NEW PROCEDURES TO DEMONSTRATE THE ELIGIBILITY OF LANDS FOR A/R PROJECT ACTIVITIES UNDER THE CDM

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ABSTRACT

The present study intends to propose under the optics of eligibility for inclusion requirements in modality Land Use, Land Use Changes and Forestry (LULUCF) of Clean Development Mechanism (CDM) in Kyoto Protocol from United Nations Framework – Convention of Climate Change (UNFCCC), the contribution for sequester the atmospheric carbon by these ecosystems. Relating changeable of growth, biomass and taking as unit of analysis the described economic total value from Contingent Valuation Method – CVM (Serôa da Motta, 1998), as well as the parameters introduced by Mattos - Fonseca (2001), in CVM for hypothesis test of Willingness To Work Volunteer – WTWv – by projects activities of mangrove ecosystems recovery and Certified Emissions Reduced - CER's issued by UNFCCC.

Preliminary conclusions as carbon sink they would be the forests in expansion and the accumulation of organic substance in the ground (Houghton *et alii*, 1983). The records of annual carbon emissions and absorptions taxes in a mangrove ecosystem at north of the Amazonian forest points with respect to positive numbers: 2.8 and 5.2 $TC.ha^{-1}.year^{-1}$ (Oliveira *et alii*, 2004). The carbon stored in another mangrove ecosystem estimate in a southeastern coastal lagoon reaches 76.09 $TC.ha^{-1}$ (Cogliatti-Carvalho & Mattos – Fonseca, 2004).

Key Words: Mangrove, Ecological – Economic Valuation, Carbon Market, Kyoto Protocol, Global Changes

1.0 – Introduction

The first organized manifestations in defense of the environment retrace middle of XX^{th} century, in the post-II Great War, when common man took conscience that he could finish definitively with the planet, with all the species, also the proper one. After Hiroshima and Nakasaki explosion bombs, pacifist manifestations against the use of nuclear energy had been initiated in Europe, in function of disastrous consequences for humanity and environment. With these manifestations the concerns with the ambient damages and consequences in depreciation of planet natural resources provoked by economics action of man kind are intensified.

The present economic question in sustainable development retraces to $XVIII^{th}$ century, the origins of the economic thought not associated on the rational use of the natural resources and the preservation of the environment, creator of these conditions, under the effect of the industrial revolution. In its more general lines, this sketch leads specie H. sapiens to look for and distinguish the value from ecosystems and to understand the multiplicity of functions inlaid them. One of these functions - the one that more distinguished for being responsible to base of planet alimentary net - is primary productivity and, consequently, the photosynthesis as its primordial agent. Main alternative to minimize the effect of anthropogenic action provoked into a large extent for fossil fuel burning and other activities in lesser scale, the photosynthesis acts minimizing anthropogenic greenhouse effect that

already is observed through climatic alterations around the planet, by guilt of the emission excess of greenhouse gases - GHG.

The forms and proposals for kidnapping the gases that provoke the greenhouse effect vary since integral preservation of forests, a respectful relation between the human being specie and the diversity of the planetary flora, until considered instruments and sophisticated institutions proposed for that appropriate themselves of the environment with diffuse interests. The diversity of solutions and its authors are thesis discussion, the example of Young & Fausto (1997) that signal necessity of having clearly benefit generated for conservation and carbon sequester, knowing itself the cost, as consequence of the carbon emission in atmosphere and, also, the preservation contribution of tropical and remaining forests for emissions reduction. In this context projects CDM looks for appropriate itself of countable credits of pertaining elements to periodic table, constituting currency stock exchange (Rock, 2003; UNFCC, 2003; FBMC, 2002; UNFCC, 2002), aggregating value and in constant association to the sustainable development.

1.1 The sustainable development stimulating the interaction between sciences in direction to the valuation of ecosystems

Two important events had offered kickoff necessary to biodiversity studies of valuation. By pressure of Sweden government on the United Nations, motivated by the ecological disaster of Minamata Bay in Japan, fulfilled in 1972 the Conference of Estocolmo, Sweden, first international meeting on environment. The Conference brought to world scene the alert for economic growth, with the Club of Rome contribution supplied through the report of Meadows *et alii* (1973) on limits to growth, arriving to consider world-wide economy growth zero. These results had been endorsed in computational projections on exponential growth of population and industrial capital as positive cycles, resulting in negative cycles represented by exhaustion of natural resources, ambient pollution and the happened hunger succeed. Thus, the “zeristas" foresaw the natural resources exhaustion in less than four generations.

As the event also had influence another report divulged from Mrs. Gro Brundtland, former-first minister of the Norway, under suggestive name Our Common Future (CMMAD, 1988), bringing for world-wide scene the concept of sustainable development, conferring definitively notoriety to ambient questions. This document determined the theoretical bases of ECO 92 or RIO 92 quarrels, international conference on environment promoted by the United Nations in Rio e Janeiro, Brazil, continuation that one carried out in 1972. The report considers concept that sustainable development would be the capacity of current generations in taking care its necessities without compromising the attendance of future generation’s necessities (CMMAD, 1988). Mattos - Fonseca (2000) extends to the ecological sustainability understanding adding the notion concept of ecosystems balance, that one high index of species diversity as indicating the dynamic balance of ecosystems, or either, the ecosystems is more healthful and presents bigger capacity to support changes how much bigger its biodiversity and the dynamic balance between its populations. This is the ecological sustainability, convergence of avenues preventing global and local consequences of biodiversity erosion and fomenting the industry of ambient goods and services sustainable, in the direction of a symbiosis between conservation of biodiversity and dynamic economics” (Veiga, 1999).

Vieira (1999) detaches the naivety of the concept, when commenting:

> It does not remain doubt that the concept of sustainable development can be used as instrument to denounce and to try to decide the conflicts between economic growth, social inequality and ambient conservation. But,

> undeniably, this concept possesses an ingenuous side when ignoring the correlation of forces in the international plan in favor of the industrialized countries, different relations in international trade, the multinationals power, etc."

Far of a consensus and next to a great mosaic concept, the sustainability adds readings and bias. De Carlo (1999) affirms that the sustainability can be strong at the point not to allow the substitution of natural capital or diminishes at long of the time, making possible the investment in its recovery same in other sectors, or sustainability can be weak, allowing the substitution of the natural capital for the material capital, keeping the total value of the constant capital. May & Chévez (1999) still detach the absurdly strong sustainability of Herman Daly, which implies in not allowing any reduction in the physical natural capital. In way to many paradigmatic controversies and categories, Giuliani (1998) *apud* Mattos – Fonseca (2004), calls the attention for the interaction necessity between Sciences and a change in the paradigms, still of XIXth century, communicating the necessity of a deep revolution in human thought and enclosing a frame picture where the environment and the natural resources are valued.

1.2 – The greenhouse effect

One of determinative factors of the species survival in its habitats is temperature. Through thermal balance, the ecosystems keep its characteristics, making possible development of life in its more diverse forms. The greenhouse effect is a natural atmospheric phenomenon, nowadays intensified for the anthropogenic action, where the temperature of the planet is warming up slow and gradually, being able to cause in long stated period significant alterations in the distribution of planetary ecosystems. The phenomenon comes mainly revealing the result of human being economic activity. As consequence, great amount of gases are introduced in the atmosphere, whose behavior thus resembles it of a greenhouse, which, at the same time where it allows solar radiation and its specter infra-red ray to warm the planet, makes difficult its exit, magnifying main effect: the heating of environment. The phenomenon report concerns 1988 with the creation of the IPCC - Intergovernmental Panel on Climate Change in the scope of UNEP (United Nations Environment Program) and the World Meteorology Organization (WMO). The main gases of greenhouse effect are following: the carbonic gas (CO_2), responsible for more than 50% of the effect, the water steam (H_2O), the methane (CH_4), the nitrous oxide (NO_2), the ozone (O_3) (of the low layers) and the composites Chlorine - Fluorine - Carbon (CFC's). These are known by the biggest capacity of absorption of the infra-red rays, generating on the degradation areas a bigger heating and influencing in the planet temperature. Some of these gases are deriving to natural processes, as the ones that involve the microorganisms of the ground, but its extreme production is decurrently of industrial processes, the discharge of auto machine vehicles, used chemical products as fertilizing, the incomplete combustion, household-electric and the heating systems. These by-products of the comfort can cause enormous upheavals harmful to human being kind, as the increase of the temperature in the Earth, already observed for the scientists and perceived by the common sense through the intensification of heat to the long one of stations. Another consequence is the increment of melting of the polar ice, provoking the increase of seas level and, surpassing, the possible change of planet axle in function of great masses melting of polar ice, less dense, starting to be part of the water denser of the oceans, or modifying the distribution of planet heat for oceanic chains, in face of salinity and temperature changes.

1.3 – The Value and the necessity to pay the sequestration price

Currently, known bibliography discourses on diverse experiences and evidences of reforestation projects efficiency in distinct ecosystems, since tropical forest to mangrove. The relation growth and biomass of species as *Tabebuia vellosoi* and others at Atlantic forest, used in reforestation projects, is known and associate to the efficiency of carbon sequester in comparison to alien species, as for example eucalyptus. The mangroves occupy up 10.000 to 25,000 km^2 in Brazil (Mattos – Fonseca & Drummond, 2003), and have not been remembered in these studies for the scientific community. The efficiency for atmospheric carbon sequester of its flora species, however, needs to be compared with that one of the Atlantic Forest species or the species of other forests, as well as the economic - ecological valuation of these efforts. A Non-Governmental Organization - NGO comes developing the forestation of a small lake transformed into lagoon by the anthropogenic intervention in Itaipu, Niterói, Rio de Janeiro, Brazil; Field (1997) organized collection of articles that describes the main experiences of mangrove ecosystem restoration between the tropics, both given chance and wait systematization for correlation biometry with the sequester of atmospheric carbon. First is not a simple task, however feasible, as Carson (1998) conclusion:

> "This is not to say that contingent valuation could not be used to value a program to prevent global warming, but rather that valuing a program to prevent global warming is likely to be more difficult than valuing a set of tropical rainforests."

Using the instrumental of institutional economy concepts, collection of rules commanding the direction in which individuals and groups cooperates and competes (Anderson, 1995; North, 1981), of involved knowledge areas integration in the study of the Market fail, of Non - Governmental Organizations performance and the responsibility of the SISNAMA agencies, in the survey of the remaining mangroves current situation and implantation of project activities for mangrove ecosystem recovery, the present study describe the principles of an inquiry that intends to evaluate under the optics of eligibility requisites for inclusion of these project activities in modality LULUCF of MDL, the contribution for sequester of atmospheric carbon through the recovery of these ecosystems and generation of CER's, foreseen at Kyoto Protocol in vigor since February, 16, 2005.

2.0 - Objectives

Relating changeable of growth, biomass and taking as unit of analysis the described economic total value by Motta (1998), as well as the parameters introduced by Mattos – Fonseca (2001), in CVM methodology for Willingness to Work Volunteer - WWV hypothesis test , this thesis describe the principles of a study that it intends to propose viability of projects activities implementation, in accordance with MDL rules and lines direction of the Kyoto Protocol, for forestation or reforestation of mangrove ecosystems, in order to allow CER's issued by UNFCCC.

3.0 - Methods

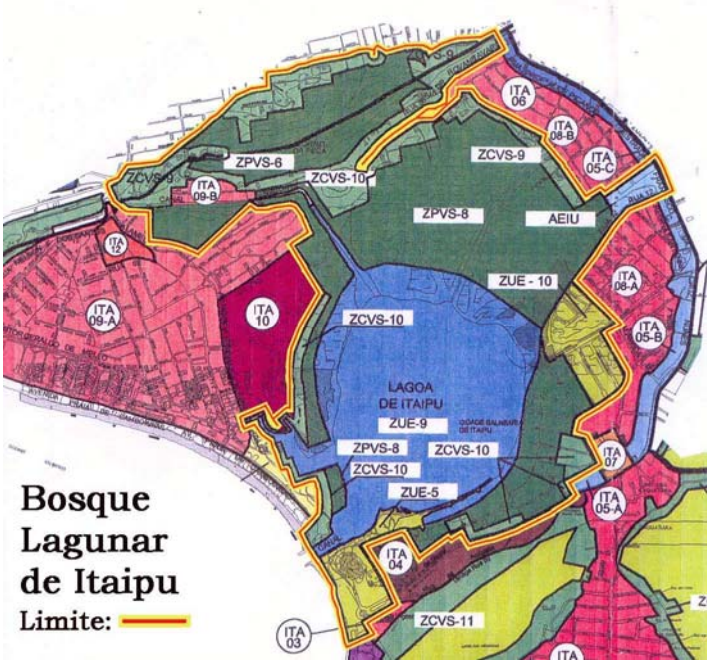
The first phase of study consists in identification and select some representatives projects developed for forestation or reforestation of mangrove, the structural characterization, on the basis of past records and/or data-collecting gotten *in situ* of the selected projects, determining it specific composition of the forestation or reforestation forests, estimating total area with remote sensing. The structural characterization will be followed by studies aiming to establish the parameters used for each executive project, for example, the determination of standards gradation of species, if related to the area topography, inclusion in cartographic bases of the places to plants introduction, duly identified, by

species size, biomass and date of the plantation. The biometric parameters of growth and total biomass will be evaluated in each visited project.
The second phase goes to search from the gotten data to establish a model for the inclusion of forestation or reforestation of mangroves projects in modality LULUCF of the MDL, in accordance with the principles established by the Kyoto Protocol of UNFCCC, and the framing institutional requirements from Brazilian legislation. Complementing the study, the evaluation of the issue and the value of CER's will be compared with studies of forest valuation, taking as unit of analysis the described economic total value from Serôa da Motta (1998), as well as the parameters introduced by Mattos – Fonseca (2001), in CVM methodology for the WWV hypothesis test.

4.0 - Preliminary results

Preliminarily the findings of the only project until the present date distinguished, which involves mangrove ecosystems in the context of the restrictions and eligibility of the MDL/Kyoto Protocol, developed in Brazil. The project "Reforestation of Mangrove and the Rescue Value of the Atmospheric Carbon Sequester" was elect by Proclamation 09/2001 of the Brazilian National Fund of the Environment - FNMA, supported by the Embassy of the Netherlands and United Nations Developing Program (UNDP), developed with the partnership of Association for the Protection of Coastal Ecosystems - APREC - the Center of Advanced Studies in Applied Economics of the São Paulo University - CEPEA/ESALQ/USP - and Center of Sustainable Development of the Brasilia University - CDS/UnB - and whose final report was presented in July, 2003.

Figure 1 – Itaipu Lagoon forest (adaptation of Niterói City Hall, 2003)



Preliminary studies developed by the project esteem a total of 152.19 ton/ha of biomass (dry weight), storing 76.09 ton/ha of carbon in the Itaipu mangrove (Cogliatti-Carvalho & Mattos – Fonseca, 2004). The values of biomass density, and carbon stored in the three studied species are in table 1:

Table 1 - Values of density, biomass and carbon stored in Avicennia shaueriana, Laguncularia racemosa and Rhizophora mangle at the Itaipu mangrove, Niterói, Rio de Janeiro, Brazil (adapted of Cogliatti-Carvalho & Mattos – Fonseca, 2004).

Specie	Density (ind/ha)	Biomass (ton/ha)(dry weight)	Carbon (ton/ha)
Avicennia shaueriana	2971	119.58	59.79
Laguncularia racemosa	3271	31.43	15.72
Rhizophora mangle	57	1.18	0.59
TOTAL		152.19	76.09

Another project for study of carbon in mangrove developed in the context of the LBA - Experiment of Large Scale Biosphere - Atmosphere in Amazonia, operates an experimental location at the city of Bragança, Pará, Brazil, that houses CARBOPARA - LBA project. In a forest whose canopy reaches heights up to 25 meters, equipment for the arrest micrometeorological data had been installed in a tower of 27 meters height.

Figure 2 - Micrometeorological tower in the Bragança mangrove, Pará, Brazil (photo of Sergio Mattos - Fonseca, February, 2004).

In January of 2001 and November of 2002, months that correspond to the rainy and dry period at the region, respectively, record had been gotten whose resulted are summarized in table 2:

Table 2 - Total Carbon flow in Bragança mangrove area (adapted of Oliveira *et alii*, 2004).

Total ($KgC.ha^{-1}.day^{-1}$)			
	Diurnal 06:00 – 18:30	Nocturnal 19:00 – 05:30	24 hours 18:30 – 19:00
Rainy	-30.54	15.97	-14.57
Dry	-26.71	18.88	-7.82
Diference	3.83	2.91	6.75
%	-12.55	18.24	-46.30

5.0 - Discussion

The attention on the possible effect by changes in the planet climate comes to few gaining prominence and attention, leaving pages of scientific articles at world-wide newspapers direction. Authorities of all nations come annually congregating in conferences of parts of the UNFCCC joined around studies on future scenarios and measures of mitigation for the anthropogenic greenhouse effect. From the 1997 meeting in Kyoto (FBMC, 2002a), in direction of commerce reduction certified emissions of greenhouse gases market, a Brazilian proposal search to establish mechanisms for a clean development (MDL). Amongst these, the support of projects activities on LULUCF opens a fan of possibilities for resetting of deforested Biomes and for the growth of human being economy still unaware of the laws and the importance of nature economy that contains it. Drift from there the hypothesis of this research:

> "The carbon balance of the mangrove system as a whole indicates atmospheric carbon sequester, therefore, the system can be used as generation of the currency-certificate for attainment emissions reduction credits of greenhouse gases".

The amount of carbon stored in the Itaipu lagoon mangrove, as a positive pointer, (76.09 ton/ha), is lesser of that found by Rezende *et alii* (2001) for areas of firm land forest (111.65 ton/ha) and of inundated forest (98.58), even so in these two last values are enclosed also the carbon stored in the roots. However, the carbon supply in the Itaipu mangrove is bigger than the one found by those same authors for the Brazilian savanna (31.46 ton/ha) and for tilled plain fields (6.84). The economy of nature valuation adds value to ecosystems: Randal (1980) *apud* Grasso (1994), detaches economic and social importance of the mangrove of the National Park of Caroni (Trinidad - Tobago), establishing a value of USS8, 000.00 for hectare of humid areas. Mattos - Fonseca (2001) found USS2, 105.04, expressing the value of existence for the willingness to pay, and the value indirectly evaluation through the voluntary work of USS7, 560.00, for hectare of the Itaipu lagoon.

6.0 – Conclusion

According Aguiar (2005), energy partition at earth surface is a complex function of long term biochemical cicle, climate interactions and short term plants fisiology and atmosferic limit layer interactions. Global changes at environment probably afects the dinamic of energy changes, mass, and *momentum* wich occurs among earth, surface and atmosphere (Giolo *et alii*, 2004 *apud* Aguiar, 2005). Eficiency of carbon storage at tropical forest and the economic – ecological valuation of this efforts, needs parametrization to model carbon storage, mass and energy balances, that is to say future scenarios models.

As carbon sink they would be the forests in expansion and the accumulation of organic substance in the ground (Houghton *et alii*, 1983). The records of annual carbon emissions and absorptions taxes in mangrove ecosystem at north of the Amazonian forest points with respect to positive numbers: 2.8 and 5.2 $TC.ha^{-1}.year^{-1}$ (Oliveira *et alii*, 2004). The carbon

stored in another mangrove ecosystem estimate in southeastern coastal lagoon reaches 76.09 $TC.ha^{-1}$ (Cogliatti-Carvalho & Mattos – Fonseca, 2004).

Preliminarily one relates that the importance of the mangrove ecosystem can thus be summarized:

- as supplier and maintained of biodiversity;
- as defensive of the marine – fluvial basins;
- as lifting of innumerable and important economic human beings activities;
- as carbon sink, contributing to brighten up the anthropogenic greenhouse effect in the planet, contributing for the CDM/Kyoto Protocol/UNFCCC.

This is the sketch of a complex scene in which inserts this thesis project, signaling for the importance to aid the resilience of mangroves ecosystems.

7.0 - Bibliographical references

AGUIAR, Renata Gonçalves: Mass and Energy Flux at Tropical Rainforest, southwest Amazon, master dissertation, Mato Grosso Federal University, Physics and Environment Post- Graduation Program, 2005

ANDERSON, J.L: Explaining long-term economic change. Cambridge University Press, 1995.

CARSON, Richard T.: Valuation of tropical rainforests: philosophical and practical issues in the use of contingent valuation. In Ecological Economics, n. 24/1, Elsevier Science, Ireland, 1998.

CMMAD – World Commission on Environment and Development: Our Common Future, Getúlio Vargas Foundation, Rio de Janeiro, 1988.

COGLIATTI-CARVALHO, L., MATTOS – FONSECA, S. M.: Quantification of biomass and carbon in Rhizophora mangle, Avicennia shaueriana and Laguncularia racemosa at Itaipu lagoon, Niterói – RJ. In: VI Brasilian Ecosystems Symphosium – Abstracts and Program, São Paulo Science Academy, INPA, São José dos Campos, 2004.

De CARLO, Sandra: Environment: integration on Statistics Information System. Discussion Text n^{o} 96, IBGE, Rio de Janeiro, 1999.

FBMC, 7th Conference on Part - COP 7 – The Marrakech Agreements. Brasília, Climate Changes Brazilian Forum, 2002.

FBMC, Climate Changes: Information Guideline. Brasília, Climate Changes Brazilian Forum, 2002a.

FIELD, Colin (org), La Restauracion de Ecosistemas de Manglar. ISME - Sociedad Internacional para Ecosistemas de Manglar, Editora de Arte, Managua, 1997.

MATTOS – FONSECA, Sérgio *et alii*: Social – environment considerations to contribute from valuation of damage with the petroleum spilling in Rio de Janeiro mangrove. Brazil, Prof. Dr. Peter May coordination, In: Diagnose and Participative Management Laboratory of Ecosystems, CPDA/UFRRJ, Rio de Janeiro, 2000.

MATTOS – FONSECA, Sérgio: The Existence Value of a Tropical Coastal Ecosystem, Throught Willingness to Work Volunteer. Environmental Science Post-Graduation Program at Federal Fluminense University, master degree dissertation, Niterói, 2001.

MATTOS – FONSECA, Sérgio, DRUMMOND, J. A: Reforestation of mangroves and the Rescue Value of the Atmospheric Carbon Kidnapping. History, Science and Health – Manguinhos, FIOCRUZ, Rio de Janeiro: v.10, n.3, p.1071-1080, 2003.

MATTOS – FONSECA, Sérgio: About the dialogue between sciences as bases for Environmental Science, draft, 2004

GRASSO, Monica: Economic Evaluation of Mangrove Ecosystem: Cananéia Complex, a case study. Master degree dissertation, IOUSP, São Paulo, 1994.

HOUGHTON, R.A., HOBBIE, J.E., MELILLO, J.M., MOORE, B., PETERSON, B.J., SHAVER, G.R., WOODWELL, G.M., Changes in the carbon content of terrestrial biota and

soils between 1860 and 1980: a net release of CO_2 to the atmosphere. Ecological Monographs, 53, p. 235-262, 1983.
MAY , P., F. Veiga & O. CHÉVEZ : Economic valuation of biodiversity: cases studies in Brazil. Brasília, Environment Ministry, 1999.
MEADOWS, D.H. *et alii*: Limits of Growth. Perspective Edition, São Paulo, 106 p, 1973.
MOTTA, R.S.: Environmental Resources Economic Valuation. Brasília, MMA, 1998.
NITERÓI CITY HALL: Itaipu lagoon forest caracterization. CD – ROM from Environment and urbanism Secretariat of Niterói City Hall, Rio de Janeiro, 2002.
NORTH, D.C.: Structure and Change in Economic History, W.W. Norton & Co, New York, 1981.
OLIVEIRA, Paulo Jorge de; FERREIRA da COSTA, Rafael; Y.MALHI; A.C.L.COSTA; J.M.N.COSTA; R.B.C.SILVA; V.M.S.ANDRADE; A.BRAGA; J.A.SILVA JUNIOR; P.H.L. GONÇALVES; P.MEIR: Atmosferic CO_2 Flux on mangrove ecosystem at Amazon area – Bragança, Pará, UFRA, MPEG, IERM/UEdin, UFPA, UFV, III LBA Scientific Meeting, Brasília, 2004.
REZENDE, D., MERLIN, S. & SANTOS, M. 2001: Carbon kidnappin, a real eperiment on Palmas. Ed. Ecological Institute, Palmas, Tocantins, 2001.
ROCHA, M. T.: Global Warming and the Carbon Market: application of the CERT model. Thesis on CEPEA/ESALQ/USP, Piracicaba, 196 p, 2003.
UNFCC, Clean Development Mechanism: Project Design Document (CDM-PDD), UNFCC Web site, Bonn, 16 p., August, 2002.
UNFCC, Kyoto Protocol; executive Board launches process for small-scale CDM projects, press Release from Framework Convention on Climate Secretariat, Bonn, 29 January 2003.
VEIGA, J.E: Biodiversity and Economic Dynamic. III EcoEco Meeting, CD-ROM Annals of Brazilian Ecological Economics Society, Recife, 1999.
VIEIRA, Liszt: Global citizenship and national State. Draft article, Rio de Janeiro, 13 p, 1999.
YOUNG, Carlos Eduardo Frickmann & FAUSTO, José Ricardo Brun: Natural Resources Valuation instruments to the agriculture frontier expansion analysis at Amazon. Discussion text n. 490, Applied Economic Research Institute – IPEA, Rio de Janeiro, jun, 1997.