**Fearnside, P.M., A.M. Yanai & C.S.M.N. Vitel. 2013. Modeling Baselines for REDD Projects in Amazonia: Is the carbon real? Chapter 2, pp. 1-11. In: *Impacts of Carbon-Optimised Land Use Management in Southern Amazonia - Multidisciplinary Perspectives*. Carbiocial, Universidade Federal de Mato Grosso (UFMT) & FONA Research for Sustainable Development BMBF, Cuiabá, Mato Grosso (CD-ROM).**

# Modeling Baselines for REDD Projects in Amazonia: Is the Carbon Real?

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## SUMMARY

Reducing Emissions from Deforestation and Degradation (REDD) projects have an important potential role in mitigating global warming, but they are subject to the effects of regulatory loopholes and information gaps that can result in attributing undeserved climate benefits or carbon credit. Carbon emission reductions must be “real” in their effect on atmospheric $CO_2$ concentrations, as distinct from being a mere accounting formality that may or may not conform to regulatory requirements. Problems in assuring that emission reductions are real also apply to many other forms of mitigation and are by no means limited to REDD. A key weak point is the baseline scenario, which is a hypothetical calculation of the land-use change and emissions that would occur without the mitigation project. Depending on circumstances, distortions can occur with either a historical baseline (based on continuation of past deforestation rates) or with a modeled baseline (based on simulation of future changes in land use). Modeling of Amazonian deforestation is improving such that modeling artifacts that have resulted in exaggerations in projected emissions are eliminated.

Keywords: Global warming, Mitigation, Deforestation, Brazil, Climate change, Environmental services

## 1. REDD AND CLIMATE MITIGATION

If mean global temperatures are to be kept within the bounds now agreed as defining “dangerous” climate change (2°C above pre-industrial temperatures), mitigation will require that large amounts of carbon emission are either avoided or absorbed within a short time frame. The emissions that must be mitigated include not only the “direct human-induced” emissions covered by the Kyoto Protocol, but all net emissions, including “indirect” and “natural” sources. Mitigating these will require greatly reducing emissions both from fossil-fuel combustion and from other sectors, including land use, land-use change and forestry (LULUCF). If global warming is to be contained, it is essential that the carbon emission reductions be real – not mere paper accounting formalities that do not correspond to changes in carbon flows into and out of the atmosphere. The large amounts of money to be spent on mitigating global warming translate into intense pressure from companies and governments to influence the regulatory and accounting procedures in the most profitable ways possible from the point of view of the interested parties. The temptation is obviously great to create loopholes in the regulations in order to allow “non-additional” projects to receive financial benefits. "Non-additional” projects are those that would happen anyway without the additional subsidy from sale of carbon benefits. Non-additional projects are explicitly forbidden by the Kyoto Protocol (Article 12) in the case of the Clean Development Mechanism (CDM). However, the fact is that non-additional projects are commonplace in the CDM; a survey of 222 registered projects founded that 26% of the projects sampled have a contribution to their overall internal rate of return (IRR) lower than 2%, suggesting that these projects would be likely to occur anyway (Wen & Yong 2010). A clear example is provided by the many hydroelectric dams that are being built as a result of massive national programs that have little or nothing to do with combatting global warming (e.g., Fearnside 2013a). Another example is credit for no-till planting of soybeans as a means of increasing soil carbon, since the shift from traditional plowing to no-till agriculture is occurring anyway simply because it is financially more attractive, even without carbon credit (see: Casão Junior et al. 2012). In projects of all types, wherever uncertainty allows a choice in constructing a baseline there is an inherent temptation for project developers to choose the scenarios that attribute the greatest carbon benefit to their proposed projects.

Mitigation projects are divided into two groups: voluntary and official. The “voluntary” market refers to carbon sales either directly from project developers to interested parties (such as companies wishing to market their products as “carbon neutral”), or to sales on a number of carbon exchanges around the world (such as the Chicago Climate Exchange, or CCX). “Official” markets include the Clean Development Mechanism and the European Union Emissions Trading Scheme (EU-ETS). A variety of national governments (such as the

Netherlands) and sub-national governments (such as the US state of California) have carbon offset programs that pay projects for climatic benefits. An important difference between voluntary and official markets is the matter of scale: the massive reductions that must be achieved globally to contain climate change imply that large amounts of carbon and money will be exchanged on official markets, where countries are purchasing carbon in order to fulfill formal commitments under the United Nations Convention on Climate Change (UNFCCC). By contrast, the voluntary market, which has until now been the only one purchasing carbon from Reducing Emissions from Deforestation and Degradation (REDD), is much more limited. This is because the voluntary market depends on the willingness of companies to pay to be able to claim corporate responsibility, which can be attained with efforts that are merely token from the perspective of the amounts of global emission reduction needed to bring climate change under control. The different carbon markets have widely varying standards for certification and verification of the emissions reductions.

Another divide in mitigation proposals is between those based on a fund and those using a market mechanism. A fund would pay for emissions reductions at a fixed rate, whereas in a market the price is determined by the equilibrium between supply and demand, as in economic exchanges of all types. An important difference between the two is the price that can be obtained. A fund for paying for mitigation projects is proposed to make payments based on the opportunity cost of foregoing deforestation (e.g., Greenpeace 2008, p. 19). In the case of most of Brazilian Amazonia this means the low return that can be had by converting forest to cattle pastures that are both ephemeral and of poor quality, thereby giving up the root of the value of the carbon in competing directly with more expensive mitigation alternatives such as increasing the efficiency of vehicles and industries (e.g., Fearnside 2012a). The equilibrium between supply and demand can maintain high carbon prices in two ways. The first way is by restricting supply, which can be done either by either excluding different forms of mitigation from the market (as has occurred for REDD in the 2008-2012 First Commitment Period of the Kyoto Protocol) or by only allowing a small percentage of mitigation to use forest credits (as occurred for afforestation and reforestation projects in the CDM under the 2001 Marrakech Accords). The second way is by increasing demand, which in this case means convincing countries to agree to making larger cuts in their greenhouse gas emissions. It is the second approach that is needed if climate change is to be contained (Fearnside 2012b).

## 2. REDD PROJECT BASELINE SCENARIOS

For calculating the carbon benefits of mitigation projects, the emission observed through monitoring as the project proceeds is compared with the emissions that would have occurred had there been no project. Estimating what “would have occurred” involves a counterfactual reference or “baseline” scenario. Because the baseline is necessarily a calculation, rather than a direct observation, it is inherently subject to “gaming,” or manipulation such that the carbon benefits are exaggerated and the mitigation project is more profitable. There are two types of baseline: historical and simulated. A historical baseline uses a deforestation rate as measured over a past period, and assumes that this will continue into the future, while a simulated baseline uses a model of future deforestation to represent what would happen without the project. The historical baseline has the advantage of being less subject to gaming, but it too can exaggerate deforestation in cases where clearing rates are declining (for example due to exhaustion of available forest, as is a factor in parts of Mato Grosso).

The challenge of ensuring that REDD project baselines are realistic is illustrated by the first project of this type in Amazonia: the Juma Sustainable Development Reserve (RDS Juma) in Brazil’s state of Amazonas. To calculate the deforestation that would occur without the project, the Project Design Document (PDD) (IDESAM 2009) used a map of the output from a regional simulation model (SIMAMAZONIA) representing deforestation in Amazonia through 2050 published in the highly respected journal *Nature* (Soares-Filho et al. 2006). While the simulation of deforestation may represent regional trends, it is subject to serious distortions when a “cookie-cutter” procedure is used to examine what will happen in a specific piece of the landscape, such as the Juma reserve. The SIMAMAZONIA model calculates deforestation in a series of sub-regions, but the one that includes the Juma reserve is enormous, covering the state of Amazonas and parts of Pará and Mato Grosso. The total amount of deforestation occurring each year was influenced by the forest area, which is tremendous in this sub-region. The location where this deforestation occurs is then determined based on probabilities that are dependent on the existence of previous deforestation and roads. Since these are concentrated in the corner of the sub-region that includes the Juma reserve, almost all of the deforestation in the sub-region is allocated to this corner of the sub-region. The baseline deforestation by 2050 in the Juma reserve used in the PDD based on the SIMAMAZONIA output is 4.3 times greater than that projected by a simulation that avoids this distortion (Yanai et al. 2012). The amount of deforestation avoided in the Juma reserve since the project began in 2008 is undoubtedly modest, as the project area is inhabited by traditional riverside residents who deforest very little anyway. Note that the REDD project excludes the portion of the Juma reserve where most deforestation is currently occurring, namely the area along the AM-174 road that bisects the reserve. The potential to have a greater carbon benefit lies in the grassroots support that the project benefits generate for creating other sustainable development reserves in the vast areas of forest that are still unprotected in the state of Amazonas. Unfortunately, this potential has so far been squandered, as creation of new protected areas in the state has been virtually zero since 2008.

REDD in Amazonian indigenous areas is potentially very important because these areas contain 26% of the remaining forest carbon in Brazilian Amazonia (Moutinho et al. 2011, p. 108). Indigenous areas are not immune from deforestation, those in Mato Grosso providing a clear example (Fearnside 2005). The first REDD project in an indigenous area is the Suruí Forest Carbon Project in the Sete de Setembro Indigenous Land (*Terra Indígena Sete de Setembro*). This indigenous area, which straddles the border between the states of Rondônia and Mato Grosso, shows improvement in baseline modeling, but illustrates other problems inherent in mitigation projects in general – not only REDD projects. A preliminary baseline calculation used the SIMAMAZONIA output; for reasons similar to those in the Juma case, the SIMAMAZONIA projection indicated very rapid deforestation. SIMAMAZONIA indicated deforestation for the 2003-2008 period in the Suruí territory 64% higher than what was observed for the same period from satellite imagery (PRODES), leading the authors of the preliminary baseline to adjust the future projection downward by this percentage (IDESAM 2010, p. 26). This contrasts with the Juma project, where no such downward adjustment was applied. A more realistic baseline model (SIMSURUÍ) was used in the version of the PDD submitted to the Voluntary Carbon Standard (VCS) (IDESAM & Metareilá 2011) and in the version that was subsequently validated (IDESAM & Metareilá 2012).

In 2010 a severe drought affected the southwestern portion of Brazilian Amazonia (Lewis et al. 2011), and fire escaped from burning of pasture that had been (illegally) planted inside the reserve under a sharecropping arrangement with neighboring ranchers. An area of 4187 ha was burned (Graça et al. 2012). Forest fires favored by climate change underway in Amazonia represent a significant threat to carbon stocks expected to be maintained through future REDD projects in the region (Aragão & Shimabukuro 2010). The Suruí project proponents have initiated preparation of a request to revise the project baseline PDD to remove the carbon stock lost to the fire (Metareilá 2013). VCS regulations permit this for a "catastrophic reversal," which can be either a natural event such as drought and fire or "man-made events over which the project proponents have no control such as acts of terrorism or war." The Suruí case illustrates the inherent difficulty of dealing with such events in REDD projects. The 2010 drought was an event of a type that is expected to become much more frequent in the future as a consequence of global warming (Cox et al. 2008). The fire started from human action with the involvement of individual Suruí, although not the tribal leadership. The carbon project commits the tribe to control deforestation (but not degradation) in all of the Sete de Setembro Indigenous Land. The tribal leadership does not have dictatorial powers over the behavior of individual Suruí. In practice, denying the group an economically viable alternative through REDD would lead to significant losses of forest in this indigenous area and, indirectly, in much wider areas in other indigenous areas. The revision baseline scenarios to remove unfavorable events is a pattern that is frequent in the in both the CDM and in the voluntary market, and is by no means restricted to REDD projects.

Indigenous REDD in Brazil has suffered a severe setback due the action of "carbon cowboys," or proponents of carbon contracts with indigenous leaders that bypass both the existing carbon verification and certification systems and FUNAI (National Foundation for the Indian), which is the Brazilian government agency charged with indigenous affairs (Talento & Luchete 2013). A national scandal over contracts with these unscrupulous operators, particularly with the Muduruku tribe, has hindered progress in initiating indigenous REDD projects in Brazil, but in the case of the Suruí project, FUNAI was consulted and has not objected. The Suruí project is the center of attention due to the project's strategic importance for REDD initiatives throughout the region.

## 3. NATIONAL BASELINES AND ACCOUNTING

A national baseline, rather than separate baselines for each individual project, has the advantage of avoiding much of the effect of "leakage," or the reduction of the net benefit of a project because the emission (in this case from deforestation) that would have occurred in the project area is displaced to a location outside of the area (e.g., Fearnside 2009a). If a national baseline is used, then only the much smaller leakage to other countries would apply

(Fearnside 1995). Brazil has proposed a baseline for the purpose of calculating national emissions reductions from reducing deforestation using a reference deforestation rate of 19,508 $km^2$/year, which is the average historical rate for the 1996-2005 period (Brazil, CIMC 2008). However, by the time this was announced annual deforestation had already decreased to about half this rate for reasons largely unrelated to mitigation (Fearnside 2009b). The decline in deforestation rate from 2004 to 2008 is explained by commodity prices, but the decline continued over the 2009-2013 period despite a recovery in these prices. After 2008 the decline is believed to be due to policies (Assunção et al. 2012). Particularly important is blocking of subsidized bank loans for properties that violate restrictions on deforestation. This is probably more important than inspections and fines for illegal clearing (fines are often never collected in practice due to legal difficulties).

REDD projects are inherently much more limited in their effect on deforestation than are changes in national policies, such as those affecting taxes, agricultural finance and subsidies, land tenure, settlement projects, enforcement programs, and the expansion of highways and other infrastructure. Policies at this level affect national deforestation totals (i.e., those reported in national inventories under the UNFCCC), but the results are hard to attribute to individual actions such as projects. The best solution is for countries such as Brazil to take on national quotas (assigned amounts) under the Kyoto Protocol or a subsequent agreement and sell carbon based on the national inventory, as through Article 17 of the Kyoto Protocol (e.g., Fearnside 1999, 2001). Although Brazil has now probably lost the opportunity to sell the carbon from most of the large decline in Amazonian deforestation rates since 2004, accepting a quota by joining Annex I of the UNFCCC and Annex B of the Kyoto Protocol remains an option that is very much in Brazil's national interest (Fearnside 2013b).

## 4. CONCLUSIONS

Is the carbon real? The answer is that often at least some of the carbon benefit claimed for REDD projects is not real. However, improvements in modeling deforestation are eliminating the repetition of past distortions. The needed role of REDD in overall efforts to contain global warming, together with the social and environmental co-benefits of using this mechanism to maintain Amazon forest, make further improvement a high priority.

## 5. ACKNOWLEDGMENTS

The author’s research is supported exclusively by academic sources: Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq: Proc. 304020/2010-9; 573810/2008-7), Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM: Proc. 708565) and Instituto Nacional de Pesquisas da Amazônia (INPA: PRJ15.125).

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