Appendix C-14

The Economic Costs of Fire in the Amazon

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Summary

Preliminary Results

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Introduction

- The use of fire for agricultural purposes is a traditional procedure in Brazil
- Fire use is also in the short-time a solution for nutrient increasing with the resultant dash
- In the few years, however, soil quality erodes.
- Fire can get uncontrolled (accidental fire) and causes damages to properties in terms of grassland, crops, native forests and farming facilities.

- Apart from that, the use of fire generates negative externalities, such as:
- Deterioration of air quality affecting people health
- Interruption of air traffic and electricity supply
- Blockading of roads and increase in car accidents
- Loss of biodiversity

Scope

- In this study we measured some of these costs for the period 1996-98. The amin aim was to estimate the costs that are directly affecting fire's users, namely::
  - Damage to property in terms of agricultural output and farm facilities due to accidental fire
  - Carbon revenue foregone from released CO2
  - Health costs associated with air quality deterioration

The estimation proceduresfollowed two steps:

i) the estimation of these physical damages and

ii) next the monetization of the estimated physical damage

Property Damages due to Accidental Fire

Based on microeconomic farming data from na IPAM field survey for 1994-95, we were able to regress intentional fire area with accidental fire area by type of soil use (pasture, crops, forests) and burn of fences, using panel techniques

Using the resulting coefficients we estimated the accidental fire area for the years 1996-98 applying them to the intentional fire area of this period

Monetization was done using observed prices of the foregone output

Econometric Model - Damage to Pasture and Forest

Dependent Variable	**Acidental Fire (Pasture)**		**Acidental Fire (Forest)**	
• **Indepent**	**Randon Effect**		**Randon Effect**	
• **Variables**	**Slope**	**P-Value**	**Slope**	**P-Value**
• Intercept	-44,65	0,019	-16,96	0,279
• Pasture	0,02	0,000	-0,05	0,000
• Total Fire	0,50	0,000	0,44	0,000
• **Observations**	404		404	
• **R^2**	0,81		0,85	

Econometric Model of Damage to Farm Facilities

Dependent Variable	**Wire Fence Losted**	
Independent Variables	**Slope**	**P-Value**
Intercept	10.749,42	0,003
Explored Forest	5,48	0,000
Pasture	-2,98	0,000
Total Fire	7,35	0,000
Dummy to Small Property	-10.737,32	0.003
Dummy to Medium Property	-10.539,46	0, 009
Dummy to Medium Large Property	-11.880,43	0,008
Observations	202	
R^2	0,44	

Carbon Foregone Revenue

- Forest area lost with fire was also measured in the proportions observed in the IPAM survey
- Carbon contents of the lost forest area were estimated
- Monetization was given by the expected CDM values per ton of carbon (US$ 3.6 –US$9.0)

Health Costs

Dose-response function of fire area and air respiratiory incidence (death and hospital attendance) was measured using minicipal data on fire and hospital attendance through panel techniques

Costs were measured using hospital expenditure and estimates of willingness to pay proxies for heath risks (transfered WTP and local output foregone)

Econometric Model - Morbity from Respiratory Deseases I

	Dependent Variable	
	Morbity	
Method of Estimation	Fixed Effect	
Independent Variables	Slope	P-value
Population	0,002711	0,0000
Hot Pixels	0,097225	0,0000
Index of Cattle	-0,695145	0,0000
Value of Agricutural Production	-0,000787	0,0011
Observations	783	
R^2	0,98	

Econometric Model - Morbity from Respiratory Desease II

• Dependent Variable	Morbity	
• Method of Estimation	Pooling	
• Independent Variables	Slope	P-value
Intercept	116,4217	0,0000
• Population	0,0072	0,0000
• Hot Pixels	0,0921	0,0000
• Index. of Cattle	-0,1244	0,0000
• Value of Timber	0,0028	0,0000
• Production		
• Non Paved	0,8064	0,0000
• Roads		
•		
• Observations	783	
• R^2	0,98	

Table 5. Econometric Model - Mortality from Respiratory Desease

• Dependent Variable		
•	Mortality	
• Method of Estimation	Fixed Effect	
• Independent Variables	Slope	P-value
• Population	1,52E-06	0,0000
• Hot Pixels	0,001244	0,0000
• Index of Cattle	0,001315	0,0000
• Value of Agricultural	1,57E-05	0,0000
• Production		
• Observations	783	
• R^2	0,98	

PHYSICAL DAMAGES

Damage	1996	1997	1998
Property			
Pasture/crops (ha)	908.050	661.350	869.150
Forest (ha)	799.084	581.988	764.852
Fences (km)	13.348.335	9.721.845	12.776.505
Carbon			
From forests (t/C)	109.407.409	79.683.487	104.720.499
Health			
Morbidity (number of hospital attendance)	2.807	4.400	7.677
Mortality (deaths)	35	54	95

MONETARY RESULTS- US$ 1998

• **Damage**	**Monetary**		**% do PIB da Região**	
• **Property**				
• 1996	197.207.318		0,45	
• 1997	147.667.209		0,33	
• 1998	185.638.567		0,39	
• **Carbon**				
• 1996	382.925.932	1.050.311.126	0,88	2,43
• 1997	278.892.205	764.961.475	0,62	1,71
• 1998	366.521.747	1.005.316.790	0,78	2,13
• **Health**				
• 1996	33.675.789	57.952.734	0,078	0,13
• 1997	52.012.084	89.507.732	0,12	0,20
• 1998	91.451.939	157.379.854	0,19	0,33
• **Total** 1996	613.809.039	1.305.471.178	1,42	3,02
• **Total** 1997	478.571.498	1.002.136.416	1,07	2,24
• **Total** 1998	643.612.253	1.348.335.211	1,36	2,86