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Carbon Risk in Forestry Investments

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Agroforestry activities are by nature more risky than most classic industrial activities. They are in fact subject, amongst other risks, to natural and anthropogenic risks, which can only be partially controlled. Moreover, the addition of a carbon chapter to a forestry project increases its risks and uncertainties. A principal reason lies in the accounting challenge imposed by the objective of action against greenhouse gas emissions.

We propose in this report to explain the main risks influencing investments in forest carbon and to outline some elements for dealing with them. We will see that while some risks can easily be mitigated by good project management, others still have no solution available and can slow investment down.

This report summarises the main lessons drawn from the preparation of a tool for indicating the carbon risk in forestry investments by its authors, for ONF International, at a project level.

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Carbon Risk in Forestry Investments

Forestry projects today get the smallest share of the tools for action against climate change. While CDM[1] forestry projects are limited to afforestation and reforestation (A/R[2]), and represent only 0.4% of registered projects, projects for reducing emissions from degradation and deforestation (REDD[3]) and for forest management (IFM[4]) in non-annexe 1 countries remain excluded from the scope of the Kyoto Protocol and from the main compliance markets. According to the European Commission: "LULUCF[5] projects cannot physically deliver permanent emissions reductions. Applying these in a company-based trading system would impose great liability risks on Member States and is contrary to the intentions of the EU ETS[6] to steer the EU towards a low carbon economy"[7].

This is less the case, on the other hand, for voluntary markets whose forestry projects account for 7% of trading in 2008. Voluntary markets are, moreover, open to a broader palette of technologies than simply A/R, and also accept REDD and IFM. The attraction of buyers is important for positive externalities and the benefits in terms of image of forestry projects. Apart from their climate benefit of reduction of greenhouse gases (GHG throughout the rest of the document), these projects provide ecosystem services (combating erosion, protection of water resources …) and contribute socio-economic co-benefits (fight against poverty, stable employment…).

In spite of the large rise recorded by forest offset trading between 2007 and 2009 (+129%, from 3.7 to 8.5 million teCO_2), **the relative share of forestry projects within voluntary markets is considerably down, falling from 50% before 2006 to 7% in 2008. That must be seen as one effect of the professionalization of the sector through the institution and application of quality standards[8].** In fact, until then the sector was mainly composed of project developers operating with quite limited methodological support. The emergence and the increasing credibility of several voluntary standards specifically developed for forestry projects have challenged that practice. According to a recent study[9] standardisation of projects is in fact the first criterion of choice of investors when they purchase forest carbon offsets. That change takes time, and that is translated by volumes which for the time being are not experiencing the rates of growth, which non-forestry projects may have.

Coinciding with this professionalization of the sector, UN negotiations have also seized hold of the subject. At the initiative of Papua New Guinea and Costa Rica a discussion process on the inclusion of forestry projects within the scope of the UNFCCC and/or the Kyoto Protocol opened at COP 11 in Montreal in 2005. In 2007, this process led at COP 13 in Bali to the adoption of a roadmap leading to an international agreement. The Copenhagen negotiations in 2009 were not conclusive but did allow substantial progress with an eye to the recognition of forestry projects within the framework of a post-2012 agreement[10]. The ongoing international negotiations on setting up of a mechanism dedicated to the forestry sector (which is called REDD+[11]) have resulted in a roadmap and brought together several billion dollars of promises of funds from several developed countries[12]. **The roadmap envisages three phases for this mechanism: i) a phase for definition of national REDD+ strategies and for capacity building for forestry countries, ii) an intermediate phase for preparation for the implementation of the policies and measures envisaged, in particular financing and iii) a phase of operational deployment and payment for results.** Already supported by several public funds[13], the first phase has started in around 40 countries. Nevertheless, the economic systems for encouraging players to protect forests or create new

[1] Clean Development Mechanism, system of low carbon projects regulated by the United Nations Framework Convention on Climate Change (UNFCCC).

[2] Afforestation and Reforestation: generally designated by its English acronym A/R.

[3] Reducing Emissions from Degradation and Deforestation.

[4] Improved Forest Management .

[5] Land Use, Land-Use Change and Forestry.

[6] European Union Emissions Trading System.

[7] Extract from the proposed amendment to European Directive 2003/87/EC.

[8] Chenost *et al.*, 2010. Bringing forestry projects to the market. UNEP, BioCF, AFD, ONFI.

[9] Neeff *et al.*, 2009. Forest carbon offsetting survey 2009.

[10] On this subject see the synthesis document of the working group on REDD of 15 December 2009 (FCCC/AWGLCA/2 009/L.7/Add.6).

[11] The Bali decision defines the scope of the REDD+ mechanism broadly. It brings together the activities of: (i) Reduction of emissions resulting from deforestation; (ii) Reduction of emissions resulting from degradation of forests; (iii) Conservation of stocks of forest carbon; (iv) Sustainable forest management; (v) Building of forest carbon stocks (which includes plantations).

[12] Around 4 billion USD following the Oslo partnership for forests conference of 26-28 May 2010.

[13] The World Bank Forest Carbon Partnership Fund (FCPF), the UN-REDD, the Amazon Fund…

ones are not yet clearly established. An essential part of the mechanism, the forest offsets accounting method, is also lacking. In spite of this vague organisational environment, numerous pilot REDD+ projects are currently being developed[14]. In this context, project promoters must endeavour to analyse the implementation of their projects as rigorously as possible, so as to facilitate their future compliance with an as yet unknown global forestry framework. To enlighten the investor on what the overall accounting framework of forestry activities could be, we can classify the plans which are in the running into three major families: the project approach, the national (or sub-national) approach and the nested approach[15] (see graphic no. 1). Before defining them briefly, let's stress that whatever the approach retained *in fine*, international negotiations will have to reach a consensus on a single system for monitoring reporting and verification[16] of reduced or sequestered emissions, a payment for results mechanism, and the definition of national and/or international institutional authorities entrusted with organising the activities and ensuring their integrity.

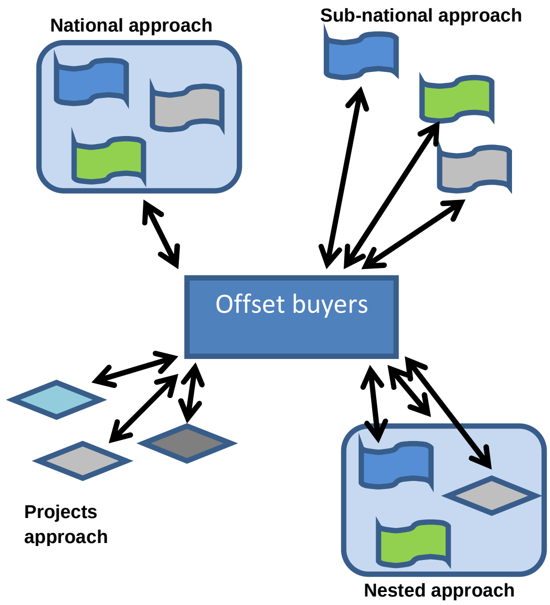
Within the framework of the first approach, projects would be undertaken over predefined areas by communities, NGOs, private firms or public entities. The projects would establish their own reference scenario and would obtain carbon offsets for reductions in emissions or absorptions observed. The organisation of this approach would therefore be close to that of the CDM defined earlier. Within the framework of a national (or sub-national) approach, the countries (or the regions, States) would establish their reference scenarios and would receive financial offsets for reductions in emissions or absorptions observed. Within the framework of their national (or sub-national) REDD+ policy, the countries (or regions, States) would be responsible for distributing the revenue from activity to reduce forestry emissions within them. A JI[17] type system could enable countries to remunerate virtuous project promoters with carbon offsets.

[14] In 2009 there would be 109 REDD+ projects being demonstrated according to a study by CIFOR: *Emerging REDD+. A preliminary survey of demonstration and readiness activities.*

[15] "nested approach" in international literature.

[16] Monitoring, Reporting and Verification: MRV throughout the text.

[17] Joint Implementation, the second flexibility mechanism with the CDM organised by the UNFCCC.



Graphic 1. Different framework approaches for REDD+ projects.

Within the framework of international negotiations, some countries favour the project approach[18] which would facilitate private investment. Others stress that a project approach is not suitable for the forestry sector because of leakage phenomena[19]. Therefore, a compromise, or the nested approach, consists of authorising projects to obtain offsets while waiting for conditions, in particular conditions of governance and MRV defined earlier, to be met to move on to a national (or sub-national) approach.

The forestry system, responsible according to estimates for up to 20%[20] of annual GHG emissions worldwide, holds significant mitigation potential. According to some estimates[21], forestry projects could reduce the world's GHG emissions by 1.5 to 2.7 billion teqCO_2 between 2005 and 2030 for an annual cost of 17.2 to 28 billion USD (i.e. an average cost of 9.3 USD/teqCO_2). The interest in this mode of action against climate change is increasing among States, NGOs and companies. Among the latter we find

[18] The United States, Indonesia and Colombia could in particular be cited.

[19] The reduction of deforestation at a given place may lead to shifting of the deforestation, so eliminating the benefit of the project.

[20] GIECC 2007; the figure is still subject to debate, other studies cite lower figures, 12% for example according to a study by G.R. van der Werf published in Nature Geoscience of November 2009.

[21] Kinderman *et al.,* 2008. Global cost estimates for reducing carbon emissions through avoided deforestation.

investors, finance companies and firms which are looking for sources of carbon offset supply, obligatorily[22] or voluntarily. Whatever the economic system and the approach retained, one of the major conditions for mobilisation of these funds is a clear understanding of the uncertainties and risks influencing forestry projects, in particular regarding their carbon chapter.

Therefore, this report aims to summarise the lessons drawn from the preparation of an indicator of the risk of generating forestry carbon offsets at project level by ONFI[23]. This indicator starts from the dual acknowledgement that the very definition of compliance forest offset has not yet been drawn up, and that **for certain risks, in particular permanence and leakage, there is no satisfactory solution for dealing with them yet**. The absence of significant historical data on forest carbon projects further complicates the task. In this evolving and history-devoid context, the indicator consequently attaches great importance to the rigour, with which the project has been defined and to the systematic recourse to the best available practices and to their adaptability over time. A forest project has in fact a service life of several decades and the standards that will prevail tomorrow are unknown. To claim a market value, a forest offset produced tomorrow by a project launched today must therefore be able to blend in with different concepts of standards, including the most rigorous ones.

Three main risk families have been identified, for a total of about 20 risks depending on the land use case. The continuation of this report is devoted to describing their main characteristics, how they are taken into account and the critical points. Generally speaking the approach adopted consists of taking the risk into account according to the most exhaustive existing methodology as the quality criterion.

Operational Risks

Forest projects are above all exposed to operational risks associated with setting up of their activities. These risks are essentially quite classic and broadly comparable with those of any type of project (defaulting of the project promoter, etc). Nevertheless, the particular nature of forest projects calls for some observations on the definition and organisation of the activities undertaken in relation to the objective of reduction or absorption of CO_2 emissions.

This reduction or absorption of emissions comes through a reduction in deforestation or degradation in the case of REDD, through the growth of a plantation in the case of A/R or through the setting up of a forestry management activity in the case of IFM. Each needs to be planned carefully. In the case of REDD, the risk of the action plan is correlated to the reasons for the deforestation. It is therefore necessary to understand them properly beforehand. Some are more difficult than others to curb, for economic or cultural reasons. An economically profitable activity involving deforestation will therefore often be more difficult to substitute than a low socio-economic profitability activity. Cultural brakes on changing of local practices can also intervene, independently of the socio-economic profitability of the activities to be replaced. Let us also mention the case of an economic activity for production of goods, for which demand is international and inelastic (soya for example). The project having no impact on demand for soya, it is probable that its implementation will only involve a shifting of the production activity (risk of leakage which may cancel out the carbon benefit, a point analysed later in the document). The action plan against deforestation and the effectiveness of the alternative activities introduced by REDD projects must therefore be analysed in detail. The quality of this plan and its realistic nature will have to be evaluated, in particular with regard to the nature of the pressure for deforestation. **The more the causes of deforestation exceed the purely local level and are determined by international markets, commodities for example, the more risky the action plan will be**. With regard to A/R, the attention of the project promoter will concern the expertise and technical means available to it to achieve the plantations. If a pilot plantation has been achieved successfully and the species planted are widely known, domesticated and suited to the land under consideration, then the risk will be minimal. It will be greater, on the other hand, if the species planted are little-known or not properly known or if they have never been introduced on a large scale successfully on the land considered.

Exogenous Risks

The central part of the project activity is exposed to internal (technical, technological, etc) risks. The management plan must take them into account and provide suitable responses to them. The project developer must also take into account the existence of the exogenous risks which influence his activity.

22 In anticipation of the integration of forest carbon into compliance markets. This is so-called "pre-compliance"

[23] This indicator tries to determine a degree of confidence in the capacity of the project to deliver the carbon offsets in the quantities and within the time limits provided for by the Project Design Document.

Exogenous risks are of two types. **Firstly a forest project must take into account the legal, social and governance specificities of the host country.** These characteristics are particularly important, since forest projects are a long-term commitment and take place essentially in emerging and developing countries, which are by nature less stable than developed countries. **The project promoter will then have to analyse the risks of destruction specific to each project, of human and natural origins.**

Firstly, **a lack of legal clarity, uncertain respect of the law or an unstable environment are major barriers to investment.** These risks moreover take on particular importance in our context because of the lack of clarity of the definition of the carbon offset and of the land tenure issues (and therefore of expropriation or of disputing of rights over land) of forestry projects. **The implementation of a project requires great simplicity in the creation of legal structures and in the exploitation of forestry assets. This simplicity will be translated amongst other things by a favourable reading of the business climate and respect of the law in the host country. A favourable perception of political and social stability will give the project promoter a certain level of reassurance regarding the resilience of his assets.** Apart from the indicators mentioned above, prior existence of similar projects in neighbouring zones is a significant indicator of the level of those risks. In other words, the track record of the country, if it has one, permits a more refined perception of the risk.

The forest governance of the host country must be analysed. The effectiveness of this governance may be altered by different factors amongst which are corruption and insufficient respect of the law (see above), but also lack of information, ineffective and/or incoherent policies and market distortion. The project promoter will have to analyse that governance and its implications to evaluate its potential impact on his enterprise. By way of example, some countries still explicitly provide incentives for deforestation by granting title deeds to those who deforest land to exploit it. **Even in countries favourable to forest projects incoherence in forest policy survives with perverse effects.** Improper control of exports is another example of this. If illegally cut timber can be exported without difficulty, valuable species are threatened. That timber, moreover, is sold more cheaply than that which has been felled legally. The illegal timber creates local and international market distortion and reduces the tax and currency revenue for the exporting country[24]. Flaws in forest governance like the two examples above are still frequent and threaten the viability of forest projects.

The project promoter will have to evaluate the clarity and enforceability of property rights and titles over land and carbon offsets. The two subjects are linked insofar as ownership of the offset may be conditional upon that of the land. We will deal with them separately here while specifying, however, that they are of equal importance for the project promoter.

We evaluate the risk linked to ownership of land according to two axes. The first is the clarity of the title deed and the possibility of present or future disputing of that deed. In many cases it is not sufficient to verify the legality and validity of just the deed for the land concerned. A check with the land registry is essential, and if possible also a check of the deeds of adjacent land. In fact it is not unusual in some countries for properties, even duly documented ones, to be partly overlapping. That comment also applies to areas where one may be faced with forest rights held by a customary authority. **The second axis of our analysis is the nature of the property right holder.** The project is less risky if the stakeholders are themselves the owners of the land. Otherwise, monoblock property rights over the land under consideration are preferable to a scattering, which may open up the way to conflict, bearing in mind the duration of the projects, which is very long (several decades). This comment is also valid in the case of forest or property rights, held by a customary authority. Alternatively, partially disputed or disputable land but on which the project undertaken is supported by a strong public desire can present a reasonable risk profile.

Carbon laws are another complex subject. **If most of the Annexe I countries have a national law defining carbon offset, this is not the case in the majority of emerging and developing countries.** The nature of offsets is not defined by international law, it will be necessary therefore to refer to national law. Offsets being instruments *sui generis* it will be necessary to reason by analogy to compare them to other existing instruments[25]. The offset may, depending on the case, be a natural resource, and therefore public, it may be a "fruit", a financial instrument or even a commodity. The implications on the ownership of the offset are different according to the case. **The natural owner of the offset**

[24] The World Bank (Forest Sourcebook, 2008) estimates annual losses of tax revenue due to illegal timber exploitation worldwide at 5 billion USD.

[25] See note no. 8.

may therefore be the owner of the land, the person who enjoys real rights over the trees, the one who enjoys the right of use, the one who contributes to sequestration … Faced with this uncertainty, the project promoter must carry out an in-depth legal analysis, on a case-by-case basis, of the ownership of the offsets. If the contractual right, between the stakeholders in a project or through an ERPA for example, allows some uncertainties to be removed, some precautions are necessary. **Being unable to predict what implications the introduction of a REDD+ system may have on the ownership of the offsets, the promoter will have to adopt a pluralist approach.** In other words, he will have to clearly document the ownership, explaining by what right such or such a stakeholder receives such a share of the offsets, providing a rigorous legal analysis and not omitting to consider therein the customary right and the rights of communities.

The opportunity cost of land where projects are undertaken is a capital factor to be analysed. **By definition, threatened forests are exploited, either commercially or for subsistence purposes.** Any project to change the ways those forests are exploited must at least cover the opportunity cost of the land concerned, if it wants to have any chance of success. Opportunity cost covers two aspects**: the cost for the surrounding populations and that for any principals behind the operation, an agri-foodstuffs company for example.** It is essential to cover the opportunity cost of the first, whether they are their own bosses or employed by a principal, because a project probably could not be viable without offering an alternative at least equally remunerative to the locally established populations. The opportunity cost of the principals is more subtle to evaluate and cover. It is broadly linked to the state of respect of the law and to the forest governance of the host country, two themes we have already mentioned. The values of opportunity costs vary according to the countries and even inside them. A heightened value characterises economic interest in deforesting or degrading forest, and therefore goes hand-in-hand with a high risk of deforestation. That high risk, for its part, is translated by a heightened potential for offsets generation: *there is more deforestation to be avoided when the latter is significant.* Value of the opportunity cost, risk of deforestation and potential for offsets generation are therefore positively correlated. Consequently, the project developer will not restrict his analysis to just the absolute value of the opportunity cost of the land, which only provides him with little useful information as such. He will have to analyse it in the light of the potential for offsets generation induced by the risk of deforestation (the specific question of evaluating the potential for offsets generation will be dealt with in the next part). The risk will be mitigated if the potential for offsets generation appears sufficient to permit the project to cover the opportunity cost. This is the case regardless of its absolute value. It must therefore be remembered that the least risky land for forest projects is not necessarily the land with the lowest opportunity cost. A/R projects are, in this regard, less risky. If they must also take into consideration the opportunity cost, their projects are generally undertaken on degraded land, which offers them wider options for covering it even with limited offsets generation.

The acceptability of the project at local level is a key factor in success. The promoter will therefore have to make sure that local communities come in with and take part in the project. **The promoter will therefore take care to formally obtain the "*prior and informed consent"* of local populations. A fair share-out of the resources generated by the sale of carbon offsets will also have to be demonstrated.** Effectiveness as much as ethics makes that consent necessary. Ethics makes it necessary for obvious reasons of socio-economic development and respect of the locals who are part of the DNA of forest projects. Effectiveness also, because those communities live on the edge of or even inside conservation areas and their non-involvement or nonparticipation may have negative consequences for the project. In practical terms that comes down to avoiding any impact imposed unilaterally on their living conditions (positive or negative), respect of their customs and ways of life and ensuring that the project will have at least a marginal beneficial impact on their general well-being.

Let us also note that the standards in place generally attach major importance to preservation of biodiversity or, at least, to the absence of a negative impact on the latter. That is to say that the developer will not be able to promote a project, the benefit of which, in terms of carbon sequestration, is obtained at the price of pressure on biodiversity and/or on the local environment. Let us imagine for example a plantation project, which would multiply tenfold the volume of carbon sequestered by a zone of natural savannah. If the sequestration takes place at the cost of the destruction of the ecosystem under consideration, it is almost certain that no standard will agree to offset the project.

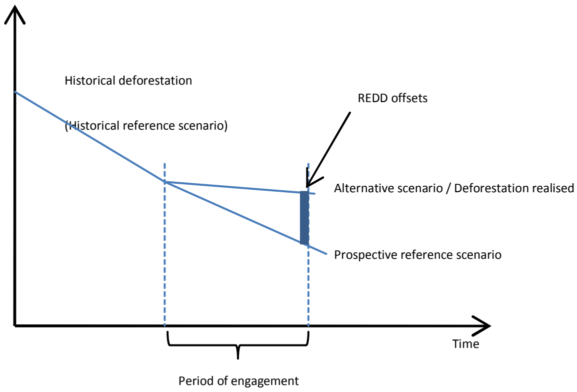
The risk of destruction by man, the anthropogenic risk, is double and must also be integrated into the analysis. It must be isolated from other risks, for example the opportunity cost, and from the risk of non-involvement and nonparticipation of the communities referred to above. **It expresses the risk potential represented by the population density in the areas around the project, *as such*, and by the need which those populations may have, to exercise unbearable pressure on their environment.** Therefore, a project isolated from local populations or near low density settlement areas, but whose inhabitants do not *need* to degrade the carbon sink (for example, they have electricity and/or gas and therefore do not need firewood), will present a low risk. Conversely, a project near to moderately or heavily inhabited areas and whose population does not have access to any form of modern energy will present a high risk of anthropogenic degradation.

The probability of occurrence of natural catastrophic events is a risk factor for the project. These events range from parasites, disease to landslips and earthquakes and including natural fire. **Where they become available, statistics or, failing that, a field survey, will have to determine the frequency of occurrence of such events in the past.** That data will have to be refined with local observation (for example, the risk of landslip increases with deforestation) and used to estimate the probability and potential for damage from natural risks.

Carbon Technical Risks

We first defined the forest project as a technical enterprise, which is exposed to internal risks, applicable to any project, and requires the definition of a realistic action plan applicable on the ground. We then devoted ourselves to defining exogenous risks, which influence implementation of the project. One of the objects of the forest carbon project, however, the generation of carbon offsets, confers upon it specific details, which must be dealt with rigorously and carefully. **The capacity of the project to actually generate carbon offsets requires the control of certain risks specific to forest carbon.**

The developer will have to make sure that the architecture of the offsets generated will allow them to be recognised by the control and validation authorities, and by the market. **The first phase consists of estimating the offsets generation potential, and therefore establishing rigorous reference and alternative scenarios.** Concerning REDD in particular, it is necessary to be clear over the terms, which we include schematically in graphic no. 2. Historical deforestation and the prospective reference scenario must be prepared carefully. The simplest models use historic deforestation rates prolonged linearly to prepare their reference scenario. Other more complex ones[26] add new variables for the purposes of forecasts (new legislation, evolution of forest commodities markets, etc.). None of these models has really emerged to date from literature or practice. Projects located in countries for which satellite



Graphic no. 2. Reference scenario and alternative scenario (REDD case)

observations are available, in particular Brazil (see image 1), start with a certain advantage because the project promoters can obtain reliable data, both historical and during the life of the project. **The issue is significant because diverging methodological interests between forest nations, according to their respective positions in forest transition in particular, have hindered the adoption of a single definition of how to calculate the reference scenario.** The project promoter will endeavour to construct or use a model open to review by third parties, based on quantifiable and verifiable hypotheses, and if possible specifically adapted to the host country and to its particular features. The model will necessarily have to be conservative, that is to say not overestimate future deforestation. The alternative scenario for its part is what the project promoter anticipates in terms of future effective deforestation. The difference between the reference scenario and the alternative scenario represents the offsets which it is envisaged generating. A too optimistic alternative scenario exposes projects to lower carbon revenues than forecast, while a too pessimistic alternative scenario risks dissuading promoters from carrying out the project. They will have to prepare this alternative scenario with the model used for the prospective reference scenario, introducing into it the effects of the avoided deforestation actions which they have chosen. For A/R projects, CDM methodologies already exist and developers will be able to have recourse to them. Their priority will therefore be

[26] In the form of "counterfactual" analyses. That is to say models to predict what would have happened in the absence of the project.

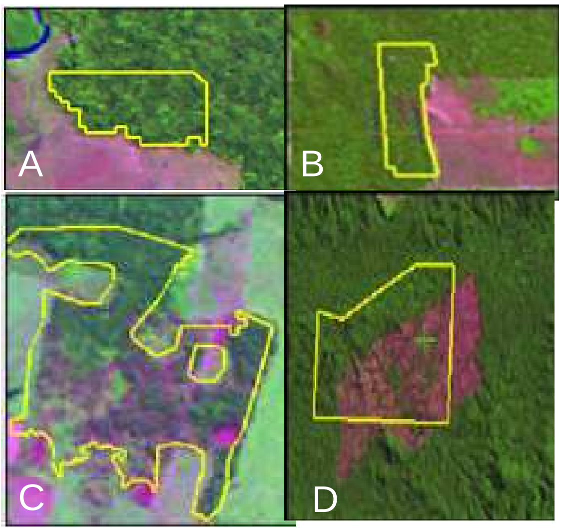


Image 1. Satellite photos illustrating different stages of degradation of the Amazon forest in Brazil. Photo A: forest cover intact. Photo B: forest cover moderately degraded. Photo C: forest cover severely degraded. Photo D: transition into pastureland ongoing. Source: Avaliação Bimestral do DETER Nov 2009. Instituto Nacional de Pesquisa Espacial, Brazil.

to use an existing methodology, both for the reference scenario and for the alternative scenario, which they will feed with local data.

MRV is particularly sensitive for REDD. The carbon mass stored by soils and vegetation varies greatly from one forest to another. The FAO (2007) estimates consequently that the Indonesian rainforests hold on average a CO_2 potential of 308 tonnes per hectare, for 792 tonnes in RDC, 473 tonnes in Brazil and 1 763 tonnes in Surinam. Those figures hide large disparities from one type of forest to another within a same country, and within a same forest depending on the dominant species and the composition of soils. **The REDD project promoter will therefore have to evaluate, on a case-by-case basis, the carbon mass contained in the sink he wants to protect through sampling (this mass will then be translated into CO_2 equivalent). Other sampling will have to take place on each check and will be supported, when such technology is available, by satellite images (see image 1).** Procedures exist for REDD projects. In each case the project promoter will have to use local data and avoid recourse to generic or even national data. The risk of error in MRV of the carbon stored in the case of A/R projects is much lower. Firstly, because the initial stock of carbon is nil or close to zero, the species planted are generally well-known and their number on a same site is low. Secondly, because access to plantations is generally easier than in the case of an REDD project. Finally, because, leaving aside natural or anthropogenic destruction which we have already referred to, the main uncertainty lies in the rate of growth of the plantation compared to forecasts.

Like any CDM project, forest carbon projects must be additional, that is to say that it must be established that they would not have been undertaken without the contribution of the carbon revenues. The first concern of the project promoter will be to make sure that the carbon chapter of the project has been considered, and documented, well upstream in the preparation process. **Despite all its potential virtues, a forest project viable without carbon revenues is not considered as additional.** Absence of upstream consideration of carbon revenues to make the project viable is in a way an admission of its non-additionality, to which auditors are very sensitive. Conversely if the project only owes its feasibility to the carbon revenues, and that can be proven, then it will have every chance of being additional. The same will go for most REDD projects without operating revenues other than carbon, for example. "First of their kind projects" even if their financial additionality is not rigorously established, will also easily be able to demonstrate additionality via an analysis of the barriers.

The risk of leakage, in other words the risk of the emissions which it is desired to eliminate in reality only being removed from the intervention site to another site, is a composite risk. It depends on numerous factors like for example the opportunity cost of land, the elasticity of production demand which existed beforehand on the site or the mobility of capital or labour. This is what makes it very difficult to model. **Carbon leakage range estimates in the forest industry are so wide, up to 92%[27], that in practice they are inapplicable to a particular case.** The main cause of deforestation is the change of land use in favour of agriculture, in direct competition with conservation. Exploitation of timber or firewood is another one. An REDD project which will hinder the development of activities with inelastic and international demand (soya, cattle, tropical timber, palm oil …) will suffer from a high risk of leakage. The estimate of this figure for the Noël Kempf project which aims in particular to stop the exploitation of timber on its perimeter has been calculated in the range from 2% to 42%. Conversely, an REDD project which will eliminate an easily substitutable production without leakage, or which will propose an alternative to exploitation of the site, will present a lower leakage risk. That will be the case for example for projects which finance substitution of gas burners for firewood, or those which supply stable and adequately remunerated employment to populations, which were previously engaged in activities harmful to the forest, of very little profitability and of elastic demand. If the

[27] Sathaye, J., Andrasko, K., 2007. Special issue on estimation of baselines and leakage in carbon mitigation forestry projects. Mitigation and Adaptation Strategies for Global Change.

effectiveness of the deployment of REDD projects does of course require that projects, which by definition are highly exposed to leakage, are not excluded, the promoter must know that he is exposing himself to a risk which broadly is not individually controllable. **The best way of significantly reducing the risk of leakage from REDD projects is still to increase the scale and number of projects, both at infra and international levels.** The implementation of REDD+ mechanisms on national and international scales will permit that. While awaiting this to be the case, the VCS[28] and the World Bank BioCarbon Fund[29] recommend integrating into the effective leakage monitoring perimeter an area corresponding to a multiple of the project area (up to 40 times for projects smaller than 100,000 hectares). That is a very strong and expensive constraint influencing project promoters.

A/R projects for their part are less exposed to leakage risk. Several reasons must be understood for that, first of all the fact that they intervene principally on degraded land, of low economic value and often not used for commercial activities, which would run the risk of just being shifted elsewhere. **Moreover, when these projects involve a commercial activity, they attract and fix capital and labour to exploit a forest resource which, in their absence, could have been exploited via deforestation.** In this context of relatively restricted risk Chomitz (1999)[30] estimates that the risk of leakage is no greater compared to CDM energy projects (5-20%).

Finally, **the non-permanence of "biological" carbon offsets is one of the main risks influencing forest offsets.** To properly understand this, the reasoning must concern stock and not flux. A reduction of the emissions fluxes associated with the production of energy is by construction permanent. For example, lignite is replaced by better quality coal and each year the production unit will reduce its GHG emissions flux. These reductions are acquired permanently. A forest carbon sink for its part emits less CO_2 if its rate of degradation decreases. On the other hand, a sudden and major degradation of that sink can occur at any time (fire, flood, anthropogenic destruction) and cancel the mitigation effort. The forest carbon stock is not eternal and despite all past reductions in its rate of degradation, it can disappear. We set out briefly some technical responses to that risk of permanence in box number 1. Approach no. 1, that of CDM, has amply proved its lack of attractiveness. With each offset, the purchaser of forest CDM offsets assumes a liability, which he will have to pay off in time. **Approaches no. 2 and 3 present the major problem of significantly shifting the cash flows of projects over time.** Since a significant portion of the offsets generated is not accessible for a long period, even if they are viable, projects whose carbon revenues are predominant are exposed to serious cash problems. Approach no. 4 is interesting as it requires a lesser sequestration of offsets

The puzzle of offsets permanence.

There are currently five techniques for managing the permanence of forest offsets, plus the one chosen by the CDM standard, which we set out below:

1. **Temporary offset**: this is the approach retained by the CDM standard for A/R projects. It consists of only granting temporary offsets to projects. They are intended to be replaced by other offsets, temporary or permanent, at the end of the project or in the event of destruction of the sink. Upon certification of the offset it creates therefore a liability, regardless of the fate of the project.
2. **The "tonne-year"**: originally discussed by GIECC, this approach starts from the dual acknowledgement that i) the present value of emissions reduction is higher today than it will be tomorrow and ii) CO_2 has a limited life-cycle in the atmosphere. Researchers have therefore calculated a temporal threshold beyond which mitigation could be considered as permanent, estimated at between 42 and 100 years.
3. **The "buffer"**: recommended in particular by the VCS this approach consists of only crediting to the project part, 50% for example, of the offsets actually generated. Therefore the buffer covers potential subsequent alterations to the carbon sink, and releases part of the offsets *in fine* if no degradation has been observed.
4. **Risk sharing**: concerns the creation of a buffer common to several projects, that is to say a form of insurance.
5. **Insurance**: this approach is an advanced version of risk sharing in which an insurer receives premiums from each project, payable in offsets. In the event of materialisation of the risk the insurer replaces the offsets destroyed by those which it holds. The residual risk may be covered with reinsurers or via financial instruments.
6. **Liability sharing**: this approach is more uncertain and remote over time as it is subject to international agreements on REDD. Developed countries would share the risk of non-permanence of forest countries in exchange for preferential access to offsets.

Box no. 1. Source: Moving ahead with REDD. Edited by Arild Angelsen, CIFOR, 2008.

[28] Voluntary Carbon Standard (www.v-c-s.org).

[29] Principal purchaser of CDM forest offsets.

[30] Chomitz, K.M., 2000. Evaluating carbon offsets from forestry and energy projects: How do they compare?

than approach no. 3. It does require, however, organisational conditions which are not always present today, and opens up a gap for *free-riding*. **The insurance approach is intuitively one of the most seductive; it should in particular be able to resolve the cash flow problem. Insurers are capable of managing that kind of risk. Before they do so, it will however be necessary to wait until a critical mass of projects is implemented to enable them to model the risk and have access to necessary diversification.** The last approach is also effective, amongst other things because it involves the Annexe I countries. However, once again, it is dependent on conditions which at this date are not fulfilled, in particular the conclusion of international or bilateral agreements over REDD+ and its financing. **Despite the significant cost borne by the projects in terms of updated cash flows, we estimate that today the adoption of the buffer or risk-sharing approach is a prudent choice.** It is very constraining, but easy to implement and fair. Moreover whatever the approach retained *in fine* for the compliance of offsets, projects which have established significant buffers will in all probability be compliant with the standards which will emerge.

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Agroforestry activities are by nature more risky than most classic industrial activities. In fact, amongst other risks, they are subjected to natural and anthropogenic risks, which can only be partially controlled. Our experience of forest projects shows us that the addition of a carbon chapter to a forest project increases its risk and uncertainties. We see that as the main reason in the accounting challenge imposed by the objective of action against GHG emissions. The three main families of forest carbon projects (REDD, REDD+ and A/R), by virtue of their specific revenue structures and the different technologies involved, offer distinct risk profiles. **With the market not offering sufficient historical perspective on each of them, a diversified portfolio investment approach may prove pertinent.** However, the latter will not exonerate the project promoter from the obligation to analyse in depth each risk which we have brought up, in the particular context of each project. Let us note finally that only the definition of a clear framework for REDD+ (scenario, MRV, accounting…) will provide public and/or private players with the conditions for the massive investment which REDD+ requires.

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