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1 **Removing the abyss between conservation science and policy decisions in Brazil**

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54 **Abstract**

55

56 The executive and legislative branches of Brazilian government have either proposed or
57 taken a variety of initiatives that threaten biodiversity and ecosystems. Opposition by
58 the scientific community has largely been ignored by decision-makers. In this short
59 essay, we present recent examples of harmful policies that have great potential to erode
60 biodiversity, and we suggest ways to communicate scientific knowledge to decision-
61 makers. If the current gap between conservation science and policies is not filled, the
62 country will threaten the maintenance of its natural capital and, consequently, the
63 sustainability of essential societal activities in the long term.

64

65 **Keywords:** Environmental laws; Scientific advice; Forest Code; Biodiversity,
66 Translational scientists, Environmental impacts, Environmental licensing

67

68 **Introduction**

69

70 Brazil has a prominent place in maintaining global biodiversity. The country has
71 continental dimensions, covers tropical and sub-tropical latitudes, and contains a huge
72 diversity of biomes, ecosystems, and species (Lewinsohn and Prado 2005; Silva 2005),
73 many of which are still poorly known or critically endangered (MMA 2014; IUCN
74 2015; Vitule et al. 2016). Efforts to conserve biodiversity have increased in recent years.
75 For instance, the “Plan of Action for Prevention and Control of Deforestation in the
76 Legal Amazon” (PPCDAm) launched in 2004 (MMA 2013), a shift in 2007 in Brazil’s
77 position in climate negotiations to allow compensation for avoiding deforestation
78 (Fearnside 2012), creation of protected areas (Soares-Filho et al. 2010) and
79 improvements in systems for satellite monitoring of deforestation in near real time
80 beginning in 2006 (Assunção et al. 2013). However, much greater effort is needed to
81 effectively stem unsustainable environmental policies (Loyola 2014; Lima-Junior et al.
82 2015). Virtually all major biomes and ecosystems have been significantly impacted by
83 human activities; some have been extensively transformed or destroyed (e.g. Atlantic
84 rainforest, Paraná River Basin). In recent years, unsustainable policies have stimulated a
85 series of harmful initiatives, with great potential to damage biodiversity and ecosystem
86 functioning because they consistently ignore scientific consensus and advice. This
87 scenario adds urgency to the need to connect decision-makers with scientific knowledge
88 in both the executive and legislative branches of government.

88

89 In this short essay, we provide a brief overview of recent unsustainable policies
90 and stress the need to connect environmental science with policy decisions as an
91 unavoidable step to preserve Neotropical biodiversity and its services. We hope
92 researchers in other nations in which science is also far from decision-making will
93 propose similar initiatives.

93

94 **Unsustainable policies**

95

96 A variety of proposed laws (*Projetos de Lei* – PL, in Portuguese), constitutional
97 amendments (*Proposta de Emenda à Constituição* – PEC, in Portuguese), and
98 provisional measures (*Medida Provisória* – MP, in Portuguese) have surfaced in recent
99 years (see Pelicice et al. 2014; Fearnside 2016a; Magalhães et al. 2017; Ruaro and

99 Mormul 2017). We offer some examples of harmful initiatives under consideration or
100 approved in Brazil today.

101 Proposed federal law No. 5989/09, which designates non-native fishes as
102 “naturalized,” will enhance the use of non-native species in Brazilian aquaculture
103 (Azevedo-Santos et al. 2011; Pelicice et al. 2014). The scientific community has
104 criticized the proposal (e.g. Azevedo-Santos et al. 2011; Lima-Junior et al. 2012; Vitule
105 et al. 2012; Pelicice et al. 2014), but it continues to progress through the federal
106 legislature and will likely become a reality. Similarly, a state law (No. 4330/2016) was
107 recently sanctioned allowing aquaculture with non-native fish (e.g. Nile tilapia
108 *Oreochromis niloticus*) in Amazonas state (Tófoli et al. 2016; Padiál et al. 2017). Both
109 laws can boost fish invasions across Brazil (Pelicice et al. 2014), posing significant
110 threats to the natural environment (e.g. Vitule et al. 2009) and possibly causing
111 important socioeconomic consequences (e.g. Pimentel et al. 2005) in biomes of global
112 interest.

113 Other threats include a variety of assaults on the environmental licensing system.
114 PEC 65, for example, would effectively eliminate licensing by automatically approving
115 projects with the mere submission of an environmental impact study; this proposal is
116 close to a final vote in the Senate plenary. This case is similar to another proposed law
117 (PLS 654/2015) that would greatly abbreviate the licensing process for major
118 infrastructure projects (Fearnside 2016a). In the House of Deputies, a similar proposed
119 law (PL 3729/2004) was recently promoted to “urgent” status and is progressing
120 towards a vote (Fearnside 2016b). Another law (MPV 727, renamed *PL de conversão*
121 *23/2016*) was approved in September 2016, with clauses similar to the proposed laws
122 that abbreviate licensing. All these proposals will have enormous negative impacts on
123 biodiversity (Fearnside 2016a; Fearnside 2016b), as large-scale development projects
124 will grant approval regardless of their environmental costs.

125 Finally, attempts to weaken the Brazilian System of Conservation Units are
126 frequent (Bernard et al. 2014). Although processing of the proposal (PL 3682/2012) that
127 “calls for 10% of even strictly protected areas to open for mining concessions, and
128 general prohibition of new PAs in areas of high mineral or hydropower potential”
129 (Ferreira et al. 2014, p. 706) has been suspended, decreases in some protected areas
130 continue to be implemented through provisional measures (e.g. ISA 2016). In a context
131 in which several scientists have warned about the importance of protected areas (e.g.
132 Scarano et al. 2012), decreasing them is a substantial setback.

133

134 **A bridge between scientists and policy**

135 Brazilian environmental policy has been weak because environmental issues
136 have little influence on government. Surely, the limitation on participation of the
137 scientific community at all political levels (federal, state, and municipal) is a major
138 impediment to policies being formulated based on high-quality information. In Brazil,
139 communication between scientists and policy-makers is historically deficient: while
140 decision-makers do not consult scientists, scientists do not act efficiently to be heard.
141 Some suggestions to try to bridge the gap between conservation scientists and decision
142 makers are presented in Figure 1.

143 *Executive level:* Many countries have a science advisor at the executive level,
144 although there is variation in the degree to which these advisors affect policy. A well-
145 known example of executive decisions without scientific input was US President
146 George W. Bush’s unilateral decision to withdraw the United States from the Kyoto
147 Protocol in March 2001, before he had appointed a science advisor. In Brazil a clear
148 example is the construction of the Belo Monte Dam in the Amazon Basin; this
149 expensive megaproject was much criticized by the scientific community, including a
150 specialist panel (see Santos and Hernandez 2009) that was ignored by the Brazilian
151 government. This is not an exception, because formal technical opinions (*pareceres*, in
152 Portuguese) by technical staff have been overridden by high-level political decisions in
153 other cases, such as the environmental licensing of the Santo Antônio, Jirau, and Belo
154 Monte hydroelectric dams (Fearnside 2014; Fearnside 2017). Brazil has no presidential
155 science advisor despite the existence of scientific committees in various ministries, e.g.,
156 the Ministry of Science, Technology, Innovation and Communication and the Ministry
157 of the Environment. We emphasize that these ministries include strong scientific staff,
158 i.e. professors and scientists working at different research institutes and universities.
159 Decision-makers can consult these committees and specialists when advice is desired,
160 but they may also choose to ignore them.

161 *Legislative level:* The existing committee system is the logical conduit for
162 scientific input to the legislative process. Brazil’s House of Deputies has a committee
163 whose purview includes science (CCTCI = Comissão de Ciência e Tecnologia,
164 Comunicação e Informática) and another committee for the environment and sustainable
165 development (CMADS = Comissão de Meio Ambiente e Desenvolvimento
166 Sustentável). The Federal Senate also has committees for these two areas (CCT =
167 Comissão de Ciência e Tecnologia and CMA = Comissão de Meio Ambiente). Elected
168 politicians constitute these committees, and in principle, they must consult specialists to
169 make decisions. The effectiveness of these committees, however, is dubious. An
170 example is provided by the 2011-2012 debates over reforming (gutting) the country’s
171 “Forest Code”, which is a package of regulations that governs deforestation (e.g.
172 Metzger et al. 2010; Nazareno et al. 2011; Soares-Filho et al. 2014; Brancalion et al.
173 2016). The law that was approved in 2012 (Law No. 12,651/2012), for example,
174 reduced protection requirements on private properties and pardoned 43 years of
175 violations of the previous “Forest Code”. Various scientists questioned the reform in
176 committee hearings, and ample literature was provided by the Brazilian Society for the
177 Progress of Science (SBPC) and the Brazilian Academy of Science (ABC) (e.g. Silva et
178 al. 2011). This input, however, had no effect on the vote, which mostly followed
179 political parties’ guidelines; the House of Deputies passed the reform by a margin of
180 seven to one (see Fearnside 2016a). It should be mentioned that the Brazilian Enterprise
181 for Agricultural and Ranching Research (EMBRAPA), which is the main scientific arm
182 of the Ministry of Agriculture, explicitly prohibited its researchers from expressing any
183 opinions on the proposed revision of the “Forest Code” when the revision was being
184 debated in the National Congress (Angelo 2011).

185 Turnout in committee hearings is often low unless a high-profile topic is on the
186 agenda, as occurred during the recent presidential impeachment case. The poor turnout
187 is evident when sessions are focused on acquiring information rather than producing a
188 vote, yet gaining information is a crucial step in guiding legislators toward wise
189 decisions. Therefore, a mechanism is needed to force authorities to give serious and
190 regular consideration to scientific advice. Of course, scientists cannot wield a veto over

191 decisions of elected officials. Nevertheless, researchers are armed with high-quality
192 information that may influence elected officials. One suggestion is to develop a
193 mechanism that demands testimony from relevant scientists indicated by credible
194 organizations such as SBPC, ABC and ABECO (Brazilian Association for Ecological
195 Science and Conservation). In addition, to have an effect, a minimum level of
196 participation by committee members must be assured, for example by a required
197 minimum quorum (as in the case of sessions for voting). Actual presence is essential,
198 not simply signing an attendance sheet and leaving (as often occurs). The relation
199 between legislative sovereignty and the need to incorporate scientific concerns therefore
200 entails a delicate balance.

201 *Translational scientists:* Equally important is improving capacity for
202 “translational scientists” (see Brosnan and Groom 2006 for more details), who are still
203 somewhat unusual among conservation scientists in Brazil. Modern science is loaded
204 with concepts, methods, and theories that are impenetrable to non-specialists. This bulk
205 of information is difficult to grasp if proper assistance is limited. To bridge this gap,
206 translational scientists would catalyze understanding of research on conservation issues
207 (Brosnan and Groom 2006; Briske 2012) and guide authorities, managers, and policy-
208 makers through complicated topics and intricate data, especially in areas where deficient
209 data and conflicting results are common. This may be a significant way to implement
210 science-based decisions, because “translations” may reach authorities as well as the lay
211 public, which exerts pressure on policy-makers.

212

213 >>>>> Figure 1

214

215 **Final remarks**

216 In Brazil (and elsewhere), environmental policy decisions should not be isolated
217 by political agents, especially because these decisions are often based on poor-quality
218 information. Misguided measures can promote unsustainable activities and drastically
219 erode biodiversity, with long-term effects on the maintenance of essential ecosystem
220 services and economic activities. Some decisions obviously transcend scientific
221 ignorance and are offered only in order to promote lobbies or to finance new political
222 campaigns; e.g., recent confessions released by federal courts indicate that corruption
223 led to approval and construction of the Belo Monte Dam (Megale et al. 2016).
224 Involvement of scientists, as we propose, could at least hinder approval of projects with
225 harmful consequences to biodiversity, resources, and natural capital.

226 Although more data and high-quality research are needed, these will not suffice
227 to improve biodiversity conservation (Ellison 2016). Many Brazilian and foreign
228 scientists are producing scientific data on biodiversity and conservation in Brazil, but
229 the knowledge abyss persists between science and decision-making. If this gap is not
230 filled, maintenance of the country’s natural capital will be threatened and, consequently,
231 the sustainability of essential societal activities.

232

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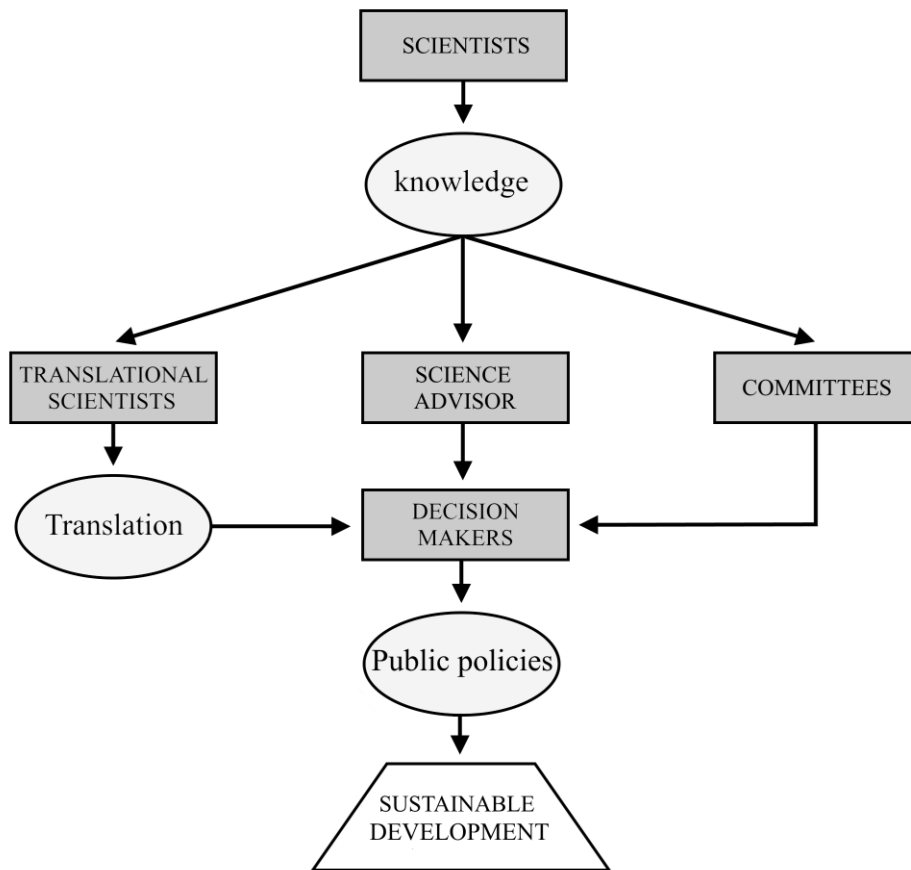
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 407 Figure 1. Paths to improve the connection between scientific knowledge and decision-
 408 makers, with the objective to propose sustainable policies