Inclusion of Soil C Sequestration in the CDM? COP-6 and Beyond

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Reports of soil C loss due to cultivation in sub-Saharan Africa

Soil C loss t/ha/yr	Conditions	Soil depth cm	Period years
10	Cultivation following land conversion in Western Kenya	0-37.5	2
8	Slash-and-burn conversion in coastal Mozambique	0-20	4
6	Comparison of forest and cultivated Nitisol in the Kenyan Central Highlands	0-15	8

Reports of soil C loss due to cultivation in sub-Saharan Africa

Soil C loss t/ha/yr	Conditions	Soil depth cm	Period years
2.7	Moimbo woodland in Zimbabwe converted to maize cultivation in a sandy Alfisol	0-50	6
2.4	Cultivation following land conversion in Western Kenya	0-37.5	30
2.2	Following forest clearing in Southern Cameroon by slash-and-burn	0-40	4
0.9	Continuous cultivation in Western Kenya	0-37.5	18-30

Sources: P. L. Woomer et al. 1997, p. 159.

Management options for soil C sequestration

- conservation tillage (no-till/minimum-till) in combination with planting of cover crops, green manure and hedgerows
- organic residue management
- mulch farming, particularly in dry areas
- water management, irrigation, and drainage to avoid potential risk of salinization and water-logging
- soil fertility management, including use of chemical fertilizers and organic wastes, liming and acidity management

Management options for soil C sequestration

- introduction of agroecologically and physiologically adapted crop/plant species, including agroforestry
- adapting crop rotations and cropping/farming systems, with avoidance of bare fallow
- controlling of grazing to sustainable levels, and
- stabilizing slopes and terraces.

C stocks in agricultural soils of Kenya, annual C losses due to cultivation, and changes in annual C fluxes due to chemical fertilization and livestock manure addition.

FAO soil order	Total soil C	Soil C flux (tC/ha/yr)		C flux from applying… ----------------tC/ha/y-------------- N	P	N&P	Manure
Acrisols	44.1	-1.24		0.11	0.01	0.58	0.89
Ferralsols	38.0	0.21		0.46	0	-0.09	--
Luvisols	30.2	-0.90		-0.11	-0.55	-0.32	0.45
Nitisols	43.1	-0.49		0	-0.05	0.10	0.92
All soils	39.5	-0.69	Total	0.07	-0.14	0.11	0.80

Source: Paul L. Woomer et al. 1997, p. 161.

Input cost, effect on yields and net cost of C sequestration in soils of smallholder settings of the East African Highlands.

Type of C input, land use system	Input cost/t C $	Effect on yields $	Net cost $	Comments
Stover, small-holder agriculture	153	-200	353	Labor costs excluded.
Manure, small-holder agriculture	260	1066	-806	Labor costs excluded.
Smallholder Agroforestry	87	n.a.	n.a.	A full-time farmer managing the project, at a cost of $40/hectare, is included in estimate.

Source: Based on Paul L. Woomer et al. 1997. n.a.= not available.

Potential of soil carbon sequestration in DCs

- Soil C sequestration projects, which increase agricultural productivity and bring economic benefits, would present developing countries with a significant incentive for participating in the CDM.

- Investors and the international community might find soil C projects attractive because their positive impact on agricultural productivity gives developing host countries an incentive for effective project implementation.

Potential of soil carbon sequestration in DCs

- It seems especially relevant to focus on sink management in those world regions that emit small amounts of energy-based GHG emissions.

- For instance, while Africa contributed around only 3 percent of the total global CO_2 emissions from fossil fuel burning and cement production in 1995, it could participate in the management of the global C cycle through C sequestration.

Potential of soil carbon sequestration in DCs

- The soil C sequestration option could combine the goals of sustainable development, food security, and desertification control in developing countries with creditable low and medium cost GHG mitigation projects.

- Increased productivity and sustainability in agriculture could reduce the demand for clearing forests and savannas to meet local agricultural and economic needs.

Next steps: some research needs and challenges

- Existing data are not readily comparable,
- it is unclear how well site-specific findings represent wider areas, and
- it is uncertain how large amounts of C could be sequestered.

- Estimating all environmental benefits and costs would be important. Analyzing carbon ‘costs’ and environmental side-effects is necessary.

Next steps: some research needs and challenges

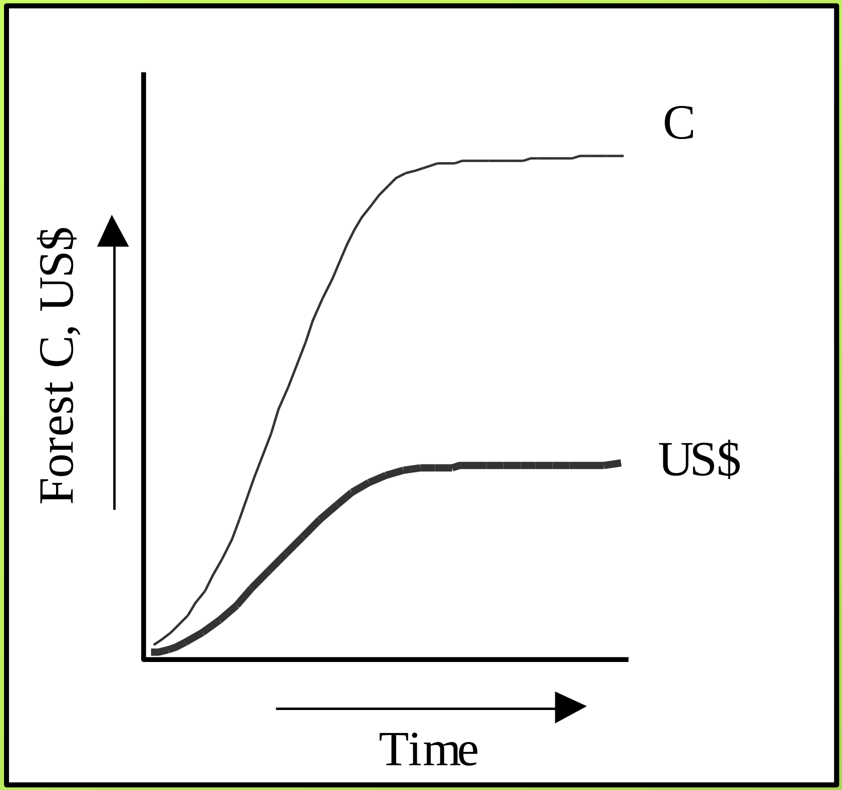
- Estimating all economic benefits and costs would be important.
  - Project level analysis
  - Sector level analysis
  - Economy-wide implications

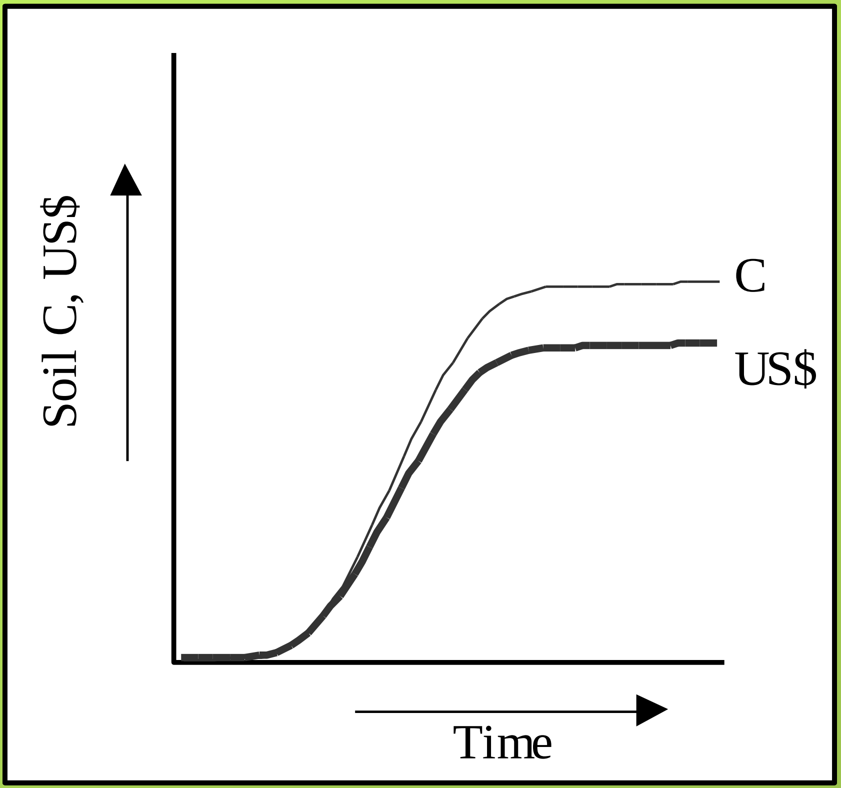
- Also opportunity costs should be estimated.

Next steps: some research needs and challenges

- Useful ways of combining agricultural and forestry systems should be identified. But agroforestry should be regarded as a means to combine agricultural production with tree growing rather than promoting trees as a substitute for agricultural crops.

Comparison of sequestration potential and local economic income from forest C and soil C sequestration.





Upper Estimates of Potential Carbon Uptake through LULUCF Activities by 2010, MtC/y

Activity (examples)	Annex B	Developing countries
Article 3.7		
Reduced deforestation	90	
Article 3.3		
Afforestation and reforestation	26 (range 7 to 46)	373 (range 190 to 538)
Reduced deforestation		1,698
Article 3.4		
Improved land management: Croplands (reduced tillage, erosion control) Forests (enhanced regeneration, fertilisation) Grazing lands (herd and fire management) Agroforests (trees in agriculture landscapes) Urban land (wood product management)	 75 101 69 12 1	 50 69 168 14 1
Deliberate land use changes: Deforested to agroforested land (instead of pasture- or crop land) Severely degraded land to crop-, grass-, or forest land Cropland to grassland	 0 1 24	 391 3 14
Total Article 3.4	**300**	**710**

Source: Noble and Scholes (2001), p. 15.

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Treatment of Sinks at COP-6 in the Haag in Nov. 2001

”If there was one word that dominated discussions at the Hague it was sinks. The issue characterized the attempts of the negotiators to strike the right balance between promoting ratification of the Protocol, while at the same time maintaining its environmental integrity…disagreement on sinks was a principal stumbling block”

(from IISD summary report).

The Complexity of Sinks: Three Groups of Concerns and Issues

- Scientific and technical issues.
- Fundamental and basic issues and topics
- Economic and fairness issues.

The Complexity of Sinks: 3 Scientific and Technical Issues

- High scientific uncertainty and even ignorance surrounds sinks, making C sequestration an uncertain and risky option.
- Under altered environmental conditions due to climate change forests and soils may become sources rather than sinks.
- There is a risk of bogus sinks because known biogeochemical processes (e.g. CO_2 fertilization), and probably some unknown ones, could stimulate sink enhancement.

The Complexity of Sinks: 3 Basic Issues

- It is problematic to rely on sinks because they could easily be reversed. Sinks are risky and temporary steps, not permanent solutions to the problem of global climate change.
- Sequestration does not lead to a net removal of CO_2 from the atmosphere because crediting sinks enables a parallel increase in fossil fuel CO_2 emissions. It is a fundamentally mistaken approach to continue emitting GHGs even though sinks absorb CO_2 emissions.

The Complexity of Sinks: Basic Issues

- Sink opportunities will delay the necessary shift to a non-fossil fuel-based energy system. Sinks are a sidetrack and will just slow down the necessary transition to non-fossil energy technologies and systems.

The Complexity of Sinks: 6 Economic Issues

- It is undesirable if Annex B countries would reach their climate targets at a low cost.
  - Climate targets should not be inexpensive: only a costly ’stick’ would be able to stimulate society, the private sector, and governments to make the necessary changes.
  - High-cost options in non-Annex B countries would mean that Annex B countries use Annex B country options instead of non-Annex B country options.

The Complexity of Sinks: Economic Issues

- If Annex B investors would invest in inexpensive sequestration options in developing countries, then only costly options would be available if developing countries in the future would have GHG emissions reductions obligations.
- The present generation would pick up the cheap sequestration options in non-Annex B countries, and climate policy would impose more burdens on future generations as a consequence.

The Complexity of Sinks: Economic Issues

- The revenue from sink projects would be unevenly and unfairly distributed among non-Annex B host countries/sellers.
  - Those countries/sellers that would offer sequestration projects with an attractive low price would benefit, whereas countries/sellers that cannot offer projects with a compete price would lose in the global GHG offset market.

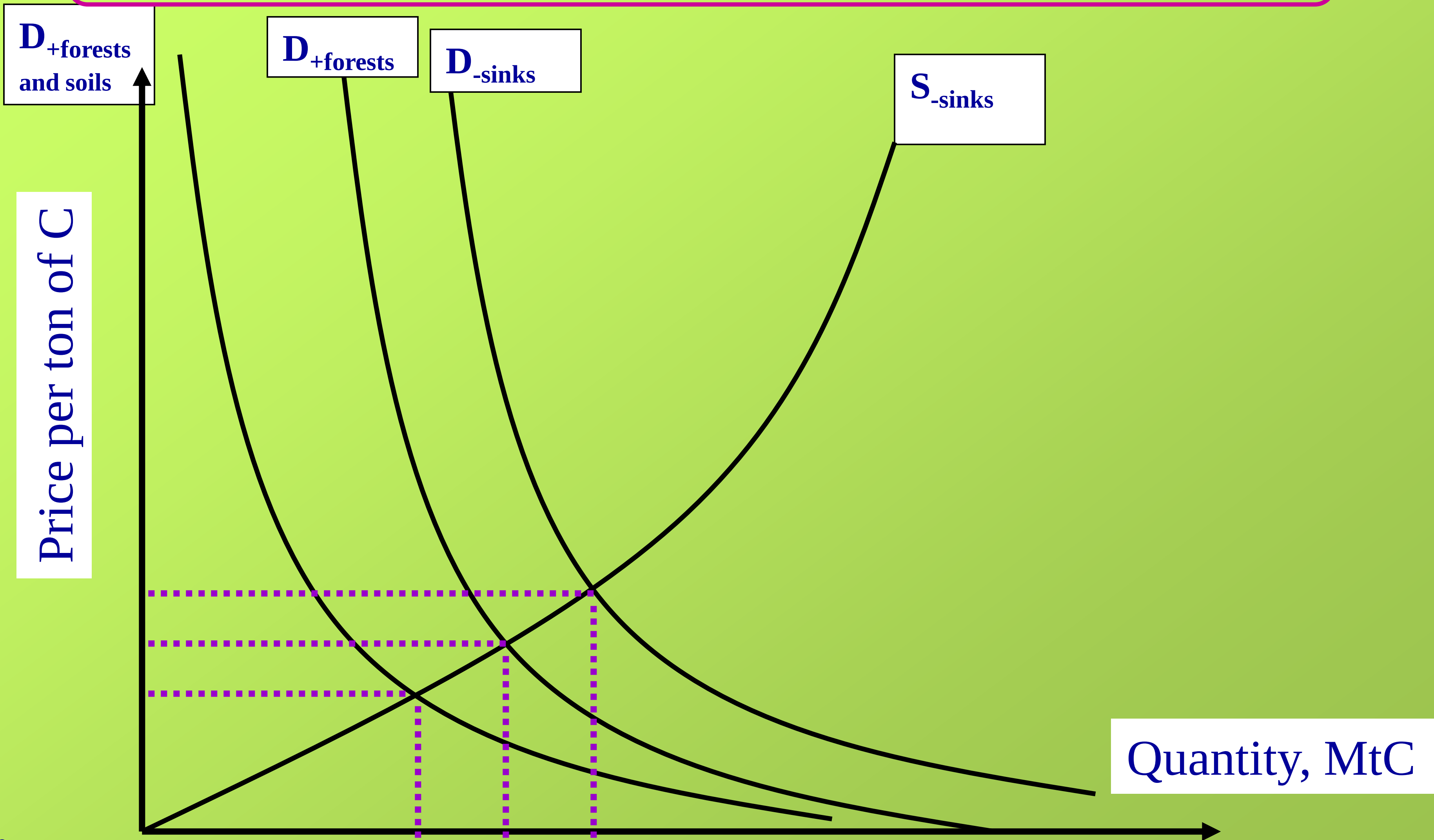
The Complexity of Sinks: Economic Issues

- Most Annex B country investments would be concentrated in the attractive low-cost forests and land-use sectors and therefore would not lead to sustainable development in the energy, industry and transportation sectors. But investments in the latter sectors are necessary and high(er) national priorities of developing countries than forestry and land-use sector investments.

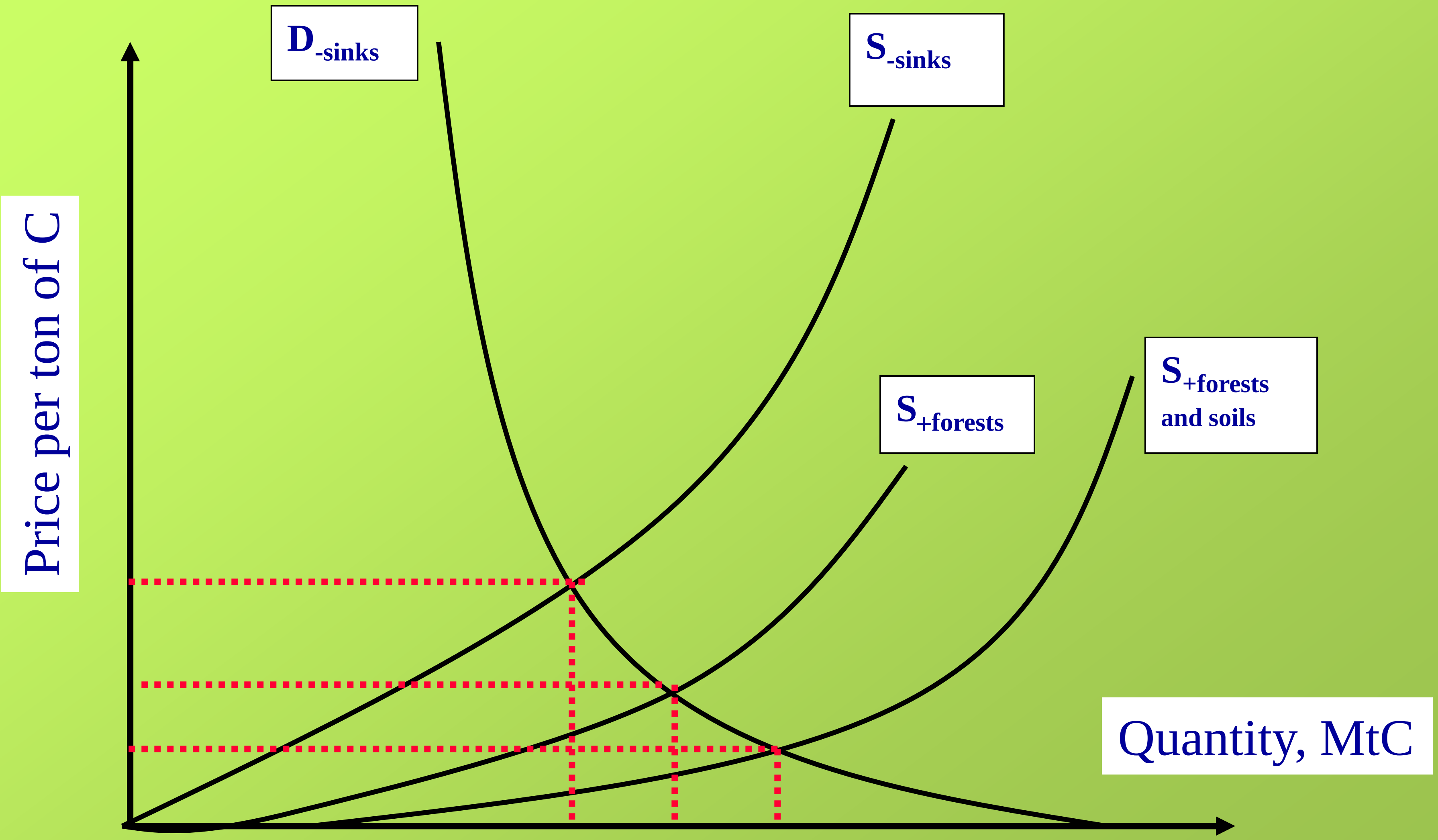
The Complexity of Sinks: Economic Issues

- Sequestration projects would be low-cost and more competitive than energy, industry, waste, and transportation projects and, since large amounts of sequestration options would be available, they would “flood” the global GHG offset market. As a result, developing countries’ earnings from Annex B investments in CDM project would be significantly reduced.

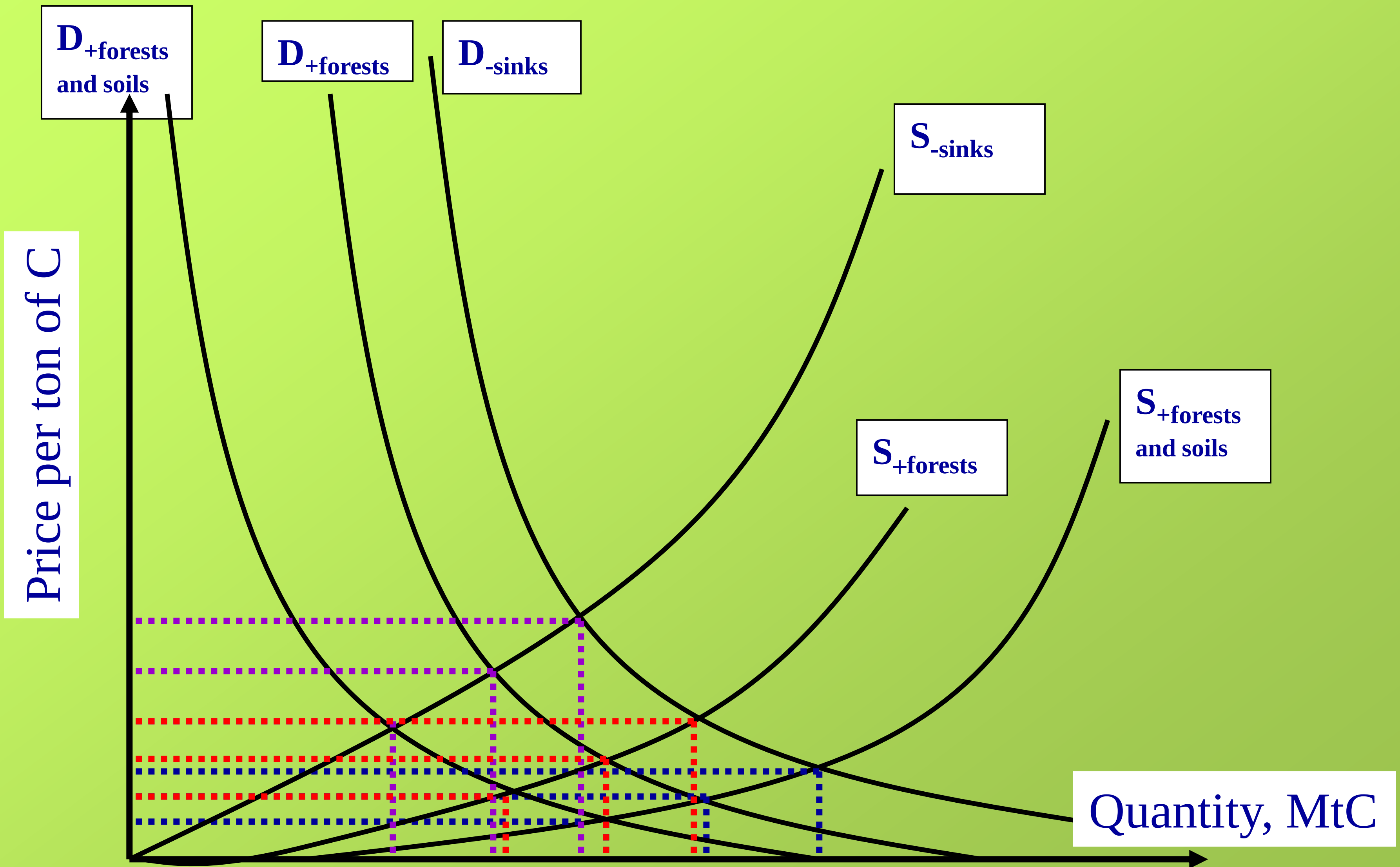
Effect on Global Offset Price of Including Sinks in Annex B countries



Effect on Global Offset Price of Including Sinks in non-Annex B countries



Effect on Global Offset Price of Including Sinks



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- Decisions should be based on sound science,
- IPCC should developed good practice guidelines for estimation and reporting on LULUCF emissions and removals,
- Credits would be dependent on reliable national systems for estimation of GHG fluxes. Independent review teams should verify national inventories prior to issuance of credits,

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- Necessary to separate out human effects on sinks (e.g. CO_2 fertilization and nitrogen deposition)
- Work on separating out natural effects and pre-1990 activities in the second and subsequent commitment periods, and
- Control for time consistency and double counting of LULUCF.

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- The focus of the art. 3.4 eligibility discussion on:
  - forest management,
  - cropland management,
  - grazing land management, and
  - revegetation.

COP-6 bis. Article 12.

- On the one hand, a modest role to forests and sequestration projects in the CDM. The priority projects should be in the areas of renewable energy (i.e. small-scale hydro) and energy efficiency.
- On the other hand, afforestation and reforestation projects should be included in the CDM, and that these activities could generate credits.
- Projects targeting deforestation and land degradation, however, excluded from the CDM. These projects would not create GHG credits.

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Some possible outcomes:

- No decision on LULUCF in the CDM-The Subsidiary Body for Scientific and Technical Advice (SBSTA) will study issues of permanence, additionality, leakage, etc..
- Inclusion of all LULUCF projects if regulated by rules for discounting and quantitative caps.
- Others

Conclusion: Crunch Time

- A negative perception or view of forest C sequestration sinks dominates in the CC negotiations.
- The issue(s) of forest C sequestration overshadows the issue of soil carbon sequestration.
- If no significant change in the negotiating dynamics, soil C sequestration unlikely to be included in the CDM.

Conclusion: Crunch Time

- But a major change in UNFCCC negotiating dynamics may happen if:
- Participants create mutually advantageous solutions rather than maximizing their own benefits.
- Justice and fairness must be achieved, otherwise no regime will arise.
- Salient solutions or focal points make it more likely that regimes are created. Striving for simplicity will facilitate negotiations involving numerous parties.

Conclusion: Crunch Time

- States must adopt a broader view of their interests and value common goods.
- The establishment of credible compliance mechanisms for regimes is an important (although not a necessary) condition.
- Regimes can arise only if individual leaders–structural, entrepreneurial, and intellectual leaders–have effective influence.