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2 What is at stake for Brazilian Amazonia in the climate negotiations

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Abstract:

Issues left undecided at COP-18 in Doha in December 2012 are critical to containing the two greatest threats to Brazil's Amazon forest: direct deforestation and forest loss through drought and fire provoked by climate change. Brazil's diplomatic positions on the role of tropical forests in mitigating global warming currently call for receiving donations through a voluntary fund, but without generating carbon credit valid against emissions-reduction commitments by countries that accept limits on their national emissions (i.e., Annex I countries). Brazil has long rejected accepting a target (assigned amount), and has instead presented a non-binding "voluntary objective." In 2011 at COP-17 in Durban, Brazil expressed willingness to accept a commitment after 2020, but only if all of the rest of the world agreed to do the same. This author argues that Brazil's national interests would be better served by accepting a target now and by supporting fully marketable carbon credit from Reducing Emissions from Deforestation and Degradation (REDD). The global goal of preventing mean temperature from increasing beyond 2°C above pre-industrial levels would be much more likely to be achieved in practice with tropical forests fully included in a carbon market as part of an agreement for the period after 2012.

Keywords: Avoided deforestation, Carbon, Greenhouse effect, Global warming, Mitigation, REDD, Tropical forest

1 Prologue

The question of what is at stake for Brazilian Amazonia in negotiations involves scientific information, such as expected climatic impacts in Brazil if greenhouse-gas emissions continue unchecked. This question also involves factors that are inherently not scientific, such as one's view of what is in the national interests of Brazil. One must be clear about underlying assumptions and opinions without shying away from drawing the conclusions that follow from them. Here it is assumed that avoiding loss of Amazon forest either to deforestation or to climate change is in Brazil's national interest. Readers should be aware that this is an opinion piece.

The proper place of Reducing Emissions from Deforestation and Degradation (REDD) is one of the most controversial topics in climate discussions today. Different governments, non-governmental organizations (NGOs) and academicians have radically different positions on the topic. REDD holds both promise and risk. The promise stems from the large amounts of carbon emission that could be avoided at comparatively low cost and on a time scale compatible with the need for rapid response to climate change. The risk comes from the existence of a variety of ways through which REDD could be used to justify carbon credits that allow fossil-fuel emissions to be authorized without a real offset from reduced forest emissions. Participants in the debate are divided into those who favor fixing REDD and those who want to throw it out. It is a matter of attitude whether REDD should simply be eliminated or whether it should be and implanted with appropriate provisions such that its mitigation potential can be tapped without incurring either greater net emissions or a variety of environmental and social impacts that can accompany some types of proposed REDD activities. As one of the originators of the concept of "avoided deforestation," now subsumed under "REDD", I am in the "fix it" camp.

65 The present paper is not a review of REDD and will not engage with the arguments in
66 the pro- versus anti-REDD debate. For both sides, readers are referred to reviews in Fearnside
67 (2012a,b). Anti-REDD arguments include questions of whether the carbon credits adequately
68 reflect the true climatic benefits considering the effects of leakage (e.g., the displacement of
69 deforestation activity to locations outside of the project boundaries), permanence (the time
70 that carbon remains out of the atmosphere) and uncertainty (the effect of the true values of
71 carbon stocks and other parameters, including baseline scenarios, being different from those
72 used in computing project benefits), as well as various possible environmental and social
73 impacts depending on the types of project implemented. Pro-REDD arguments include the
74 climatic benefits of maintaining forest after adjustment for leakage, permanence and
75 uncertainty (plus an additional margin to ensure that benefit estimates are conservative), and
76 the many non-carbon co-benefits of retaining forests, such as maintaining biodiversity,
77 hydrological functions, water cycling and the human cultures that depend on forest presence.

78
79 It should be noted that the carbon benefits of reduction in emissions from
80 deforestation and degradation are inherently different from those of carbon sequestration in
81 forms with fast turnover, such as silvicultural plantations for paper pulp. The differences lie
82 in the permanence of the carbon removal from the atmosphere, in the value of the time
83 needed for the sequestration to take place (for example in waiting for planted trees to grow),
84 and in the levels of certainty (Fearnside 1995, 2000, 2002). It was unfortunate that plantations
85 and avoided deforestation were lumped as “sinks” in debates over the Kyoto Protocol’s Clean
86 Development Mechanism (CDM).

87
88 Readers should not expect opinions to be referenced in the literature. The author has a
89 long history of participation in these debates, including prolonged contact with an
90 extraordinarily wide range of actors, such as government officials, diplomats, and NGOs of
91 diverse persuasions and national origins (including grassroots and indigenous groups), as well
92 as academics on all sides of these issues. To a certain extent, the reader will have to take it
93 on faith that the author knows what he is writing about.

94 95 **2 History and controversies**

96
97 Among the many issues not settled at the Climate Convention’s 18th Conference of
98 the Parties (COP-18), held in Doha in December 2012, are decisions regarding the place of
99 tropical forests in mitigating global warming. These decisions could offer key opportunities
100 for Amazonia, Brazil and the world to switch course instead of following the current path,
101 which many see as inexorably leading to a climatic disaster. Inclusion of some form of
102 REDD is now accepted in principle, but much remains to be negotiated that could result in
103 REDD playing only in a severely limited role in the overall mitigation effort.

104
105 Over the years that climate negotiations have been in progress, various aspects of
106 Brazil’s diplomatic position have evolved, while others have not. From before the 1992
107 “Earth Summit” in Rio de Janeiro that produced the United Nations Framework Convention
108 on Climate Change (UN-FCCC) until COP-13 in Bali in 2007, Brazil’s Ministry of External
109 Affairs resolutely resisted any suggestion of linking reductions in deforestation to mitigation
110 of global warming (Fearnside 2006). This is best explained as a reflection of the common
111 perception in Brazil, and especially inside the “bubble” of the diplomatic community, that the
112 rest of the world is engaged in a long-standing conspiracy to take Amazonia away from
113 Brazil and declare it an “internationalized” zone similar to Antarctica (Council on Foreign
114 Relations Independent Task Force 2001, Fearnside 2001a). Any sort of payment for carbon

115 was seen as opening the door to pressure in this direction. This blanket resistance began to
116 change in late 2007 after Amazon deforestation rates had dropped by about half since their
117 peak in 2004. The opportunity to gain financial returns from reducing deforestation was
118 apparent, and this had stimulated the governors of Brazil's nine Amazonian states to mount
119 increasing pressure on the federal government to alter the country's negotiating positions
120 (e.g., Ecodebate 2009). The shift in position that began in 2007 applied to receiving
121 international funds based on reduced deforestation, not to the questions of Brazil accepting an
122 emissions cap (assigned amount) under the Kyoto Protocol or to allowing reduced
123 deforestation to generate carbon credit (Certified Emissions Reductions, or CERs) that could
124 be sold to fulfill emissions-reduction commitments in the countries that have accepted
125 assigned amounts (Annex I countries) (e.g., FSP 2007).

126
127 In 2008, Brazil established the Amazon Fund to receive international donations for
128 the purpose of slowing deforestation to avoid greenhouse-gas emissions (Brazil, Fundo
129 Amazônia 2011). This fund is administered by Brazil's National Bank for Economic and
130 Social Development (BNDES) and is overseen by a commission from government agencies
131 and environmental NGOs. The major donor has been Norway, which has contracted
132 contributions totaling US\$418 million and transferred US\$112 million out of a promised
133 US\$1 billion to be paid in installments by 2015, subject to progress in reducing deforestation;
134 Germany has contracted US\$27.2 million and transferred US\$4.7 million (Amigos da Terra-
135 Amazônia Brasileira 2012; Brazil, Fundo Amazônia 2013).

136
137 At COP-15 in Copenhagen in December 2009, Brazil presented a refinement of its
138 Amazon Fund proposal (Brazil, MMA 2009) and of the country's National Plan for Climate
139 Change (Brazil, CIMC 2008). The proposal taken to Copenhagen was for forests to enter
140 mitigation plans only if "limited" (Munhoz 2009), meaning that most of the funds would be
141 donated to a voluntary fund (the Amazon Fund) and would not be valid for carbon credit that
142 can be sold to compensate for fossil-fuel emissions. This author has long argued that Brazil's
143 representatives should take a more courageous stance (Fearnside 1999, 2001b). For
144 Amazonia and Brazil, it is essential both to control global warming at a level that assures
145 survival of the Amazon forest and to include Amazon forest maintenance as a mitigation
146 option on a scale that effectively halts further expansion of deforestation in the region.
147 Brazil's current plan for slowing deforestation falls short of this, leaving Amazonia still at
148 risk (Fearnside 2009a).

149
150 The decline in Brazil's deforestation rates from 2004 through 2011 does not mean that
151 the process is under control: while improvements in enforcement of environmental legislation
152 played a role in this decline, falling commodity prices and increasingly unfavorable currency
153 exchange rates for Brazilian exports were key factors (Fearnside 2010). Econometric analyses
154 indicate that through 2007 there was close agreement between deforestation rates and
155 commodity prices (expressed in Brazilian reais, therefore including the effect of changing
156 exchange rates); only beginning in 2008 did deforestation rates diverge from this pattern,
157 indicating an important contribution from governance policies (Assunção et al. 2012; see also
158 Hargrave and Kis-Katos 2011). Brazil's massive plans for building highways and dams in
159 Amazonia imply future deforestation increases, rather than decreases (e.g., Fearnside and
160 Graça 2006). Moreover, the powerful "ruralist block" (representatives of large landholders)
161 in the National Congress has succeeded in dismantling Brazil's Forest Code and other key
162 pieces of environmental legislation (e.g., Metzger et al. 2010). The law finally passed on 25
163 September 2012 (Law No. 12.651/12 with partial vetoes, alterations in law 12.727/12 and
164 accompanying provisional administrative measures) greatly reduces protection of forests on

165 private land; the still-unsettled “regulation” of the law, and the extent to which it is
166 enforced and obeyed in practice, will determine how great these losses will be.

167

168 At the COPs in Cancun (2010), Durban (2011) and Doha (2012) some progress was
169 made on negotiating the details of REDD, which became “REDD+” to include enhancement
170 of per-hectare forest carbon stocks and the consideration of social benefits and benefits for
171 other environmental services, such as maintaining watershed functions and biodiversity
172 (Angelson 2008; Moutinho et al. 2011a,b). A wide range of issues remain to be resolved
173 both of a political nature and on theoretical questions regarding carbon accounting (Fearnside
174 2012a,b).

175

176 Important as they are, the shifts to date in the positions of Brazil’s Ministry of
177 External Relations represent only a first step along the path of change that is needed to tap the
178 potential of Amazonia in climate mitigation and the potential of mitigation to contribute to a
179 more sustainable future economy in Amazonia. The arguments that have led to resisting any
180 connection between deforestation and climate are still present, and, of course, many of the
181 same individual actors are also still present. Neither Brazilian civil society nor the Brazilian
182 government has a monolithic view on any of these issues. An internal struggle over climate
183 policy between the Ministry of External Affairs and the Ministry of the Environment has
184 been longstanding, with the more-powerful Ministry of External Affairs always having the
185 upper hand. This became most public in 1999 in an incident over the inclusion of avoided
186 deforestation in the CDM (see Fearnside 2001b, 2005). In the lead-up to Copenhagen in
187 2009, a similar struggle became public over Brazil’s taking on an assigned amount under the
188 Kyoto Protocol (Telles 2009).

189

190 While support for REDD is the most common view in Brazil’s civil society, this is not
191 universal. Divisions over the question of whether REDD is good or bad are the result of long
192 debates within Brazil. Pro-REDD arguments are reviewed in Moutinho et al. (2011a,b); anti-
193 REDD arguments are reviewed in Barr (2011). It would be remiss not to mention that some
194 of these divisions reflect influences from NGOs on either side of this issue in other parts of
195 the world, several of which have invested considerable effort in organizing events in Brazil to
196 promote their views among Brazilian NGOs and/or funding foreign visits by key NGO
197 leaders. Of course, self-interest is also a factor, with those groups that plan to make money
198 from REDD projects strongly supporting this approach. Another factor is electoral politics,
199 with REDD projects promoted by state governments (as in Acre and Amazonas) being
200 resisted by those in opposition parties or groups. Amid this cacophony, there is ample room
201 for different opinions as to where Brazil’s best interests lie.

202

203 The best guide in this debate in Brazil is the impact that different proposals would
204 have on the Amazon forest. This is illustrated by an incident from the earlier debate over
205 inclusion of tropical forests in the CDM, which split the world’s environmental NGOs along
206 geographical lines during the 3½ years between the Kyoto Protocol in December 1997 and
207 the Bonn agreement in June 2001 (see Fearnside 2001a, c). In Brazil only one locally based
208 NGO supported the European position opposing all “sinks” in the CDM (see Fearnside
209 2001a). In an event in São Paulo, the head of the NGO in question made the statement that
210 the issue of forests in the CDM was so complicated that each morning when he got out of bed
211 he never knew which side to support. The contrast couldn’t have been greater with the
212 statement at the same event by Marina Silva, a rubber tapper from the forests of Acre who
213 later went on to become a senator and then Minister of the Environment. There was no
214 question where she stood. The difference lies in Marina Silva having an anchor from which

215 to judge different issues: if something helps to maintain the Amazon forest and the traditional
216 peoples who inhabit it, then she is for it, if something contributes to destroying the forest then
217 she is against it.

218

219 **3 Why a voluntary fund is not enough**

220

221 A “voluntary fund” would condemn forests to a decidedly secondary role as compared
222 to their role if reductions were linked to mandatory targets through credit that is valid under
223 the Kyoto Protocol or its successor. If the principal industrial emitters become more serious
224 in facing the challenge of containing global warming, then these countries will have to take
225 on much larger reduction commitments, and meeting these commitments will absorb all of
226 the money they have for fighting global warming. There would be little or no money left over
227 for contributions to voluntary funds that are essentially for public relations (Fearnside 2012a).

228

229 The argument used to relegate REDD to a separate fund, instead of being included in
230 carbon trading as part of the effort to meet the emissions-reduction targets of countries with
231 national commitments (Annex I countries), is that the potential decrease in tropical forest loss
232 represents so much carbon that offering it on the market would depress carbon prices to the
233 point where no one would invest in clean technologies in the rich countries. This argument is
234 defective because it assumes that the commitments of the countries are fixed, but the reality is
235 that no country has any binding commitment to a specific reduction in emissions from 2013
236 onwards. The price of any commodity, be it soybeans or carbon, depends on an equilibrium
237 between supply and demand. This means that the price can be maintained or increased either
238 by reducing supply or by increasing demand. The low price of carbon foreseen by defenders
239 of a separate fund, and also by defenders of allowing only a very limited offering of forest
240 carbon on the market, presumes that the demand for purchasing carbon credit will remain
241 constant (e.g., KEA 3 2009, p. 18). But it is exactly this demand that cannot be allowed to
242 remain constant: the main battle is to convince countries to take on much larger commitments
243 to reduce their net emissions, which means greatly increasing their demand for purchasing
244 carbon. With sufficient commitments, the price of carbon can be maintained at a level where
245 the world gets both more clean energy (as from wind and solar power in Europe) and real
246 elimination of tropical deforestation. It is foolish to surrender on increasing these
247 commitments before the battle has even begun.

248

249 One of the ways often used to counter fear of forest carbon “flooding” the market is
250 to suggest a limitation, where only a small percentage of mitigation can be done through
251 claiming carbon credit from this source. This is similar to the limit agreed for in Marrakech
252 in 2001, where a maximum of 1% of each Annex I (developed) country’s 1990 emissions
253 could be offset by credit from CDM projects for afforestation and reforestation (i.e.,
254 silvicultural plantations) (see Schlamadinger et al. 2007). Fear of allowing full volume of
255 trading in forest carbon stems from the mistaken belief that there is so much forest carbon
256 that might be sold that buyers would be lacking. However, the emissions reductions needed
257 to contain global warming are much greater than the amount emitted by deforestation each
258 year. Much of the reduction will therefore still have to come from other sources with greater
259 expense per ton of carbon, ensuring that the carbon price will be bid up to a reasonable level
260 and a “collapse” avoided – provided the large commitments to reduction are made.

261

262 **4 Why forest carbon credit should be traded**

263

264 There is a world of difference between payments through a fund that generates no
265 carbon credit and selling credit in an open market. The main difference is in the volume of
266 money, which, as mentioned earlier, is bound to be very limited in the case of a fund because
267 mitigation that counts towards fulfilling negotiated targets will absorb the vast majority of
268 available money. Another reason for a fund condemning countries like Brazil to much
269 smaller levels of financial return from forest carbon is that the amount paid through the fund
270 is not based on the value of the carbon in the market. A market price would be the result of
271 competing against expensive alternatives in the industrialized countries. In contrast, the price
272 paid by the fund would only compensate for the “opportunity costs” of not deforesting (e.g.,
273 Greenpeace 2008, p. 19). The “opportunity cost” refers to paying for what would have been
274 earned had the forest been cut and converted to the land use that would normally replace
275 forest, which is low-productivity cattle pasture in most of Amazonia today (Nepstad et al.
276 2007, 2009). But would accepting this as the basis of payment be in Brazil’s best interests?
277 The opportunity cost represents the lowest possible return that would be accepted in a market
278 system, but there is no upper limit as to how much can be earned if supply and demand cause
279 the price to rise above this low level.

280
281 The idea that a market mechanism will result in the price of any commodity falling
282 until it approaches the opportunity cost is based on the assumption that producers will
283 produce more and more of the commodity until supply satisfies demand, and that the
284 identities and locations of the producers will shift until the market is being supplied in the
285 cheapest way. If a single class of producer (such as those forgoing deforestation for
286 Amazonian cattle pastures) were able to supply the entire market, then the equilibrium
287 between supply and demand that determines the price would settle near the opportunity cost
288 of these actors. But in the context of bringing global warming under control, this special case
289 (with potential ranchers being the only actors) does not apply. If human society is to cut its
290 emissions by, say, 80% to avoid “dangerous” climate change, then the contribution of
291 avoiding tropical deforestation and degradation will be grossly inadequate. Even if all forest
292 carbon loss were completely halted, an enormous amount of emissions reduction would still
293 have to come from using less fossil fuel. There is no getting around this fact. What this
294 means for carbon price is that markets will adjust such that the price is at the opportunity
295 cost, not of Amazon ranching, but rather of the most expensive fossil-fuel replacement option
296 that needs to be tapped in order to reach the goal of 80% total reduction in total emissions.
297 This will be substantially higher than the opportunity cost of avoided deforestation.

298
299 The possibility of getting additional payments for each hectare of avoided
300 deforestation on the basis of other environmental services, such as water cycling and
301 biodiversity maintenance, can be added on top of the pure carbon market value. These
302 additional financial flows might well come from a fund rather than a market arrangement,
303 since, unlike carbon, the environmental services involved are not interchangeable with offset
304 measures elsewhere. There is no need to throw out the logic underlying the carbon value in
305 order to gain the financial benefit of the other environmental services.

306
307 Throwing away the potential for much greater returns by having forest carbon sold in
308 a market system is not a rational negotiating strategy for Brazil. As an illustration, imagine if
309 in the 1940s, before oil exploitation began in the Middle East, an offer had been made to
310 Saudi Arabia to buy development rights on the basis of opportunity cost. It could have been
311 argued that Bedouins with a few camels in the desert produce a cash value of, say, less than
312 ten US cents per hectare per year, and so they would be happy to accept US\$10/ha for use of
313 the area for the next hundred years. Would it be wise, or fair, to accept such a deal? Should

314 Brazil sell its Amazon carbon for the per-hectare price of a poor-quality pasture? This only
 315 makes sense as a negotiating position if seen through the lens of the belief among Brazilian
 316 diplomats that the world is in a constant conspiracy to take Amazonia away from the country,
 317 and that the value of Amazon carbon could provide the motive (e.g., Fearnside 2009b).

318

319 **5 Why Brazil's interests are inherently different from those of Europe**

320

321 It has become fashionable in Europe to oppose allowing tropical forest maintenance to
 322 earn carbon credit that can be traded against the commitments that industrialized countries
 323 make to reduce their national emissions. Both European governments and European-
 324 dominated NGOs like Greenpeace International take this position. They justify this with a
 325 moral discourse, claiming that the countries that caused the current climate crisis have a
 326 responsibility to mitigate it "at home" (e.g., Greenpeace 2008, p. 14). This confuses two very
 327 different questions. One is who should pay the bulk of the cost, and few would disagree that
 328 this should be the developed countries. However, it is an entirely different question as to
 329 whether this should all be done "at home," where the cost for each ton of carbon kept out of
 330 the atmosphere can easily be double or triple the cost of achieving the same climate benefit
 331 by applying the funds abroad.

332

333 Climate responsibility is not the key factor here. Putting oneself in the shoes of a
 334 politician in a European country, such as Germany, one can easily imagine a group of
 335 environmentalists presenting a demand that Germany spend X% of its gross domestic product
 336 (GDP) on fighting global warming. The politician might say, "Sure, we will build a wind
 337 turbine factory, a solar panel factory, retool the Opel automobile factory to make ecological
 338 cars, etc." All of this creates employment and income in Germany. On the other hand, if the
 339 politician says "OK, let's send the money to Brazil to stop deforestation" it would do nothing
 340 for the economy of Germany. Europeans will therefore oppose major money flows for
 341 avoiding tropical deforestation even if the climate benefit is several times greater for the same
 342 expenditure. What this means is that restricting all or almost all of the mitigation to
 343 expensive investments "at home" will result in these countries not agreeing to the much
 344 greater commitments to emissions reductions that are needed to really keep global
 345 temperature from rising beyond 2°C above pre-industrial levels. As a result, Brazil would
 346 lose not only the financial inputs from selling carbon but could also lose its Amazon forest.
 347 Brazil's interests are inherently different from those of Europe.

348

349 **6 Why 450 ppmv is not enough**

350

351 The countries of the world have now reached a consensus that an increase of mean
 352 global temperature of 2°C above the pre-industrial average represents "dangerous" climate
 353 change. Although the Ministry of Foreign Affairs claims in virtually every public statement
 354 on climate that Brazil is a "leader" in climate negotiations, Brazil was one of the last
 355 countries to get on the 2°C bandwagon, only accepting this goal in July 2009 after over 100
 356 other countries had already endorsed this objective. Now the critical question to be
 357 negotiated is what concentration of greenhouse gases should be allowed to accumulate in the
 358 atmosphere in light of this goal, and Brazil's leadership would be welcome on this crucial
 359 decision. A frequently mentioned number is 450 parts per million by volume (ppmv) of
 360 carbon dioxide equivalent (CO₂e). The problem with this is that this concentration
 361 corresponds to a 50% chance of average temperature staying within the 2°C bound, but it also
 362 implies a 50% chance that the temperature will rise beyond this level (Hare and Meinshausen
 363 2006). Since a 2°C average global temperature rise corresponds to a rise of at least 4°C in

364 Amazonia, this is approximately the limit for maintaining the Amazon forest (Nobre and
 365 Borma 2009). Brazil must therefore throw its diplomatic weight behind a definition well
 366 below 450 ppmv CO₂e.

367
 368 A dramatic reminder of this came in 2005, when a devastating drought struck
 369 Amazonia, practically drying up tributaries on the southern side of the Amazon and causing
 370 forest fires in Acre. The year 2005 was not an El Niño year, when warm water in the Pacific
 371 Ocean causes drought in northern Amazonia, as during the 1997-1998 Great Roraima Fire.
 372 Instead, the drought was caused by a patch of warm water in the Atlantic Ocean (Marengo et
 373 al. 2008), and global climate simulations indicate this type of drought becoming a very
 374 frequent occurrence if CO₂ concentrations in the atmosphere rise above 400 ppmv (Cox et al.
 375 2008). A CO₂ concentration of 400 ppmv is approximately equal to 450 ppmv CO₂e because
 376 the total effect on global warming is raised by the CH₄, N₂O and other trace gases included in
 377 CO₂e, but not counted in the pure “CO₂ concentration” figure. With continuation of present
 378 emission patterns, a drought as severe as that of 2005 was a one-in-twenty-year event in 2005
 379 but would increase in frequency to be one in every two years by 2025 and nine in every ten
 380 years in 2060 (Cox et al. 2008). Clearly, this is far beyond the capacity of the Amazon forest
 381 to withstand drought and fire. In 2010 another record drought struck, this time combining a
 382 strong Atlantic dipole with a modest El Niño event (Lewis et al. 2011; Marengo et al. 2011).

383
 384 The Stern Review represents the most comprehensive effort to date to estimate the
 385 cost of achieving different stabilization targets. The review focuses on stabilizing the
 386 atmosphere at 450-550 ppmv CO₂e, and dismisses the 450 ppmv lower end of this range as
 387 “almost out of reach” (Stern 2007, p. xv). The 550 ppmv CO₂e target emphasized in the
 388 review corresponds to a most-probable warming of 3°C, rather than 2°C (p. 294). Targets
 389 below 450 ppmv CO₂e were not considered, partly because “cost modelling exercises rarely
 390 consider stabilisation below 500 ppm CO₂e” and partly because “it would be unwise to
 391 assume that any overshoot could be clawed back” (p. 299). The cost of stabilizing at 500-550
 392 ppmv CO₂e (450-500 ppmv CO₂) is estimated at 1% of global GDP in 2050, assuming that
 393 global GDP at that time will be four times larger than it was in 2005 (p. xv). Stabilizing at
 394 450-500 ppmv CO₂e would cost approximately three times more (p. 247). The cost of
 395 stabilizing at levels lower than this is evidently too frightening for economists to even
 396 consider. This outlook of the “dismal science,” as economists call their discipline, appears to
 397 be approaching the problem from the wrong direction. The starting point is the cost that is
 398 considered politically feasible to bear, and the stabilization level is then the lowest
 399 concentration of greenhouse gases that will fit within that constraint. A better approach for
 400 guaranteeing the future welfare of humanity would be to start with the environmental limits
 401 (such as 400 ppmv CO₂ or 450 ppmv CO₂e as an approximate limit for maintaining
 402 Amazonian forest) and then adjust the economic system to pay the corresponding costs, even
 403 if painful.

404 405 **7 Why Brazil should take on a real target**

406
 407 The voluntary objective for reducing Brazil’s emissions by 36-39% by 2020 (as
 408 compared to what is projected to be emitted in that year with no mitigation) is very different
 409 from a target (assigned amount). An assigned amount implies that there are consequences if
 410 the target is not met, whereas an “objective” has no such consequences attached. In the case
 411 of a binding international agreement like the Kyoto Protocol, this means that a country that
 412 exceeds its assigned amount would have to buy carbon credit from somewhere else at the
 413 going price at that time until the target is met. Under a binding agreement, the commitment

414 remains in effect regardless of who is governing the country. By contrast, between now and
 415 2020 Brazil will have several presidential administrations, any of which will be free to
 416 disavow the voluntary objective announced by the government in 2009. Making the
 417 “voluntary objective” into a federal law does not greatly change this, as a simple vote of the
 418 National Congress could reverse it if emissions turn out to be greater than hoped.

419
 420 Taking on a real target under a binding agreement would be advantageous for Brazil
 421 for several reasons. First, such a target would allow much more carbon credit to be sold
 422 based on national total emissions, not just the results of specific mitigation projects, and even
 423 within these limits only the portion that can be shown to be “additional” to a no-project
 424 scenario. Second, Brazil’s taking on a target would be a key step both in inducing
 425 industrialized countries that had commitments under the Kyoto Protocol to commit to larger
 426 cuts now and to induce developing countries to also take on commitments under the post-
 427 Kyoto agreement. Brazil is one of the countries that is most at risk from global warming, and
 428 so achieving this greater global reduction in emissions is essential to Brazil’s national
 429 interest. Otherwise, the country risks losing much of its Amazon forest to climate change
 430 (e.g., Fearnside 2009c; Malhi et al. 2008; Nepstad et al. 2008; Salazar et al. 2007).

431
 432
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 436 these arguments is available at
 437 <http://www.redeamazonica.com.br/portalamazonia/especiais/especial.php?idEspecial=19>.
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