

Comparing results of Carbon balance appraisal using on-going Bio-Carbon fund projects

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This paper aims at presenting the comparison between EX-ACT results and other carbon analysis results made in the context of CDM projects, questioning the relevance of EX-ACT potential use in this project approach, assuming a time-saving to appraise projects's activities and different options during the formulation of projects.

Four projects respectively implemented or proposed in Mali, India, Ethiopia and Moldavia were tested within EX-ACT, to first compare the results obtained by EX-ACT with initial appraisal results, and then to appraise the additional benefits of using EX-ACT

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1. Background

The central feature of the Kyoto Protocol is its requirement that countries limit or reduce their greenhouse gas emissions. By setting such targets, emission reductions took on economic value. To help countries meet their emission targets, and to encourage the private sector and developing countries to contribute to emission reduction efforts, market-based mechanisms have been included such as the Clean Development Mechanism.

The World Bank has mobilized a fund (BioCarbon Fund) to demonstrate projects that sequester or conserve carbon in forest and agro-ecosystems. The Fund, a public/private initiative administered by the World Bank, aims to deliver cost-effective emission reductions, while promoting biodiversity conservation and poverty alleviation. The fund can consider purchasing carbon from a variety of land use and forestry projects (including Afforestation and Reforestation, Reducing Emissions from Deforestation and Degradation) and is exploring innovative approaches to agricultural carbon.

2. Need of Carbon Assessment tools

Tools are used to calculate, determine, demonstrate, estimate, identify and/or test information relating to project activities. The activities of CDM projects were evaluated using some tools (TARAM, CO2fix) that required much data to calculate the benefits of projects in regards of carbon, hence increasing the cost of project formulation.

Four projects respectively implemented or proposed in Mali, India, Ethiopia and Moldavia were tested within EX-ACT, to first compare the results obtained by EX-ACT with initial appraisal results, and then to appraise the additional benefits of using EX-ACT.

EX-ACT consists of a set of linked Microsoft Excel sheets in which basic data will be inserted. The data required concern land use and management practices foreseen under projects' activities. EX-ACT adopts a modular approach – each “module” describing a specific land use – and following a three-step logical framework:

- a. general description of the project (geographic area, climate and soil characteristics, duration of the project);
- b. identification of changes in land use and technologies foreseen by project components using specific “modules” (deforestation, afforestation and reforestation, annual/perennial crops, rice cultivation, grasslands, livestock, inputs, energy); and
- c. computation of C-balance with and without the project using IPCC default values and – when available – ad-hoc coefficients.

With a minimum of data found in the presentation of CDM project and when available project's document the tool provides in a short time estimations of the benefits brought by the implementation of project's activities.

Moreover using EX-ACT could help going further in the appraisal of carbon costs and benefits, taking into account some other indirect activities and externalities foreseen by the project (value chain approach, natural resources consumption, indirect avoided deforestation...) that could have impact on the mitigation to climate change and that are not yet accounted in the usual CDM methodology.

Its interface may be more user-friendly than other tools that could be too much complicated for novice users or non scientific users.

3. Comparative analysis of Carbon Balance

	Mali	India	Ethiopia	Moldavia
Tool used in Initial Analysis	TARAM	TARAM ?	TARAM ?	CO2fix
Period of analysis	30 years	20 years	30 years	20 years
Initial Result (in eq-CO₂)	1.4 MT	3.9 MT	880,295.9 t	3,970,839 t
Result with EX-ACT (in eq-CO₂)	1.459 MT	- 4.19 MT	869,377 t	3,922,666 t
Variation (%)	-4.2%	-7.4%	-1.3%	-1.2%

EX-ACT provides really similar results which reflect that it could be used easily in the assessment of CDM projects. The tool gives more information about the carbon benefits indicating the reduced emissions of CO₂, CH₄, N₂O, but also the sequestered carbon in biomass and soils. The results are given for the whole duration of the project, per year, per hectare, per year and per hectare. It also represents on a synthetic graph the different activities that tackle mitigation to Climate Change.

Some description of the tested projects is provided next as country project profiles.

4. Detailed project description and results

4.1. Acacia Senegal Plantation Project in Mali

➤ **Background**

The project is reforesting around 6,000 ha of Acacia Senegal, a species endemic to the whole African Sahel, over a 6-year period (2006 – 2011) in the northern region of Nara. The project will build on a pilot project developed in the same type of environment in Niger, which also developed adapted technology. Out of the 6,000 ha, 3,000 ha will be developed on private land owned by Déguessi Groupe, a Malian private producer and importer/exporter of agricultural products, and the other 3,000 ha will be developed by local communities on communal land under a partnership agreement with Déguessi Groupe.

Déguessi Groupe is the project developer and “carbon aggregator”, having signed sub-project agreements with local communities for the commercialization of the Emission Reductions produced on their lands. It will develop and manage cost-effective modern nurseries, contribute to farmers' training and assistance for planting trees, maintaining plantations, and Arabic gum harvesting. The project will also re-introduce agricultural activities through intercropping with groundnuts and cowpeas. The project will respond to the disappearance of Mali natural dry forests provoked by clearing way beyond regeneration capacity to meet the growing demand of firewood and cattle grazing. This deforestation has particularly affected gum-producing Acacia Senegal.

Déguessi Groupe will be the pivot in the development of the project, with the continued technical support of the International Center for Research in Agro-forestry (ICRAF) and the International Crop Research Institute for Semi-Arid Tropics (ICRISAT).

➤ **Application to EX-ACT**

Within EX-ACT two different modules have to be filled according to the project document to get an estimation of the impact of the project on carbon balance.

Description module:

The climate selected is **tropical dry** with **sandy** soils. The total duration of the project is 30 years, including an implementation phase of 20 years.

Afforestation module:

The land mobilised is **set-aside** degraded land which is transformed in **tropical shrubland**. **6,000** hectares are afforested

➤ **Results**

	Initial TARAM Appraisal	FAO EX-ACT Appraisal
Carbon Balance (Tons EqCO ₂)	1.4 MT	- 1.459 MT

The results are very close. EX-ACT could have been used to analyse additional carbon-balance effects linked with Agro forestry, energy and petrol consumption and eventual post-harvest and marketing carbon effect linked with acacia value chain.

4.2. India: project Afforestation in Himachal Pradesh

➤ **Background**

Himachal Pradesh is a mountainous state in northern India. The outer and lesser Himalayan watersheds of the state covering 28,970 km² area are of great national importance, as entire northern India depends largely for water and power produced by runoff from this region. The mid Himalayas are fragile ecosystems due to topography and soils as well as because of high intensity rainfall especially over three months i.e., July to September. Long dry spells ranging from 3-4 months before and after the monsoon are also common.

The objective of this Project is to restore degraded land and make them functioning ecosystems while enhancing the sustainability of the watershed interventions and peoples' livelihoods options and maximizing carbon sequestration. The project will conduct reforestation and afforestation activities to restore degraded natural forest corridors that fall within the catchment treated by a larger mid-Himalaya watershed project (MHWP), ii) to increase soil fertility, protect watersheds and stabilize land-use. These activities will significantly increase tree cover and turn a source of CO₂ emissions into a carbon sink. Activities will be implemented in 12,000 hectares of land (8,000 ha degraded forest and common land +4,000 ha of non arable agriculture waste land). The main objective is ecological rehabilitation of the degraded catchment by carrying out soil and water conservation measures.

The additional income from carbon sequestration is essential to the implementation of this project. Barriers to the project implementation are related to investment and lack of capital. In the current situation, the financial capacity of the state forestry sector is very low.

The project is developed by the Government of Himachal Pradesh – Department of Forests, through the Natural Resource Management Society and MHWP. Total project costs for the Mid-Himalayan Watershed Development Project MHWDP is \$100 million distributed as follows: IDA is providing a credit of \$60 million, the Government of Himachal Pradesh is contribution some \$30 million, whereas the remainder is financed through the BioCarbon Fund and community contributions.

➤ **Application to EX-ACT**

Within EX-ACT two different modules have to be filled according to the project document to get an estimation of the impact of the project on carbon balance.

Description module:

The climate option is **tropical moist** while land option is **HAC** soil. The implementation phase last 10 years and the capitalization phase is expected to last 10 years also.

Afforestation module:

The afforestation will restore **12,000 ha** of degraded natural forest **set aside** and other degraded into **tropical dry forest plantations**.

➤ **Results**

	Initial Appraisal	FAO EX-ACT Appraisal
Carbon Balance (Tons EqCO ₂)	3.9 MT	- 4.19 MT

The results are very close. EX-ACT could have been used to analyse additional carbon-balance effects linked with other watershed management options (agro forestry, grasslands improvement). The energy and petrol consumption linked with afforestation actions.

4.3. Afforestation/Reforestation CDM Humbo Ethiopia assisted Natural regeneration

➤ **Background**

The main activity of the project consists in establishing biodiverse native forest and support income through assisted natural regeneration of the Humbo area. It is aimed at stopping the loss of original Ethiopian high forest that affect livelihoods of communities and biodiversity, helping to reduce the threat of critically endangered species and improving the connectivity of fragmented forest resources.

➤ **Application to EX-ACT**

Within EX-ACT two different modules have to be filled according to the project document to get an estimation of the impact of the project on carbon balance.

Description module:

The project takes place in **Ethiopia**, Eastern **Africa**, within a **moist tropical montane** climate and moisture regime. The dominant soil types in Ethiopia are vertisols/nitrosols that were considered as **LAC** soils.

The project adopts a **15-year** implementation period to reach a total project duration of 30 years.

Afforestation/reforestation module:

The project will lead to the conversion of **2728 ha** of degraded lands to natural tropical mountain forest. It was assumed that this plantation would not have happened if the project was not implemented.

➤ **Results**

Finally EX-ACT indicates that the project acts positively on the carbon balance. The benefits of the project are estimated to reach a sink of **-869,377** tons of eq-CO₂. This result is really similar to the one given by the project document, estimating the project carbon stock change to **880,295.9** t of eq-CO₂. EX-ACT allows having a global relevant estimation of the benefits provided by the implementation of a project, with a minimum of data.

The carbon accounted presented in the project document only concerns the activity of reforestation. There are some other indirect activities that could be taken with EX-ACT. For example, it doesn't take into account the consumption of fossil resources to implement the project (i.e fuel consumption). We could also account the expected emissions of carbon due to the livestock grazing.

Indicators given by EX-ACT:

	<i>Results (tons of eq-CO₂ for the whole project duration)</i>
Benefits due to the project implementation	-869377
Biomass Gain	-461914
Biomass Loss	10003
Carbon sequestration in soil	-417465

4.4. Afforestation/Reforestation CDM Moldavia Soil conservation Project

➤ **Background**

The main activity of the project consists in restoring the productivity of degraded lands through afforestation activities involving locally adoptive species (4 groups of species including Quercus, Robinia, populus, pinus species).

➤ **Application to EX-ACT**

Within EX-ACT two different modules have to be filled according to the project document to get an estimation of the impact of the project on carbon balance.

Description module:

The project takes place in Moldavia, **Eastern Europe**, within a **cool temperate** climate and a moisture regime. The dominant soil type in Moldavia is chernozems that were considered as **HAC** soils.

The project adopts renewable 20-year crediting period for a total project period of 60 years. To comply with different carbon accounting methodology, we considered a period of a total **20-year** implemented period.

Afforestation/reforestation module:

The project will lead to a plantation of 20,289.91 ha of both degraded lands (**4,610.81 ha**) and degraded grasslands (**15,679.1 ha**) among a period of 20 years.

The project design assumed that about 315 ha of forest are planted on the national degraded lands (85,700 ha) each year. It leads to 75.7 ha per year (or **1514 ha** for the 20-year period) of afforestation in the expected situation without project on the surface improved with the project (20,289.91 ha).

➤ **Results**

Finally EX-ACT indicates that the project acts positively on the carbon balance. The benefits of the project are estimated to reach a sink of **-3,922,666** tons of eq-CO₂. This result is really similar to the one given by the project document, estimating the project carbon stock change to **3,970,839** t of eq-CO₂. EX-ACT allows having a global relevant estimation of the benefits provided by the implementation of a project, with a minimum of data.

The carbon accounted presented in the project document only concerns the activity of reforestation. There are some other indirect activities that could be taken with EX-ACT. For example, it doesn't take into account the consumption of fossil resources to implement the project (i.e fuel consumption). Yet, with the given data on the project document we can assess a consumption of 19640.8 l of fioul that could be accounted in the *other investments* module of EX-ACT. We could also account the expected emissions of carbon due to the nursery technologies (treatments with fungicides, insecticides, micronutrients...) but also the avoided deforestation in the situation with project caused by the plantation of *Robinia pseudoacacia* which is a major source of fuel wood.