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Gabriela Simonet[1] and Julien Wolfersberger[2]

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Abstract

This paper discusses the challenge of the forest transition in developing economies. The forest transition refers to the evolution of the forest stock in a country under three phases: deforestation, stagnation and reforestation. When a country experiences a transition, the turning point occurs and net deforestation ends. In other words, once reached the turning point, the country turns from net emitter to net CO2 absorber. Within this framework, we consider the potential role of REDD+ for future forest transitions. Depending on the type of programme (e.g. reforestation or avoided deforestation), REDD+ may lead to different transitions in terms of both deforestation length and environmental values. We found that favouring AR projects reduces the length of cumulative deforestation, while the development of RED projects helps to provide turning points with higher CO2 emissions reduction and more biodiversity. In the end, our work completes the general theory of the forest transition by distinguishing primary native forests from secondary ones.

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1. Introduction

Deforestation in developing countries is responsible for considerable ecological damage, including flooding and soil erosion. In addition, deforestation is among the main factors contributing to global greenhouse gas (GHG) emissions, accounting for approximately 10% of these emissions (Werf et al., 2009).

According to the Forest Transition (FT) theory, net deforestation in a given country ends up to halt once reached a threshold of development. This theory (Mather, 1992) is based on observation of developed nations, such as France or the USA, which have implemented a permanent transition in their deforestation, from positive to negative rates. In the global context of climate change, implementing such a transition is now a major challenge for developing economies, in order to reduce emissions from the forestry sector and contribute to the preservation of biodiversity, water quality and other ecosystem services.

The REDD+ mechanism, which aims at Reducing Emissions from Deforestation and Degradation, may be a good way of achieving these transitions in developing countries. Indeed, the central idea of REDD+ is to help reduce the rate of deforestation by providing financial compensation to the countries concerned.

However, REDD+ does not currently take into account the heterogeneity between countries, especially in terms of development. Clearly, different stages of deforestation call for different policies. For them to be effective, it is then necessary to implement programmes suited to the macroeconomic characteristics of each country.

In this paper, we tackle the issue of FT in developing countries involved in the REDD+ mechanism. For this purpose, REDD+ is discussed in light of an improved FT framework. Indeed, we go beyond the usual concept of FT by distinguishing primary and secondary forests. Since they are not perfect substitutes in terms of carbon and biodiversity, we then attempt to provide a more accurate picture of the transitions' benefits on the environment. Our work offers new insights for the design of public policies.

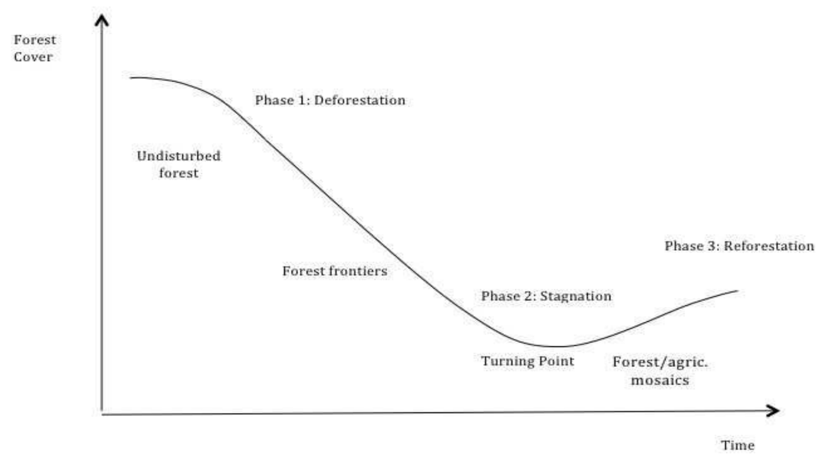
In the following section, we present the FT and extend its analytical framework to include the composition of the forest stock (i.e. distinction between primary and secondary forests). Section 3 introduces the REDD+ mechanism and discusses the potential improvements in its efficiency when taking into account the development stages of countries. In section 4, we highlight the impact of REDD+ on future transitions when separately considering primary and secondary forests. We conclude in section 5.

2. Economic development and long-term forest trends: the FT theory

2.1 Original framework

Land use constantly changes throughout a country's development. In the early stages, the main trade-off is between agriculture and forest. On the basis of empirical observation, Mather (1992) developed the Forest Transition (FT) hypothesis, describing the evolution of the forest cover in a given country over time. Based on the French case, Mather argues that a country's forest cover undergoes various major phases: first deforestation, then stagnation, and finally reforestation. These phases correspond to different forest contexts/stages, as presented in Figure 1. Prior to deforestation, we refer to undisturbed forest. The frontier areas stage comes next, during which land and forests are exploited. Finally the forest-agriculture mosaic stage occurs, in which forests have both high financial and environmental values (Chomitz et al., 2007). The moment of minimum forest cover is termed the turning point.

Figure 1: The Forest Transition



Source: Authors

Initially, most of the land is under forest cover (the undisturbed forest stage), with little variation in land uses. The country is in a "pre-development stage", with developing infrastructure roads and rents from agriculture and forest.

With the development of infrastructure and the control of all the land, the growing population migrates to previously inaccessible areas, for rent seeking in forest and agriculture. Agriculture-based development takes place, providing income, food and energy. The marginal value associated with agriculture is higher than that of forest and the land-use trade-off favours the conversion of forests into croplands. An abundant supply of labour and the low cost of access to land ensure high agricultural rents. This is the major phase of deforestation, at the end of which the GDP per capita and the capital stock significantly increase. Subsequently a greater investment is made in new and more profitable sectors, particularly industry, and the pressure on forests slowly decreases. The country is approaching the turning point.

The gross deforestation rate finally turns sustainably from positive to zero or negative. Different paths may account for this switch. In the economic development path (Rudel et al., 2005), new non-rural jobs, with higher wages, emerge from the development of the economy. Farmers leave their land for these jobs, leading to a rural exodus and urbanisation, with some of the abandoned land reverting to forest. Furthermore, the forest scarcity path (Rudel et al., 2005) causes the price of wood to rise and may result in environmental problems such as flooding and desertification. It follows that the marginal value of forestland becomes higher than that of agriculture. Some tree planting programmes take place on previously less productive agricultural land, although natural forest harvesting may continue.

In addition to economic development and forest scarcity, more recent pathways have been identified in studies to explain the occurrence of the turning point (Lambin and Meyfroidt, 2010). Globalization can help reaching a transition, with the adoption of economic reforms leading to the growth of non-agricultural sectors, including tourism, and the emergence of environmental concerns. For instance, in Costa Rica, the creation of protected areas for tourism purposes speeded up the arrival of the turning point. Another pathway involves social and political will. For example in Bhutan, the forest cover is not legally permitted to fall below 60% of total area. As a result, the country underwent a turning point several years ago, and a high level of forest cover remains in place.

As it describes the whole forest cover evolution, the FT theory is a good tool to study deforestation issues, especially in a long-term view (Wolfersberger et al., 2013). Now, a key challenge is to introduce new features to this theory. In reality, the gross forest cover in the FT encompasses two dynamics: the decrease of primary forests (i.e. natural old-growth forests) and the increase of secondary forests (i.e. natural regeneration of forests and plantations). Several consequences may emerge from this distinction, since primary and secondary forests are not perfect substitutes.

2.2 On the necessity to integrate a more accurate description of the forest stock

So far, the literature on FT only considered forests vs. non-forests land uses. As mentioned above, the total stock of forest is actually composed of two different types of forests: primary and secondary. It is important to differentiate these two types of forests since they are not perfect substitutes in terms of climate and biodiversity. Primary forest refers to a forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age. On the other hand, secondary forest refers to a forest that has been logged and has recovered naturally or artificially, including plantations.

Luyssaert et al. (2008) highlight the fact that “old-growth forests accumulate carbon for centuries and contain large quantities of it” so it would take a long time before a newly planted forest stores the same amount of carbon. Moreover, Stephenson et al. (2014) recently found that most trees of natural old-growth forests around the world grow faster than younger ones, taking up more carbon dioxide from the atmosphere. We can thus conclude that, with regard to the carbon storage and sequestration functions, primary forests have a higher marginal value than secondary ones.

Montagnini and Nair (2004) compare three options for climate change mitigation: carbon sequestration (afforestation, reforestation, restoration of degraded lands, agroforestry), carbon conservation (preserving carbon in biomass and soil in existing forests, improved logging techniques, fire protection), and carbon substitution (increased use of bio-fuels, introduction of bio-energy plantations). They conclude that carbon conservation has been regarded as the most effective method of rapidly mitigating climate change, whereas carbon sequestration takes places over a long period of time. In this last category, agroforesty systems are particularly interesting as they link forestry and agricultural productions and can thus, under certain conditions, conciliate environmental and development issues (Simonet and Wolfersberger, 2013).

Regarding carbon dioxide emission, it is therefore more efficient in the short and mid terms to conserve old forests than to plant new ones, while this statement may be reversed in the long run, if planted forests are sustainably managed.

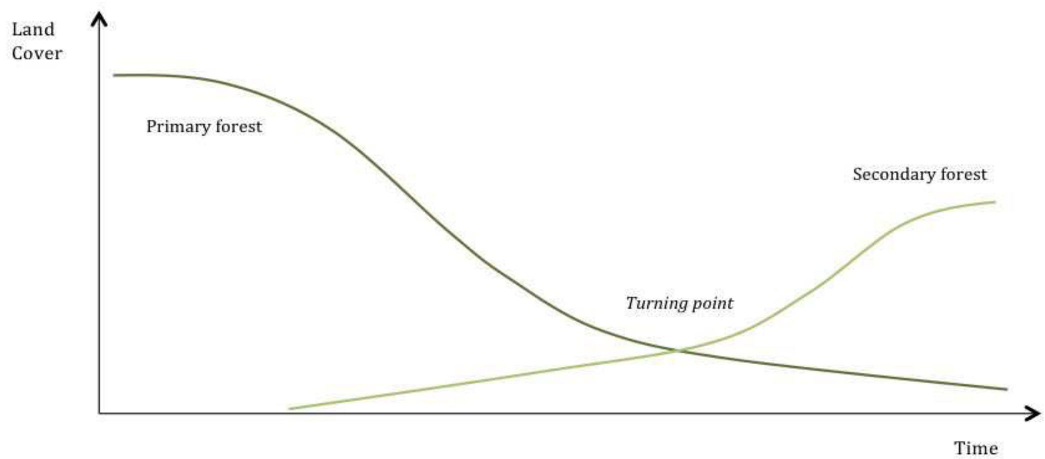
Also, it is well known that world natural old-growth forests host most of the total biodiversity. According to Burley (2002), tropical forests are home to 50% of the known vertebrates and 60% of plant species. For this reason, we can reasonably assume that one hectare of primary forests contains a higher share of biodiversity than one hectare of that secondary.

However, it is important to note that in some cases, such as ecosystem restoration on degraded land, reforestation contributes to biodiversity.

Globally, we see that primary forests have a higher marginal value for environment in terms of both climate and ecological benefits. It seems crucial to take this information into account in the FT framework since it would allow researchers to provide more accurate recommendations for public policies.

Figure 2 represents the FT as the transition between two dynamics of forest cover. The turning point occurs when the two curves intersect.

Figure 2: The forest transition composed of two distinct stocks of forests



Source: Authors

Deforestation issues have been regularly discussed in the past couple of decades. In the mid 80's, Integrated Conservation and Development Projects (ICDP) were introduced with the aim of reconciling biodiversity and rural development issues at stake in protected areas. With the signature of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, the question of climate change was brought to the forefront of international debates. This created a renewed interest for tropical forests, with a new focus on their carbon stock. The next section analyses the potential of the two distinct dynamics previously introduced for carbon economy.

3. REDD+: different strategies corresponding to different levels of development

3.1 Two levers to combat climate change

Since the 90's, the interest for forests in developing countries has been reinforced by the new focus of the international sphere on climate change.

The significant role of tropical deforestation in the global emissions of greenhouse gases (GHG) provided an additional argument to support forest conservation. Emissions from deforestation were first estimated at around 17.4% of the global anthropogenic or 22.7% of the global emissions of carbon dioxide (CO2) (IPCC, 2007). These figures were then revised downward to around 10% of global GHG emissions or 12% of global CO_2 emissions (Werf, 2009), but the potential of avoiding emissions by conserving tropical forests remains remarkable.

However, the role of forests in climate change mitigation is not limited to deforestation that could be avoided. Indeed, Pan et al (2011) stressed the important carbon sink capacity of forests. They reveal that around 14.8 billion tons of CO_2-equivalent ($GtCO_2e$) has been sequestered yearly by global forests over the 1990-2007 period thanks to the natural growth of forests and the regrowth of secondary forests after deforestation. More than 10 $GtCO_2e$ of this was achieved in tropical forests, the remaining being in boreal and temperate forests. Such figures reveal that the activities of afforestation and reforestation could capture a large stock of carbon dioxide.

Finally, forests in developing countries offer two levers to fight against climate change: avoiding the emissions from deforestation and enhancing sequestration through reforestation.

How were these two levers taken into account during the global negotiations against climate change?

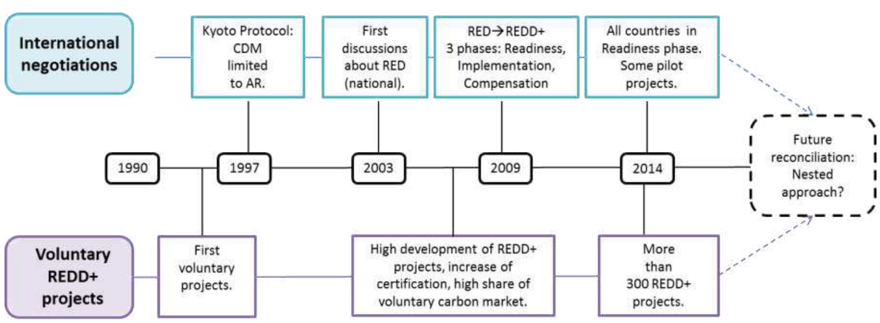
The integration of forestry in climate change negotiations began slowly and remains quite limited. Forests in developing countries were integrated into the Kyoto Protocol only through the Clean Development Mechanism (CDM). Projects of Afforestation/Reforestation (AR) were the only forestry projects allowed in the CDM, avoided deforestation projects being excluded notably because of the complexity of taking into account leakage. Forestry CDM was very unsuccessful due to the complexity of the methodologies and the lack of attractiveness of the temporary credits created specifically for forestry CDM. Finally, the decision of the European Union to exclude forestry offsets from its Emissions Trading System (EU ETS) contributed to the low development of AR CDM. According to UNEP-Risoe, as for January 2014, there were 52 A/R CDM projects registered and 14 at validation, representing 0.8% of the total CDM projects in the pipeline.

In 2005, while discussions about deforestation issues had been set aside until then, Costa Rica and Papua New Guinea suggested the creation of a new mechanism that would pay developing countries for their effort to Reduce Emissions from Deforestation. The RED mechanism was born. To alleviate the problem of leakage, it was suggested that emissions could be accounted for at a national level, the issue of international leakage being still unresolved.

Then RED became REDD and REDD+, encompassing a wider variety of activities, including averted degradation, carbon stock conservation and enhancement. In 2009, it was agreed that the mechanism would progress through three phases, starting with capacity-building, before moving to demonstration activities and then full implementation and performance-based payments. At present, all countries are still in the first phase, also called the "Readiness phase", meaning that neither implementation nor payment will have been realized yet.

However, as shown in Figure 3, while official REDD+ negotiations and their application at a national scale are stalling (because key questions like the financing of the third phase remain unsolved), numerous "REDD+ projects" are blossoming in developing countries.

Figure 3: REDD+, a two-speed, two-scale mechanism



Source: Authors

These projects are mainly initiated by the private sector, which saw in REDD+ an opportunity to have a new source of funding for forestry projects. Though some pilot projects concerted with governments, most of them are not integrated in a national strategy. They consist of projects with a stated goal of reducing GHG emissions through averted deforestation/degradation (RED projects) or afforestation/reforestation (AR projects). A minority of projects of Improved Forest Management (IFM) have also developed. REDD+ projects monitor and report their emission reductions and some project developers certify the process with labels like the Verified Carbon Standard (VCS). They expect to deliver carbon credits that might be sold in the voluntary carbon market, where forestry credits are particularly successful. In 2012, forestry projects generated 26% (or 19.3 MtCO2e) of the volume of offsets transacted on the voluntary market (Peters-Stanley and Yin, 2013): 12% from AR projects, 9% from REDD projects and 5% from IFM projects.

REDD+ appears to be a two-speed mechanism, with a duplication of the scale of realization between the local and the national. This duplicity might be problematic when countries move to the second and third phases of the mechanism. A nested-approach is under consideration to reconcile local and national approaches, with accounting problems to be resolved.

Conservation and reforestation are both integrated in REDD+ as a double lever to fight climate change and increase forest cover. Among the countries involved in REDD+ negotiations or hosting REDD+ projects, trends might emerge between a conservation strategy and a reforestation strategy. The next section identifies these trends and analyses them within the FT theory framework.

3.2 Adapting REDD+ strategies to FT phases

REDD+ negotiations involve more than forty countries, which can be separated into three main groups depending on their position on the FT curve. This position has several implications regarding REDD+, as summarized in Table 1.

Angelsen and Rudel (2013) pointed out that "matching REDD+ Policies to FT stages" is of particular interest because countries have different patterns of demand[3] depending on their position on the curve. Then, the different positions on the FT curve led countries to adopt different points of view during REDD+ negotiations. A first point of contrast between countries was the scope of activities that should be included in REDD+. Indeed, REDD+ was initially limited to "Reducing the Emissions from Deforestation" (RED). The addition of the second "D" and of the "plus" led to the integration of forest degradation, forest management, carbon stock conservation and enhancement. An expansion to REDD++ is even under discussion and would include the carbon held in agricultural soils. However, the broadening of the mechanism did not receive the support of all countries, as explained further on.

Another main point of dissent, still under discussion, is the choice of the method for the calculation of the baseline scenario. This point is particularly strategic as it conditions the

[3] Here the term demand refers to the needs in REDD+ programs.

performances measured and thus the payments that each country will receive. Three main positions are being discussed: an historical approach, a projected approach and a stock approach.

We now present in table 1 the different profiles of countries depending on their position on the FT curve. Based on the recommendations of Angelsen and Rudel (2013), we discuss countries' REDD+ strategies when taking into account the two types of forest. In addition to this contribution, we also add examples of countries and their positions in REDD+ negotiations.

Table 1: Views of countries on REDD+ negotiations depending on their position on the FT curve

Position on FT curve	Phase 1	Phase 2	Phase 3
Profile	High forest cover, low deforestation rate.	High and medium forest cover, high deforestation rate.	Low forest cover, low deforestation rate.
Countries	Cameroon, Democratic Republic of Congo, Guyana (no projects).	Brazil, Indonesia, Mexico, Peru.	China, India, Uruguay.
Position in REDD+ negotiations	REDD with projected emissions.	RED to REDD+ with historic emissions.	REDD+ focus on carbon stock.
REDD+ strategy and policy	Protection of natural old-growth forest - Develop institutions	Protection of natural old-growth forest and implementation of plantations - Reduce extensive agricultural rent	Implementation of plantations - Increase forest rents

Source: Authors

Phase 1: This group contains countries with high forest cover and low deforestation rate, such as Cameroon, Colombia, Congo (Democratic Republic) or Guyana. Economic development, directly taken from the forests, hasn't started yet and the GDP per capita is still low[4]. For these countries,

4 Exceptions can be found when other natural resources are available, such as oil or mining.

it is necessary to establish property rights that will frame access to rents[5]. REDD+ policy should consist of primary forest protection (i.e. RED actions) as the proportion of natural old-growth forest that could be preserved is still important.

Regarding REDD+ negotiations, countries of the first group defended the limitation of the mechanism to REDD as they are generally affected by forest degradation but rarely concerned by reforestation. Highlighting their low deforestation rates and their right to development, they struggle against a historical approach and promote the use of a projected baseline. A projected baseline has been adopted by Guyana in a bilateral agreement with Norway, allowing Guyana to maintain its deforestation at current levels[6].

Phase 2: This group includes countries such as Brazil or Indonesia; with a high deforestation rate and a relatively high forest cover remaining. Their growth is strongly built on forest clearing. Harvested lands are used for agricultural production, cattle ranching, oil palm plantation, etc. Industrial wood or forest products are exported. The first priority of this stage is to reduce the rent from extensive agriculture. It is necessary to implement targeted policies aiming at intensifying production. The second priority is to develop property rights and promote forces that stabilize forest cover, such as plantations. As a consequence, both RED and AR projects may be efficient.

Due to their high deforestation rates, most of group 2 countries claimed the restriction of REDD+ to RED in order to limit the number of countries that would benefit from the mechanism. This was the position of Brazil for example. Countries of this group support a historical approach instead of a projected one. Indeed, their effort to reduce deforestation and reach their objectives would be lower as their deforestation rates are particularly high and expected to naturally decrease with the development of the country.

Phase 3: This group encompasses countries with low forest cover remaining and low deforestation rates, such as China or India. They are characterized by better property rights, more developed non-agricultural sectors and they participate in the global market. During this phase, REDD+ programmes are focused on tree planting and extensive plantations policies. One direct environmental benefit is to fix issues from previous deforestation. At this point, secondary forests may be sustainably managed and supply both industrial and energy producing wood.

Because of their low or negative deforestation rates and increasing reforestation rates, group 3 countries defended the expansion of RED to REDD+, China and India leading the way. A

5 In developing countries, road construction often triggers deforestation (Angelsen, 2007). Public policies should then focus on framing this, with well-defined property rights, a national forestry code, etc.

6 For more details on this agreement see http://www.regjeringen.no/en/dep/md/Selected-topics/climate/the-government-of-norways-international-/guyana-norwaypartnership.html?id=592318

further expansion to REDD++ would benefit countries with low deforestation and reforestation, but with highly degraded agricultural soils, like Kenya or Sudan. Countries belonging to group 3 defend a stock approach that would account for the variation of carbon stocks in national forests and would be the most eligible for taking into account their re(af)forestation or plantation policies.

The position of countries in REDD+ negotiations is clearly related to their phase of FT. In that sense, the national REDD+ policies have to adapted to this phase. For countries that are in the first phase, the development of RED projects seems obvious, while AR projects are more appropriate to countries that are in the third phase of the FT. Finally, both RED and AR programmes can be efficient in phase 2 countries.

As introduced in section 3.1, although the national REDD+ mechanism is still in its preparatory phase (Readiness), hundreds of REDD+ projects are being developed, mainly driven by the private sector. The next section compares the type of projects developed in each country and their location on the FT curve.

3.3 Empirical facts on REDD+ projects

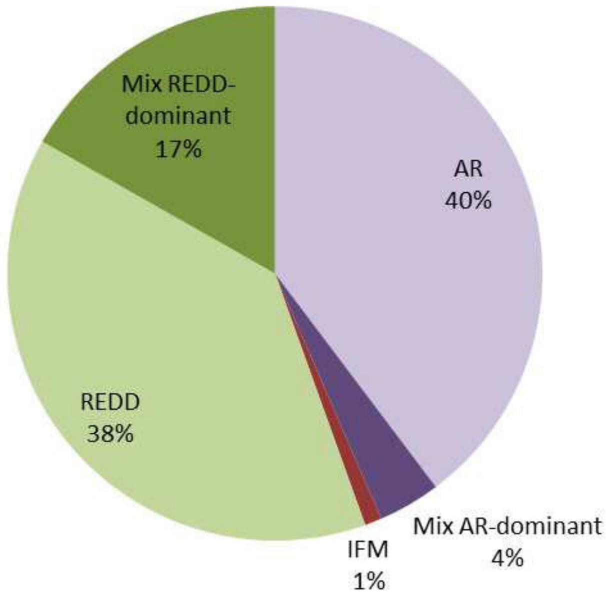
To compensate for the lack of information that can be used to analyse REDD+ projects, a new database of REDD+ projects is being implemented jointly by the Climate Economics Chair, the CIRAD[7] and the University of Michigan. The database gathers information on general aspects of the projects, as well as carbon and socio-economic variables. This work is based on project certification reports (VCS and CCBA mainly) and on the data available on project developers' websites and other websites[8]. According to this database, around 325 projects could be identified in 2014, located in 47 countries. Their location is illustrated in Figure 5.

As shown in Figure 4, 55% are REDD projects (including 18% of mixed projects whose dominant activity is conservation), 44% are A/R projects (including agroforestry, plantation and ecosystem restoration) and the remaining 1% are IFM projects.

[7] French Agricultural Research Centre for International Development

8 The main ones are Ecosystem Market place Forest Carbon Portal, The REDD desk and the REDD+ database of the Institute for Global Environmental Strategies (IGES).

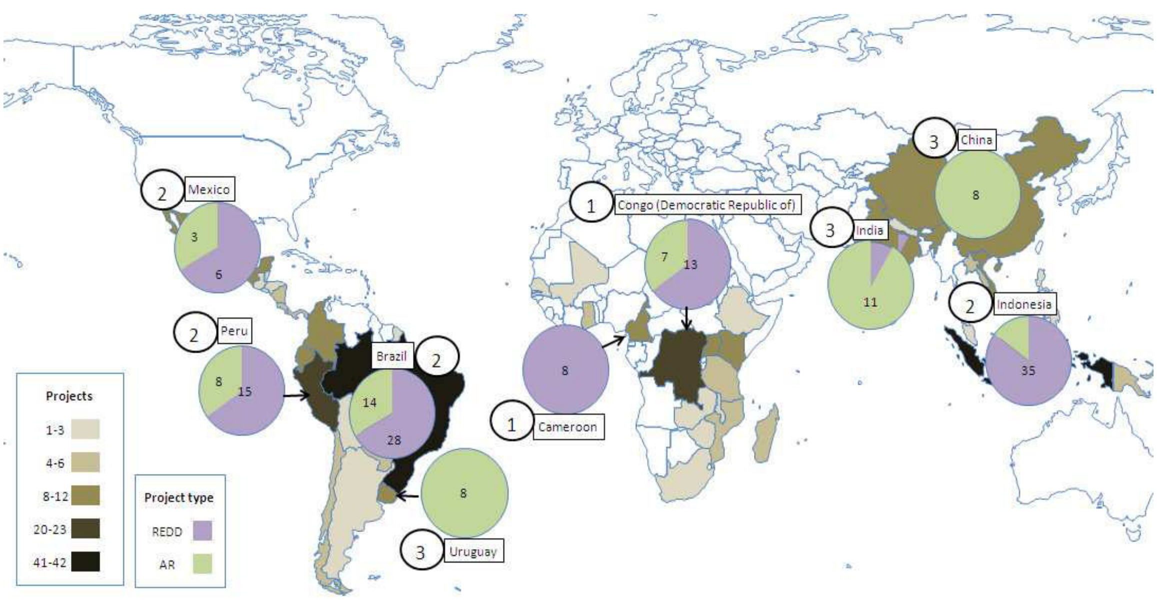
Figure 4: Global repartition of REDD+ projects by type



Source: Authors

As shown in Figure 5, focusing on the countries gathering the most important number of projects, we can see that there is a link between the dominant type of REDD+ projects developed and their stage in the FT.

Figure 5: Location of REDD+ projects and repartition by type for key countries



Source: Authors

Countries belonging to group 1 (as defined in Table 1) show a clear trend towards RED projects. Countries of group 3 present mainly or exclusively AR projects. Finally, countries situated in the second stage of FT present a mix of AR and RED projects, but with a significant dominance of REDD projects. These findings corroborate our hypothesis that there is a link between the location of a country on the FT curve and its trend in terms of REDD+ projects development.

AR and RED projects have very different profiles and thus different impacts. Thanks to a preliminary analysis[9] of the CEC-Cirad-Michigan database, we can see that REDD projects cover on average a much larger area and have a significantly higher potential in terms of emission reductions. The mean size of AR projects is around 9,770 ha whereas it reaches 689,850 ha for REDD projects (mix projects having a mean area of 219 780 ha). In terms of climate benefits, AR projects are expected to capture on average 50,000 tCO2e annually and around 1million tCO2e throughout the life of the project. As regards RED projects, the previsions are around 0.7 million tCO2e annually and reach 22.2 million tCO2e for the life of the project. These figures are consistent with Berne (2012) who analyzed REDD+ projects certified by the VCS and showed that RED projects deliver on average 26 times more VCUs (Voluntary Carbon Units) per year than AR projects and 4 times more VCUs per hectare per year. RED projects are thus more efficient in terms of climate change mitigation.

Moreover, it appears that REDD projects are generally conservation projects, with a high focus on biodiversity. One third of the REDD projects were found to cover all or part of a protected area, and conservation is the main objective of half of these projects. Even though AR projects can provide many social co-benefits in terms of job creation and alternative revenues, it clearly appears that REDD projects have a higher potential for biodiversity conservation.

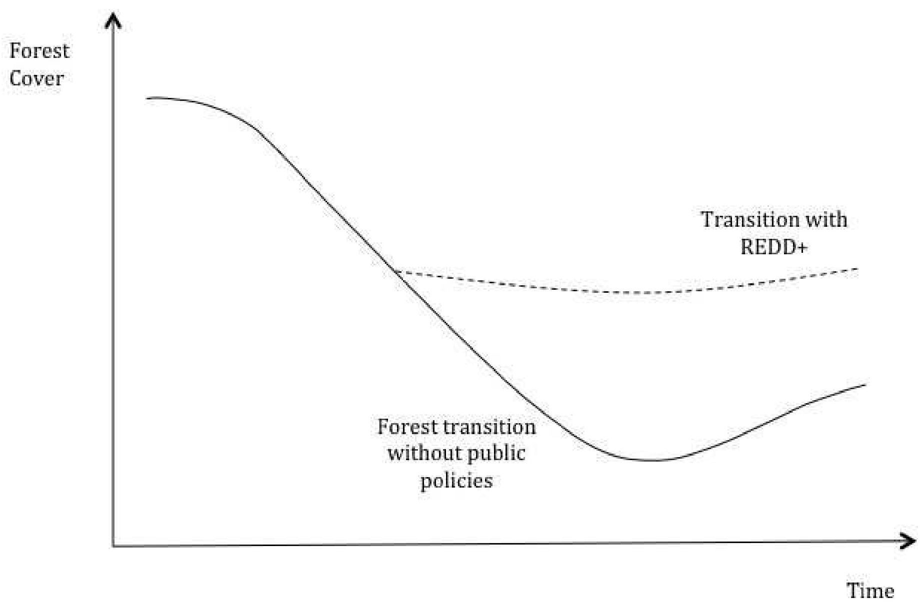
Projects of conservation and reforestation deliver different benefits, notably in terms of climate mitigation and biodiversity. This highlights the lack of substitutability between primary and secondary forests. Depending on how we value these environmental benefits, we can wonder whether the two REDD+ policies (conservation and reforestation) should be considered to be equivalent. In the next section, we explore the effect of promoting either of the above strategies on the “quality” of the forest transition.

9 As of January 2014, 297 projects have been fully completed and included in this first analysis.

4. How REDD+ policies can lead to different forest transitions

The central idea of REDD+ is then to provide financial compensations to countries that avoid deforestation. Following this definition, the usual effect of REDD+ on the FT can be represented such as on Figure 6. The implementation of REDD+ during the transition modifies the curve and reduces cumulative deforestation[10].

Figure 6: A common representation of the effect of REDD+ on FT



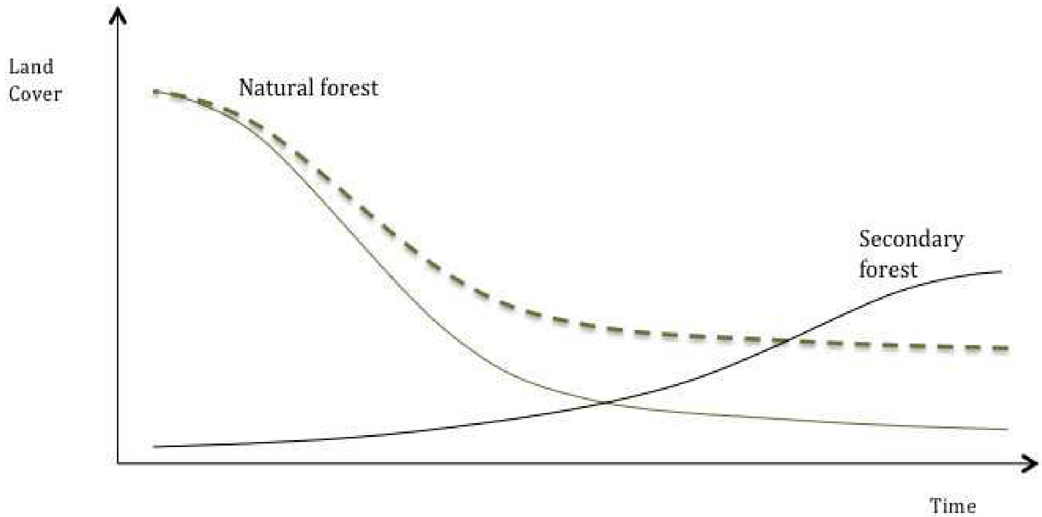
Source: Authors

This is the usual representation that we can find in the literature. It does not distinguish between the types of forest. Yet, when considering the two dynamics of deforestation and reforestation, we can show that REDD+ may have a different effect on FT depending on which of the dynamics (conservation or reforestation) is emphasized.

In Figure 7, we first illustrate the application of a public policy (type RED programs) on the dynamics of primary forests depletion.

[10] Note that this theoretical representation holds for countries in phases 1 and 2, since countries in phase 3 have already experienced their turning point.

Figure 7: RED programs on the dynamics of deforestation within the FT

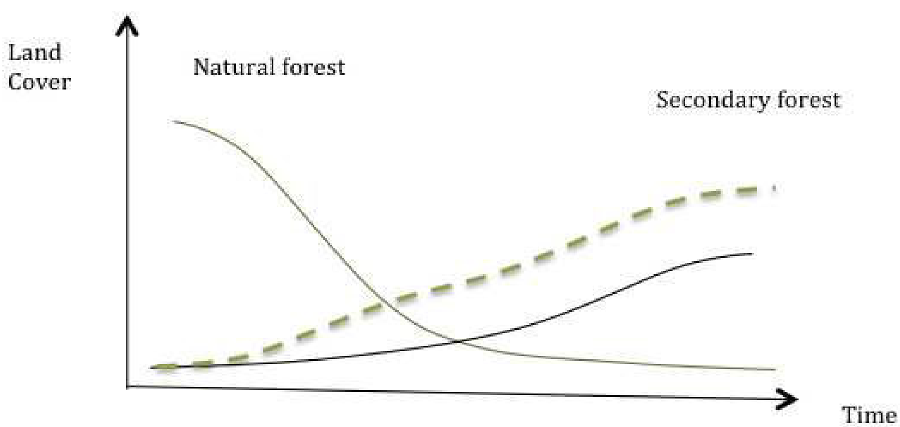


Source: Authors

We can see that the turning point occurs (1) with more forest cover and (2) later in time. Favouring the protection of the natural old-growth forests with RED programmes delays the turnaround but allows to preserve a larger amount of primary forest. Then, even if net deforestation lasts longer, the transition is more environmentally valuable.

In Figure 8, we now examine the case of a public policy (type AR programs) on the reforestation dynamics of secondary forest.

Figure 8: AR programs on secondary forest dynamics



Source: Authors

In this case, the turning point occurs: (1) with more forest cover (2) earlier in time. We assume that the gain of total forest cover is the same between figure 7 and 8. It allows us to drop the hypothetical quantity effect, and focus on the quality of transitions. Favouring the reforestation dynamics with AR programmes leads to a shorter period of net deforestation. However, due to the lower amount of primary forest conserved with this type of policy, we can assume that the level of biodiversity and the effect on carbon emissions reduction is lower than in figure 7. As a consequence, we observe that the second case of transition is ecologically less valuable than the first, where primary forests are targeted.

This raises the issue of evaluation in REDD+, which is a performance-based mechanism. Until now, performance has only been considered in terms of CO_2 emission reductions, whereas other elements should be taken into account in the calculation of performance (e.g. the biodiversity).

The first reason is that carbon emission reductions in the forestry sectors are particularly difficult to measure and monitor, due to complex issues such as non-permanence, leakage and baseline scenario. These barriers lead to an expensive and uncertain monitoring of emission reductions, which slow down considerably the development of the REDD+ mechanism. Several cases of dubious accounting at project scale have been denounced, weakening the credibility of REDD+. Lowering the weight of carbon accounting in REDD+ payment might thus avoid such problems.

Moreover, beyond climate change mitigation, REDD+ is a mechanism aiming at protecting biodiversity and at participating in countries' development. The recognition of the multiple objectives of REDD+ was formalized by the establishment of environmental and social safeguards in the Cancun Agreement (2010)[11] (Simonet et al. 2012). Payments should thus be indexed on more elements than emission reductions. Karsenty (2012) recommends the definition of performance criteria that include proxies for all measurable activities contributing to reducing deforestation and not only the emission reductions themselves. The possibility of taking into account governance indicators such as the one created by UN-REDD[12] could notably be discussed. Considering the non-substitutability of primary and secondary forests, we suggest that biodiversity should also be taken into account. Simple indicators must be found in order to avoid a more complex process.

[11] http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=2
12 http://www.un-redd.org/NewsCentre/Support_to_Effective_Governance/tabid/5543/Default.aspx

5. Concluding remarks

In this paper, we discussed the effect of REDD+ policies on future forest transitions in developing countries. To do this, we exposed the original FT framework, and then highlighted the importance of extending this framework by distinguishing between primary and secondary forests. Thus, our major contribution is to provide a more accurate picture of the potential effect of REDD+ on the FT.

We first saw that in order to efficiently influence the FT in a country, REDD+ policies should take into account the macroeconomic background of the country. For phase 1 countries, it is important to control the main factors that usually trigger massive deforestation (e.g. development of infrastructures, entrance into global markets, etc.) of primary forest. The priority for phase 2 countries is to limit extensive agricultural production and preserve the remaining natural forest. As phase 3 countries have already reached a turning point, AR programs generally become the most common strategy.

We then saw that the choice of the REDD+ strategy (RED or AR programs) for countries in phases 1 and 2 has an impact on their future forest transition. When RED projects are targeted on the deforestation dynamics of primary forest, the turning point may occur later in time but with a higher environmental value due to the imperfect substitution between primary and secondary forests. Despite a longer period of net deforestation, we can assume that this type of FT provides better outputs in terms of carbon sequestration, biodiversity and ecosystem services conservation. On the other hand, favouring the reforestation dynamics of secondary forest may lead to faster transitions (i.e. shorter period of net deforestation) but with less environmental benefits.

As a conclusion, REDD+ may be an adequate tool for speeding up forest transitions if it takes into account the entire ensemble of features of countries, both environmental and economic. In addition, depending on REDD+ policies, different transitions may emerge, with greater or lesser environmental benefits. The success and the pace of these public policies now obviously depend on the willingness of countries to reverse the trend and the ability of public decision-makers to question the effectiveness of their policy.

References

A. Angelsen and T.K. Rudel, 2013. Designing and implementing effective REDD+ policies: a Forest Transition approach. Review of Environmental Economics and Policy. Oxford University Press.

G.P. Asner, M. Keller, M. Lentini, F. Merry, and C. Souza. (2009) Selective Logging and Its Relation to Deforestation, in Amazonia and Global Change (eds M. Keller, M. Bustamante, J. Gash and P. Silva Dias), American Geophysical Union, Washington, D. C.

M. Berne, (2012), 'La forêt dans la finance carbone : reboiser ou éviter de déforester', Les Cahiers de la Chaire Economie du Climat- Série Informations et Débats 20.

J. Burley (2002), 'Forest biological diversity: an overview', UNASYLVA-FAO-, 3--9.

Chomitz, Kenneth M., Piet Buys, Giacomo De Luca, Timothy Thomas, and Sheila Wertz Kanounnikoff. 2007. At loggerheads? Agricultural expansion, poverty reduction, and environment in the tropical forests. World Bank Policy Research Report. Washington, DC: World Bank.

P. Delacote, S. Garcia and J. Wolfersberger. (2013). An empirical analysis of the cumulative nature of deforestation. Working Paper.

M. Dutschke. (2013), 'Key issues in REDD+ verification', Technical report, CIFOR.

IPCC (2007): T. Barker et al. in IPCC climate change 2007. Contribution of Working Group III to the Fourth Assessment Report of the IPCC: Mitigation of climate. Summary for policymakers (eds Metz, B. et al.) 25-93 (Cambridge Univ. press, 2007).

A. Karsenty. (2012), 'Financing options to support REDD+ activities', Technical report, European Commission.

E. F. Lambin, and P. Meyfroidt. 2010. Land use transitions: Socio-ecological feedback versus socio-economic change. Land Use Policy 27 (2): 108–18.

S. Luyssaert, E. Schulze, A. Borner; A. Knohl, D. Hessenmöller, B.E. Law, P. Ciais; and J. Grace. (2008) “Old-growth forests as global carbon sinks”. Sierra Forest Legacy Nature Letters, Vol 455, Pg. 213-215

Mather, Alexander. 1992. The forest transition. Area 24: 367–79. (Rudel et al., 2005)

Montagnini, F., Nair, P.K.R., 2004. Carbon Sequestration: An Underexploited Environmental benefit of agroforestry Systems. Agroforestry Systems. 61, 281-295.

Y. Pan; R. Birdsey; J. Fang; R. Houghton; P. Kauppi; W. Kurz; O. Phillips; A. Shvidenko; S. Lewis; J. Canadell, & others (2011), 'A Large and Persistent Carbon Sink in the World's Forests', Science.

Peters-Stanley, M. & Yin, D. (2013), 'Manoeuvring the Mosaic-State of the Voluntary Carbon Markets 2013', Technical report, Forest Trends' Ecosystem Marketplace and Bloomberg New Energy Finance.

N. L. Stephenson, A. J. Das, R. Condit, S. E. Russo, P. J. Baker, N. G. Beckman, D. A. Coomes, E. R. Lines, W. K. Morris, N. Rüger, E. Álvarez, C. Blundo, S. Bunyavejchewin, G. Chuyong, S. J. Davies, Á. Duque, C. N. Ewango, O. Flores, J. F. Franklin, H. R. Grau, Z. Hao, M. E. Harmon, S. P. Hubbell, D. Kenfack, Y. Lin, J.-R. Makana, A. Malizia, L. R. Malizia, R. J. Pabst, N. Pongpattananurak, S.-H. Su, I-F. Sun, S. Tan, D. Thomas, P. J. van Mantgem, X. Wang, S.K. Wiser & M. A. Zavala, (2014), Rate of tree carbon accumulation increases continuously with tree size. Nature, 1476-4687.

T. K. Rudel, O. T. Coomes, E. Moran, F. Achard, A. Angelsen, J. Xu and E. Lambin. (2005). Forest transitions: towards a global understanding of land use change. Global Environmental Change, 15(1):23 – 31.

G. Simonet, G. Bouculat and A. Oliveira. (2012) 'Forest carbon: tackling externalities' Les Cahiers de la Chaire Economie du Climat- Série Informations et Débats 17.

G. Simonet and J. Wolfersberger. (2013) 'Agroforesterie: un gisement de croissance verte?' in 'La croissance verte : une solution d'avenir ?', Les Cahiers du Cercle des économistes, 53-62.

G. R. Van der Werf, D. C. Morton, R. S. DeFries, J. G. J. Olivier, P. S. Kasibhatla, R. B. Jackson, G. J. Collatz and J. T. Randerson (2009), 'CO2 emissions from forest loss', Nature GeoScience 2, 737-738.

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