

The Effectiveness of Global Carbon Mitigation Mechanisms, a Top-down Analysis. Reflections from the Mata Atlantic Forest

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Introduction

Global climate change and population growth poses important challenges to the world in the near future, especially issues related to food security and the supply of ecosystem services. The framework for carbon sequestration projects under the framework of Land Use, Land Use Change and Forestry (LULUCF) of the Clean Development Mechanism (CDM) could represent a valuable opportunity to protect severely endangered ecosystems and at the same time enhance the living conditions of the inhabitants of the surrounding areas.

The municipality of Cachoeiras de Macacu (Rio de Janeiro State, Brazil) is located in a highly biodiverse but intense degraded ecosystem: the Atlantic Forest. The overexploitation has been continuous over the last 400 years (Instituto Bioatlantica, 2009) and increased in the last decades (Wilson et al., 2009) due to the high exploitation of natural resources to supply the wealth of the habitants of the surrounding areas, especially highly populated cities like Rio de Janeiro.

Objectives and Methodology

The present study is the result of an analysis of the feasibility of carbon mitigation projects in the municipality of Cachoeiras de Macacu, RJ. Potential areas for Land Use, Land Use Change and Forestry (LULUCF) projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol were determinate. The starting point was the analysis of the institutional framework and potential stakeholders related to forest carbon projects in national, regional and municipal levels. Using a snowball sampling methodology decision makers were selected. Afterwards, semi-structured interviews to principal stakeholders were conducted at various sectors: federal government, universities, non-governmental organizations, the Federation of Industries, City Hall and farmers associations (Reed et al, 2009; Corbera and Brown, 2008).

According to the procedures of the IPCC (2006) an analysis of land cover and selected suitable areas for carbon sequestration projects was carried out. The baseline was developed according to a top-down regional baseline approach (Sudha et al, 2007; Hargrave et al, 1998).

Remote Sensing Images (LANDSAT 5 TM 217/75 (1985-07-04) and LANDSAT 5 TM 217/76 (1985-04-15)) and land cover/ land use maps (the more coherent to the DNA of Brazil (UNFCCC, 2009) were obtained (DINARIO project database; Land Use and Land Coverage data for Cachoeiras de Macacu from INEA, 2007; GIS database from the Prefeitura of Cachoeiras de Macacu). The Criteria to select the potential areas was the following:

- a. Any area inside the municipality of Cachoeiras de Macacu that does not contain forest in the images of 1985.
- b. Areas that do not contain forest in 2007, after the comparative analysis.
- c. Exclusion of water bodies

Results and Discussion

The main barriers to the development of LULUCF projects in Brazil are the difficulties to select the suitable lands, complexities for measuring carbon reservoirs and the question of temporality of the credits. In addition, the specificity of existing methodologies (which limits their replication) and demonstration of additionality represent other important obstacles. Additionally, both for large-scale and for small-scale, the specificity of the existing methodologies, does extremely difficult to use them in other initiatives.

The eligible LULUCF activities under the CDM have been defined in Marrakech during the COP-7 in December 2001. Afforestation and reforestation activities could be developed during the first commitment period of Kyoto Protocol (2008-2012). Thus, only the areas that had no forest at least since early 1990 are eligible for reforestation activities. For purposes of CDM forests in Brazil are set a minimum of one (1) hectare, with trees capable of reaching five (5) meters as well as crown cover of at least thirty percent (30%). Given these assumptions, Table 1 shows the estimate of the areas available for reforestation under the CDM project in the municipality of Cachoeiras de Macacu.

Table 1 - Changes in land cover classes in Cachoeiras de Macacu, State of Rio de Janeiro, RJ (1985, 2007).

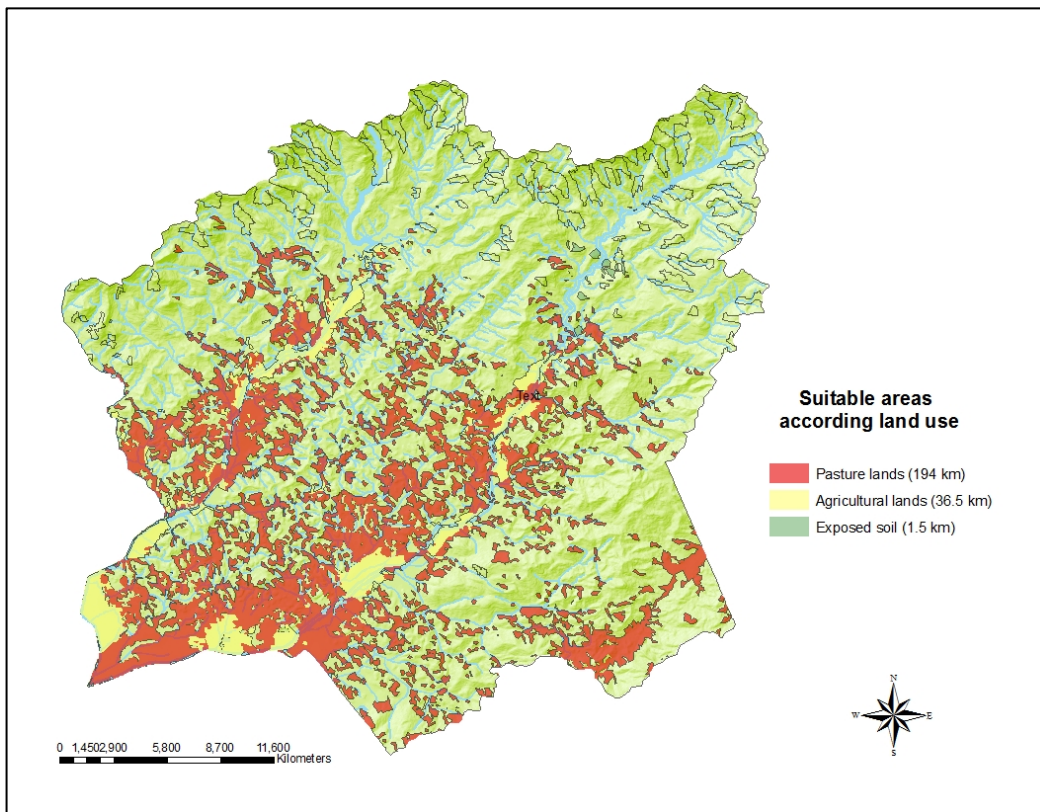
Land Cover Class	1985 (%)	2007 (%)
Forest	34,62	65,13
Secondary Vegetation	3,54	5,86
Urban Areas	0,30	1,36
Suitable areas for LULUCF	56,19	27,64

In Cachoeiras de Macacu, 27% (264 km²) of the municipal area has potential lands for LULUCF projects (Table 1). However, the lands are highly fragmented and mainly occupied by pastures lands (194 km²) or agricultural lands (36.47 km²). Historically deforested areas, like the Atlantic forests, have relatively high percentage of suitable areas for LULUCF initiatives, but also a significant demand for areas for settlements and food production (situation that will be intensified with the establishment of the Petrobras Petrochemical Complex COMPERJ in the region).

The methodology here presented, represents a first approach to map the suitable lands for A/R projects under the CDM. It is a rapid assessment methodology that could be developed in municipalities like Cachoeiras de Macacu to prioritize areas and consequently resources. Correspondingly, there is a need to develop rapid and cheaper methodologies to measure potential sites. Likewise, the available information for land use cover is still squat. More research should be done to identify native tree species (fast-grow and economic representative) that can be applicable for LULUCF projects, but also for silviculture and agro forestry practices.

LULUCF methodologies should be multifaceted to be well integrated in conditions like the present in the municipality. For that reason, other CDM modalities like Programmatic CDM and Bundling of Activities have to be explored. Figure 1 shows the location maps of areas available for LULUCF projects in accordance with the methodology of LULUCF under the CDM.

Figure 1: Potential areas for reforestation methodologies under the CDM Afforestation and Reforestation LULUCF (INPE, 1985, INEA, 2007).



The suitable lands also correspond to the most productive areas of the Municipality and also where the two more important rural settlements are located (São José da Boa Morte and Serra Queimada). Probably also, these are the most parceled areas. This fact also shows that probably the majority of suitable lands were deforested along rivers and today shifting of activities could be almost unavoidable.

There are other existing schemes like the ecologic ICMS, voluntary carbon markets and PES that have demonstrated to be more effective than the CDM in protecting forests. Definitely, other mechanisms like REDD should be implemented and enforced to avoid deforestation and GHG emissions.

There is a well-established overall national framework for CDM projects. Generally, the implementation of LULUCF worldwide is still limited, mainly because of the difficulties to determine available areas and baseline, accounting of carbon pools and carbon sequestration potential as well as the costs related to the design and implementation of projects. Other problems are the specificity of the existing methodologies, the size of the lands and difficulties to demonstrate additionality. External dilemmas include financial schemes and technology transfer.

Conclusions

The current situation of the landscape in the Cachoeiras de Macacu Municipality (i.e. Atlantic Forest Region) remains us the necessity to seek for options to integrate the complex human-social-environmental conditions in order to enhance the socio-economical well being of the inhabitants, but also to increase the biodiversity and the provision of ecosystemic services. A mosaic of

agricultural lands, patches of remaining natural forests and urban and rural settlements make difficult to find conditions to satisfy all necessities.

Difficulties to measure the available areas, the costs, the lack of local communities' engagement and finally the absence of stakeholders' participation are main concerns. Nevertheless, the existing institutional infrastructure and the megacities in the vicinity of the area make a future appliance of Payment of Environmental Services in the region possible. There is a need to develop a more holistic and integrative approach that incorporates carbon mitigation alternatives to other ecosystem services.

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