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1 Amazon Dams and Waterways: Brazil's Tapajós Basin Plans

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24 **Abstract**

25 Brazil plans to build 43 "large" dams (> 30 MW) in the Tapajós Basin, ten of which are
26 priorities for completion by 2022. Impacts include flooding indigenous lands and
27 conservation units. The Tapajós River and two tributaries (the Juruena and Teles Pires
28 Rivers) are also the focus of plans for waterways to transport soybeans from Mato
29 Grosso to ports on the Amazon River. Dams would allow barges to pass rapids and
30 waterfalls. The waterway plans require dams in a continuous chain, including the
31 Chacorão Dam that would flood 18 700 ha of the Munduruku Indigenous Land.
32 Protections in Brazil's constitution and legislation and in international conventions are
33 easily neutralized through application of "security suspensions," as has already occurred
34 during licensing of several dams currently under construction in the Tapajós Basin. Few
35 are aware of "security suspensions," resulting in little impetus to change these laws.

37 **Keywords:**

38 Amazonia; Brazil; Dams; Hydropower; Hydroelectric dams

40 **1.) Introduction**

41
42 The Amazon Basin, roughly two-thirds of which is in Brazil, is the focus of a massive
43 surge in hydroelectric dam construction, with plans that would eventually covert almost
44 all Amazon tributaries into chains of reservoirs (e.g., Fearnside 2014a; Finer and
45 Jenkins 2012; Kahn et al. 2014; Tundisi et al. 2014). Dams in tropical areas like
46 Amazonia have a wide range of environmental and social impacts, including loss of
47 terrestrial and aquatic biodiversity (Santos and Hernandez 2009; Val et al. 2010),
48 greenhouse-gas emissions (Abril et al. 2005; Fearnside and Pueyo 2012; Kemenes et al.
49 2007), loss of fisheries and other resources that support local livelihoods (Barthem et al.
50 1991; Fearnside 2014b), methylation of mercury (rendering the poisonous to animals,
51 including humans) (e.g., Fearnside 1999; Leino and Lodenius 1995), and population
52 displacement (Cernea 1988, 2000; McCully 2001; Oliver-Smith 2009, 2010; Scudder
53 2006; WCD 2000). Dam projects throughout the tropics have followed a pattern of
54 systematic violation of human rights, including violence and murder, especially
55 involving indigenous peoples. Recent examples of murders of indigenous leaders
56 opposing dams include Miguel Pabón in 2012 at the Hidrosogamoso Dam in Colombia
57 and Onesimo Rodriguez in 2013 at the Barro Blanco Dam in Panama (Ross 2012; Yan
58 2013). The murder of two children (David and Ageo Chen) in 2014 at the Santa Rita
59 Dam in Guatemala when the gunmen were unable to locate the leader they had been
60 hired to kill has become an emblematic case (e.g., Illescas 2014). Ironically, all of these
61 dams have projects for carbon credit approved by the Clean Development Mechanism
62 and supposedly represent "sustainable development." In Brazil, the killing of Adenilson
63 Kirixi Mundurku by police in November 2012 is the emblematic case for indigenous
64 peoples impacted by hydroelectric dams in the Tapajós River Basin (e.g., Aranha and
65 Mota 2014). The Tapajós is a north-flowing Amazon tributary with a 764 183-km²
66 drainage basin. Brazil's portion of the Amazon Basin is roughly the size of western
67 Europe, and the Tapajós Basin is about the size of Sweden and Norway together. Many
68 of the challenges exemplified by the Tapajós plans apply throughout the world. As will
69 be illustrated by development plans in Brazil's Tapajós River Basin, the decision-
70 making process in Brazil and the legal system surrounding the country's dam-building
71 frenzy are stacked against the environment and the traditional Amazonian inhabitants.

72

73 The present paper concentrates on a little-discussed aspect of decision-making and
 74 licensing for major development projects: the legal tools employed to neutralize
 75 protections for the environment and for human rights. Many other topics also require
 76 change to reduce the impacts and improve the benefits of developments such as those in
 77 Brazilian Amazonia. These include reform of energy policy and of the environmental
 78 impact assessment system, creation of mechanisms to prevent conflicts of interest for
 79 those who evaluate and decide on proposed infrastructure such as dams, and containing
 80 corruption both in its simple financial form and in its even more perverse political
 81 forms, including both illegal payoffs and legal campaign contributions (see Fearnside
 82 2014a).

83
 84 The theoretical framework used in the present study follows the pattern of identifying a
 85 limited set of objectives and then examining the critical points that prevent the
 86 objectives from being achieved. Frameworks that follow this principle are efficient in
 87 indicating priorities for change (e.g., Mermet 2011; Ostrom 2011). In this case the
 88 objectives are both maintenance of Amazonian ecosystems (together with their
 89 environmental services) and maintenance of traditional populations (including
 90 indigenous peoples). Conflicts between hydroelectric plans and different kinds of
 91 protected areas, including indigenous lands, are documented. Other important aspects of
 92 Brazil's development decisions, such as alternative means of providing the benefits of
 93 electricity to country's population, are discussed elsewhere (e.g., Moreira 2012).

94

95 **2.) The Tapajós dams**

96

97 A total of 43 "large" dams are either planned and under construction in Brazil's Tapajós
 98 River Basin (Figures 1 and 2). "Large" dams in Brazil are defined as those with more
 99 than 30 megawatts (MW) of installed capacity. Nearly all of the planned dams are much
 100 larger than 30 MW. Three of these would be on the Tapajós River itself and four on the
 101 Jamanxim River (a tributary of the Tapajós in the state of Pará) (Table 1). On Tapajós
 102 tributaries in the state of Mato Grosso six dams are planned in the Teles Pires River
 103 Basin (Table 2) and 30 in the Juruena River Basin (Table 3). There are also plans for
 104 numerous "small hydropower plants" (PCHs), meaning dams with installed capacity \leq
 105 30 MW that are exempted from the federal government's Environmental Impact Study-
 106 Environmental Impact Report (EIA-RIMA).

107

108 [Figures 1 & 2 & Tables 1, 2 & 3 here]

109

110 Brazil's Second Program for the Acceleration of Growth (PAC-2), covering the 2011-
 111 2015 period, includes six dams on the Tapajós and Jamanxim Rivers and five dams on
 112 the Teles Pires River (Brazil, PR 2011). Priorities and schedules for dams have been
 113 evolving continuously, as indicated by the Ten-Year Energy Expansion Plans (PDEs)
 114 launched every year by the Ministry of Mines and Energy, containing the dams planned
 115 for the succeeding ten years. For example, the dams on the Jamanxim River appeared in
 116 the PDEs through the 2011-2020 Plan but disappeared from subsequent plans, meaning
 117 that they were postponed to beyond the ten-year horizon. They were replaced by the São
 118 Simão Alto and Salto Augusto Baixo mega-dams on the Juruena River, plus smaller
 119 dams such as Castanheira, on the Arinos River, which is a tributary of the Juruena and
 120 the location of one of the ports planned for loading soybeans onto the barges that would
 121 descend the Tapajós Waterway (Brazil, MME 2013). These changes favor dams that
 122 comprise the waterways that are planned to transport soybeans and postpone the dams

123 that are not part of these routes. The Ministry of Mines and Energy does not build locks,
 124 its contribution to the waterways being limited to reserving space for this purpose next
 125 to each dam and locks being the purview of Ministry of Transportation. Although the
 126 two ministries are not always in agreement on priorities, the final word lies with the
 127 “Civil House” (*Casa Civil*) of the president’s office.

128
 129 Of the 43 planned dams planned in the Tapajós Basin, ten are included in the 2013-2022
 130 PDE: two on the Tapajós River itself, five in the Teles Pires Basin and three in the
 131 Juruena Basin (Tables 1, 2 and 3). The dams have multiple impacts, including damage
 132 to indigenous lands (“*terras indígenas*”, or “TIs”) (Figure 3) and flooding in
 133 conservation units (CUs) (Figure 4). Note that in Brazil “conservation units” refer to
 134 protected areas of types included in the National System of Conservation Units (SNUC)
 135 (Brazil, PR 2000). Other types of protected areas, such as indigenous lands, are also
 136 important for maintaining Amazonian forest. Dams expel riverside populations and
 137 drive deforestation in various ways.

138
 139 [Figures 3 & 4 here]

140
 141 Flooding of land in protected areas is one of the environmental impacts of planned dams
 142 in the Tapajós Basin. The Brazilian government has degazetted parts of several
 143 conservation units even before the planned dams have been evaluated and licensed. Part
 144 of Amazonia National Park has already been degazetted (removing legal protection) by
 145 means of a provisional measure (No. 558/2012), subsequently converted into law (No.
 146 12 678/2012). This was done explicitly to make way for the reservoir of the São Luiz do
 147 Tapajós Dam (e.g., IHU 2012; WWF Brasil 2012). The federal government also
 148 removed part of the Juruena National Park to make way for the São Simão Alto and
 149 Salto Augusto Baixo Dams on the Juruena River (WWF Brasil 2014). The planned
 150 dams would inundate 15 600 ha of Amazonia National Park, 18 515 ha of Jamanxim
 151 National Park, 7352 ha of Itaituba-I National Forest, 21 094 ha of Itaituba-II National
 152 Forest and 15 819 ha of the Tapajós Environmental Protection Area (APA), or a total of
 153 78 380 ha in protected areas.

154
 155 In the case of the Tapajós River Basin, the impact of many dams and the Tapajós
 156 Waterway, including its branches on the Teles Pires and Juruena Rivers, is much larger
 157 than the damage that usually comes into discussion for any specific project, such as the
 158 first planned dam: São Luiz do Tapajós (CNEC Worley Parsons Engenharia, S.A.
 159 2014a, b). The waterway has a key role in ensuring construction of all dams required to
 160 make the route navigable, including the most damaging dam: Chacorão.

161 162 **3.) The Tapajós Waterway**

163
 164 Dams flood rapids that impede navigation and the locks associated with the dams allow
 165 the passage of barges. Brazil has extensive plans for inland navigation (Fearnside 2001,
 166 2002; Brazil, PR 2011). These dams would allow the Tapajós Waterway to carry
 167 soybeans from Mato Grosso to ports in Santarém, Santana and Barcarena, thus giving
 168 access to the Amazon river and the Atlantic Ocean (Brazil, PR 2011; Millikan 2011).

169
 170 Completion of the waterway would require an additional dam that is not mentioned in
 171 the “energy axis” of PAC-2. This is the Chacorão Dam on the Tapajós River in the state
 172 of Pará (e.g., Millikan 2011). Chacorão also does not appear among the dams listed in

173 the PDEs for 2011-2020, 2012-2021 and 2013-2022 (e.g., Brazil, MME 2013). On the
174 other hand, Chacorão appears in the feasibility study for the São Luiz do Tapajós Dam
175 (CNEC Worley Parsons Engenharia, S.A. 2014a). It also appears in the Integrated
176 Environmental Assessment (AAI) for the Tapajós dams (Grupo de Trabalho Tapajós
177 and Ecology Brasil 2014, p. 60). The locks associated with Chacorão are listed as a
178 "priority" in the National Waterways Plan (Brazil, MT 2010, p. 22). The reservoir
179 behind the dam would allow barges to cross the Chacorão rapids.

180

181 Chacorão would inundate 18 700 ha of the Munduruku Indigenous Land (Millikan
182 2011). In the case of the São Luiz do Tapajós and Jatobá Dams, the reservoirs would
183 flood Munduruku tribal lands that have not been officially designated as an "indigenous
184 land" (Lourenço 2014; Ortiz 2013). Creation of new indigenous lands in Brazil has been
185 "paralyzed" for several years, reportedly due to orders from above that the National
186 Indian Foundation (FUNAI) does not deny (e.g., CIMI 2014). This "paralyzation"
187 appears to represent a policy to facilitate the flooding of areas inhabited by indigenous
188 populations where indigenous lands have not yet been created, such as the Munduruku
189 populations in the areas that would be flooded by the planned São Luiz do Tapajós and
190 Jatobá Dams. This is clear in a video of Maria Augusta Assirati, the "president" (head)
191 of FUNAI, in tears as she tries to explain to a group of Mundurku in September 2014
192 that the paperwork for creating their reserve was completely ready for her signature and
193 had been sitting on her desk for a year, but that "other government agencies began to
194 discuss the proposal" because of the hydroelectric plans (Amigos da Terra-Amazônia
195 Brasileira 2014). She was replaced as head of the agency nine days later with the
196 paperwork still unsigned and, later, she confirmed the interference (Aranha 2015).

197

198 Implementation of the Tapajós Waterway would encourage future deforestation for soy
199 in the northern part of Mato Grosso, which would be served by this infrastructure
200 complex. The waterway would also encourage soy plantations in the cattle pastures that
201 currently dominate land use in areas that have already been cleared in this part of Mato
202 Grosso. Such a conversion causes deforestation indirectly in other places: both the cattle
203 and the ranchers who sell their land to soy planters ("*sojeiros*") move from Mato Grosso
204 to Pará (Fearnside 2001). The effect on deforestation in Pará from advancement of soy
205 in pastures in Mato Grosso has been shown statistically (Arima et al. 2011). This effect
206 has been denied by Brazilian diplomats, who were successful in getting mention of it
207 removed from the summary for policy makers of the Fifth Assessment Report (AR-5) of
208 the Intergovernmental Panel on Climate Change (IPCC) in March 2014 (Garcia 2014).
209 Stimulus to deforestation by the Tapajós Waterway is not included among impacts
210 considered in environmental licensing and in evaluating greenhouse-gas emissions of
211 projects for generating carbon credits from dams in the Tapajós Basin, as in the case of
212 the Teles Pires Dam (Fearnside 2013).

213

214 On April 25, 2014, Bunge, a multinational company currently responsible for 25% of
215 Brazil's soy production, opened a port for export of soybeans in Barcarena, at the mouth
216 of the Amazon River. The company expects Brazil's exports to double by 2024, mainly
217 targeting China (Freitas 2014). Soybeans for the first vessel loaded at the port of Vila de
218 Conde (in Barcarena) came from Mato Grosso in trucks to the port of Miritituba (on the
219 lower Tapajós River), and from there proceeded to Barcarena in barges operated by
220 Navegações Unidas Tapajós Ltda. (Unitapajós), a joint venture between the Amaggi and
221 Bunge companies. In the future, it is expected that the soybeans exported from

222 Barcarena will travel all the way from Mato Grosso on barges descending the Tapajós
223 Waterway, starting with the branch of the waterway on the Teles Pires River.

224

225 The portion of the waterway in the state of Mato Grosso will fork, with one branch on
226 the Teles Pires River and the other on the Juruena. The first branch of the Tapajós
227 Waterway to be built would make the Teles Pires River navigable as far as Sinop, and,
228 subsequently, to Sorriso. The Teles Pires branch requires a series of five dams, three of
229 which (Colider, São Manoel and Sinop) are already under construction. The São
230 Manoel Dam is less than 1 km from the Kayabi Indigenous Land and already has
231 provoked conflicts with the tribe (ISA 2013). The Foz do Apiacás Dam is located only 5
232 km from the same indigenous area. Interministerial Ordinance 419/2011 considers that
233 indigenous areas are affected by any hydroelectric plant within 40 km.

234

235 For the second branch of the waterway, which would be built on the Juruena River,
236 soybeans would reach the two planned ports via roads from the south, including a new
237 road (MT-319) that would connect Juína, Mato Grosso, with Vilhena, in eastern
238 Rondônia, bisecting two indigenous areas: TI Enawenê Nawê and the Aripunã
239 Indigenous Park (Macrológica 2011). The Juruena River branch of the waterway
240 requires six dams to reach the proposed ports, and three of the reservoirs would flood in
241 indigenous lands: the Escondido and Erikpatsá Dams would flood in TIs with the same
242 names, and the Tucumã Dam would flood part of TI Japuíra (CNEC Worley Parsons
243 Engenharia, S.A. 2014a, Illustration 3.5/1). Sixteen more dams are planned on the
244 tributaries in the headwaters of the Juruena above the portion of the river to be made
245 navigable (Brazil, ANEEL 2011). Of the 16 "large" dams in the headwaters of the
246 Juruena, four affect TI Nambikwara (Poçilga, Jacaré, Foz do Formiga Baixo and
247 Nambikwara), and two affect TI Tirecatunga (Salto Utiariti and Foz do Sacre) (CNEC
248 Worley Parsons Engenharia, S.A. 2014a). A number of "small hydropower plants"
249 (PCHs) are also planned, several of which affect indigenous areas (CNEC Worley
250 Parsons Engenharia, S.A. 2014a, Illustration 3.5/1; de Almeida 2010; Fanzeres 2013).

251

252 **4.) Laws overriding protection**

253

254 Legal treatment of licensing, and especially of impacts on indigenous peoples, provides
255 a clear illustration of the barriers preventing implementation of protections specified in
256 Brazil's constitution and legislation. This also applies to international agreements such
257 as Convention 169 of the International Labor Organization (ILO-169), under which
258 indigenous peoples impacted by development projects have the right to "consultation."
259 Unfavorable decisions on dam construction in Brazil are routinely reversed by invoking
260 a "security suspension" ("*suspensão de segurança*") that allows construction to continue
261 regardless of any social or environmental violations if halting the project would cause
262 grave damage to the "public economy." A law originating from Brazil's military
263 dictatorship authorizes

264

265 the President of the Court to **suspend** the execution of **injunctions** and rulings on
266 claims against public authorities and their agents in order **to avoid serious injury**
267 **to the public economy** (Law No. 4348 of 26 June 1964; replaced by Law 12 016
268 of August 7, 2009). [emphasis added]

269

270 After Brazil's 1988 Constitution created the Public Ministry (a public prosecutor's
 271 office charged with defending the interests of the people), applicability of security
 272 suspensions was reconfirmed by clarifying that

273
 274 it is the responsibility of the President of the Court, to whom an appeal
 275 ["*recurso*"] is submitted, **to suspend**, by means of a substantiated order, the
 276 execution of **injunctions** in claims against public authorities or their agents, at the
 277 request of the Public Ministry or of any concerned legal entity governed by public
 278 law, in the event of manifest public interest and blatant unlawfulness, and **to**
 279 **avoid serious injury to the** public order, health, safety and **economy** (Art. 4 of
 280 Law 8437 of June 30, 1992). [emphasis added]

281
 282 It was clarified that no subsequent appeal ("*agravo*") could have the effect of
 283 temporarily reverting a security suspension:

284
 285 When, at the request of an interested legal entity governed by public law or the
 286 Public Ministry, and **to avoid serious injury to the** public order, health, security
 287 and **economy**, the President of the Court to which the respective appeal
 288 ["*recurso*"] is submitted **suspends**, by means of a substantiated decision, the
 289 execution of **the injunction** and the sentence, this decision is **subject to**
 290 interlocutory **appeal** ["*agravo*"], **without any suspensory effect**, within five
 291 days, which will be judged in the session following its filing (Art. 15 of Law 12
 292 016 of August 7, 2009). [emphasis added]

293
 294 Of course, any hydroelectric dam has economic importance, thus effectively negating
 295 all protections of the environment and of impacted peoples (e.g., Prudente 2013, 2014).
 296

297 In the case of the Teles Pires Dam, use of the security suspension was denounced before
 298 the Inter-American Commission on Human Rights (IACHR) of the Organization of
 299 American States (OAS), on March 28, 2014 (ISA 2014). The Teles Pires Dam affects
 300 three indigenous tribes (Kayabi et al. 2011). Loss of fishing will affect the Kayabi's
 301 nutrition. The group will also lose sacred sites associated with waterfalls to be flooded.
 302 The licensing process contained a variety of irregularities (Millikan 2012). Successive
 303 legal attempts to stop the dam were reversed, usually in just two or three days. The
 304 speed with which decisions are reversed despite extensive documentation of impacts
 305 and of violations of laws is probably due to the fact that a security suspension is
 306 independent of arguments concerning the impacts and legality of a project, depending
 307 only on demonstrating the project's economic importance. The Teles Pires Dam was
 308 suspended on December 14, 2010 (Kayath 2010), on March 27, 2012 (Lessa 2012;
 309 MPF/PA 2012), on April 9, 2012 (Menezes 2012a) and on August 1, 2012 (see Fiocruz
 310 and Fase 2013), and on October 9, 2013 (TRF-1 2013). On November 11, 2014, for the
 311 12th time in the case of the Tapajós Dams, a security suspension was granted. This
 312 allowed the Brazilian Institute of the Environment and Renewable Natural Resources
 313 (IBAMA) to issue an operating license to the Teles Pires Dam without the dam
 314 consortium having complied with many of the conditions that IBAMA had previously
 315 established (Palmquist 2014).
 316

317 Licensing of the São Manoel Dam has produced a spectacular chronology irregularities
 318 (Monteiro 2013a, b). Several attempts to prevent construction were legally reversed. A
 319 suspension of bidding for construction contracts was reversed on December 13, 2013

320 (Fiocruz and Fase 2013). On April 28, 2014 a judge in Cuiabá suspended work on São
321 Manoel based on legislation guaranteeing the rights of indigenous peoples (Presser
322 2014). Meanwhile, a public civil suit against São Manoel, which was initiated on
323 September 17, 2013, reached the “concluded for sentencing” stage on July 21, 2014
324 (TRF-1 2014).

325

326 The Sinop, Colíder and Magessi Dams had their construction blocked on December 6,
327 2011 when a judge in Sinop issued a preliminary injunction based on violation of
328 legislation on environmental licensing (da Silva Neto 2011). Among other irregularities,
329 licensing was being done only by the Mato Grosso Environment Secretariat, while dams
330 such as these require licensing at the federal level by IBAMA (MPF/PA 2011). The
331 dams in question impact indigenous peoples (Monteiro 2011). As early as January 16,
332 2012 a judge in Brasilia rejected the suit based on a security suspension (Menezes
333 2012b), allowing construction to continue. As in any country, interpretation of laws
334 varies with individual judges, and some are more prone than others to decide in favor of
335 economic concerns over indigenous rights or environmental impacts. This subset of
336 judges is often sought out by government attorneys in appeals to overturn decisions on
337 dams, even though the judges in question may be located far from the dams in question
338 (see example in Fearnside and Barbosa 1996).

339

340 The existence of laws authorizing “security suspensions” is not generally known either
341 to the academic community or to the Brazilian public. Discussion of the need to change
342 these laws is therefore almost nonexistent. The same lack of awareness applies to high-
343 impact projects like the Chacorão Dam, which is omitted from virtually all public
344 discussion of the Tapajós Basin developments despite being a key part of the overall
345 plan. Omitting discussion of the most controversial components of Brazil’s
346 hydroelectric plans represents a general pattern, repeating the recent history of licensing
347 the Santo Antônio and Jirau Dams on the Madeira River (Fearnside 2014c) and the Belo
348 Monte Dam on the Xingu River (Fearnside 2006, 2012).

349

350 While discussion is invariably concentrated on the pros and cons of each individual
351 proposed project, the way that decisions are made is much more fundamental to the
352 environmental and social conditions that will prevail in the future. The interdependence
353 of project complexes like dams and waterways is a part of this little-debated area.
354 Another is the underlying legal structure, which in the case of Brazil represents a
355 “safety net” for project proponents that provides an ultimate guarantee against
356 environmental and social limitations. Those in the environmental field who have
357 worked long and hard to build the impact-assessment and licensing system usually view
358 the legal system as a given – part of the institutional landscape that must simply be
359 accepted. Fortunately, national laws are not natural laws, and they are subject to change
360 by social decisions. This is true in any country, Brazil providing an example.

361

362 **5.) Conclusions**

363

364 The plans for dams and waterways in the Tapajós Basin imply large impacts, both
365 individually and together. These impacts include damage to indigenous lands and to
366 protected areas. The combination of proposals for dams and waterways implies impacts
367 that could otherwise not occur. An example is provided by the Chacorão Dam, which
368 would flood part of the Munduruku Indigenous Land; this dam might not be a priority if
369 it were not part of the route of the Tapajós Waterway. Brazil’s environmental licensing

370 system has been unable to prevent the approval of projects with large impacts, and the
 371 legal system has been unable to enforce constitutional and other protections due to the
 372 existence of laws authorizing "security suspensions" to allow the continuation of any
 373 construction project with economic importance. Public discussion is needed of the laws
 374 that currently guarantee completion of any dam or other large infrastructure project
 375 irrespective of environmental and social impacts and violations of licensing
 376 requirements. Disclosure and democratic debate are also needed on the full range of
 377 components comprising basin development plans, including high-impact projects like
 378 the Chacorão Dam that are now virtually absent from public view. The immediate
 379 policy recommendation arising from the Tapajós experience is obvious: repeal laws or
 380 portions of laws (e.g., Article 15 of Law 12016 of August 7, 2009) authorizing "security
 381 suspensions" and allow Brazil's existing environmental licensing system to function.
 382 On a wider scale, those concerned with environmental and social impacts of
 383 development in every country need to work to purge aberrations of this kind from their
 384 legal and regulatory systems.

385

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387

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398

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413

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 415 desconsiderada", diz ex-presidente [*FUNAI is being devalued and its autonomy*
 416 *totally ignored*] says the ex-president (in Portuguese)]. *Publica Agência de*
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 828

829 Figure Legends

830
 831 Figure 1. Brazil and locations mentioned in the text. **Brazilian states:** MT=Mato
 832 Grosso, PA=Pará, RO=Rondônia. **Dams:** 1=São Luiz do Tapajós, 2=Jatobá,
 833 3=Chacorão, 4=Teles Pires, 5=Salto Augusto Baixo, 6=São Simão Alto, 7=Colíder,
 834 8=São Manoel, 9=Sinop, 10=Magessi, 11=Cachoeira do Caí, 12=Cachoeira dos Patos,
 835 13=Jardim de Ouro, 14= Jirau, 15=Santo Antônio, 16=Belo Monte. **Cities:** 17=Santarém,
 836 18=Cuiabá, 19=Juína, 20=Sinop, 21=Sorriso, 22=Itaituba, 23=Miritituba,
 837 24=Barcarena, 25=Brasília, 26=Vilhena. Highways: 27=MT-319, 28=BR-230, 29=BR-
 838 319, 30=BR-364. **Rivers:** 31=Amazon, 32=Tapajós, 33=Teles Pires, 34=Juruena,
 839 35=Arinos, 36=Jamanxim, 37=Madeira, 38=Xingu.

840
 841 Figure 2. Large dams (> 30 MW) planned in the Tapajós Basin: 1=Roncador,
 842 2=Kabiara, 3=Parecis, 4=Cachoeirão, 5=Juruena, 6=Chacorão, 7=Jatobá, 8=Cachoeira
 843 do Caí, 9=Cachoeira dos Patos, 10=Jardim de Ouro, 11=São Luiz do Tapajós,
 844 12=Jamanxim, 13=Tucumã, 14=Erikpatsá, 15=Salto Augusto Baixo, 16=Escondido,
 845 17=Apiaka Kayabi, 18=Jacare, 19=Pocilga, 20=Foz do Sacre, 21=Foz do Formiga
 846 Baixo, 22=Salto do Utariti, 23=Castanheira, 24=Paiaguá, 25=Nambiquara, 26= São
 847 Simão Alto, 27=Barra do Claro, 28= Travessão dos Índios, 29=Fontanilhas,
 848 30=Enawene Nawe, 31=Foz do Buriti, 32= Matrinxã, 33=Tapires, 34=Tirecatinga,
 849 35=Água Quente, 36= Buriti, 37=Jesuíta, 38= Colíder, 39= Foz do Apiacás, 40=São
 850 Manoel, 41=Sinop, 42=Teles Pires, 43=Magessi. TI=Indigenous Land (“*Terra*
 851 *Indígena*”); CU=Conservation Unit; IP= Integral Protection; SU= Sustainable Use.

852
 853 Figure 3. Indigenous Lands (*Terras Indígenas*: TIs) in the Tapajós Basin: 1= Manoki,
 854 2= Ponte de Pedra, 3= Uirapuru, 4= Estação Parecis, 5= Menkú, 6= Batelão, 7= Maró,
 855 8= Munduruku-Taquara, 9= Bragança-Marituba, 10= Apiaká do Pontal e Isolados,
 856 11=Praia do Índio, 12= Praia do Mangue, 13=Apiaká/Kayabi, 14= Bakairi, 15=
 857 Enawenê-Nawê, 16= Erikpatsá, 17= Escondido, 18= Irantxe, 19= Japuirá, 20=Juininha,
 858 21= Cayabi, 22= Menkú, 23= Munduruku, 24= Nambikwara, 25= Panará, 26= Paresi,
 859 27= Parque do Aripuanã, 28=Pirineus de Souza, 29= Rio Formoso, 30= Sai-Cinza, 31=
 860 Santana, 32= Tirecatinga, 33=Utiariti. CU=Conservation Unit; IP= Integral Protection;
 861 SU= Sustainable Use.

862
 863 Figure 4. Conservation Units (UCs) in the Tapajós Basin. 1=Águas do Cuiabá State
 864 Park, 2= Igarapés do Juruena State Park, 3=Sucunduri State Park, 4= Cristalino State
 865 Park, 5= Peugeot-ONF-Brasil Private Reserve of Natural Patrimony (RPPN), 6=Área de
 866 Proteção Ambiental do Salto Magessi, 7=Reserva Particular do Patrimônio Natural
 867 Cristalino-I RPPN, 8=Cristalino-III RPPN, 9= Fazenda Loanda RPPN, 10=Cabeceiras
 868 do Rio Cuiabá Environmental Protection Area (APA), 11=Bararati Sustainable

869 Development Reserve, 12=Apuí State Forest, 13= Sucunduri State Forest,
870 14=Amazonia National Park, 15=Juruena National Park, 16=Jamanxim National Park,
871 17= Nascentes Serra do Cachimbo Biological Reserve, 18= Iquê Ecological Station,
872 19=Rio Novo National Park, 20=Tapajós National Forest, 21=Amaná National Forest,
873 22=Crepori National Forest, 23=Riozinho do Anfrísio Extractive Reserve, 24=Tapajós
874 Arapiuns Extractive Reserve, 25=Tapajós APA, 26=Itaituba-II National Forest,
875 27=Altamira National Forest, 28=Jamanxim National Forest, 29=Itaituba-I National
876 Forest, 30=Trairão National Forest. TI=Indigenous Land (*Terra Indígena*); IP= Integral
877 Protection; SU= Sustainable Use.

Table 1 –Planned dams on the Tapajós and Jamanxim Rivers

No. in Figure 2	Name	Code	River	Power [MW] ^(a, b)	Reservoir Area (km ²) ^(b)	Status	Inclusion in waterway	Inclusion in PDE 2013-2022 ^(a)	Indigenous areas affected	Conservation units affected
7	Jatobá	TPJ-445	Tapajós	2338	646	Planned	Yes	Yes	Munduruku areas not officially recognized ^(c)	Amanã National Forest
6	Chacorão	TPJ-685	Tapajós	3336	616	Planned	Yes	No	TI Munduruku	
8	Cachoeira do Caí	JMX-043	Jamanxim	802	420	Planned	No	No		Itaituba-II National Forest
9	Cachoeira dos Patos	JMX-166 [J]	Jamanxim	528	117	Planned	No	No		Parque Nacional do Jamanxim, Jamanxim National Forest
10	Jardim de Ouro	JMX-257	Jamanxim	227	426	Planned	No	No		Jamanxim National Forest
11	São Luiz do Tapajós	TPJ-325	Tapajós	6133	722	Planned	Yes	Yes	Munduruku areas not officially recognized ^(c)	Amazonia National Park, Itaituba-I National Forest, Itaituba-II National Forest
12	Jamanxim	JMX-212	Jamanxim	881	75	Planned	No	No		Jamanxim National Park

(a) Brazil, MME (2013, pp. 84-85).

(b) See Fearnside (2014a).

(c) Ortiz (2013).

Table 2-PLanned dams in the Teles Pires Basin

No. in Figure 2	Name ^(a)	Code	River	Power [MW] ^(a)	Reservoir Area (km ²) ^(b)	Status	Inclusion in waterway	Inclusion in PDE 2013-2022	Indigenous areas affected
38	Colíder	TPR-680	Teles Pires	300	171.7	Under construction	Yes	Yes	
39	Foz do Apicás (Salto Apicás)	API-006	Apicás	230	89.6	Planned	No	Yes	Kaiabí
40	São Manoel	TPR-287	Teles Pires	700	53	Under construction	Yes	Yes	Kaiabí
41	Sinop	TPR-775	Teles Pires	400	329.6	Under construction	Yes	Yes	
42	Teles Pires	TPR-329	Teles Pires		1820	Under construction	Yes	Yes	
43	Magessi	TPR-1230	Teles Pires	53	60	Planned	No	No	

(a) Dams, installed capacities and inclusion in the Ten-Year Energy Expansion Plan (PDE) from Brazil, MME (2013, pp. 84-85).

(b) Areas of reservoirs: see Fearnside (2014a).

Table 3-Planned dams in the Juruena Basin

No. in Figure 2	Name ^(a, c)	Code	River	Power [MW] ^(a)	Inclusion in waterway	Inclusion in PDE 2013-2022 ^(b)	Indigenous areas affected ^(c)
1	Roncador		do Sangue	134.0	No	No	TI Manoki
2	Kabiara		do Sangue	241.2	No	No	TI Erikpatsá
3	Parecis		do Sangue	74.5	No	No	TI Manoki
4	Cachoeirão		Juruena	64.0	No	No	
5	Juruena		Juruena	46.0	No	No	
13	Tucumã	JRN-466	Juruena	510	Yes	No	TI Japuíra
14	Erikpatsá	JRN-530	Juruena	415	Yes	No	TI Erikpatsá
15	Salto Augusto Baixo	JRN-234b	Juruena	1461	Yes	Yes	
16	Escondido	JRN-277	Juruena	1248	Yes	No	TI Escondido
17	Apiaká-Kayabi	PEX-093	dos Peixes	206	No	No	
18	Jacaré	JUI-048	Juína	53	No	No	TI Nambikwara
19	Pocilga	JUI-117	Juína	34	No	No	TI Nambikwara
20	Foz do Sacre	PPG-147	Papagaio	117	No	No	TI Tirecatina
21	Foz do Formiga Baixo	JUI-029b	Juína	107	No	No	TI Nambikwara
22	Salto Utariti	PPG-159	Papagaio	76	No	No	TI Tirecatina
23	Castanheira	ARN-120	Arinos	192	Yes	Yes	
24	Paiaguá		do Sangue	35.2	No	No	TI Manoki; TI Ponte de Pedra
25	Nambiquara	JUI-008	Juína	73	No	No	TI Nambikwara
26	São Simão Alto	JRN-117a	Juruena	3509	Yes	Yes	
27	Barra do Claro		Arinos	61.0	No	No	
28	Travessão dos Índios		Juruena	252	No	No	

29	Fontanilhas	JRN-5771	Juruena	225	No	No	
30	Enawenê-Nawê	JRN-7201	Juruena	150	No	No	
31	Foz do Buriti	PPG-1151	Papagaio	68	No	No	
32	Matrinxã	SAC-0141	Sacre	34.5	No	No	
33	Tapires	SAN-0201	do Sangue	75	No	No	
34	Tirecatina	BUR-0391	Burití	37.5	No	No	
35	Água Quente	BUR-077	Burití	42.5	No	No	
36	Buriti	BUR-0131	Burití	60	No	No	
37	Jesuíta		Juruena	22.3 ^(d)	No	No	

(a) Source of data on dams: Brazil, ANEEL (2011); several of the installed capacities listed reflect downward revisions by ANEEL as compared to initial proposals.

(b) Ten-Year Energy Expansion Plan (*Plano Decenal de Expansão de Energia: PDE*) 2013-2022: Brazil, MME (2013, pp. 84-85).

(c) CNEC Worley Parsons Engenharia, S.A. (2014a, Fig. 35-1. Illustration 3.5/1).

(d) Listed as a large dam, but with currently expected installed capacity < 30 MW.







