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GLOBAL IMPLICATIONS OF AMAZON FRONTIER SETTLEMENT: CARBON, KYOTO AND THE ROLE OF AMAZONIAN DEFORESTATION

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INTRODUCTION

Land use and land-use change in Amazonia contribute to global climatic change in several ways. Climatic changes affected by deforestation include decrease of rainfall due to the decrease of the recycling of water, especially in the dry season. Water recycled by the Amazon forest makes a substantial contribution to rainfall in the central and southern parts of the country in the months of December and January, which is the critical time for refilling hydroelectric reservoirs in that area (Fearnside, 2004a). Deforestation also makes a contribution to global warming. Brazil's Amazonian deforestation released net committed emissions of 258-270 million tonnes of CO_2-equivalent carbon annually over the 1988-1994 period. In 2002, considering the preliminary official estimate of the rate of deforestation of 25.5 thousand km^2/yr and median values for trace gases, the net committed emissions (*i.e.*, with the regrowth of secondary vegetation already deducted) totaled 442 million tons of carbon--an astronomical amount. Gases are released by deforestation through burning and decomposition of biomass, and from soil, logging, hydroelectric dams, cattle and the repeated burning of pasture and secondary forests.

Burning also affects the formation of clouds and affects the chemistry of the atmosphere in several ways in addition to the greenhouse effect. The contribution of forest loss to these climatic changes, together with other global changes such as biodiversity loss, provides the basis for a new strategy to sustain the population of the area. Instead of destroying the forest to produce some kind of merchandise, as is the current pattern, this alternative strategy would use forest maintenance to generate cash flows based on the environmental services of the forest, in other words, the value of avoiding the impacts that result from destruction of the forest (Fearnside, 1997a). The value of avoided deforestation in combating global warming is closer than other environmental services to becoming an alternative to deforestation in the region's economy. However, controversies surround the inclusion of avoided deforestation in the Kyoto Protocol's Clean Development Mechanism (CDM), and credit for this measure has now been barred until 2013. As a matter of disclosure, I have been arguing since 1982 for reducing deforestation as a means of mitigating global warming, and since 1983 a large part of my professional efforts have been devoted to filling the gaps in data and analysis needed to quantify deforestation emissions and make avoided deforestation a source of value for supporting the Amazonian population. Therefore, although I will attempt to explain the positions of all sides, readers should not expect neutrality.

Saving tropical forests as a measure to mitigate the greenhouse effect divides the environmental movement. The divisions among non-governmental organizations (NGOs) are as large as the differences among national governments. While the debate is frequently couched in scientific terms with appeals to high universal principles, the positions of the different parties are better understood in terms of hidden agendas. In the case of European governments, which have opposed inclusion of forests in the CDM in the first commitment period (2008-2012), the exclusion of the forests would force the USA to meet its Kyoto commitments almost exclusively from domestic measures, most importantly an increase in the price of gasoline; this would improve Europe's industrial competitiveness with the United States. This is due to the fact that the emission quota for each industrialized country during the

first commitment period was fixed in the Kyoto conference in December 1997, in other words, before reaching an agreement on the rules of the game, mainly on inclusion or not of the tropical forests in the CDM. In the case of Brazil's Ministry of Foreign Relations, opposition to including avoided deforestation derives from fear of threats to Brazil's sovereignty in Amazonia, combined with a vision of the process of deforestation as inherently beyond the government's control. Other sections of Brazilian society, including the state governments in the Amazon region, do not share the interpretation of the Ministry of Foreign Relations. The best news with regard to the opposition of Brazilian diplomats is the experience of deforestation control in Mato Grosso from 1999 to 2001, indicating the government's capacity to control the process when it chooses to do so (although there is still discrepancy with INPE data regarding 2001 deforestation in Mato Grosso).

For NGOs headquartered in Europe, opposition to inclusion of forests follows logic parallel to that of the European governments. It is best explained as a blow against the United States, which is seen as deserving punishment for its many sins in the world, including its place as the largest single emitter of greenhouse gases and its role as an obstacle to international negotiations on climate change. From the point of view of Brazilian NGOs interested in maintaining the Amazon forest, these alternative agendas are side issues that, although they may have merit, do not justify throwing away a major opportunity for maintaining the forest. The technical arguments presented by critics of avoided deforestation contain great distortions of the climatic consequences of projects in this area. Proposals exist to deal with such issues as uncertainty and the permanence of carbon; adoption of these would make the climatic benefits of the avoided deforestation become a reality, allowing carbon mitigation activities to provide a gain both for the climate and for biodiversity and other values.

In July 2001 the Bonn agreement excluded avoided deforestation from the CDM for the first commitment period, but the chances of this type of mitigation entering in the CDM are much better for the second period (2013-2017). This is because the emission quotas of the industrial countries have not yet been negotiated, and if forests are not included these countries will simply agree to decrease their emissions by less. Decisions on the second period will be negotiated in 2005. In the same year the level for "stabilization" of the concentration of CO_2 in the atmosphere will also be negotiated. The United Kingdom's Hadley Centre has made catastrophic forecasts concerning the survival of the Amazon forest from climate changes that are expected without mitigation (Cox *et al.*, 2000, 2003); these simulations indicate that the stabilization level should be below 550 parts per million by volume (ppmv) of CO_2 to avoid massive mortality of trees in the 21st century (Arnell *et al.*, 2002). The future of the Amazon forest depends on human decisions.

AMAZONIAN DEFORESTATION

On 25 June 2003, Brazil's National Institute for Space Research (INPE) released data on its website (Brazil, INPE, 2003) indicating two significant changes in Amazonian deforestation: a large revision of the estimate for deforestation in 2001 (15% increase over the preliminary 2001 estimate released in 2002), and a preliminary estimate for deforestation in 2002 indicating a tremendous jump in the annual rate (40% increase over the revised 2001 estimate). Anecdotal evidence indicates that the rate for 2003 will also be

high. Among the disturbing features of the 2002 data is an explosion of clearing activity around Novo Progresso, on the BR-163 Highway. In the 185 × 185 km LANDSAT scene (227-65) centered on Novo Progresso the deforestation rate more than tripled in 2002 relative to the rate in 2001. This site has been the scene of a frenetic migration of sawmills, ranchers and hopeful soybean planters in anticipation of paving the highway under the 2004-2007 Pluriannual Plan, or PPA—the successor to Avança Brasil (Fearnside, 2002a).

Most important is the meaning of deforestation data for evaluating the success of the deforestation licensing and control program in Mato Grosso. The new results from INPE contain significant discrepancies with those from LANDSAT imagery interpreted by the State Foundation for the Environment (FEMA) of the Mato Grosso state government; these need to be clarified before firm conclusions can be drawn (Fearnside and Barbosa, 2004). Data through 2000 offer several indications that the control and licensing program was having an effect on clearing rates (Fearnside, 2003). At the state level, INPE data indicate the annual deforestation rate in Mato Grosso declining over the 1999-2000 period while the rest of Amazonia had an upward trend in the same period. However, the annual rate of deforestation in Mato Grosso was already beginning to fall off before the control program began in1999, indicating that at least part of the decline was probably the result of running out of forest in some parts of the state. The decline in deforestation was sharper after 1999, which is consistent with an effect from the program. In order to separate the effect of dwindling forest from the enforcement program, FEMA data were examined from a series of counties (*municípios*) with a range of levels of previous clearing and with different dominant land uses: soybeans, ranching, and small-farmer settlement (mixed with ranching), as well as locations where enforcement effort was concentrated and not. The FEMA data used in these comparisons is for clearing in all vegetation types, including *cerrado*, as well as forest, "transition" (note, this differs from INPE data, which do not include clearing in *cerrado*). For counties with little previous clearing, the FEMA data show the clearing rate increasing until 1999, after which the trend reverses direction and declines; in contrast, in areas with clearing was already well advanced, the annual rate declines beginning before 1999 and is unaffected by the control program. This pattern suggests that some of the decline at the state level is a result of the program. Also consistent with this is a stronger effect where the enforcement was concentrated.

County-level data for 2002 from FEMA indicate a generalized upsurge in deforestation throughout Mato Grosso, independent of the dominant land use, the degree of previous clearing, and the level of enforcement. This may be a reflection of anticipation among large landholders that Blairo Maggi would be elected governor in the October 2002 elections, and that all previous deforestation sins would be forgiven. Maggi is the World's largest individual soybean entrepreneur, and easily won the 2002 election with a self-financed campaign (Edward, 2003). The effort and sophistication of the enforcement program increased progressively since its inception in 1999, making the upsurge in 2002 a disappointment. In 2002, enforcement increased substantially, with fines applied to 94% of the area detected of illegal clearings larger than 200 ha (clearings subject to control by FEMA). However, this finding would have little effect in 2002 itself, since the clearing was almost always already completed by the time of the inspection.

With the entry of the Maggi administration in 2003, the enforcement program went into an obvious decline (although it has not been officially abolished). Among the changes was disappearance of the website where, beginning in 2001, public access had been provided to the list of registered properties, with indications of what properties were in violation of environmental legislation. The site provided maps and measurements of clearings in legal reserves and permanently protected areas in each property, together with the names, addresses and identity information of the property owners.

The significance of the Mato Grosso program for climate mitigation is considerable. As an illustration, if one uses the clearing rate in 1999 as the baseline (*i.e*., taking credit for all reduction in the rate below the 1999 level), the average annual reduction in clearing through 2000 was 319,393 ha, of which 223,559 ha was in forest and transition. Considering the biomass of each vegetation type and soil changes to 1-m depth, this reduction avoided an emission of 36 million tonnes of carbon annually (Fearnside and Barbosa, 2003). An idea of the potential economic significance can be gained by considering a carbon value of US$20/tonne (a value used in budget planning by the Clinton administration in the US, which is now purely illustrative due to the US withdrawal from the Kyoto negotiations in March 2001 under the Bush administration and the exclusion of avoided deforestation for the 2008-2012 period under the July 2001 Bonn Agreement). What the price will actually be (*i.e*., what the supply and demand will be for CDM carbon credits) and what percentage of avoided deforestation carbon can be claimed as credit will, of course, depend on future decisions. At US$20/tonne, the program would be producing a carbon value of US$722 million annually. This would represent a maximum value, as it assumes that all carbon is credited in full, without the adjustments for such factors as permanence, uncertainty and leakage that are advocated by this author (*e.g*., Fearnside, 2001a). Note that for the first commitment period, with no US participation and with avoided deforestation excluded by the Bonn Agreement, the price of carbon is expected to be only US$9/tonne C (den Elzen and de Moor, 2001).

If avoided deforestation is eventually included in the CDM the bulk of the profit from sale of carbon credit generated will go to project developers. These might be federal agencies (such as the National Institute for the Environment and Renewable Natural Resources-IBAMA), state governments, private landowners, or cooperatives and citizens' groups. A 5% tax on the proceeds will go to the climate convention's adaptation fund and for activities related to biodiversity conservation); some of this smaller stream of funding may also become available to Brazilian government and non-government organizations. The prospects for the use of funding generated by avoided deforestation during the second commitment period will depend heavily on experience gained with the more modest amounts of money expected from the CDM during the first commitment period, when only projects for plantations and energy-sector mitigation will be eligible credit. The difficulties in actually spending the money properly to promote sustainable development and conservation are tremendous (see discussion in Fearnside, 1997a). The great effort that has been needed to spend smaller sums under the Pilot Program to Conserve the Brazilian Rainforest (PPG7) makes this clear. Despite these difficulties, the source of value must be maintained of the transition to an economy based on environmental services is ever to take place. This means both recognition of the value of avoiding deforestation and having a forest left to maintain.

GREENHOUSE-GAS EMISSIONS FROM DEFORESTATION

Amazonian deforestation makes a significant contribution to global warming, but the amount of this contribution has been the subject of extended controversies and strong political implications underlie the debate. Half of the dry weight of wood is carbon. Both burning and decay release this carbon as greenhouse gases such as carbon dioxide (CO_2) and methane (CH_4), in addition to releasing non-carbon greenhouse gases such as nitrous oxide (N_2O). The magnitude of greenhouse gas emissions from deforestation in Brazil's Amazon forest is the subject of longstanding debate both inside and outside of Brazil. The range of estimates is very large (*e.g.,* R.J.A. Houghton *et al*., 2001). Only a relatively small part of this range is the result of genuine differences in data for forest biomass and other relevant factors. Most is from the choice of what items to include in the estimates. The choices made have direct impact on policy questions about which opinions are sharply divided for non-scientific reasons. Close examination of the effect of choices is therefore necessary. The goal should be to base all policies on complete accounting.

The Brazilian government has long had a pattern of announcing lower deforestation and emissions estimates than what other evidence suggests (see Fearnside, 1997b, 2000a). Just before the Kyoto conference the government even announced that the country produces *zero* net emissions from Amazonian deforestation [!] (*IstoÉ*, 1997). In recent years the official deforestation rate estimates have been free of the errors understating deforestation that occurred in several earlier estimates, but the calculations of emissions continue to minimize the impact of deforestation on global warming.

The political context in Brazil was made most explicit by José Domingos Gonzalez Miguez, head of the climate sector of the Ministry of Science and Technology (MCT), in the transcript of a workshop on the greenhouse gas emissions from reservoirs held at MCT's Center for the Management of Strategic Studies in Brasília in February 2002. Although this "smoking gun" relates to the question of emissions by hydroelectric dams (see Fearnside, 2002b) rather than deforestation for ranching and agriculture, the political context is the same:

> *"I asked for the help of ELETROBRÁS* [on the subject of greenhouse gas emissions from dams]*; actually, it was ELETROBRÁS that coordinated this work exactly because of this, because this subject was becoming political. It has a very great impact at the World level; we are going to suffer pressure from the developed countries because of this subject. And, this subject was little known. It is mistreated. It is mistreated and continues to be mistreated by Philip Fearnside himself, and we have to be very careful. The debate that is taking place now in the press shows this clearly; that is to say, you can take any one-sided statement to show that Brazil is not clean, that Brazil is very remiss, that Brazil, implicitly, will have to take on a commitment* [to reduce emissions] *in the future. This is a great political debate and we are preparing ourselves for it."* (Brazil, MCT, 2002).

It is worth noting that the above confession is maintained on a public website administered by the MCT climate sector itself. Needless to say, the idea that research on emissions must be carefully "coordinated" in order to assure that only politically palatable conclusions are

reached is not the only viewpoint. As unpopular as it may be, I defend the position that *all* sources and sinks of greenhouse gases must be quantified and taken into account in policy making.

Brazil is preparing its first national inventory of greenhouse gas emissions, as required the 1992 United Nations Framework Convention on Climate Change (UN-FCCC) (UN-FCCC, 1992). The inventory is now several years late, but is expected to be completed in 2004. The current Brazilian inventory covers the 1988-1994 period, when the average annual deforestation rate in Amazonia was 15.2 thousand km^2. Estimates for the deforestation portion of the report have evolved over time. In August 2002, a preliminary estimate for this component totaled 90 million t C, a value which was increased to 117 million t C in September 2003, but may undergo further revision. My estimates for the same period are 56% higher (Table 1). Differences include counting below-ground biomass, dead trees, and trace gases. The upsurge in the deforestation rate in 2002 implies astronomical emissions—in the neighborhood of 450 million tonnes of carbon annually (Table 1).

[Table1 here]

Controversies over numbers for emissions from Amazonian deforestation are also common within the academic community. A recent estimate by researchers at the European Union's Joint Research Centre, in Ispra, Italy, concluded that emissions are much lower than what others have found (Achard *et al*., 2002; Eva *et al*., 2003). However, a series of omissions in this low estimate adds up to an understatement of the global-warming impact of deforestation by more than a factor of two (Fearnside and Laurance, 2003, 2004). Outside observers often react to differing results among scientific groups by assuming that the truth must lie somewhere between the two extremes, presumably at the midpoint. Unfortunately, this kind of shortcut methodology is utterly insufficient: there is no substitute for reading the original literature on these controversies and tracing the origin of each item back to its source. Entering into this literature will quickly reveal that many of the published estimates are little more than guesses. The reliability of an estimate depends on three basic factors: the quality of the data, the quantity (and representativeness) of the data, and the consistency of the interpretation.

Some values for input parameters in emissions calculations are much better than others in terms of the underlying data and in terms of the interpretation of those data. Great care must be taken that all components of the carbon stock are included. Values for the percentage of above-ground live biomass (AGLB) for frequently omitted components include: trees less than 10 cm in diameter (12%), vines (4.3%), palms (3.5%) and strangler figs and other "non-tree" components (0.2%) (Fearnside, 1994, 1997c, 2000c). A valid estimate must include below-ground biomass, which averages 19.3% expressed as a percentage of AGLB for all Amazonian forests (Fearnside *et al*., 1993) and dead biomass (necromass), which is typically 9-12% of AGLB (Nascimento and Laurance, 2002). The full emission must include either the "committed emissions" after the year or (or multi-year time period) used for the estimate, or the "inherited emissions" from decay or combustion of biomass that remains unoxidized from deforestation in the years prior to the year or period of interest. Regrowth in the deforested landscape is often overestimated by using

data on secondary forests that are not derived from cattle pasture, which overwhelmingly predominates as a land-use history and which produces secondary vegetation that grows only slowly (Fearnside, 1996a; Fearnside and Guimarães, 1996). Soil carbon release from the top meter of soil (9.6% of the impact: Fearnside, 2000c; Fearnside and Barbosa, 1998) is often an additional omission. To fully reflect the global-warming impact of deforestation, emissions of trace gases such as CH_4 and N_2O must be included, as well as carbon (*i.e.*, CO_2). Inclusion of trace gases increases the impact of deforestation by 15.5±9.5% over calculations that only consider carbon (Fearnside, 2000b, pp. 143-145). All of the above factors are omitted in varying degrees from a number of widely-used emissions estimates for Amazonian deforestation (see Fearnside and Laurance, 2003).

TROPICAL DEFORESTATION IN THE KYOTO PROTOCOL

International negotiations on climate change have been underway since the preparatory conferences for the 1992 "Earth Summit" (UNCED or ECO-92) in Rio de Janeiro. Tropical deforestation was considered a major contributor to global warming by European governments and by European-headquartered NGOs. A 1989 report published by Friends of the Earth-UK (Myers, 1989, p. 73) and a 1990 report published by Greenpeace (Leggett, 1990, p. 399), made similar claims. This widespread agreement on the importance of tropical deforestation would evaporate abruptly with the Kyoto Protocol in December 1997, after which European governments and European-based NGOs would turn against avoiding tropical deforestation as a form of mitigation.

The Kyoto Protocol established an "assigned amount", or quota, for the emissions of each of the countries in Annex I of the Climate Convention and Annex B of the Kyoto Protocol (UN-FCCC, 1997). These are currently the developed countries. The amount that each of these countries could emit without penalty in the Kyoto Protocol's first commitment period (2008-2012) was fixed in Kyoto—but the rules of the game had not yet been settled. Especially important was the question of whether tropical forests would be included for credit under the Protocol's Clean Development Mechanism. Blocks of countries formed with distinct positions on credit for different types of forest-sector projects in the CDM (Table 2).

[Table 2 here]

GOVERNMENT POSITIONS

BRAZIL

The Brazilian Ministry of Foreign Relations (MRE) has opposed inclusion of avoided deforestation in the Clean Development Mechanism, but at the same time has supported credit for silvicultural plantations (*i.e.*, afforestation and reforestation). This split position makes Brazil unusual. It should be emphasized that the official position of the portions of government responsible for the negotiation (the Ministry of Foreign Relations and the Minister of Science and Technology) differed sharply from that of other parts of the government, such as the Ministry of the Environment. It is also relevant that the Minister

of Science and Technology during the presidential administration of Fernando Henrique Cardoso (1995-2002) was a high-ranking diplomat from the Ministry of Foreign Relations.

In June 1999, the divergent opinion of the Ministry of the Environment became a matter of public record. At the meeting of environment ministers of Amazonian countries, held in Cochabamba, Bolivia, the Brazilian minister of the environment (José Sarney Filho) signed a joint declaration calling for approval of credit under the CDM for avoided deforestation (Environment Ministers of the Amazonian Countries, 1999). Sarney Filho signed the document despite objections from the envoy from the Ministry of Foreign Relations; the disagreement even took on the form of a physical struggle, with Sarney Filho and the MRE representative engaged in a tug-of-war for microphone, to the amazement of the audience (Luis Castello, personal communication, 2000). Sarney Filho, who was physically much more imposing than the slender young man who represented MRE, easily won the contest. However, by the time of the next meeting of the environment ministers, held in Quito, Ecuador in October 1999, the Ministry of the Environment had been forbidden to say anything related to the Kyoto negotiations.

It should be emphasized that Brazilian negotiating policy for Kyoto has been set by a handful of individuals, and the result is very much tied to the opinions of these individuals, rather than to a logical argument on which there is wide agreement. Each new set of individuals represents a toss of the coin, and the probability is significant that key positions will eventually be occupied by individuals who favor forests.

A sort of allergy has developed to discussion of the role of avoiding tropical deforestation as a means of mitigating climate change stems from fear of "international covetousness" – the belief that the World at large is engaged in a permanent conspiracy to take Amazonia away from Brazil. The key individuals who determine Brazil's negotiating stance all believe piously in the threat internationalization, and fear that carbon could lead to international interference with Brazilian sovereignty in Amazonia is at the root of the aversion of the Ministry of Foreign affairs and the Minister of Science and Technology to credit for avoided deforestation. Important as the internationalization theory is in this arena (Council on Foreign Relations Independent Task Force, 2001, Fearnside, 2001b), it is not, in itself, enough to explain the aversion to carbon credit for avoided deforestation. This is best illustrated by the case of the Governors of the Amazonian states, who have traditionally been on the other side of the issue. These include Amazonino Mendes, governor of Amazonas until 2002; in his political discourse, Amazonino Mendes constantly raises the threat of international covetousness, yet he has been voluble in support of carbon credit and even traveled to Chicago to try to sell Amazonian forest carbon on international commodities markets.

The essential question is whether or not one believes that Amazonian deforestation is controllable. The key individuals in Brazil's negotiating position believe that deforestation is inherently uncontrollable. If this is accepted as a starting point, then if Brazil were to commit itself to reduce deforestation and then not actually do so, the country could be open to international pressures. Although Article 12 (paragraph 5a) of the Kyoto Protocol makes clear that the CDM is entirely voluntary, the fear persists that Brazil could be threatened with economic punishments such as tariffs on Brazilian exports ranging from

orange juice to shoes unless the country agrees accept carbon projects that are in the interest of major economic powers, especially the United States.

If the impediment to using forest conservation as a global-warming mitigation measure is concern over national sovereignty, then it is national sovereignty that must be discussed and examined, rather than debating the sources of climate change or the moral value of changes in this century versus the next. Admitting that sovereignty is the issue implies the need to subject this problem to the same level of critical scrutiny as that applied to the technical aspects of mitigation proposals. The notion that the World is permanently conspiring to take Amazonia away from Brazil is not likely to stand up to such scrutiny. Nevertheless, it is important to remember that no amount of evidence is likely to change the opinion of the individual diplomats involved, since the internationalization theory rests directly on their "pre-analytical vision" (*sensu* Daly and Cobb, 1989). Even the most intelligent people only draw conclusions from the experiences that their prejudices allow.

While the internationalization theory is directly analogous to religion in terms of its means of acquisition of belief, its immunity to "reason" and the need for respecting a diversity of opinions, it is also analogous in another way. This is in the proper relationship with government decision-making. With the exception of a few countries under Islamic law, most present-day governments operate on the principle that church and state should be separate. The same principle should be applied to the internationalization creed.

REST OF LATIN AMERICA

The Latin-American countries most active in the effort to get rules approved for the CDM to allow credit for avoided deforestation under the CDM were Bolivia, Costa Rica, Colombia and Mexico. Besides Brazil, only Peru (under President Alberto Fujimori) opposed granting credit for avoided deforestation. Peru has since reversed its position (Ambassador Armando Lecaros-de-Cossío, public statement, 31 October 2002). The question arises as to why the Fujimori government in Peru opposed credit for forests in the Kyoto negotiations, a stance that appears to be contrary to Peru's national interest as a country with substantial areas of tropical forest that could potentially generate revenues through avoided deforestation projects under the CDM. The timing of Peru's adoption of this position is intriguing: Peru's opposition was made known at the Intergovernmental Panel on Climate Change (IPCC) plenary session in Montreal in February 2000--just weeks before the 9 April first round of Fujimori's "re-re-election". Peru's opposition to avoided deforestation represented a reversal of its previous position (*e.g.*, Environment Ministers of the Amazonian Countries, 1999). During the "crisis" between the allegedly fraudulent 9 April first round and the 28 May runoff election, Brazil showed support for Fujimori by granting Order of the Southern Cross medals to three of Fujimori's cabinet ministers and, perhaps more importantly, by receiving a secret delegation of Peruvian diplomats and informally agreeing to support the official results of the upcoming runoff election even if the validity of the election were to be questioned by the international community (*Folha de São Paulo*, 2000). The runoff election, in which Fujimori ran unopposed, was questioned by the Organization of American States (OEA), but Brazil was decisive in blocking sanctions against Peru by the OEA (Cantanhêde, 2000). The tilt towards Fujimori was unexpected in light of Brazil's customary discourse in favor of democratic institutions.

Fujimori was eventually forced from office in November 2000, by which time Brazil had discretely ceased to support him. Conclusions about whether there was a causal link between the Fujimori government's positions on Kyoto and Brazil's suggestively timed support in the first half of 2000 will necessarily remain speculative until such time as the diplomatic records of Brazil and/or Peru are released to the academic community.

CHINA AND INDIA

China and India are key countries in discussions regarding global warming because these countries are likely to greatly increase their emissions in the coming decades, as a result both of population growth and increased consumption. These countries have little forest left to deforest and have tremendous emissions from inefficient fossil fuel combustion. China and India therefore see allowing inexpensive credit from avoided deforestation as competition that would reduce their chance to profit from energy-related CDM projects (Dutschke, 2002, p. 385). It is worth noting that Brazilian diplomats have cultivated China and India as potential allies in climate negotiations.

USA

The United States is the World's largest single emitter of greenhouse gases, with a baseline emission of 1.6 billion tonnes of carbon in 1990 from fossil fuel and cement. Prior to the Kyoto conference, the US Senate approved a motion by a vote of 95 to zero advising the President that no agreement would be ratified unless it included a significant commitment by developing countries to reduce emissions. In the weeks before the Kyoto conference, and during the three months leading up to the conference, the fossil fuel industry spent US$13 million in advertising in the US to convince the public that global warming is scientifically unfounded (Beder, 1999). Public understanding of the problem is still low in the US, a feature that extends to the country's current president (George W. Bush), who has made a variety of statements indicating his skepticism about climate science. On 13 March 2001, only two months after taking office and before he had appointed any science advisors, Bush withdrew the US from Kyoto negotiations over the first commitment period. The US has not withdrawn is participation in the 1992 Climate Convention, and continues to send representatives to negotiating meetings.

During the period when the US was engaged in the Kyoto negotiations, the country supported granting credit for avoided deforestation, as did other members of the "Umbrella Group" such as Canada, Japan and New Zealand. It should be emphasized that this position cannot be interpreted as a sign of environmental concern, but rather as a means of minimizing the cost of compliance with the Kyoto agreement. It could, nevertheless, be used to environmental advantage to obtain resources for maintaining tropical forests.

EUROPE

In 1989 Germany held a series of parliamentary hearings on tropical deforestation and climate change (in two of which this author testified), and the resulting report identified reducing deforestation as a top priority to avoid global warming (Deutscher Bundestag, 1990). The Pilot Programme to Conserve the Brazilian Rainforest (PPG7) was negotiated

in the lead-up to the 1992 United Nations Convention on Environment and Development (UNCED, or ECO-92) in Rio de Janeiro. This author served for nine years (1993-2001) as a member of the Programme's International Advisory Group, during which time the G7 countries (primarily European countries) contributed over US$250 million to the Programme. Among the objectives of the PPG7 was to reduce the emission of carbon dioxide from tropical deforestation (World Bank, 1992). In fact, of the four supposedly equal objectives of the program, this was undoubtedly the "most equal" from the point of view of the PPG7's European donor countries at that time. Germany was and remains the largest funder of the PPG7. Needless to say, this echoes from a previous age, given that the European countries, especially Germany, suddenly turned against forests as evil "sinks" in the Kyoto negotiations from December 1997 until the Bonn Agreement in July 2001.

In the negotiations following from Kyoto the theoretical argument these European countries against assigning any value to avoided deforestation is based on the notion that only the very long term (*i.e*. equilibrium) composition of the atmosphere matters and that combating tropical deforestation is therefore unimportant because forests are likely to be cut and/or burned anyway for one reason or another over the course of a few centuries. Obviously, in the context of the PP-G7 the European countries think that avoided deforestation has a real value for climate, even though the impossibility of controlling history over a time scale of centuries means that the carbon in the forests might eventually be emitted to the atmosphere. The European counties were not wrong in 1991, nor in the years since then over which they have supported this ongoing program. Instead, they are being hypocritical now in claiming that emissions avoidance only has value if it is permanent and certain.

The geographical distribution of national positions on the issue of crediting avoided deforestation could not be more striking, with opposition concentrated in Europe, and North America favoring credit. The parameter that matches this distribution most perfectly is that of gasoline prices (Table 3). In virtually any European country a liter of gasoline costs at least double the price in the USA (Sheehan, 2001, p. 48).

[Table 3 here]

NGO POSITIONS

NGO positions on the Clean Development Mechanism are listed in Table 4. Some obvious patterns emerge. Brazilian grassroots NGOs universally support credit for avoided deforestation, including groups throughout Brazil's Amazon region. These include the National Council of Rubbertappers (CNS) (founded by Chico Mendes and his allies), the largest organization of indigenous peoples in the region (COIAB), and groups representing hundreds of small-farmer organizations (GTA, FETAGRI and CPT) ("Manifestação ...", 2000). Brazilian research NGOs, such as ISA, IPAM and IMAZON, have a similar position, although there is one exception (Vitae Civilis) ("A Brazilian NGO Declaration", 2000). Brazilian branches and affiliates of European-headquartered "international" NGOs, such as WWF, Greenpeace and FOE-Porto Alegre, have opposed credit for forests in line with their European headquarters; an important exception has been FOE-Brazilian Amazonia, which has resisted pressure from Europe and assumed a leading role in

promoting credit for forest carbon (*e.g.*, Monzoni *et al*., 2000). The pattern in the United States is exactly parallel to that in Brazil, with US-headquartered NGOs (EDF, TNC, NRDC, and UCS) supporting credit for forests and US branches and affiliates of European-based NGOs, such as WWF, Greenpeace and FOE, opposing it.

[Table 4 here]

The positions of the European NGOs underwent an abrupt turnabout at the time of the December 1997 Kyoto Protocol. Prior to that time, the same NGOs had argued strongly in favor of using forests as a tool to combat global warming, for example in a 1989 report by Friends of the Earth-UK (Myers, 1989), and in the 1990 Greenpeace report on global warming:

> "It now appears that one of the most cost-effective and technically feasible ways to counter the greenhouse effect lies with grand-scale reforestation in the tropics as a means to sequester carbon dioxide from the global atmosphere—provided, of course, that the strategy is accompanied by greatly increased efforts to slow deforestation." (Myers, 1990, p. 399).

Such statements would be considered absolute heresy by Greenpeace and other European NGOs after 1997. Carbon sequestration through reforestation (*i.e*. plantations) became anathema to these NGOs, and, unfortunately for tropical forests, these NGOs chose to lump avoided emissions through forest conservation under the same catchword as "sinks".

The reasoning, as described in the various publications and websites of these organizations, is well represented by the following quotation from WWF:

> "every ton of carbon absorbed by a sink allows a ton of carbon to be emitted from burning fossil fuels" (WWF Climate Action Campaign, 2000).

Taking such statements at face value for the moment, it is important to recognize that this interpretation of the Kyoto Protocol is in error. It is not every tonne of carbon "absorbed" but every tonne of credit that is granted that permits a tonne of fossil fuel carbon to be emitted. The credit is very different from the physical tonne of carbon present in the trees. Credit is a piece of paper that will be negotiated on international commodity exchanges. Nothing in the Kyoto Protocol specifies a one-to-one ratio between the physical carbon and the credit; one could easily grant substantially less credit for each tonne of physical carbon in order to more than compensate for concerns regarding permanence of carbon, leakage (indirect effects outside of the project boundaries that nullify the climatic benefit) and uncertainty. Throwing out the forest option is foolhardy for various reasons, including the obvious fact that the task of combating global warming so greatly exceeds the capacity of different individual mitigation measures that one must use all available measures to confront the problem.

The European NGOs seized upon the question of permanence as a defect of forests and dismissed forest carbon as a "loophole" or a "dangerous distraction" (*e.g*., Greenpeace, 2000; WWF Climate Action Campaign, 2000). Permanence is falsely portrayed as an all-

or-nothing proposition: either carbon is permanent or it is worthless by this view. Greenpeace drafted a document explaining how a tonne of carbon might be sequestered by a forest project for 100 years, after which the carbon is released when the forest burns down or is otherwise destroyed (Meinshausen and Hare, 2000). The atmosphere thereby winds up with two tonnes of emitted carbon: one from fossil fuels that were permitted to be emitted by the carbon credit, and the other from the trees destroyed at the end of 100 years. The argument has two problems: the assumption of a one-to-one ratio between carbon credit and physical carbon in the forestry project, and the assumption that holding a tonne of carbon out of the atmosphere for 100 years has no value to human society. In fact, holding carbon out of the atmosphere for finite periods has substantial value in that a corresponding quantity of impacts (including human deaths) would be averted over the period that the carbon remains out of the atmosphere (Fearnside, 2002c).

Greenpeace lawyers stress two clauses to bolster their rejection of carbon that is less-than-permanent. One is Article 2 of the UN Framework Convention on Climate Change (UN-FCCC), which defines the purpose of the Convention in terms of "stabilization" of atmospheric concentrations of greenhouse gases. Because emissions changes require on the order of 200 years to be reflected in a new equilibrium of atmospheric gases, the transient course of our pathway to reaching stabilization would have no importance under the UN-FCCC. Unfortunately, this grossly misrepresents the interests of human society, which will be greatly affected by climate changes over the coming decades and not only by the situation 200 or more years in the future. The other legal argument used is that Article 12 of the Kyoto Protocol, which creates the Clean Development Mechanism, specifies that the benefits must be "long term"—leaving the question of what constitutes "long term" up to future negotiations. Greenpeace has even gone so far as to demand that carbon be held for "geological time". Luis Gylvan Meira Filho, one of the most influential voices shaping the Brazilian negotiating position, has argued for considering events as long as 35,000 years in the future (see Fearnside, 2002d). Needless to say, these positions would render any kind of forest project unviable.

The intellectual argument for dismissing forests as an option based on infinite or very long time horizons runs counter to the interests of human society and the way that decisions are made in virtually all other spheres. The 21st Century must not be dismissed as unimportant in order to try for presumed climatic gains several centuries or millenia in the future. Projections of global warming over the course of the 21st Century imply catastrophic changes in this time frame (J.T. Houghton *et al*., 2001). This century will be critical both for the climate and for the fate of Brazil's Amazon forest.

As indicated earlier, there are strong reasons *not* to believe that the intellectual arguments regarding such issues as permanence represent the real reason for the positions adopted by the European NGOs. The geographical distribution of the positions of the different groups and governments makes the probability of this explanation being correct vanishingly small. People in Europe are not more concerned with distant generations than are people in South America, Central America or North America. Basically, the intellectual structure that the European NGOs have erected is best viewed as a smokescreen of sophistry that has been built for the purpose of justifying a position that is based on a hidden agenda. Most rank-and-file members of European NGOs would probably be hard

pressed to explain the intellectual rationale of their opposition to avoided deforestation, but simply accept without question that all "sinks" must be bad if WWF, Greenpeace and Friends of the Earth say so.

The underlying motivation of the European NGOs is parallel, but not identical, to that of the European governments. Unlike the governments, NGOs are not much concerned with economic competitiveness and terms of trade, but the opportunity to strike a blow at United States drew the governments and the NGOs together in a common position. NGO members, as with much of the European population, dislike the US for a variety of reasons (see Fearnside, 2001c). In the area of climate, the US is, in fact, the principal villain, being the largest single emitter of greenhouse gasses on the Planet and having repeatedly maneuvered to block or weaken international efforts to contain global warming. The March 2001 decision by US President George W. Bush to withdraw from negotiations for the first commitment period of the Kyoto Protocol was only the crowning incident in a long series of diplomatic efforts to weaken international agreements on climate change, dating from the preparatory meetings leading up to the 1992 UNCED (ECO-92) meeting that approved the UN-FCCC (*e.g.*, Carvalho, 1992). Punishing the US is the primary reason for opposing credit for forests in the CDM.

It is difficult to converse with European NGO campaigners for more than a few seconds on the subject of credit for forest carbon without hearing the opinion that that we "can't let the US off for cheap". Two considerations are relevant. First, the cost of the mitigation is irrelevant to climate change, as a tonne of carbon emission avoided has the same effect, whether it was achieved by cheap or expensive means. In fact, low cost is beneficial for climate change in that it encourages willingness to make deeper cuts in emissions in future commitment periods. Second, nobody is suggesting that the US or any other country should be "let off" and allowed not to meet the commitments agreed to in Kyoto. By appropriate assignment of credit, allowing projects for avoided deforestation would fully meet (and, in reality, exceed) the emissions reductions promised in Kyoto.

The debate over the role of tropical forests in mitigating global warming has revealed in unprecedented clarity the undemocratic nature of many "international" NGOs. These organizations function well when all are in basic agreement, for example for issues like saving whales. This changes dramatically when issues divide along geographical lines, as in the question of forests in the CDM. While NGO branches are allowed to have some differences of opinion on minor issues, on "key issues" all branches and employees are expected to close ranks around a single position. The question of forests in the CDM has been considered to be such a "key issue." The positions adopted on key issues are virtually always those of the European branches, which are more numerous than those from any other part of the world, including North America. Employees of Brazilian branches of European NGOs suffered a long series of subtle and not-so-subtle pressures, with several notable casualties on the Brazilian side (see Fearnside, 2001a).

European NGO reaction to the existence of a different viewpoint in Brazil has been that the Brazilian NGOs are under the influence of North-Americans because few European NGO staff speak Portuguese and they lack a tradition of working in Brazil. Needless to say, the implication that Brazilian NGOs have been tricked by NGOs from North America,

and that they are mere pawns in a game masterminded from the US, would not be well received in Brazil. Brazilian NGOs are fully capable of thinking for themselves and arriving at their own conclusions. The other theory presented to explain the difference is that Brazilian NGOs have favored credit for forests because they want money from the carbon credits. The prospect of monetary flows is, indeed, a reason for interest in carbon credits. However, this in no way can be construed as a sin. The desire to use the environmental services of the forest as a new basis for economic development in the region is a healthy shift, and very much furthers the environmental objectives of the NGOs.

It is very important to distinguish between avoided deforestation and plantation silviculture, despite the two being frequently lumped as "sinks" in European NGO discourse. They are very different, both in terms of carbon benefits and in terms of their impacts and benefits for biodiversity and social concerns (Fearnside, 1996b). Avoided deforestation almost always is more beneficial.

It is important to realize that the reasons for the different positions on forest carbon are *not* scientific, despite the debate frequently being couched in scientific terms. The NGOs have a scientific argument that, combined with moral choices regarding time horizon, time preference and "ancillary" effects, leads to their conclusion of rejecting avoided deforestation. However, an equally sound scientific argument, combined with different moral choices on the other critical factors, leads to the opposite conclusion.

It is also very important to distinguish between what is a scientific conclusion and what is a moral judgment. Science can provide answers to questions such as "how much carbon will a given project hold out of the atmosphere, for how long and with what degree of certainty". It cannot tell us whether that answer means that the CDM should include or exclude avoided deforestation. Such a conclusion requires moral choices. We must have the courage to admit that we are making moral decisions, and to go ahead and make them.

It would be consummate foolishness to throw away the Amazon rainforest in exchange for a climate benefit several centuries or millennia in the future. Despite the discourse of European NGOs justifying their positions in terms of the interests of generations in the [far] future, it would be well to remember the famous words of E.O. Wilson that allowing the Earth's wealth of species to be lost is "the folly that our descendants are least likely to forgive us" (Wilson, 1992).

The debate over forest carbon as a mitigation option in terms of an arcane jargon regarding such concepts as leakage, additionality, permanence and uncertainty leads many to be confused. However, no one is confused who is closer to the heat of the burning in Amazonia, as evinced by the positions of Brazilian NGOs. One needs to know what it looks, sounds, smells and feels like to be at the frontier where trees are being chain-sawed and burned. It is difficult for those closer to the burning to understand how any environmental organization could take a stand that implies throwing away one of the most important opportunities for maintaining tropical forests.

The forces driving deforestation in Amazonia have evolved continuously over the past three decades. Today, powerful economic forces such as soybeans are much greater

threats than when a larger share of clearing and its underlying infrastructure were driven by an economically weaker lobby of ranchers and land speculators (Fearnside, 2001d). Substantial funds will be necessary to change some of these trends. The hard fact is that there is no other money on the table that is likely to fill this role. The Convention on Biological Diversity, for example, is well behind the UN-FCCC in terms of having billions of dollars of potential funding in the coming years.

The common European NGO response that tropical forests should be protected with money from other sources, such as the Biodiversity Convention, is only a diversion, since significant amounts of money simply do not exist in these "other" sources. None of the countries (or NGOs) suggesting that these sources be used is offering to put billions of dollars on the table. The same applies to calls for using the Kyoto Protocol's adaptation fund (Article 4.8) for saving tropical forests. Needless to say, countries where the human population will soon be facing heavy impacts from climate change would not take kindly to having the scant adaptation resources provided by the Protocol diverted to conservation projects elsewhere.

The funds potentially available through climate mitigation could make a tremendous difference for tropical forest conservation, in addition to generating real carbon benefits at highly competitive cost. An illustration of scale is offered by the expectations of State Department planners during the Clinton administration in the US: over the 2008-2010 first commitment period a gap of 600 million tonnes of carbon was expected annually above domestic energy-sector mitigation results. If all were purchased abroad through the various "flexibility mechanisms" in the Kyoto Protocol, the total for the US would be US$12 billion/year at the US$20/tC carbon price projected at that time. The US wanted to obtain 300 million t C of credit from Articles 3.3 and 3.4 (domestic afforestation, reforestation and deforestation activities, plus "other" activities such as forest and soil management), leaving a shortfall of 300 million t C for mechanisms like the CDM; this 300 million t C corresponds to an expected cost of US$6 billion/year. Prior to its withdrawal from Kyoto negotiations, the US represented approximately half of the expected total demand for carbon credits.

NGOs that oppose using carbon funds to maintain forests seem to have forgotten that some urgency is appropriate with respect to combating biodiversity loss. If we wait until the second commitment period begins in 2013, there won't be nearly as much tropical forest left to save. Not taking advantage of the carbon value of tropical forests in the efforts to save them, claiming as an excuse that saving tropical forests is an objective that is doomed to failure, is inappropriate as a stand for environmental NGOs. It is no time to throw in the towel on Brazil's Amazonian deforestation when only 16% of the forest has been cleared. Instead, environmental NGOs should be committed to fighting deforestation tree by tree.

International NGOs should take stock of what they are trying to accomplish. Organizations like WWF represent their stakeholders, who are a contributing membership composed of people who are primarily concerned about biodiversity. In the 21st Century it is habitat loss, especially tropical deforestation, which is likely to be the greatest threat to biodiversity. On longer timescales climate change would rise in importance, and in this

case would act mainly in finishing off species that had escaped a century of direct habitat destruction. In keeping biodiversity and carbon issues in perspective, it should be remembered that carbon is more reversible than most environmental problems, such as biodiversity loss, toxic and nuclear wastes, or ozone loss. This is also true of underlying forces such as population growth and rising per-capita consumption.

European NGOs take great pains to find weaknesses in avoided deforestation projects (as well as with plantation projects). This "watchdogging" effort provides a valuable service. On the other hand, the same information on project defects can be used for two distinct purposes. One is to suggest improvements to the system that will help to make the CDM work. The other is to provide ammunition to efforts to torpedo the entire process. The first use is an appropriate goal of environmental NGOs, while the second is counterproductive for both the climate and biodiversity objectives of these organizations.

The process of developing carbon mitigation projects is inherently difficult, with multiple opportunities for some portion of the credit granted to be for activities that have less climatic benefit in reality than they do in the official accounting (Fearnside, 1999a, 2003, 2004b; Van Vliet *et al*., 2003). This applies both to energy and forest sector projects (Herzog *et al*., 2003). The important question here is what should be done: should one work to solve or at least minimize the various problems as they are identified, or should one simply oppose all credit *a priori*. I would argue that it is essential to have an attitude of making it work.

In going forward, it is essential that focus be maintained on the second commitment period (2013-2017). Negotiations for this period will begin in 2005, making the issues extremely current. All environmental NGOs concerned with climate, including those based in Europe, will have to reach out to grassroots NGOs if effective alliances are to be built to maintain tropical forest. The history of European NGOs having turned their back on over 500 grassroots groups in the Brazilian Amazon is an unfortunate backdrop, but it must be overcome if the common goals of maintaining forests are to be achieved.

LIKELY CHANGES

The Bonn and Marrakech accords of 2001 ruled out avoided deforestation for the first commitment period (2008-2012), but the question remains open for the second and subsequent commitment periods. The finalization of the decisions on the first commitment period changes the underlying motivations for the opposition that has existed to forests and opens the way for the various groups to make peace with each other.

Another change has been European NGO positions on temporary certified emissions reductions (T-CERs). This proposal (Blanco and Forner, 2000), known as the "Colombian proposal", was rejected prior to the July 2001 Bonn agreement. The European Union (EU) also rejected the proposal. After plantation silviculture was included in the CDM under the Bonn agreement, T-CERs were seen by both the EU and the European NGOs as the best way to do the carbon accounting. Again, this is a healthy change. However, one might wonder, if T-CERs are now seen as the best accounting method for forestry projects, why weren't they supported prior to inclusion of forestry becoming a *fait accompli*? The

obvious reason is that doing so would have been an admission that the "permanence problem", which was constantly presented as an insurmountable obstacle to having meaningful climate benefits from forestry, could indeed be solved. The sudden switch in positions on T-CERs was essentially a confession of hypocrisy indicating that before the Bonn agreement the European governments and NGOs had simply been maneuvering to block all forest projects by thwarting any efforts to solve the problems associated with them. Adoption of T-CERs effectively removes any intellectual foundation for future opposition to avoided deforestation on the basis of permanence—but intellectual consistency has clearly not always been a priority in the past efforts of European NGOs to block inclusion of forests in the CDM.

The good news in this arena is that for the second commitment period there is no motive to keep forests out. The fact that the assigned amounts (emissions quotas) will be renegotiated means that keeping forests out of the CDM would only result in the various countries agreeing to reduce their national emissions by more modest amounts than they would if forests are included for credit.

ARTICLE 17: EMISSIONS TRADING

While the CDM, namely Article 12 of the Kyoto Protocol, is the focus of the vast majority of debate regarding forests in the Protocol, it should never be forgotten that this is not the only way that the Protocol could provide carbon credit for maintaining tropical forests. Article 17 (Emissions Trading) also offers this possibility to members of Annex I of the UN-FCCC and Annex B of the Kyoto Protocol—those countries that have accepted caps on their national emissions totals. Article 3.7 of the Protocol (the "Australia clause") specifies that any Annex B country that had a positive emission of carbon from its forests in 1990 can trade any difference below the baseline established in the initial national inventory through the "emissions trading" provisions of Article 17. With the exception of Australia, the current members of Annex B, such as the United States, are thereby excluded from trading forest carbon based on their national inventories, but Brazil, were it to join Annex I and Annex B, could trade this carbon at will. This represents a substantial opportunity for Brazil, and would suffer much less loss of credit than would be the case for the project-based mitigation allowed under the CDM (Fearnside, 1999b, 2001d). All emissions reductions below the baseline can be traded, without need to show a causal link to the results of any given mitigation project. The major questions for this option relate to whether the Brazilian government could, in fact, reduce deforestation rates to levels below those in the period chosen as the baseline for the national inventory (1988-1994). The *Brasil em Ação* (Brazil in Action) and *Avança Brasil* (Forward Brazil) plans of the Fernando Henrique Cardoso government have been succeeded by the *Plano Plurianual* (Pluriannual Plan), or "PPA", of the Luis Inácio Lula da Silva government, but the current plan is just as ambitious as its predecessors in proposing extensive highway paving and other infrastructure projects that make slowing deforestation more difficult. Despite the great reversal represented by the upsurge in deforestation in 2002 to 25.5 thousand km^2 per year (versus 15.2 thousand km^2 per year in the baseline period), the process could still be brought under control if the government so decided (Fearnside, 2003; Fearnside and Barbosa, 2004).

CONCLUSIONS

Amazonian deforestation makes a significant contribution to global warming. Complete accounting of emissions and uptakes is needed to reflect the climatic impact of deforestation and the consequent benefits of avoiding it. Gaining credit for avoided deforestation could provide substantial potential environmental and economic benefit to Brazil, particularly to Amazonia. Changes in the way that Kyoto negotiations fit into the wider geopolitical context greatly increase the chances of avoided deforestation becoming eligible for credit under the Clean Development Mechanism (Kyoto Protocol Article 12) in the second commitment period (2013-2017). Credit for avoided deforestation through emissions trading (Kyoto Protocol Article 17) remains a possibility with substantially greater potential gains, but is threatened by continued plans in the Pluriannual Plan (PPA, the successor to Avança Brasil) for extensive highway paving and other infrastructure projects that make slowing deforestation more difficult. The most positive sign is the experience with deforestation control in Mato Grosso over the 1999-2001 period, providing a concrete example of the ability of the government to prevent landholders from clearing if the government wishes to do so. The substantial value of avoided deforestation is the most likely source of the political will that is needed for this to happen in a sustained fashion and on a large scale.

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Table 1: Emissions from Amazonian deforestation

	1988-1994	2002
Deforestation rate in Legal Amazon (thousand km^2/year)	15.2	25.5
Net Committed Emissions from deforestation in Legal Amazon (million t CO_2-equiv. C/year)		
Low trace-gas scenario	258	432
Midpoint	264	442
High trace-gas scenario	270	451
Brazilian inventory (Amazon deforestation)	117	
Approximate discrepancy	56%	

Table 2: Government positions on the Clean Development Mechanism[(a)]

	Plantations	Agro-forestry	Avoided deforestation
Brazil	+	+	-
Umbrella Group (USA, Canada, Japan, Australia, New Zealand)	+	+	+
European Union	-	-	-
AOSIS (Association of Small Island States)	-	-	-
G-77 + China	?	?	?

(a) Plus sign indicates favoring inclusion, minus sign opposing, and blank indicates no position.

Table 3: Gasoline prices[a]

Country	***Price (US$/litre)***
Brazil	0.92
U.SA.	0.41
Canada	0.50
UK	1.13
France	0.96
Italy	0.95
Germany	0.92
Spain	0.73

(a) Prices in October 2000 from Sheehan (2001).

Table 4: NGO positions on the Clean Development Mechanism

	Plantations	Agro-forestry	Avoided deforestation
A.) International NGOs			
Greenpeace-International	-	-	-
WWF-International	-	-	-
FOE-International	-	-	-
Birdlife International	-	-	-
Climate Action Network	-	-	-
Indigenous People's Forum on Climate Change	-	-	-
B.) US NGOs			
National and US-headquartered NGOs			
EDF (Environmental Defense)		+	+
CI (Conservation International)		+	+
TNC (The Nature Conservancy)		+	+
NRDC (Natural Resources Defense Council)		+	+
UCS (Union of Concerned Scientists)		+	+
Branches or affiliates of International NGOs			
WWF-US	-	-	-
FOE-US	-	-	-
C.) Brazilian NGOs			
National NGOs			
CNS (National Council of Rubber Tappers)		+	+
GTA (Amazonian Working Group)		+	+
COIAB (Coordinating Body of Indigenous Peoples of Brazilian Amazonia)		+	+
FETAGRI (Federation of Agricultural Workers of Pará)		+	+
CPT (Pastoral Land Commission)		+	+
IMAZON (Institute for Man and the Environment in Amazonia)		+	+

IPAM (Institute of Environmental Research of Amazonia)		+	+
ISA (Socio-Environmental Institute)		+	+
Vitae Civilis (Institute for Development, Environment and Peace	-	-	-
Branches or affiliates of International NGOs			
Friends of the Earth--Brazilian Amazonia		+	+
Friends of the Earth--Porto Alegre	-	-	-
Greenpeace-São Paulo	-	-	-
WWF-Brazil	-	-	-

(a) Plus sign indicates favoring inclusion, minus sign opposing, and blank indicates no position. Often, NGOs that support avoided deforestation and agroforestry and do not have positions on silvicultural plantations would be likely to oppose many plantation projects on the basis of their environmental and social impacts (not on the basis of carbon accounting). The G-77 + China does not have a unified position.