EX-Ante C-balance Tool

Estimating mitigation potential of agricultural projects: an application of the EX-Ante Carbon-balance Tool (EX-ACT) in Brazil

by

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Outline

1. Rural development and mitigation options in Brazil
2. The SC Rural and Rio Rural projects
3. The EX-Ante C-balance Tool (EX-ACT)
4. SC Rural and Rio Rural EX-ACT cases
5. The way forward on applying EX-ACT
6. Field experience and policy options

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1. Rural development and mitigation options in Brazil

- Brazil leads the world's exports in a number of agricultural commodities but unsustainable land use practices have left roughly 10% of areas so highly degraded that they have been abandoned
- Balancing agricultural development with sustainable management of natural assets is essential to Brazil
- Brazil is responsible for 5% of the current GHG emissions. Most relevant sectors in terms of emissions as well as abatement opportunities
  - **Forestry** sector: deforestation responsible for 55% of country's emissions
  - **Agriculture**, including **cattle**, accounts for 25% of current emissions (expected to increase to 30% by 2030)

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1. Rural development and mitigation options in Brazil

- In this context, some of the most relevant activities contributing to GHG emission reduction and C sequestration are those related to LULUCF: forest conservation, improved cropland and grassland management, expansion of agro-forestry systems
- Sustainable small-farm agriculture can increase food security (lower land degradation, enhance crop productivity) while reducing GHG emissions and enhancing C sinks
- Priority to Brazil to implement its national CC Plan (approved in Dec 2008) and to promote mitigation efforts concerning rural development

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2. The SC Rural and Rio Rural projects

- We present here two examples of rural development projects which also have mitigation potential:
  - SC Rural Competitiveness (proposed for WB-financing)
  - Rio de Janeiro SRD (start-up phase, WB-funded)
- Case-studies to test the EX-Ante C-balance Tool (EX-ACT) which estimates agriculture project impact on GHG emissions and C sequestration (first cases of application of the tool at the appraisal stage)

Project feature	SC Rural	Rio Rural
No. beneficiaries / small farmers' families	90,000 (priority target group: 25,000)	37,000 (priority target group: 19,000)
Land area under improved production and NRM systems	661,001 ha	227,811 ha
Total cost (WB loan)	USD 189 mi ($90 mi)	USD 79 mi ($ 39.5 mi)

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2. The SC Rural and Rio Rural projects

- Similarities:
  - importance of agricultural sector and natural resource base of project area
  - objectives associated with increased competitiveness of family agriculture in the State while improving its environmental sustainability (increased productivity, improved market access and reduced pressure over the native Atlantic Forest)
  - project strategy, e.g. increasing capacity of small farmers, promoting small business investments and rural infrastructure, generating environmental benefits through sustainable agriculture and conservation practices

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2. The SC Rural and Rio Rural projects

- Differences:
  - project size
  - biodiversity conservation and natural resource management approaches (e.g. Conservation credits in SC Rural vs. corridor connectivity in Rio Rural);
  - SC Rural adopts a SWAP involving 5 sectors (Agriculture, tourism, Environment, WRM and Infrastructure) vs. Rio Rural not a SWAP though coordinating with at least 5 sectors (Education, Environment, Health, Energy, Industry)

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3. The EX-Ante C-balance Tool (EX-ACT)

- EX-ACT (by FAO) can estimate the impact of agricultural projects on GHG emissions and C sequestration
- Measures C-balance with and without project:

  C-balance = GHG emissions – C sequestered
- Indicator of project mitigation potential as effect of changes in agricultural production systems (land use and management): land-based accounting system
- Easy to be used in ex-ante project formulation (quick appraisal)
- Helps project designers to integrate climate response activities in agriculture projects

3. The EX-Ante C-balance Tool (EX-ACT)

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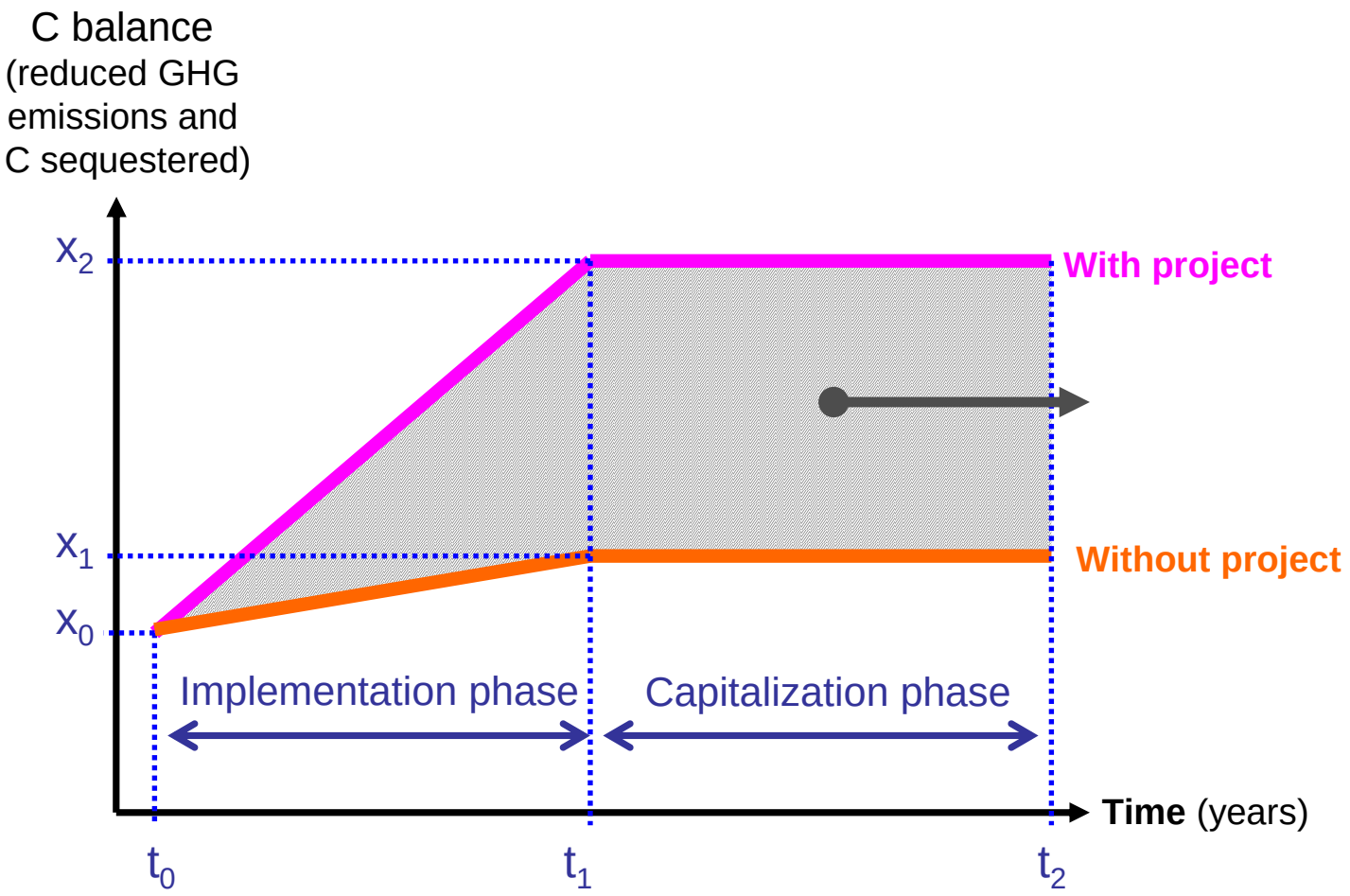

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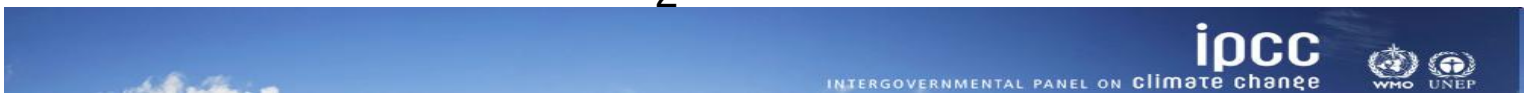
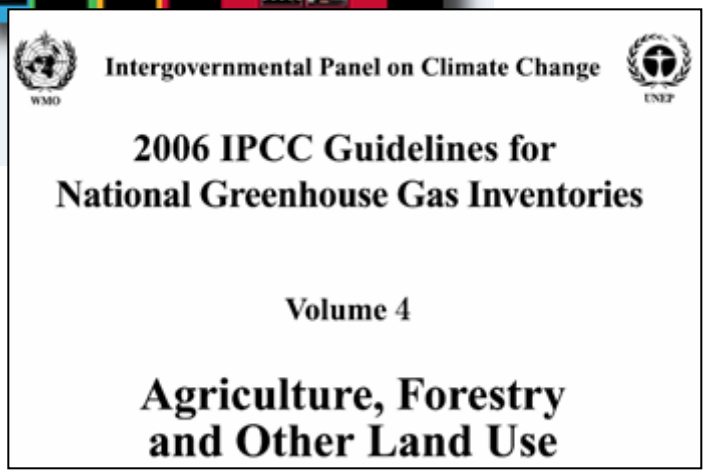
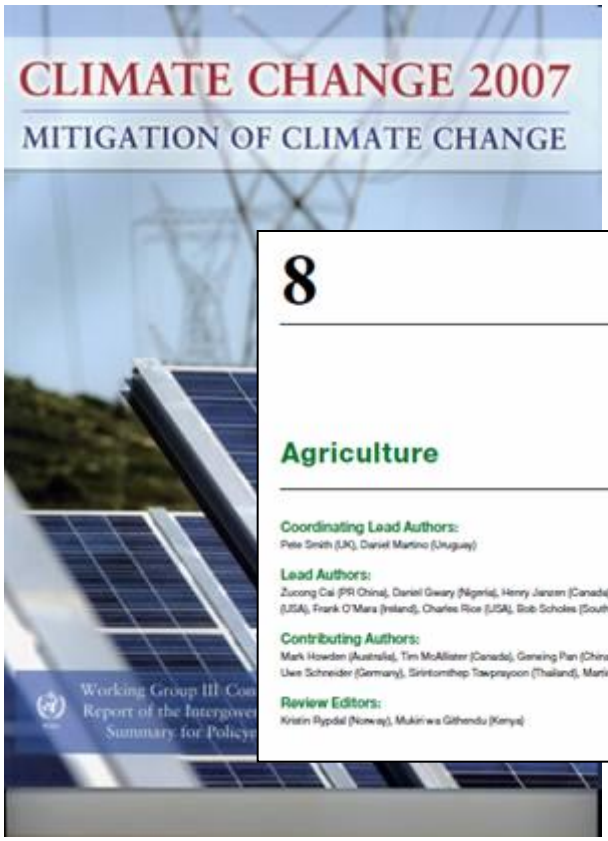
3. The EX-Ante C-balance Tool (EX-ACT)

- Mainly IPCC default values (Tier 1), but also *ad hoc* coefficients (Tier 2)
- All emissions in CO_2e

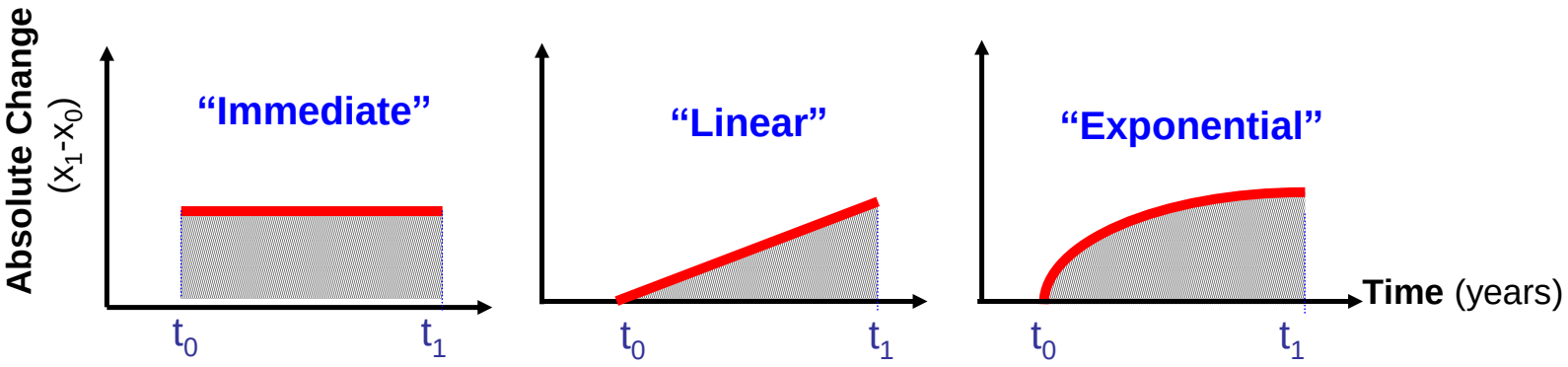






3. The EX-Ante C-balance Tool (EX-ACT)

- Different dynamics of change depending on the characteristics of the specific project activity and on the information available on the adoption rate of the selected practice among project participants.



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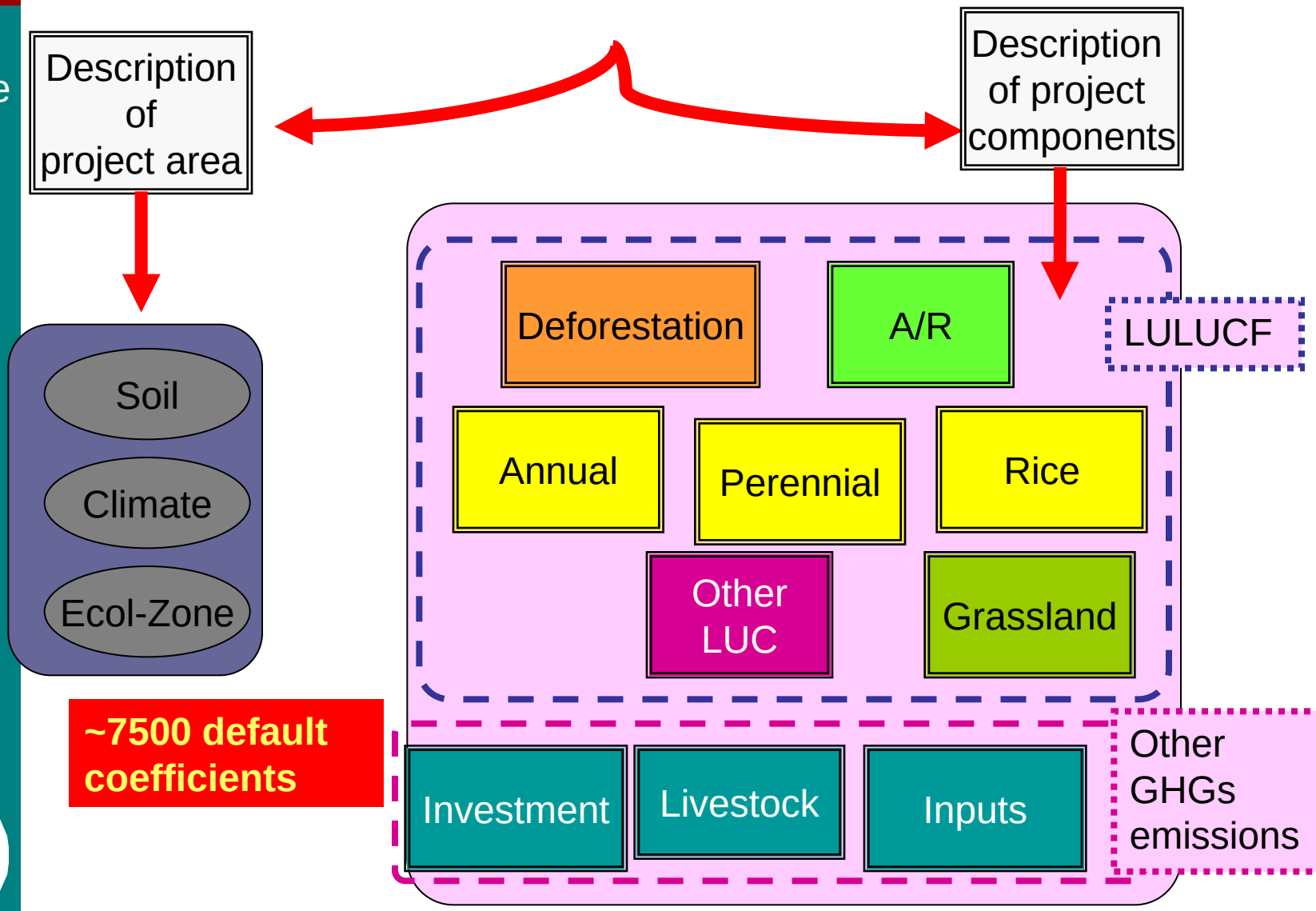

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4. SC Rural and Rio Rural EX-ACT cases

SC Rural project: mitigation potential of project activities

Project activities	Mt	% of total GHG mitigated	% of total GHG emitted
Expansion of training and extension services (pre-investment activities)	0.01	-	0.3
Improved annual crop management	1.7	-	82.8
Improved livestock production	0.3	-	14.0
Support to the implementation of small-scale agro-industry and to the construction of sanitary installation	0.1	-	2.9
Total GHG emitted	2.1		100.0
Improved grassland management	-3.8	26.9	-
Expansion of perennial crops	-0.4	3.0	-
Fencing of riparian areas	-0.9	6.3	-
Expanding agro-forestry systems	-8.8	61.7	-
Ecological corridors and land rehabilitation	-0.3	2.1	-
Total GHG mitigated	-14.3	100.0	-
Total C-balance	-12.2	-	-

4. SC Rural and Rio Rural EX-ACT cases

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E.g. Expansion of perennial crops (SC Rural)

- expand perennial trees (banana, erva mate, orange, apple, palm trees, peach and grape) on 1,434 ha of degraded grasslands
- reverse the process of land degradation by preventing 210 ha of peach trees from being abandoned

C-balance of land use change

Project activity	Biomass Change		Soil Change		**Total Balance**		**Difference**
	Without tCO2	With tCO2	Without tCO2	With tCO2	Without tCO2	With tCO2	tCO2
Conversion of 1,434 ha of degraded pastures to perennial crop	0	-5784	0	-188649	0	-194433	**-194433**
Conservation of 210 ha of perennial crops (peach trees)	12166	0	27008	0	39174	0	**-39174**

C-balance of land management (perennial crops)

		CO_2 mitigated from Biomass		CO_2 mitigated from Soil		**Total Balance**		**Difference**
With Project		Without	With	Without	With	Without	With	
End	Rate					tCO_2	tCO_2	tCO2eq
0	Linear	0	0	0	0	0	0	**0**
0	Linear	0	0	0	0	0	0	**0**
1434	Linear	0	-182189.7	0	-17065	0	-199254	**-199254**

Total C-balance = - 432,861 tCO_2e (net sink)

4. SC Rural and Rio Rural EX-ACT cases

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E.g. Improved annual crop management (SC Rural)

• increase adoption of SLM: extending crop rotations, water and nutrient management, tillage management, manure application

C-balance of wider SLM adoption

Vegetation Type	Areas					Soil CO2 mitigated		Total Balance	
	Start	Without project		With Project		Without	With	Without	With
	t0	End	Rate	End	Rate			tCO2	tCO2
Beans SLM	32429	32429	*Linear*	36032	*Linear*	0	-69830	0	-69830
Beans conventional	3603	3603	*Linear*	0	*Linear*	0	0	0	0
Millet SLM	21637	21637	*Linear*	24041	*Linear*	0	-46591	0	-46591
Millet conventional	2404	2404	*Linear*	0	*Linear*	0	0	0	0
Soybeans SLM	111505	111505	*Linear*	123894	*Linear*	0	-240107	0	-240107
Soybeans conventional	12389	12389	*Linear*	0	*Linear*	0	0	0	0
Tomatoes SLM	24944	24944	*Linear*	27715	*Linear*	0	-53712	0	-53712
Tomatoes conventional	2772	2772	*Linear*	0	*Linear*	0	0	0	0
Onion SLM	5856	5856	*Linear*	6507	*Linear*	0	-12611	0	-12611
Onion conventional	651	651	*Linear*	0	*Linear*	0	0	0	0
Rainfed rice SLM	46280	46280	*Linear*	51422	*Linear*	0	-99656	0	-99656
Rainfed rice conventional	5142	5142	*Linear*	0	*Linear*	0	0	0	0
Potato SLM	2624	2624	*Linear*	2915	*Linear*	0	-5649	0	-5649
Potato conventional	292	292	*Linear*	0	*Linear*	0	0	0	0
Cassava SLM	7848	7848	*Linear*	8720	*Linear*	0	-16899	0	-16899
Cassava conventional	872	872	*Linear*	*0*	*Linear*	0	0	0	0
Total	281246	281246		281246		**Agric. Annual Total**		**0**	**-545055**

C-balance of agro-chemicals use

Emissions ($MtCO_2e$)	Without prj	With prj	Balance
CO_2 from Lime application	5.8	6.0	0.2
CO_2 from Urea application	0.6	0.7	0.0
N_2O from N application on managed soils (except manure management)	11.2	11.6	0.4
CO_2e from production, transportation, storage of agricultural chemicals	46.2	47.8	1.6
Total	63.9	66.1	2.2

Total C-balance = 1.7 $MtCO_2e$ (net source)

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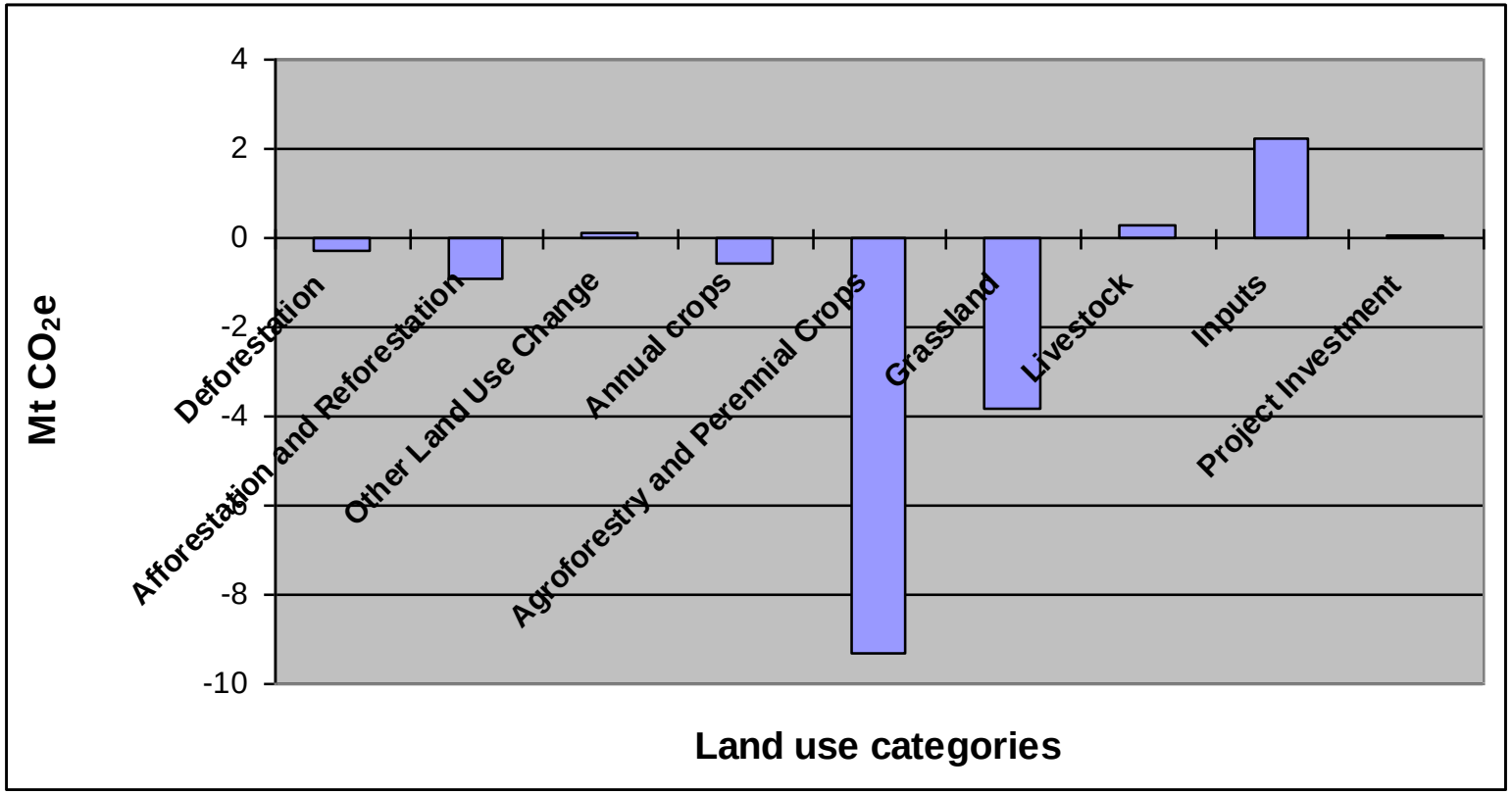
4. SC Rural and Rio Rural EX-ACT cases

SC Rural project: land use change and management mitigation potential



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4. SC Rural and Rio Rural EX-ACT cases

Rio Rural project: mitigation potential of project activities

Project activities	Mt	% of total GHG mitigated	% of total GHG emitted
Protection of springs and streams and support to the establishment of the Legal Reserves	-0.52	60.6	-
Expansion of agro-forestry systems	-0.27	31.1	-
Improved annual crop management	-0.02	2.1	-
Improved grassland management	-0.02	2.3	-
Improved feeding practices of dairy cattle	-0.04	4.6	-
Total GHG mitigated	-0.86	100.0	-
Support to small agro-industry	0.010	-	94.7
Technical assistance for project implementation	0.001	-	5.3
Total GHG emitted	0.011	-	100.0
Total C-balance	-0.85	-	-

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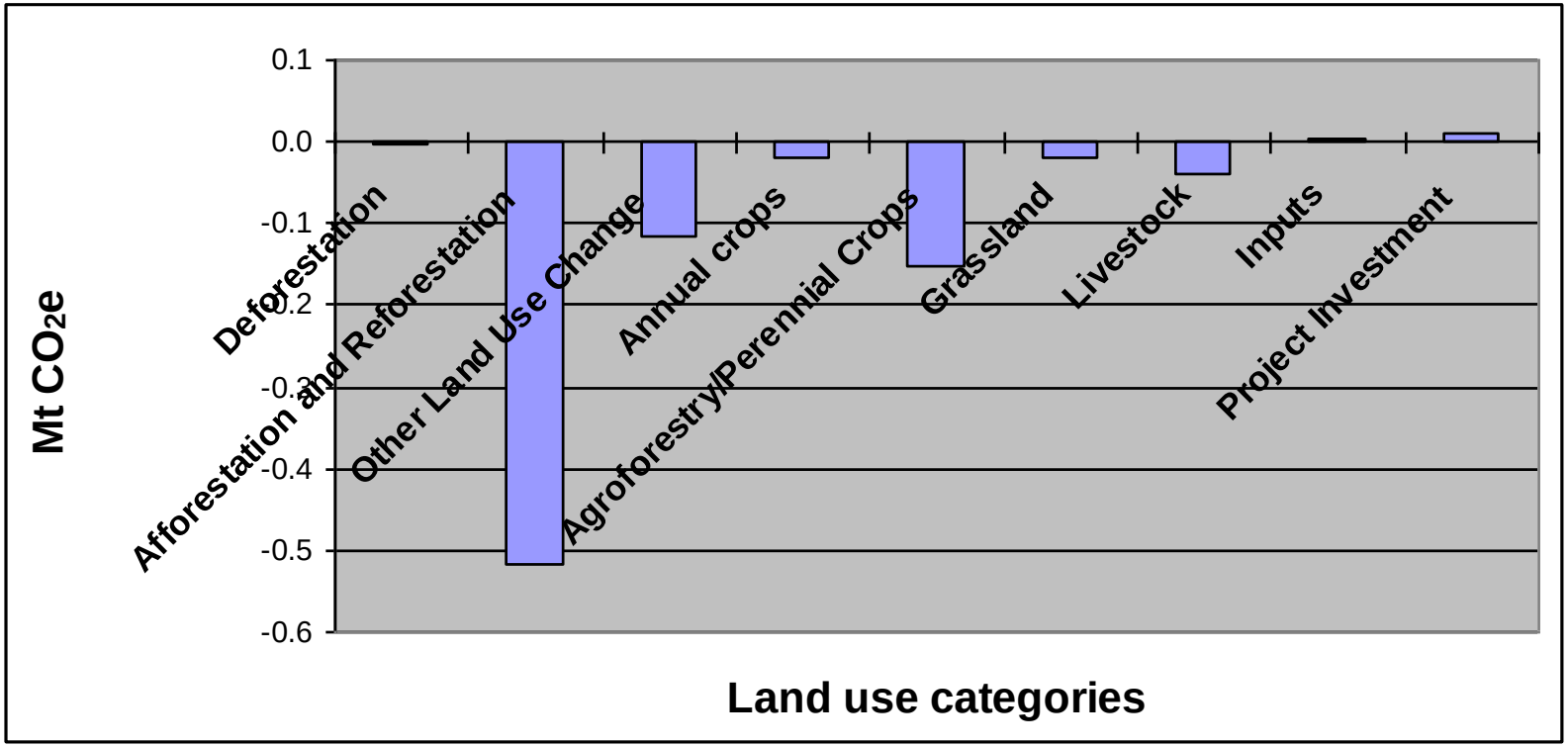
4. SC Rural and Rio Rural EX-ACT cases

Rio Rural project: land use change and management mitigation potential



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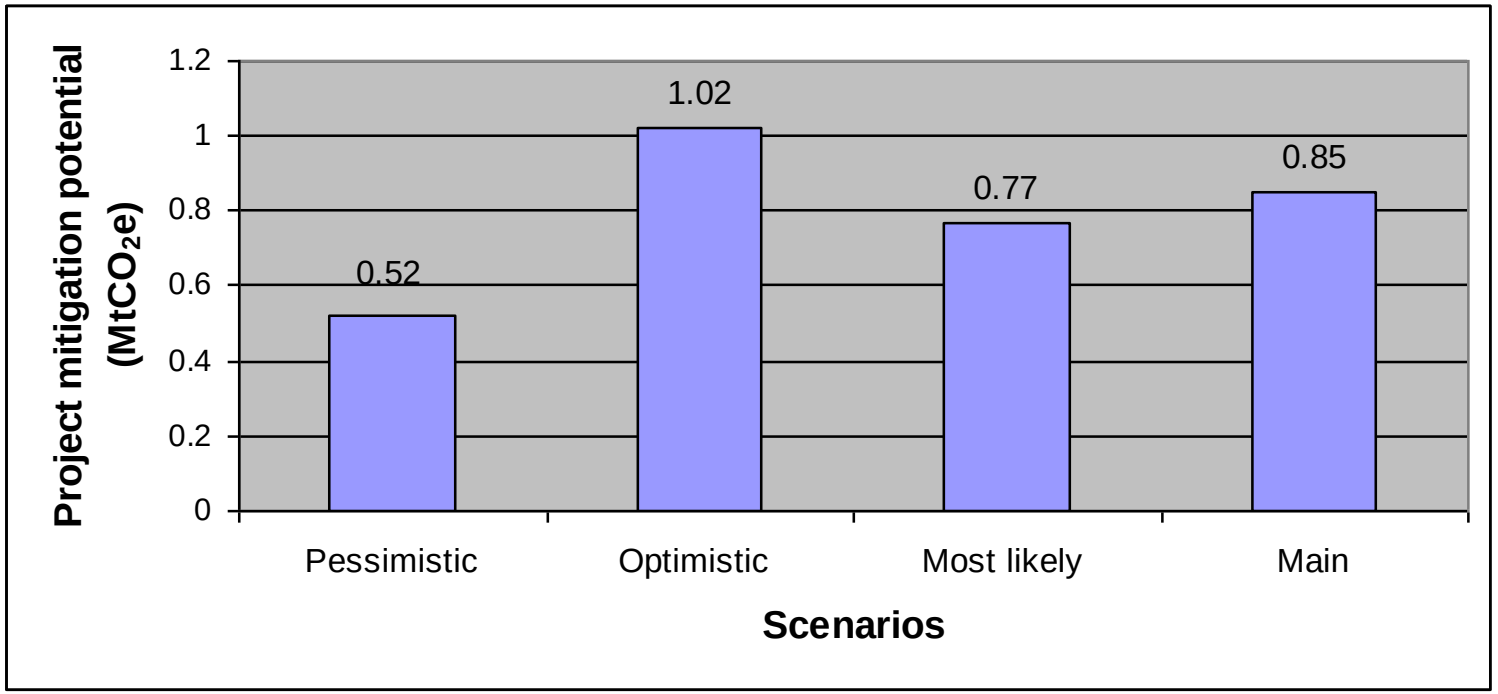
4. SC Rural and Rio Rural EX-ACT cases

- Main results:
  - projects implement activities aimed at reducing rural poverty while contributing to CC mitigation
  - effectiveness of sustainable rural development on delivering climate change mitigation services
- Nevertheless, there is a difference in average mitigation potential of the two projects:

  0.92 tCO_2e/ha/year (SC Rural) vs. 0.19 (Rio Rural)
- SC Rural more weight on activities aimed at environmental compliance (conserving forests, rehabilitating degraded land) and expansion of agro-forestry systems
- Sensitivity analysis: discuss how the project design could be improved in order to increase mitigation benefits in both cases.

4. SC Rural and Rio Rural EX-ACT cases

E.g. sensitivity analysis for the Rio Rural project



Pessimistic scenario:

- decreased adoption rate (average)

Optimistic scenario:

- increased adoption rate (improved livestock practices)
- additional mitigation benefits from rehabilitation of rural roads

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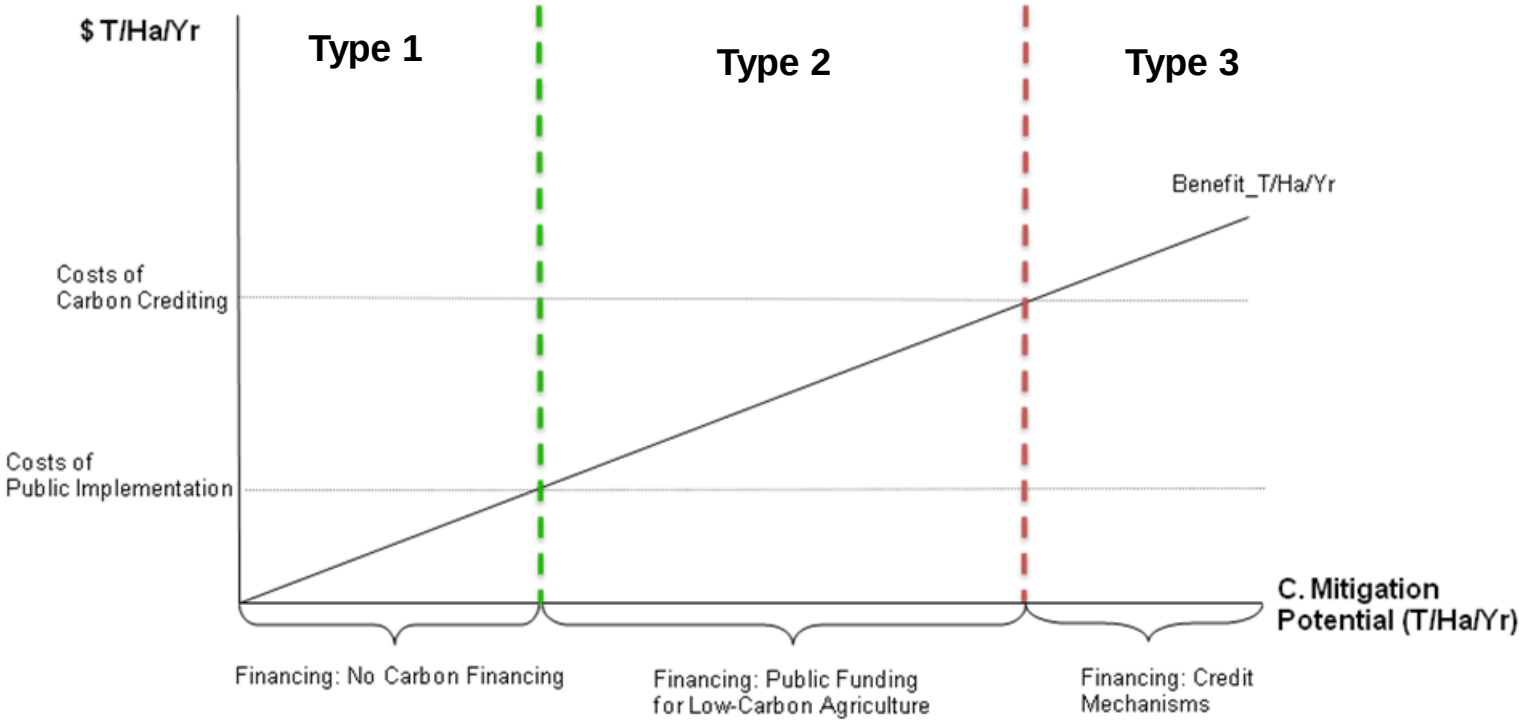
4. SC Rural and Rio Rural EX-ACT cases

CBA:

@ 3 US$/$tCO_2e$

2.76 US$/ha/year (SC Rural) vs. 0.57 (Rio Rural)



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5. The way forward on applying EX-ACT

- wider application in projects, including those funded by IFIs
- database of estimated mitigation benefits from changes in land use and management for different farming systems, soil and climatic conditions, geographical region (L. America pilot?)
- sectoral/sub-sectoral analyses at national/sub-national level (Brazil pilot?)
- validation of results

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6. Field experience and policy options

- Use of EX-ACT in project appraisal, expansion of environmental impact analysis of project (innovation)
- EX-ACT useful to drive project designers towards building a project with reduced negative environmental externalities and enhanced positive ones (design modified on the basis of EX-ACT results)
- Future application of EX-ACT :
  - at community level e.g. involving clusters of micro-watersheds
  - simulation of different policy options/scenarios (e.g. fuel/ethanol issues, reduction in the use of chemicals)

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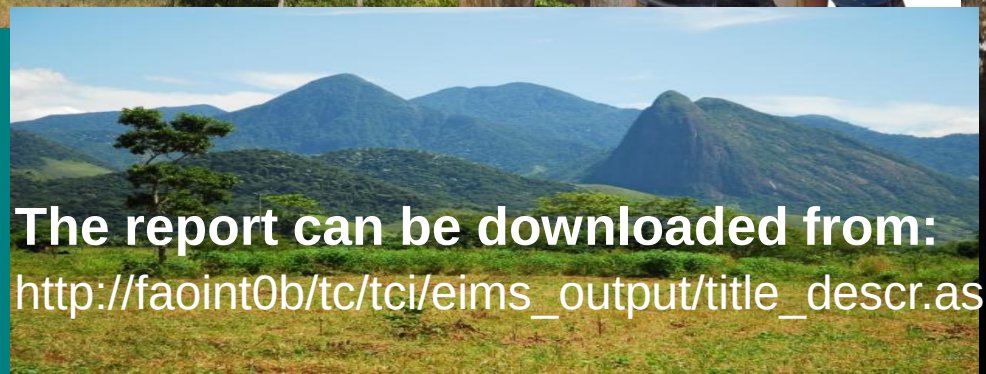

The report can be downloaded from:
http://faoint0b/tc/tci/eims_output/title_descr.asp?pub_id=274772&lang=EN