric sector model created in 2004 (Hauser and Medeiros, 2010). Hauser et al. (2015) indicate that the mechanism contributed to a substantial share of the emissions reductions generated in the sector and also to the country's voluntary commitments in the pre-2020 period in the context of nationally appropriate mitigation actions[33] (NAMAs, under the framework of the Copenhagen Accord).

In the forestry sector, despite the methodological evolution and pioneer cases of CDM projects, the same government effort to integrate with public policies was not observed. There is an attempt in the state of Minas Gerais, where the CDM was explicitly integrated with the state's new forest law, but there were still no signs of successful implementation.[34] In fact, Brazil did not develop a cross-cutting policy to promote the use of the mechanism as a mitigation instrument, despite the existence of relatively successful experiences, as in the case of the power sector, and to have created good technical and regulatory capacity through the CIMGC.

However, the Brazilian NDC has been incorporated into national legislation and represents a significant opportunity, as it relies heavily on several mitigation actions, directly and indirectly linked to the forestry sector, including restoration and reforestation activities eligible for the CDM (box 6). It is worth remembering that activities related to land use, including agriculture and forests, represent the main source of net emissions in Brazil (Brazil, 2016a).

32. See an abrupt fall in prices between 2010 and 2012 in graph 4.

33. *Nationally appropriate mitigation actions*.

34. In 2009, local stakeholders from the forestry and steel sector, together with the World Bank, developed a preliminary assessment of a possible CDM program of activities, but the initiative was not implemented, most likely due to the price crisis.

BOX 6
Activities provided for by the Brazilian NDC related to the forestry base[35]

Group 1: mitigation activities mentioned in the Brazilian NDC with direct relation to the generation of net GHG removals through the forest sector:

I) strengthen compliance with the Forest Code at the federal, state and municipal levels;

II) strengthen policies and measures aimed at achieving zero illegal deforestation by 2030 in the Brazilian Amazon and offsetting GHG emissions from legal suppression of vegetation by 2030;

III) restore and reforest 12 million hectares of forest by 2030 for multiple uses;

IV) scale up sustainable forest management systems through georeferencing and traceability systems applicable to native forest management, in order to discourage illegal and unsustainable practices; and

V) In the agricultural sector, strengthen the Low-Carbon Agriculture Plan (ABC Plan) as the main strategy for sustainable development in agriculture, including through the additional restoration of 15 million hectares of pasture degraded by 2030 and 5 million hectares of crop-livestock-forest integration (iLPF) systems by 2030.

Group 2: mitigation activities mentioned in the Brazilian NDC that may be directly related to the generation of GHG emission reductions through the forest sector – for example, use of forest biomass and second-generation biofuels:

VI) to increase the share of sustainable bioenergy in the Brazilian energy mix by approximately 18% by 2030, expanding the consumption of biofuels, increasing the supply of ethanol, including by increasing the share of advanced biofuels (second generation), and increasing the contents of biodiesel in the diesel blend;

VII) in the energy sector, to achieve an estimated 45% share of renewable energy in the energy mix by 2030, including:

- to expand the use of renewable sources, in addition to hydropower, in the total energy mix for a 28 to 33% share by 2030; and
- to expand domestic use of non-fossil energy sources, increasing the share of renewable energy (in addition to hydropower) in the supply of electricity to at least 23% by 2030, including increasing wind, biomass and solar energy.

VIII) in the industrial sector, promote new clean technology standards and expand measures of energy efficiency and low-carbon infrastructure.

Source: Brazil, ([s.d.]).
Author's elaboration.

Given that CDM regulations have allowed the mechanism to be used as a means of implementing policies and legislation, it is natural to assume that this principle would continue to apply to new mechanisms. [36] Thus, when considering: *i)* the role of removals in Brazilian NDC; *ii)* the diversity of policies in the areas of reforestation and restoration; *iii)* the demand for significant resources to implement

35. Indicative activities. Division in groups made at the discretion of the author.

36. In the CDM, the E+ and E-policy regulations made it possible to exclude mitigation policies and measures from the baseline, in order to prevent the CDM from being applicable to emission reduction projects within the scope of their respective policies (regulation of the 22nd Meeting of the CDM Executive Board). Hauser and Medeiros (2010) make a more complete analysis of these regulations. Manfrinato et al. (2005) assess similar situation related to the interface with legal instruments.

them;[37] and *iv)* the urgent need for coordination among these policies, the use of the CDM forest experience and the use of a new mechanism emerge as a relevant means of implementation for the country's full mitigation potential. This is an opportunity that goes well beyond the use of the framework for the measurement, reporting and verification of emissions reduction already included in the CDM methodologies.[38]

In addition to the implementation of the new Forest Code, including the recovery of legal reserve areas and Permanent Preservation Areas through Environmental Regularization Programs[39] and possible synergy with the mechanisms provided for by the Code (especially environmental reserve quotas), there are other important policies that can be optimized through synergies with the mechanism – for example, the National Policy on Planted Forests (PNFP), the Low-Carbon Agriculture Plan (ABC Plan) and the National Plan for the Recovery of Native Vegetation (Planaveg). Even national efforts to combat deforestation (Plan of Action for the Prevention and Control of Deforestation in the Legal Amazon – PPCDAm and Plan of Action for the Prevention and Control of Deforestation and Burnings in the Cerrado – PPCERRADO)[40] can be taken into account. Although they address other types of forest mitigation activity (avoiding deforestation), they also mention the need to create additional wood stocks to reduce pressure on native forests. In this regard, there seems to be good potential for synergies with the National REDD+ Strategy. A clear opportunity is the creation of a reference level (analogous to a baseline in the CDM) for increasing forest carbon stocks under the REDD+ system. This could provide the basis for raising funds for restoration and reforestation activities, at the aggregate level and through results-based payments, even if they do not involve offset markets.

Figure 1 illustrates in a simplified way the design of the main plans, policies and regulatory elements, at national and international level, whose synergy potential can be better utilized, considering the transversal synergies with a market-based mechanism such as the CDM or its successor.[41]

37. One of the studies on the cost of implementing actions related to forest recovery indicates costs that could get to R$ 52 billion (Kishinami and Watanabe Júnior, 2016).

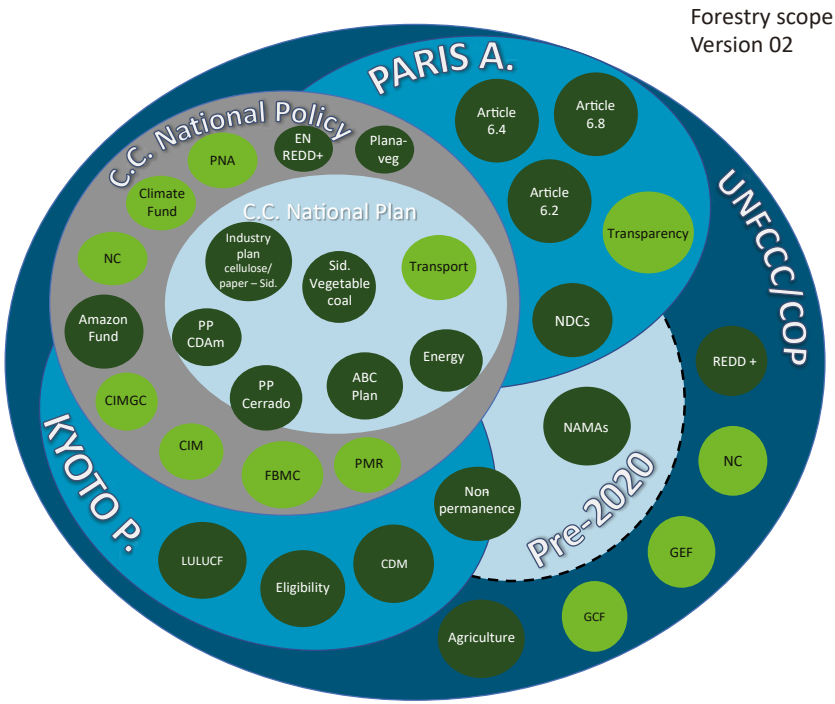
38. Naturally, credits generated by the use of the CDM or the future SDM should be accounted only once. A CDM or SDM project can be carried out in the country, but if the respective credits are sold, the accounting of emission reductions should be carried out only by the agent or country that has acquired the credits, which should not be confused with double counting.

39. The national legislation, through the new Forest Code (Law no. 12.651, of May 25, 2012) already provides for the use of market-based mechanisms, under the terms of Para. 4, of Art. 41: "The maintenance activities of the Permanent Preservation Areas, Legal Reserve and restricted use areas are eligible for any payments or incentives for environmental services, configuring additionality for national and international markets for certified greenhouse gas emission reductions" (Brazil, 2012). This provision is consistent with the use of the CDM or the substitute mechanism.

40. National Plans to fight Deforestation in the Amazon and Cerrado regions (Brazil, 2016b).

41. In addition to the government tools cited in this version of Figure 1, there are a number of civil society governance initiatives in which there is also potential for synergies – for example, corporate reports from the Carbon Disclosure Project (CDP), ISO 14.064 and GHG Protocol, and in some cases voluntary markets, such as the Verified Carbon Standard (VCS).

FIGURE 1
Climate change governance: government policies and instruments[42]



Source: Plantar Carbon.
Preparation: Fábio Marques and Rodrigo Ferreira.

The interface with the previously mentioned policies also represents the potential for *horizontal synergies* between two types of reforestation activities contemplated by the CDM, that is, for economic and restoration purposes. If there is greater demand, these synergies can be explored in scale, for example through the umbrella structure of the program of activities, as explained in section 3.2. In addition, there is the potential for *vertical synergies* between projects along production chains that can generate emission reductions through the use of renewable forest biomass instead of fossil or non-renewable energy products and sources.[43] The Brazilian NDC contemplates several measures in this area.[44] There

42. See in appendix A all the acronyms used in figure 1.
43. In terms of carbon accounting, the two types of climate benefits generated by removals from increased carbon stocks and by emissions reductions generated by the use of forest biomass should be computed separately, according to the rules applicable respectively to the sector of land-use change and forests and the industrial and energy process sectors.
44. See Group 2 activity in box 6.

are also a number of activities, not mentioned explicitly in the NDC, which can be encouraged by the mechanism, in coordination with industrial, energy and transport policies, as described below.

- Examples of activities that are not fully disseminated, but technologically handled: more advanced wood carbonization technologies – conversion of wood to charcoal – which reduce CH_4 emissions; replacement of diesel oil by forest biomass in boilers; technologies for the use of carbonization gases and blast furnace gases for energy cogeneration;[45] independent thermoelectric generation through forest biomass; use of various wood products, including those based on pulp and paper; and use of treated wood in civil and rural construction instead of fossil or non-renewable wood inputs, etc.
- Examples of activities still under technological development: the recovery and use of lignin from pulp production processes; cellulosic ethanol; the best use of black liquor from the industrial processing of wood and the production of bio-oil; and the recovery and refining of the tar from the carbonization process to replace petroleum derivatives, plastics and resins etc.

The design of projects or policies that address removals and emissions reductions by the use of wood and its byproducts throughout production chains may enable several benefits, such as: substantial gains in scale, the development and diffusion of new technologies and improvements in the distribution of value attributable to mitigation along the supply chain. This approach may be especially relevant now that the government has announced the revision of the governance structure related to climate change.

Some policies and initiatives under development indicate that there is room for the best use of vertical synergies. A good example is the Sustainable Iron & Steel Program, implemented by the Federal Government[46] and by the United Nations Development Program (UNDP), based on resources from the Global Environment Facility (GEF), with the support of the Minas Gerais State government. The program aims at promoting alternatives for low-carbon development in the national iron & steel industry, especially in the process of producing charcoal, through payments for mitigation results attributable to corporate investments. The CDM methodological basis has been used as

45. See the Plantar Case (box 6) for an example of vertical synergies and technological development.

46. Technical coordination of the Ministry of the Environment with the Ministry of Industry, Foreign Trade, and Services and the Ministry of Science, Technology, Innovations and Communications. For more information, go to: https://bit.ly/2yXydLw.

a reference for structuring the monitoring process. Another example is the potential for the use of forest biomass as a source of thermoelectric generation. These activities are already included in the Ten-Year Energy Expansion Plan of Brazil (2024), but could be better explored through the energy auctions criteria. There is also the possibility of promoting reforestation activities, in synergy with the potential of hydroelectric generation, as the wood biomass could be treated as a backup for the activation of thermal plants in periods of droughts (Penido e Azevedo, 2016).

It is also important to highlight the interfacing potential with diverse financial instruments, as a cross-cutting measure. In addition to the creation of specific funds related to the financing of mitigation activities – for example, the Climate Fund (Ministry of the Environment/National Bank for Economic and Social Development) – there is a possibility of combining the certified emission reductions (CERs) with other financing mechanisms. The recent green bond market, which reached $118 billion in 2016, is a good example (Climate Bonds Initiative, 2016). One possibility would be to link the remuneration of the security to the issuance of CERs or future units (credits) under Art. 6.4. Various forms can be studied – for example, the progressive reduction of spreads associated with the generation of credits, call options and even the distribution of part of the credits or the respective income to the holders of the securities. The same logic can be applied to the traditional debt market – for example, by gradually reducing interest rates vis-à-vis the generation of CERs. All of these possibilities, which need to be further analyzed, could enable the combination of incentives for mitigation, linking finance to the monetary value of a carbon asset.

It should be emphasized that the interface with broader financial policies and instruments could also help overcome some of the barriers affecting the supply and demand side. An example of a relevant solution on the demand side is the Pilot Auction Facility (PAF), recently developed by the World Bank. Under the PAF, CDM project developers have the possibility to guarantee a minimum price for their CERs, through a *put options system*. Project developers pay a premium to have the right to sell a specific amount of credits in the future, at a predetermined price regardless of the market price in the future. The PAF still does not address F/R projects, but the same logic could be used in the design of similar programs in Brazil.

At last, in view of the strong connection between the topic and the international context – considering regulatory, cooperation and funding perspectives –, the coordination between the elements of domestic policy and

the formulation of foreign policy is a crucial factor for optimized results and for overcoming supply and demand side barriers. A permanent internal consultation mechanism could facilitate, given the technical complexity of the subject and the need for in-depth sectoral knowledge. There also appears to be room for South-South cooperation, based on balanced incentives for both suppliers and users of technologies. It should be recalled that despite the various internal barriers, the country has the most advanced forestry technology. And on the other hand: *i)* more than 2 billion people on the planet still depend on forest biomass as a source of energy (FAO, 2017); *ii)* there is a theoretical demand for the establishment of an additional 250 million additional hectares of forest stocks (WWF, 2012); and *iii)* most NDCs depend on the land-use and forest sectors, especially in developing countries (Canaveira, 2015).

4.3 THE INTERFACE WITH OTHER SUSTAINABLE DEVELOPMENT TOPICS

Some studies suggest that the potential contribution of CDM projects to the second objective of the mechanism – promotion of sustainable development – is significantly conditioned to additional incentives or to the creation of supplementary institutions (Marques, 2007, Cossen et al., 2006, Olsen, 2005). Such incentives can be provided by the State through better coordination with broader public policies, which may include the NDC, as mentioned above, and also address policies on other issues – for example in the areas of biodiversity and water resources. However, if the coordination between a market-based mechanism and mitigation policies within aNDC is not straightforward, as illustrated in the previous item, the challenges and transaction costs associated with possible co-ordination with other sustainable development topics seem to be even deeper. While there are desirable synergies, there may be trade-offs between the mechanism's efficiency as a mitigation tool and coordination with other areas.

It is possible to generate incentives through the market and civil society actions, by legitimazing practices that differentiate projects, in addition to government regulations. As an example, one can mention the adoption of forest certification processes, observed in some cases of CDM projects in Brazil, or sustainability seals with a high degree of market acceptance, which could generate a premium price for the respective forest carbon credits. Under the CDM, a number of voluntary initiatives have been implemented for this purpose, and continue to face the challenge of combining additional benefits, emissions reduction and good pricing.[47]

47. Some examples: Gold Standard, Climate Community and Biodiversity Alliance (CCBA), Community Development Carbon Fund (CDFC).

By making a conceptual relationship between these experiences and the future, the reference to a *sustainable development mechanism* is a clue *per se*. Given the embryonic state of regulations, any conclusive analysis is premature. There are indications from the past that supplementary institutions, in addition to carbon pricing, are in fact necessary for a greater contribution of projects to sustainable development.

5 FINAL CONSIDERATIONS

The CDM is a market-based mechanism, and as such, it is important to bear in mind that it represents an attempt to internalize a new variable in economic activities at the micro level (project), based on classic principles of Environmental Economics (Coase, 1960; Kahn, 2005). This is intrinsically complex from the technical and political point of view, particularly for the need for multilateral consensus.

There are additional complexity layers in the forest scope, shown by various aspects of the current regulation. The challenge of the fungibility of forest credits in the carbon market, which is determined by addressing the issue of non-permanence, and the need to improve eligibility criteria of areas illustrate two central aspects. Regulatory complexity is of course one of the elements that contributes to the low number of F/R projects in the world and in Brazil. The constraints on the demand side, however, seem to have played a more significant role. Even with all the complexity, what would be the performance of the forest CDM in Brazil and in other countries if it were not for the exclusion of forest credits of the largest demand markets?

The answer to this question goes beyond the scope of this chapter. But Brazil's forest potential and the volume of transactions generated in other types of projects suggest that there may be a much greater potential. Two of the three projects approved in Brazil managed to overcome the demand barrier (credit sales). Substantial results have been generated in terms of mitigation and sustainable development. Depending on the level of innovation of the mechanism and, above all, on constraints on the demand side, the analysis of the role of the forest CDM in the country, and probably in the world, cannot be made only in terms of the number of projects or the volume of removals achieved.

In this context, it is possible to support the argument that the main legacy of the mechanism in Brazil was institutional. A central and positive element of this legacy was the creation of methodologies in the country and approval at the multilateral level, which made it possible, for the first time, to internalize the climate variable in the economic routine of reforestation and restoration activities. They also generated monitoring , reporting and verification parameters for GHG removals, as well as *accountability* in a broader sense. Such benchmarks

can be simplified and leveraged to build public and organizational policies – for example, criteria for domestic carbon pricing systems and compliance with the NDC. Two other important elements of the institutional legacy were the creation of new contractual arrangements, both technological and financial, essential for the viability of a new low-carbon economy, and, finally, the internalization, via carbon, of other sustainable development parameters.

Despite all the challenges, over 192 countries reached a set of methods that are globally applicable by any organization as a mitigation tool. Brazil was successful in leading the inclusion of two of its main forestry activities in the process: reforestation and restoration.

It is precisely the recognition of the inherent constraints of the mechanism and its imperfections that allows an analysis, although preliminary, of its future potential. Perhaps because it was the first multilateral carbon pricing mechanism, there has been an over-expectation on its role in fighting climate change, even if it was created "only" to give flexibility or cost-effectiveness to mitigation efforts by Annex 1 countries, and with a generic reference to the promotion of sustainable development. The literature presents studies that indicate that carbon pricing cannot be seen as the only mitigation measure and that its intended effects require articulation with broader policies. Given the complexity of the forestry sector, the application of this comprehensive rationale to market-based mechanisms seems to be even more necessary, since it enables synergies between the public and private sector. The experience of the CDM in the country is a relevant reference in this regard.

Thus, the potential to use the forestry CDM in Brazil in the future may be significant, but tends to be conditioned by several factors, among which the transition to the new market-based mechanism in the Paris Agreement and the possible interface with a domestic carbon pricing system. Both could represent the overcoming of supply and demand side barriers. Nonetheless, if some form of transition succeeds, such a potential seems to be strongly related to Brazil's ability to promote proactive coordination, with broader mitigation policies and instruments, taking into account vertical and horizontal synergies. Cross-cutting coordination could effectively convert the capillarity provided by the institutional legacy of the mechanism – a bottom-up approach through scalable projects and programs – into means of implementation of mitigation and sustainable development policies.

The cross-cutting nature of the forest sector is such and its role in the Brazilian NDC is so relevant, that it is necessary to think of a specific plan for this area, conducive to the coordination of interdisciplinary actions and the promotion of vertical and horizontal synergies. This integrated approach could create the basis for a virtuous cycle where the broader public policy framework could facilitate the overcoming of transaction costs, inherent to the mechanism, and generate additional incentives for

entrepreneurs through a marginal and marked-based revenue source, in order to achieve public objectives. This is especially applicable to Brazil, as a country with major public spending restrictions, which often jeopardizes nationally determined objectives. The task is not simple. But since there is no single policy instrument capable of providing the ultimate solution for climate change on its own, it would be a huge waste not to take advantage of a significant legacy derived from the leadership of Brazilian society in building the only multilateral market-based mechanism since 1992.

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ANNEX A

SPECIFIC CDM DEFINITIONS FOR THE FOREST SCOPE

Approaches to baseline definition: in selecting a baseline methodology for a project for afforestation or reforestation under the Clean Development Mechanism (CDM), project participants should select, among the following approaches, the one considered more appropriate to the project activity, taking into account any guidance from the Executive Board and justifying their choice:

- Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project;
- Changes in carbon stocks in the carbon pools within the project boundary from a land use that represents an economically attractive course of action, taking into account barriers to investment; and
- Changes in carbon stocks in the pools within the project boundary from the most likely land use at the time the project starts (UNFCCC, 2003, p. 22, with our highlights).

Additionality: an A/R CDM project activity or A/R CPA will be additional if actual net GHG removals increase above the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the A/R CDM project activity or A/R CPA (UNFCCC, 2003, p. 11).

Forest: A minimum area of land of 0.05–1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10–30% with trees that have the potential to reach a minimum height of 2–5 metres at maturity in situ, and may include either closed forest formations where trees of various storeys and undergrowth cover a high proportion of the

ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 metres are considered as forests, as well as areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention, such as harvesting, or natural causes (UNFCCC/Decision 11/CP.7, p. 58).

Afforestation: The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or human-induced promotion of natural seed sources (UNFCCC/Decision 11/CP.7, p. 58).

Leakage: an increase in GHG emissions which occurs outside an A/R CDM project activity, and which is measurable and attributable to the A/R project activity (UNFCCC, Decision 19/CP.9, p. 5).

Project boundary: the physical delineation and/or geographical area of the A/R CDM project activity under the control of the project participants. The PoA may have more than one distinct are of land (UNFCCC, Decision 19/CP.9, p. 5).

Baseline: for an A/R CDM project activity or A/R CPA, the scenario for the A/R CDM project activity or A/R CPA that reasonably represents the sum of the changes in carbon stocks in the carbon pools within the project boundary that would occur in the absence of the project activity. (UNFCCC, Decision 19/CP.9, p. 11).

Temporary certified emission reduction (RCE*t*): a CER issued for a CDM A/R project activity which expires at the end of the commitment period following the one during which it was issued (CQNUMC, Decisão 19/CP.9, p. 5).

Long-term Certified Emission Reduction, or lCER: a unit issued pursuant to an A/R CDM project activity which expires at the end of the crediting period of the A/R CDM project activity for which it was issued (UNFCCC, Decisions 19/CP.9, p. 6).

Reforestation: The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources on land that was forested but has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989 (UNFCCC/Decision 11/CP.7, p. 58).

Actual net GHG removals by sinks or forest carbon credits converted into tCERs ou lCERs: the sum of the verifiable changes in carbon stocks in the carbon pools within a project boundary, minus any increase in GHG emissions, measured in carbon dioxide equivalents, from sources that have increased *as a consequence* of the implementation of the A/R project activity, avoiding double counting, at the project boundary, *attributable to the afforestation or reforestation project activity under the CDM* (UNFCCC, Decision 19/CP.9, p. 5, with our highlights).

Small-scale projects: projects producing up to 16,000 actual net tCO2e per year. In addition to this requirement related to the amount of removals, the project has to be implemented by low-income communities, according to criteria determined by the host country. In the case of Brazil, the Interministerial Commission on Global Climate Change defined in Art. 3 of its Resolution No. 3 of March 24, 2006, that low-income communities are those in which members involved in the development and implementation of A/R project activities have a monthly family income per capita of up to half a minimum wage.

Small-scale A/R projects may benefit from regulatory simplification for larger projects, including: *i)* the use of simplified methodologies and forms; *ii)* the right to use the same Designated Operational Entity to carry out the validation

and verification processes; and *iii)* exemption from the 2% CER rate for aid to adaptation measures to the adverse effects of climate change in the most vulnerable countries. These benefits are the same as those granted to other small-scale CDM projects (UNFCCC, 2005a).

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APPENDIX A

KEY FOR THE ACRONYMS USED IN FIGURE 1 – CLIMATE CHANGE GOVERNANCE: GOVERNMENT POLICIES AND INSTRUMENTS (FOREST SCOPE)

- National Policy on Climate Change
  - Instruments
    - Climate Fund
    - PPCerrado – Action Plan for the Prevention and Control of Deforestation in Cerrado
    - PPCDAm – Action Plan for the Prevention and Control of Deforestation in the Legal Amazon Forest
    - CN – National Communication
    - Amazon Fund
    - PNA – National Adaptation Plan
    - EN REDD+ – National Strategy of REDD+
    - PlanaVEG – National Native Vegetation Recovery Plan
    - National Climate Change Plan
      - Energy – Ten-Year Energy Plan
      - Industry – Sector Plan on Climate Change Mitigation for the Consolidation of a Low Carbon Emission Economy in the Processing Industry
      - Charcoal-Based Steel Industry – Steel Industry Emission Reduction Plan
      - Sustainable Steel Industry – Payment Program for Emission Reduction Results in the Steel Industry.
- Institutional Instruments
  - CIM – Interministerial Committee on Climate Change
  - Gex – Executive Group on Climate Change
  - CIMGC – Resolutions of the Interministerial Commission on Global Climate Change
  - FBMC – Brazilian Climate Change Forum

- PMR – Partnership for Market Readiness
  - COP – Conference of the Parties to the Convention
    - GCF – Global Climate Fund
    - GEF – Global Environmental Facility
    - NC – National Communications from Parties not Included in Annex I to the Convention
    - Agr – Agriculture
    - REDD+ – Reduction of Emissions from Deforestation and Forest Degradation and Conservation.
  - CMP – Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
    - LULUCF – Land use, land use change and forestry
    - CDM – Clean Development Mechanism
    - Eligibility – Eligibility of AR CDM
    - Permanence – Non-permanence for tCERs.
  - Pre-2020
    - NAMAs – Nationally Appropriate Mitigation Actions (MRVs + Diversity)
  - The Paris Agreement
    - Article 6.4 – New Market Mechanisms
    - Article 6.2 – Cooperative Approaches
    - Article 6.8 – Non-Market Mechanisms
    - Transparency Framework
    - NDC – Nationally Determined Contribution