

The text that follows is a PREPRINT.

Please cite as:

**Grasel, D., P.M. Fearnside, J.R.S. Vitule,
R.L. Bozelli, R.P. Mormul, R.R.
Rodrigues, F. Wittmann, A.A.
Agostinho & J.A. Jarenkow. 2018.
Brazilian wetlands on the brink.
Biodiversity and Conservation **28(1):**
255-257. [https://doi.org/10.1007/s10531-
018-1666-z](https://doi.org/10.1007/s10531-018-1666-z)**

ISSN: 0960-3115 (Print) 1572-9710 (Online)

Copyright: Springer Netherlands

The original publication is available at:

<https://doi.org/10.1007/s10531-018-1666-z>

<http://link.springer.com/>

Authors: Daniel Grasel^{1,*}, Philip Martin Fearnside², Jean Ricardo Simões Vitule³, Reinaldo Luiz Bozelli⁴, Roger Paulo Mormul⁵, Ricardo Ribeiro Rodrigues⁶, Florian Wittmann⁷, Angelo Antonio Agostinho⁵, João André Jarenkow^{1,8}

Title: **Brazilian wetlands on the brink**

Affiliations:

¹ Programa de Pós-Graduação em Botânica, Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves 9500, CEP 91501-970, Bloco IV, Prédio 43.433, Porto Alegre, Rio Grande do Sul, Brazil

² Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo 2936, CEP 69067-375, Manaus, Amazonas, Brazil

³ Departamento de Engenharia Ambiental, Setor de Tecnologia, Universidade Federal do Paraná, Av. Francisco H. dos Santos 100, CEP 81531-970, Curitiba, Paraná, Brazil

⁴ Departamento de Ecologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Av. Carlos Chagas Filho 373, CEP 21941-902, Bloco A, Rio de Janeiro, Rio de Janeiro, Brazil

⁵ Departamento de Biologia, Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura, Universidade Estadual de Maringá, Av. Colombo 5790, Bloco H-90, CEP 87020-900, Maringá, Paraná, Brazil

⁶ Departamento de Ciências Biológicas, Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo, Av. Pádua Dias 11, CEP 13418-900, Piracicaba, São Paulo, Brazil

⁷ Department of Wetland Ecology, Institute for Geography and Geoecology, Karlsruhe Institute for Technology, Josef-Str. 1, 76437, Rastatt, Germany

^{1,8} Departamento de Botânica, Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves 9500, CEP 91501-970, Bloco IV, Prédio 43.433, Porto Alegre, Rio Grande do Sul, Brazil

* Corresponding author. E-mail address: graselbio@gmail.com. Tel.: 55-51-33087580

ORCID: DG 0000-0001-6978-7508, PMF 0000-0003-3672-9082, JRSV 0000-0001-6543-7439, RLB 0000-0001-9916-1629, RPM 0000-0001-9020-4784, RRR 0000-0003-4818-0736, FW 0000-0001-9180-356X, AAA 0000-0002-4707-9444, JAJ 0000-0003-2747-3468

Keywords Wetland policy, Unsustainable legislation, Biodiversity, Ecosystem services

Acknowledgments DG was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES); PMF, JRSV, RLB, RPM, RRR and AAA received grants from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq); PMF, RLB and RRR were also supported by Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM) and Rede Clima, Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ), and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), respectively.

Wetlands harbor a huge amount of biodiversity, provide essential services, and are key regulators of climate change (notably peatlands) (MA 2005). Brazil not only hosts the world's richest freshwater aquatic biota (Padial et al. 2017) but also leads in wetland area and peatland volume in the tropics and subtropics (Gumbricht et al. 2017). In 2012, controversial revisions to Brazil's "Forest Code", now renamed the "Native Vegetation Protection Law" (hereafter NVPL; Federal Law nº 12,651/2012; http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/12651.htm), imposed catastrophic risks to wetlands. The reform was catalyzed mainly by the agribusiness sector, which argued that the Forest Code was too restrictive in the face of an alleged need for agricultural expansion (Metzger et al. 2010). However, this argument has been strongly contested by multiple studies (e.g., Soares-Filho et al. 2014; Strassburg et al. 2014; Brancalion et al. 2016). The question now is how to minimize the setbacks.

Riparian wetlands can now be cleared because the NVPL changed the basis for delimiting "buffer zones" (legally considered "Permanent Preservation Areas"; hereafter PPAs) from the maximum water level to the regular bed of watercourses, thus removing protection from many riparian areas, especially from the vast floodplains with high-amplitude flood pulses in Amazonia (Souza et al. 2011). Ponds <1 ha and wetlands adjacent to intermittent springs and ephemeral streams lost their legal protection. These habitats are also threatened by destruction (Brancalion et al. 2016; Grasel et al. 2018). The same goes for large tracts of salt marshes and hypersaline areas, which can now be used for shrimp farming and salt exploitation, also threatening associated mangroves (Rovai et al. 2012; SBPC and ABC 2012). Other setbacks include dramatic reduction of required restoration of PPAs cleared before 22 July 2008 (Brancalion et al. 2016), allowing 50% of any required restoration of PPAs to be done with exotic woody species, and permitting aquaculture in most cleared PPAs.

Among other consequences, setbacks associated with the NVPL may substantially increase greenhouse gas emissions (Moomaw et al. 2018), cause a massive loss of native species (Metzger et al. 2010; Volcan and Lanés 2018), introduce alien taxa (Pelicice et al. 2017), and jeopardize vital ecosystem services (MA 2005). However, Brazil now has a valuable opportunity to rescue its wetlands and so sustain its international treaties and its leadership in conservation. Although in force since 2012, the NVPL's 'regulation' (setting of rules to implement a law) is still in progress at the state level, where its setbacks can be attenuated through adoption of more rigorous policies. We urge policymakers and scientists to engage in open dialogue on this critical 'regulation'.

Compliance with ethical standards The authors declare compliance with all ethical standards.

Conflict of interest The authors declare that they have no conflict of interest.

References

- Brancalion PHS, Garcia LC, Loyola R, Rodrigues RR, Pillar VD, Lewinsohn TM (2016) A critical analysis of the Native Vegetation Protection Law of Brazil (2012): updates and ongoing initiatives. *Nat Conserv* 14:1-15. <https://doi.org/10.1016/j.ncon.2016.03.003>
- Grasel D, Mormul RP, Bozelli RL, Thomaz SM, Jarenkow JA (2018) Brazil's Native Vegetation Protection Law threatens to collapse pond functions. *Perspect Ecol Conserv*. <https://doi.org/10.1016/j.pecon.2018.08.003>
- Gumbricht T, Roman-Cuesta RM, Verchot L, Herold M, Wittmann F, Householder E, Herold N, Murdiyarso D (2017) An expert system model for mapping tropical wetlands and

- 101 peatlands reveals South America as the largest contributor. *Glob Change Biol* 23:3581-
 102 3599. <https://doi.org/10.1111/gcb.13689>
- 103 MA (Millennium Ecosystem Assessment) (2005) *Ecosystems and Human Well-Being:*
 104 *Wetlands and Water Synthesis*. World Resources Institute, Washington, DC.
 105 <https://www.millenniumassessment.org/documents/document.358.aspx.pdf>. Accessed
 106 08 October 2018
- 107 Metzger JP, Lewinsohn TM, Joly CA, Verdade LM, Martinelli LA, Rodrigues RR (2010)
 108 Brazilian law: full speed in reverse? *Science* 329:276-277.
 109 <https://doi.org/10.1126/science.329.5989.276-b>
- 110 Moomaw WR, Chmura GL, Davies GT, Finlayson CM, Middleton BA, Natali SM, Perry JE,
 111 Roulet N, Sutton-Grier AE (2018) Wetlands in a changing climate: science, policy and
 112 management. *Wetlands* 38:183-205. <https://doi.org/10.1007/s13157-018-1023-8>
- 113 Padial AA, Agostinho AA, Azevedo-Santos VM et al (2017) The “Tilapia Law” encouraging
 114 non-native fish threatens Amazonian river basins. *Biodivers Conserv* 26:243-246.
 115 <https://doi.org/10.1007/s10531-016-1229-0>
- 116 Pelicice FM, Azevedo-Santos VM, Vitule JRS, Orsi ML, Lima Junior DP, Magalhães ALB,
 117 Pompeu PS, Petrere Jr M, Agostinho AA (2017) Neotropical freshwater fishes
 118 imperiled by unsustainable policies. *Fish Fish* 18:1119-1133.
 119 <https://doi.org/10.1111/faf.12228>
- 120 Rovai AS, Menghini RP, Schaeffer-Novelli Y, Molero GC, Coelho Jr. C (2012) Protecting
 121 Brazil's Coastal Wetlands. *Science* 335:1571-1572.
 122 <https://doi.org/10.1126/science.335.6076.1571>
- 123 SBPC, ABC (Sociedade Brasileira para o Progresso da Ciência, Academia Brasileira de
 124 Ciências) (2012) *The Brazilian Forest Code and Science: Contributions to the Dialogue*.
 125 SBPC, ABC, São Paulo. [http://www.sbpnet.org.br/site/publicacoes/outras-](http://www.sbpnet.org.br/site/publicacoes/outras-publicacoes/CodigoFlorestal_ingles.pdf)
 126 [publicacoes/CodigoFlorestal_ingles.pdf](http://www.sbpnet.org.br/site/publicacoes/outras-publicacoes/CodigoFlorestal_ingles.pdf). Accessed 08 October 2018
- 127 Soares-Filho B, Rajão R, Macedo M, Carneiro A, Costa W, Coe M, Rodrigues H, Alencar A
 128 (2014) Cracking Brazil's Forest Code. *Science* 344:363-364.
 129 <https://doi.org/10.1126/science.1246663>
- 130 Souza Jr PT, Piedade MTF, Candotti E (2011) Brazil's forest code puts wetlands at risk.
 131 *Nature* 478:458-458. <https://doi.org/10.1038/478458b>
- 132 Strassburg BBN, Latawiec AE, Barioni LG, Nobre CA, Silva VP, Valentim JF, Vianna M,
 133 Assad ED (2014) When enough should be enough: improving the use of current
 134 agricultural lands could meet production demands and spare natural habitats in Brazil.
 135 *Global Environ Chang* 28:8497. <https://doi.org/10.1016/j.gloenvcha.2014.06.001>
- 136 Volcan MV, Lanés LEK (2018) Brazilian killifishes risk extinction. *Science* 361:340-341.
 137 <https://doi.org/10.1126/science.aau5930>