

Philippine Peñablanca sustainable reforestation project (PPSRP)

EX-ACT results verification



Introduction

EX-ACT is a tool developed by FAO and aimed at providing ex-ante measurements of the impact of agriculture (and forestry) development projects on GHG emissions and C sequestration, indicating its effects on the C-balance¹, which is selected as an indicator of the mitigation potential of the project (EX-ACT 2010). EX-ACT can be used in the context of ex-ante project formulation and it is capable of covering the range of projects relevant for the land use, land use change and forestry (LULUCF) sector. It can compute the C-balance by comparing two scenarios: “without project” (i.e. the “Business As Usual” or “Baseline”) and “with project”. Main output of the tool consists of the C-balance resulting from the difference between these two alternative scenarios.

EX-ACT has been confronted to a testing process in order to have an idea of its estimated results within the tier 1 approach mainly based on the IPCC methodology².

The present document relates the comparison between results provided by project document and results obtained with EX-ACT following the Tier 1 approach (use of default coefficients). Indeed if EX-ACT was designed to perform ex ante analysis, it is important and relevant to confront the estimates provided with other tools. This procedure will allow comparing ex-ante estimates. Thus the aim of this test is to verify the quality of the estimates provided by EX-ACT against other estimations.

Project background

The Philippines is one of world's seventeen megadiversity countries³. At the same time, it is one of the world's most threatened biodiversity hotspots. It especially suffer from unsustainable use of forest lands and its resources. This has resulted in the fragmentation of the forest that threatens the endemic and threatened species of plants and animals and the integrity of the watersheds that may be further compounded by the unpredictable impacts of climate change.

To reverse the negative trends, Conservation International (CI) has initiated conservation projects within the Peñaflanca Protected Landscape and Seascape (PPLS), a protected area located at the heart of Sierra Madre Mountains, in partnership with local NGOs, the Department of Environment and Natural Resources (DENR) and the Local Government Unit of Peñaflanca (LGU).

Project goals

The goal of the project is to promote forest restoration, forest and biodiversity conservation, and alternative livelihood through reforestation, enhancement planting and agro-forestry. The project will cover 2 943 hectares of degraded lands (formerly grazed grassland and patches of degraded secondary forest) in five barangays² within PPLS, of which 2 500 hectares will receive active intervention of either

¹ C-balance = GHG emissions - C sequestered above and below ground.

² IPCC Guidelines provide three methodological tiers varying in complexity and uncertainty level: Tier1, simple first order approach which uses data from global datasets, simplified assumptions, IPCC default parameters (large uncertainty); Tier 2, a more accurate approach, using more disaggregated activity data, country specific parameter values (smaller uncertainty); Tier 3, which makes reference to higher order methods, detailed modeling and/or inventory measurement systems driven by data at higher resolution and direct measurements (much lower uncertainty).

³ R. A. Mittermeier, P. Robles Gil & C. G. Mittermeier. (Eds.), Megadiversity: Earth's Biologically Wealthiest Nations. Monterrey, Mexico: CEMEX. 501p.

reforestation, enhancement planting, or agroforestry. The project will be implemented in two phases (Phase 1 from 2007 to 2010; Phase 2 from 2010 to 2013). For the long-term sustainability of the benefits the project impacts after the initial funding ends, the project will create Reforestation Fund.

Carbon balance appraisal

The carbon balance appraisal has been realized with data and information provided in the PPSRP's project document. The activities accounted to do the carbon balance appraisal are gathered in two EX-ACT module: *Deforestation* and *Afforestation/Reforestation*.

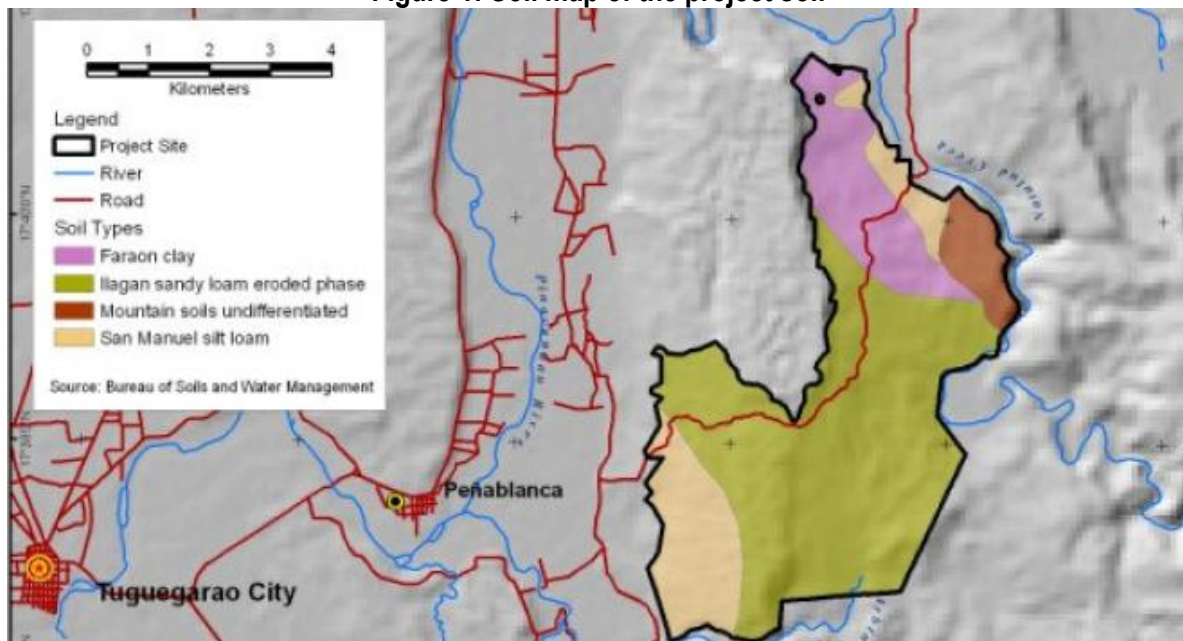
Assumptions used to fill the description module

The (PPSRP) site is situated between latitudes of 17° 36' 14.66" N and 17° 41' 28.26" N and between longitudes of 121° 49' 12.55" E and 121° 52' 40.02" E in the Municipality of Peñablanca, Province of Cagayan in northern Luzon Island, Philippines. Consequently the chosen continent is Asia (insular).

The climate of the project site is characterized by no pronounced dry and wet seasons (type IV of the Corona climatic type classification), relatively dry from December to April and wet during the rest of the year. According to the IPCC climate classification map, the zone is under tropical wet climate.

There are three distinct soil types that cover the project site: Ilagan Sandy Loam Eroded Phase (LAC), Faraon Clay (LAC) and San Manuel Silty Loam (HAC). The dominant type of soil will be LAC soils in EX-ACT.

Figure 1: Soil map of the project soil



The project is implemented in two phases of three years and the carbon changes estimations have been realized within 30 years. Consequently a period of 6 years of implantation phase will be considered as well as 24 years of capitalization phase.

Figure 2: Description module of EX-ACT

Description of the project		
Project Name		GWP (choose values) <i>Official-CDM</i> CO2 1 CH4 21 N2O 310
Continent	Asia (Insular)	
Climate	Tropical	
Moisture regime	Wet	
See "Climate" for Help		
Dominant Regional Soil Type	LAC Soils	
See "Soil" for Help		
Duration of the Project (Years)	Implementation phase	6
	Capitalisation phase	24
	Duration of accounting	30

Assumptions used to fill the deforestation module

The protection of the existing forests covering an area of 1010.67 ha will be undertaken within the project. With the implementation of forest protection program as a result of the project, emissions of carbon from deforestation and degradation will be avoided. The deforestation rate chosen in the project document to build the baseline is estimated at 0.30%/year. Without the project, it is expected that deforestation will continue to occur with this rate which will consequently result to emissions of carbon.

The existing forests in the project area are estimated to hold a carbon density of 94.05 tC/ha (Lasco et al 2007). Within EX-ACT the default category of forest corresponding to this carbon density is the forest 4 having a carbon density of 93.7 tC/ha.

Translating in EX-ACT it means a start forested area of 1010.67 ha remaining with the implementation of the project and reaching only $1010.67 - (1010.67 \times 0.3 / 100 \times 30) = 919.716$ ha in the future without project.

No information was provided about HWP. Thus it will be considered that there will not be fire use for the conversion.

Figure 3: Deforestation module of EX-ACT

Type of Default forest/plantation proposed within the specified Climatic zone						Suggested Default Values per hectare (t/ha)									
	Ecological Zone	Go to Map	Above-Ground Biomass		Below-Ground Biomass		Litter		Dead Wood		Soil C				
			tonnes dm	t C	tonnes dm	t C	t C	t C	tC	tC	tC	tC			
Natural Forest	Forest1	Tropical rain forest	350	164.5	129.5	60.9	3.65	0	0	60					
	Forest2	Tropical moist deciduous forest	290	136.3	69.6	32.7	3.65	0	0	60					
	Forest3	Tropical dry forest	160	75.2	44.8	21.1	3.65	0	0	60					
	Forest4	Tropical shrubland	70	32.9	28.0	13.2	3.65	0	0	60					
Plantation	Plantation1	Tropical rain forest	150	70.5	55.5	26.1	3.65	0	0	60					
	Plantation2	Tropical moist deciduous forest	120	56.4	24.0	11.3	3.65	0	0	60					
	Plantation3	Tropical dry forest	60	28.2	16.8	7.9	3.65	0	0	60					
	Plantation4	Tropical shrubland	30	14.1	12.0	5.6	3.65	0	0	60					

Conversion details (Harvest wood product exported before the conversion, use of fire, final use after conversion)										Losses (positive value) and gain (negative value) per ha									
Name	Vegetation Type	HWP before		Fire use		Final Use after deforestation	Biomass 1 yr after	Biomass		Soil		CH4 kg	N2O kg	Total tCO2 eq					
		tonne	t C exported	yes/no	% released			t C	t CO2	R _{soil}	Delta C				tCO2/yr				
Defor.1	Forest4	0	0	NO	0	Degraded	1.0	49.7	182.3	0.24	45.6	8.4	0.0	0.0	0.0				
Defor.2	Please specify the vegetation	0	0	NO	0	Select Use after deforestation	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0				
Defor.3	Please specify the vegetation	0	0	NO	0	Select Use after deforestation	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0				
Defor.4	Please specify the vegetation	0	0	NO	0	Select Use after deforestation	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0				
Defor.5	Please specify the vegetation	0	0	NO	0	Select Use after deforestation	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0				
Defor.6	Please specify the vegetation	0	0	NO	0	Select Use after deforestation	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0				

GHG emissions										Total Balance																	
Vegetation Type	Forested Area (ha)				Area deforested (ha)				Biomass loss				Biomass gain (1yr after)				Soil				Fire				Total Balance		Difference
	Start	Without Project	With Project	Rate	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With			
Defor.1	1010.67	919.716	Linear	1010.67	91	0	16578	0	-333	0	15208	0	0	0	31452	0	-31452	0	0	0	0	0	0	0			
Defor.2	0	0	Linear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Defor.3	0	0	Linear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Defor.4	0	0	Linear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Defor.5	0	0	Linear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Defor.6	0	0	Linear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Deforestation Total										31452				0				-31452									

Assumptions used to fill the Afforestation/reforestation module

The project document explains that 1329 ha are considered for A/R activity carbon accounting.
 1114 hectare will be forested on degraded lands (former grassland)
 3 hectare will be forested on cultivated areas (annual crops in EX-ACT)
 212 hectare will be forested on other degraded land (shrublands).

Figure 4: Afforestation/deforestation module of EX-ACT

Type of Default forest/plantation proposed within the specified Climatic zone				Suggested Default Values per hectare (/ha)															
				Up to 20 year-old				After 20 year-old				Litter total				Dead Wood		Soil C	
				Above-Ground Biomass Growth		Below-Ground Biomass gr		Above-Ground Biomass Gr		Below-Ground Biomass gr									
		Ecological Zone		tC		tonnes dm		tC		tonnes dm		tC		tonnes dm		tC			
Natural Forest Type	Natural1	Tropical rain forest		13.00	6.11	4.81	2.26	3.40	1.60	1.26	0.59	3.65	0	60					
	Natural2	Tropical moist deciduous forest		11.00	5.17	2.20	1.03	3.00	1.41	0.60	0.28	3.65	0	60					
	Natural3	Tropical dry forest		7.00	3.29	3.92	1.84	2.00	0.94	1.12	0.53	3.65	0	60					
	Natural4	Tropical shrubland		2.00	0.94	0.80	0.38	1.00	0.47	0.40	0.19	3.65	0	60					
Plantation Type	Plantation1	Tropical rain forest		15.00	7.05	5.55	2.61	15.00	7.05	5.55	2.61	3.65	0	60					
	Plantation2	Tropical moist deciduous forest		10.00	4.70	2.00	0.94	10.00	4.70	2.00	0.94	3.65	0	60					
	Plantation3	Tropical dry forest		8.00	3.76	4.48	2.11	8.00	3.76	4.48	2.11	3.65	0	60					
	Plantation4	Tropical shrubland		5.00	2.35	2.00	0.94	5.00	2.35	2.00	0.94	3.65	0	60					

Conversion details (Previous land use, use of fire before afforestation/reforestation,...)				GHG emitted during Burning				Biomass of forests/plantation																			
Vegetation Type		Previous use before afforestation/reforestation		Burnt before conversion		Default Biomass		Specific Biomass		Soil		CH4		N2O		Total		Annual Biomass Grow		Litter+dead		wood					
										ksoil		Delta C		tCO2/yr		kg		kg		tCO2 eq		<=20yrs		>20yr			
A/R1	Natural4	Degraded Land		YES	1.0					0.33	40.2	7.4	4.60	0.42	0.2	1.3	0.7	3.7									
A/R2	Natural4	Annual Crop		YES	5.0					0.48	31.2	5.7	13.50	3.50	1.4	1.3	0.7	3.7									
A/R3	Natural4	Degraded Land		YES	1.0					0.33	40.2	7.4	4.60	0.42	0.2	1.3	0.7	3.7									
A/R4	Please specify the vegetation	Select previous use		NO	0.0					0.00	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0									
A/R5	Please specify the vegetation	Select previous use		NO	0.0					0.00	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0									
A/R6	Please specify the vegetation	Select previous use		NO	0.0					0.00	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0									

GHG emissions																	
Vegetation Type	Afforested or reforested Area (ha)						Biomass Gain		Biomass Loss		Soil		Fire		Total Balance		Difference
	Without Project			With Project			Without tCO2	With tCO2	Without tCO2	With tCO2	Without tCO2	With tCO2	Without tCO2	With tCO2	Without tCO2	With tCO2	
	Start t0	End	Rate	End	Rate												
A/R1	0	0	Linear	212	Linear	0	-25854	0	825	0	-31249	0	48	0	-56229	-56229	
A/R2	0	0	Linear	3	Linear	0	-366	0	59	0	-343	0	4	0	-646	-646	
A/R3	0	0	Linear	1114	Linear	0	-135856	0	4337	0	-164204	0	253	0	-295470	-295470	
A/R4	0	0	Linear	0	Linear	0	0	0	0	0	0	0	0	0	0	0	
A/R5	0	0	Linear	0	Linear	0	0	0	0	0	0	0	0	0	0	0	
A/R Total														0	-352345	-352345	

EX-ACT matrix of land use change

As mentioned in the project document the carbon accounting concern 2340 ha.

Figure 5: Land use and land use change matrix of EX-ACT

Without Project		FINAL							Total Initial
		Forest/ Plantation	Cropland			Grassland	Other Land		
			Annual	Perennial	Rice		Degraded	Other	
INITIAL	Forest/Plantation	919.716	0	0	0	0	90.954	0	1010.67
	Cropland	Annual	0	3	0	0	0	0	3
		Perennial	0	0	0	0	0	0	0
		Rice	0	0	0	0	0	0	0
	Grassland	0	0	0	0	0	0	0	
	Other Land	Degraded	0	0	0	0	1326	0	1326
	Other	0	0	0	0	0	0	0	
Total Final		919.716	3	0	0	0	1416.954	0	2339.67

With Project		FINAL							Total Initial
		Forest/ Plantation	Cropland			Grassland	Other Land		
			Annual	Perennial	Rice		Degraded	Other	
INITIAL	Forest/Plantation	1010.67	0	0	0	0	0	0	1010.67
	Cropland	Annual	3	0	0	0	0	0	3
		Perennial	0	0	0	0	0	0	0
		Rice	0	0	0	0	0	0	0
	Grassland	0	0	0	0	0	0	0	
	Other Land	Degraded	1326	0	0	0	0	0	1326
	Other	0	0	0	0	0	0	0	
Total Final		2339.67	0	0	0	0	0	0	2339.67

EX-ACT Results

Figure 6: Screenshot of the EX-ACT results module

Project Summary		Area (Initial state in ha)			Duration of the Project (years)	
Name		Forest/Plantation		1010.67	Implementat 6	
Continent	Asia (Insular)	Cropland	Annual	3	Capitalisatic	24
			Perennial	0	Total	30
Climate	Tropical Wet	Grassland	Rice	0		
				0		
Dominante Soil	LAC Soils	Other Land	Degraded	1326		
			Other	0		
				Total Area 2339.67		

Components of the Project	Balance (Project - Baseline) All GHG in tCO2eq	CO2		N2O	CH4	Per phase of the project		Mean per year		
		Biomass	Soil			Implement.	Capital.	Total	Implement.	Capital.
Deforestation	-31452 this is a sink	-16245	-15208	0	0	-18526	-12926	-1048	-3088	-539
Afforestation and Reforestation	-352345 this is a sink	-156854	-195796	176	129	-60868	-291477	-11745	-10145	-12145
Non Forest Land Use Change	0	0	0	0	0	0	0	0	0	0
Agriculture										
Annual Crops	0	0	0	0	0	0	0	0	0	0
Agroforestry/Perennial Crops	0	0	0	0	0	0	0	0	0	0
Rice	0	0	0	0	0	0	0	0	0	0
Grassland	0	0	0	0	0	0	0	0	0	0
Other GHG Emissions		CO2 (other)								
Livestock	0	---		0	0	0	0	0	0	0
Inputs	0	0		0	---	0	0	0	0	0
Other Investment	0	0		---	---	0	0	0	0	0
Final Balance	-383797 It is a sink	-173099	-211003	176	129	-79394	-304404	-12793	-13232	-12683
Result per ha	-164.0	-74.0	-90.2	0.1	0.1	-33.9	-130.1	-5.5	-5.7	-5.4

The net change in carbon stocks due to the project activities are estimated over the 30 year period.

The activity of avoided deforestation imply a carbon sink reaching 31 452 tons of eq-CO₂ whereas the activity of A/R imply a carbon sink of 352 345 tons of eq-CO₂.

Finally, EX-ACT calculations within the tier1 approach estimates the mitigation potential of the project of 383 797 tons of eq-CO₂ during 30 years.

Comparison of results

The total net carbon benefits due to the project activities over the 30 year period will be 366 524 tons of eq-CO₂ according to the carbon project appraisal, whereas it will be 383 797 tons of eq-CO₂ according to the EX-ACT calculations.

The difference can be explained in two main points:

- the carbon density of existing forests differ: within the default EX-ACT category a carbon content of 93.7 tC/ha is considered whereas the project appraisal is estimated with a carbon content of 94.05 tC/ha.

- the activities of tree planting, agroforestry and forest conservation have been appraised only within the A/R EX-ACT module as it is specified in the project document that it corresponds to A/R activities. However, the perennial crops could have been treated separately in the EX-ACT perennial module if specific coefficient had been available. The coefficient in A/R module are bigger than within the perennial module, hence amplifying the final carbon balance.

There is a difference of 17 273 tons of eq-CO₂ or about 4.7 % of divergence.