Operación CO_2

Analyzing the carbon potential of Muntanya d'Alinya

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Activity selection criteria

- **Available land use types (vegetation)**

⇒ Is there land available for its implementation?

- **Social and technical feasibility**
  - Methodological rules set by VCS
  - Infrastructure
  - Land ownership/legislation
  - Local support



- **Additionality**

⇒ Would carbon saving have occurred without the project?

⇒ Know your baseline situation:

For example:

- Alternative land use scenarios (trends, legislation, FMP, etc)
- Demonstrate financially more attractive scenarios

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Identification of land use types

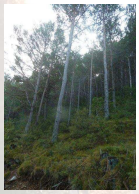
Vegetation types in finca d'Alinya	
Forest Vegetation	**Hectares**
Sclerophyllous vegetation:	
Quercus rotundifolia	155,75
Coniferous vegetation:	
Pinus nigra	662,08
Pinus sylvestris	849,73
Pinus ucinata	736,51
Mixed Quercus-Pinus	11,47
Shrub vegetation	
Quercus, Juniper, etc.	1430,95
Meadows and pastures	
Meadows	543,36
Abandoned pastures	389,82
Vegetation of rocky and stony areas	
	493,06
Weeds and antropogenic vegetation	
Crop land	190,82
Total vegetation cover (hectares)	**5463,55**

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Conversion of Low-productive forest to high-productive forest (LtHP)

Activity Purpose:

Increase carbon stock through improved forest management



Forest/land use criteria:

Degraded or in process of degradation, poorly stocked with commercial species, small diameters, slow growth, etc

Potential measures:

Introduce other species, enrichment planting, mitigation disturbance (grazing, cutting, etc), thinning

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Conversion of Low-productive forest to high-productive forest (LtHP)

Justification for this activity:

- No "degraded" forests, but the project could claim to increase diameters to access timber markets.
- Thinning fits current FCX policy and CCB standard



Land availability:

- Potentially hundreds of hectares of dense forests

Conditions for additionality:

- Already natural forest regeneration (no degradation)
- Proof of improved access to timber market
- Apply in forests not set aside for thinning in FMP

⇒ Conclusion: possibly yes, but carry out a timber/wood product market study

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Extension of rotation age (ERA)

Activity Purpose:

Increase carbon stock through extending of rotation age



Forest/land use criteria:

Current short harvesting rotation cycles;
requires FSC forest certification;
Only in forests not set aside for thinning in FMP.

Potential measures:

Stop/decrease harvesting; protect against Logging

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Extension of Rotation Age (ERA)

Justification for this activity:
- Not possible to achieve mandatory FSC certification in short term



Land availability:
- Potentially hundreds of hectares of forest Land in Alinya (*Pinus* and *Quercus*)

Conditions for additionality:
- Maximum rotation age already maintained in FMP
- Already natural forest regeneration

⇒ Conclusion: not viable

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Afforestation, Reforestation and Revegetation (ARR)

Activity Purpose:
Increase carbon stock through establishing, increasing or restoring vegetative cover through planting, sowing or human-assisted forest regeneration.



Forest/land use conditions:
Available empty lands; degraded forests; Eroded areas.

Potential measures:
Planting/sowing; protect against grazing; protect against harvesting and other disturbances

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Afforestation, Reforestation and Revegetation (ARR)

Justification for this activity:
- Traditions in Alinya focus on pasture
- Subsidies for pasture are declining
- Already much natural forest regeneration



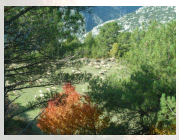
Land availability:
- Potentially hundreds of hectares of (bare) land in Alinya

Conditions for additionality:
- Areas without natural regeneration (e.g. agricultural lands)
- Areas currently degraded or in process of degradation (e.g. over-grazing or eroded)
- Conclusion: yes, provided there is such land available

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Avoid planned or unplanned conversion from forest to non-forest (APDD/AUDD)

Activity Purpose:
- Reduce net greenhouse emissions by avoiding deforestation or forest degradation under legal and planned conversion (APDD)
- Idem under conditions where deforestation and forest degradation would have occurred anyway without planning (AUDD)



Forest/land use conditions:
Forest land prone to wildfires and other catastrophes; Forest land awaiting conversion due to ownership change

Potential measures:
- Avoid change of ownership that would result in forest conversion
- Avoid wild fires and other catastrophes that would reduce forest cover

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Avoid planned or unplanned conversion from forest to non-forest

Justification for this activity:
- There are dense forests prone to wildfires.
- But in FMP (baseline scenario) already measures for protection



Land availability:
- Potentially hundreds (?) of hectares of forests in Alinya

Conditions for additionality:
- Difficult to proof extra avoidance forest fires (additional to FMP)
- Difficult to proof land conversion after ownership change

⇒ Conclusion: Not viable

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Improved Grassland Management

Activity Purpose:
Reduce net greenhouse gas emissions by increasing soil carbon (SOC), and reducing N_2O and CH_4.



Forest/land use conditions:
Pasture land currently intensely grazed, showing signs of degradation, soil erosion.

Potential measures:
Reduce grazing intensity, reduce cattle density, deny access to pasture land

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Improved Grassland Management

Justification for this activity:

- This activity fits the historic context
- But, very low current grazing density
- ARR is more efficient in carbon sequestration

Grazing land availability:

- Potentially hundreds (?) of hectares of land in Alinya.



Conditions for additionality:

- (Almost) no available high intensity grazing land with signs of soil degradation and erosion

⇒ Conclusion: Not viable

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Biomass thermal applications substituting fossil fuels (BTA)

Activity Purpose:

Avoiding greenhouse gases by using biomass for thermal applications, substituting fossil fuels



Forest/land use conditions:

- Sufficiently large forest mass to sustain consistent biomass production.
- (External condition) Stable biomass demand for thermal applications

Potential measures:

- Safeguard market for biomass thermal applications
- Introduce wood harvest rotation cycle for stable production

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Biomass thermal applications substituting fossil fuels (BTA)

Justification of this activity:

- Already experience with this activity
- Potential social and economic benefits in this region
- But, inefficient use of forest resource: should be combined with timber markets



Biomass producing land availability:

- Potentially hundreds of hectares

Conditions for additionality:

- Established market for biomass combustion
- Established market for primary wood products

Conclusion: Yes, but requires stable timber and biomass market

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Summary and conclusion

ARR: Yes. But, we need the right land:

- Still used agricultural land (kept clean - not abandoned)
- Pasture land with soil degradation, erosion
- Eroded areas and other bare land areas



BTA: Yes. But we need

- Biomass and timber market
- Guaranteed biomass supply

LtHP: Maybe. Conditions:

- (Future) timber market guaranteed (proof)

Discussion

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Carbon offset calculations ARR

Baseline situation:

Pools to be measured; above and below ground, above ground non trees, soil and deadwood

	Determining Actual Onsite Carbon Stocks	Amount	Unit	Source
1	Actual (ex post) annual net carbon stocks above ground			
	Standing average volume at this moment	0,10	m3/ha	Some shrubs perhaps (IPCC figs)
	BCEF IPCC factor expansion factor	1,70		IPCC table 4.5, temperate hardwoods
	Standing Biomass above ground in shrubs	0,17	ton/ha	Is standing volume * BCEF factor
	Standing Biomass in grassland above ground	2,20	ton/ha	IPCC average for grasslands (1 Carbon ton/ha)
	Total Biomass above ground	2,37	ton/ha	
2	Actual (ex post) annual net carbon stocks below ground			
	Root-shoot ratio shrubs	0,32		IPCC tables, subtropical steppe
	Biomass below ground shrubs	0,05	ton/ha	
	Root-shoot ratio grass	2,80		IPCC tables, temperate steppe
	Biomass below ground grass	6,16	ton/ha	Is below ground volume * root to shoot factor
	Total Biomass below ground	6,21	ton/ha	
3	Live Biomass loss			NA, assumed no influence on total/ha
4	Avoided burning of grasslands			NA, this can be substantial but no figs as evidence
5	Live Biomass gain			NA, assumed no influence on total/ha
6	Dead wood, standing, lying down and roots			NA, assumed no influence on total/ha
7	Soils			NA, this can be substantial but no figs as evidence
8	Fossil fuel emissions from logging, transport, and manufacture			NA, assumed not significant
	Total above and below ground biomass in baseline situation	**8,58**	**ton/ha**	**above + below ground**

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Carbon offset calculations ARR

Project scenario:

Pools to be measured; above and below ground, above ground non trees, soil and deadwood

	Determining Actual Onsite Carbon Stocks	Amount	Unit	Source
1	Actual (ex post) annual net carbon stocks above ground			
	Standing average volume after rotation years	110,00	m3/ha	Several sources
	BCEF IPCC factor expansion factor	0,55		IPCC table 4.5, subtrop. Conif. >100 m3
	Standing Biomass above ground	60,50	ton/ha	Is standing volume * BCEF factor
2	Actual (ex post) annual net carbon stocks below ground			
	Root-shoot ratio (below & above ground biomass	0,28		IPCC table 4.4, subtropical dry forest >20 ton/ha
	Biomass below ground	16,94	ton/ha	Is below ground volume * root to shoot factor
3	Live Biomass loss			NA, assumed no influence on total/ha
4				
5	Live Biomass gain			NA, assumed no influence on total/ha
6	Dead wood, standing, lying down and roots			NA, assumed no influence on total/ha
7	Soils			NA, this can be substantial but no figs as evidence
8	Fossil fuel emissions from logging, transport, and manufacture			Below VCS barriers
	Total above and below ground biomass in project situation	**77,44**	**ton/ha**	**above + below ground**

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Carbon offset ARR

Project scenario – Baseline

Determining CO2 additional stored in tonnes/year	Amount	Unit	Source
Baseline situation biomass	9	ton/ha	
Project situation biomass	77	ton/ha	
Net result in rotation years	69	ton/ha	
Land available for this activity	20	ha	
Net result over total project area in rotation years	1.377	ton/rotation yrs	
Net result per year in Biomass	16	ton/year	
Carbon fraction in dry weighth in %	0,47		IPCC table 4.3
Carbon in total	8	tonnes/yr	
1 ton Carbon equals to 3,664 tons of CO2	3,66		
CO2 stored in tonnes	**28**	**tonnes CO2/year/in project area**	

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Carbon offset calculations BTA

Conversion of one type of energy to another:

Biomass and fuels: Joules
Wood/biomass: 19 MJ/kg DAF (600 g/liter)
Gasoline: 45 MJ/kg (750 g/liter)
Hydrogen: 140 MJ/kg (70 g/liter)



Combustion equipment: Watt*hour
Pelletizer: 140 W*h / kg pellets
Power Plant : 2000 MW

Conversion:
1 Joule = 1 Watt * second
1 MJ = 1000 kW*second
3,6 MJ = 1 kW*h

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Carbon offset calculations BTA

No Baseline Situation (=0)

Assumptions:

- Thinnings of 20 tons of biomass/ha
- Fresh wood: 50%; chips: 30%
- Chip transport (empty return) = 70 km
- 10 ha per year = 200 tons of biomass /year
- Regrowth takes 7 years: 70 ha is required for continuous biomass production.

2 scenario's:

- Substituting gasoil
- Substituting fossil coal

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Carbon savings from 14 ton biomass harvesting (1 ha) substituting gasoil and fossil coal			
Fuel consumption	**CO2 cost (kg)**	**CO2 cost (kg)**	**Measuring unit**
Diesel carbon profile	83,8	83,8	Grams CO_2/MJ
Harvest	30,629	30,629	Kilogram CO2/ha
Biomass transport	44,2	44,2	Kilogram CO2/ha
Chipping	91,887	91,887	Kilogram CO2/ha
Chip transport	216,58	216,58	Kilogram CO2/ha
Biomass alternative	**Wood chips**	**Wood chips**	**Unit**
Harvested wood chips	14,0	14,0	Tons/ha (30% moisture)
Biomass energy	12,0	12,0	Mega Joule/Kg
Chips combustion efficiency	90	90	MJ_{heat}/MJ_{fuel}
Energy density	151200,0	151200,0	Mega Joule/ha
Fossil fuel substituted	**Gasoil**	**Fossil coal**	**Unit**
Energy density	36,55 MJ/litre	29 MJ/Kg	MJ
Fuel combustion efficiency	90	42	MJ_{heat}/MJ_{fuel}
Quantity substituted	4596,44 litre	12413,79 Kg	Litre (gasoil) or Kg (coal)
Fossil emissions	83,8	111,28	Grams CO_2/MJ
CO_2 equivalent	385,1	1381,4	Kilogram CO_2/ha
Net CO2 savings	**0,0019**	**0,9981**	**Ton CO2/ha**
Total project hectares	10	10	
Net CO_2 savings	**0,0190**	**9,9810**	**Ton CO_2 per year**

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Is this activity feasible (economically and energetically?

- Biomass transport is very inefficient
- Not viable without market for timber
- Not desirable (sub-optimal biomass use: Value triangle base and against "cascading" principle)
- Pelletizing required for longer distances, requires large volumes (20.000 tons per year)
- Rotational harvesting sytem needed

Need for accurate data:

- Timber market (only use forest byproducts as biofuel)
- Chip/pellet market (nearby)

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Total project carbon savings

Available tonnes in total from ARR activities			21,37	tonnes CO2/year/in project area	
Available tonnes in total from Biomass activities			9,98	tonnes CO2/year/in project area	
Total tons in project area			31,32	tonnes CO2/year/in project area	
Total amount of hectares in use			30	hectares (20 ARR & 10 BTA)	
Current value of 1 Carbon credit in the market VCS			6,6	Euro/credit	
Current value of 1 Carbon credit in the market VCS/CCB			8,6	Euro/credit	
Withdrawn by VCS and register (bank)*	0,13	Euro/credit	6,5	Euro/credit	remaining
Withdrawn by VCS, CCB and register (bank)*	0,14	Euro/credit	8,4	Euro/credit	remaining
Income per year with VCS			204	Euro/Euro 6,79	per ha
Income per year with VCS/CCB			264	Euro/Euro 8,79	per ha

*for various purposes; levy, transfer fee etc. ask FSG for details

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Carbon Activity Action Plan

- Link diameter to timber market (LtHP)
- Pellet/chips/timber/wood product market
- Legislation (ownership change)
- Identify suitable land for ARR
- Soil tests! (Baseline)



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