



Chinese giant salamanders are overstocked in farms but endangered in the wild.

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Giant salamanders: Farmed yet endangered

Chinese giant salamanders (*Andrias davidianus s.l.*) are the largest extant amphibians, attaining a body size of almost 2 meters (1). As “living fossils,” their common ancestor lived in the Middle Jurassic (2). However, their population density has decreased since the 1950s because of habitat loss and overharvesting (3). Chinese giant salamanders now appear in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the International Union for Conservation of Nature lists them as Critically Endangered (4, 5). Conservation efforts include national reserves, breeding in captivity (6), and release back into nature (7), but these strategies have proved inadequate. The existence of multiple species (1) complicates conservation planning. Moreover, although extremely endangered in nature (8), Chinese giant salamanders are overstocked in commercial farms (9). Conservation strategies must reflect this contradiction.

Between 1990 and 2010, the potential for high profits drove frequent illegal capture of salamanders in the wild for farm breedstock, decimating wild populations (9). Since 2002, in an attempt to facilitate the recovery of wild salamander populations, the government has paid farmers to release more than 270,000 farm-bred individuals (10) but has not required genetic or health

assessments before release. The mass release could accelerate extinction of some species through genetic homogenization (1). Most farms also pump water directly from streams and rivers into their facilities, circulate it within ponds, and then discharge the effluent directly into the wild without wastewater treatment (9). This activity may drive transmission of viruses and threaten ecological security (9). Given that observations of Chinese giant salamanders remain extremely rare in nature (3, 8), it seems that the release from farms has not succeeded in augmenting the population.

The balancing of conservation and utilization is key to the future of Chinese giant salamanders. Governmental agencies should coordinate unflinching supervision of the commercial market. Wastewater from farms must be treated before release back into nature. Stringent law enforcement must stop commercial farming in or near reserves and end poaching. Coordinated national scientific investigations need to evaluate the status of each species, especially in areas where natural breeding-caves persist (11, 12). All releasing of farm-bred animals should cease until testing confirms disease-free, pure-native species. Ecotourism should be developed to educate and promote the conservation of Chinese giant salamanders and build local pride in them as cultural and biodiversity resources.

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REFERENCES AND NOTES

1. F. Yan *et al.*, *Curr. Biol.* **28**, R590 (2018).
2. K. Gao, N. H. Shubin, *Nature* **422**, 424 (2003).
3. K. Zhang, X. Wang, W. Wu, Z. Wang, S. Huang, *Biodiv. Sci.* **10**, 291 (2002) [in Chinese].
4. G. Liang, B. R. Geng, E. M. Zhao, “*Andrias davidianus*,” *The IUCN Red List of Threatened Species* (2004).
5. CITES, Appendices I, II and III (2019); <https://cites.org/eng/app/appendices.php>.
6. A. S. Yang, G. J. Liu, *Hunan Fish. Sci. Technol.* **4**, 29 (1978) [in Chinese].
7. Q. H. Luo, Y. Liu, L. Y. Zhang, *Hunan. Biodiv. Sci.* **17**, 310 (2009) [in Chinese].
8. S. T. Turvey *et al.*, *Curr. Biol.* **28**, R592 (2018).
9. A. A. Cunningham *et al.*, *Oryx* **50**, 265 (2016).
10. G. C. Shu *et al.*, paper presented at the 2019 Annual Meeting of Chinese Herpetological Society, Nanchong, China, 18 to 21 October (2019).
11. Z. Q. Liang *et al.*, *Ecol. Evol.* **9**, 3879 (2019).
12. J. Wang, H. X. Zhang, F. Xie, G. Wei, J. P. Jiang, *Asian Herpetol. Res.* **8**, 174 (2017).

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The U.S. military is not sustainable

As Australian wildfires raged and youth-led climate movements inspired millions globally to march against climate change, commentators dubbed 2019 “the year the world woke up to the climate crisis” (1). However, one of the major contributors to climate change over the course of the past century too often remains overlooked: the U.S. military. Two recent studies demonstrate the scale of U.S. military greenhouse gas emissions, which rivals the emissions of the majority of countries around the world (2, 3). As global leaders prepare to discuss the next phase of international agreements at COP26 in Glasgow and political discourse around sustainable transitions to green economies becomes more mainstream, the United States must reconsider the ecological costs of its military’s global operations, including its domestic and global base infrastructure.

The U.S. military’s contribution to global climate change and local environmental damage is extensive (4). The U.S. military’s global greenhouse gas (GHG) emissions amount to 593 million metric tons of CO₂ equivalent from 2010 to 2018, an annual average similar to the annual GHG emission output of 14 million passenger cars. [(2), p. 14]. U.S. military operations—such as the use of herbicides during the Vietnam War (5) and white phosphorous in Iraq (6), and the construction of the global network of military bases (7)—have disrupted local ecological systems. Moreover, in May 2019, the Anthropocene Working Group

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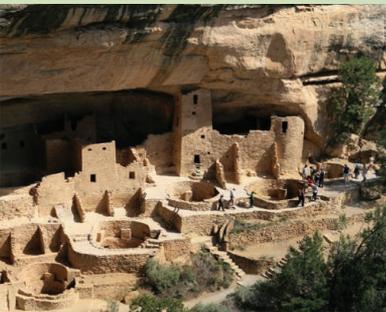


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under the International Commission on Stratigraphy voted to designate the Anthropocene as a new geological epoch, with the 1945 atomic bomb blasts serving as the strongest anthropogenic marker in the geological record (8). Looking forward, the U.S. military continues to invest billions in carbon-intensive preparations for conflicts in areas disproportionately affected by climate change (9).

The U.S. military's status quo is inconsistent with the aspirations of policy proposals like the Green New Deal (10) and the Paris Climate Accord (11). To decarbonize government and private sectors to the greatest possible extent, the United States and countries around the world must reevaluate American geopolitical aspirations and the foreign policy norms that have guided decisions since the Second World War.

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REFERENCES AND NOTES

1. E. Kolbert, "What will another decade of climate crisis bring?" *The New Yorker* (2020).
2. N. C. Crawford, "Pentagon fuel use, climate change, and the costs of war" (Watson Institute, Brown University, 2019).
3. O. Belcher, P. Bigger, B. Neimark, C. Kennelly, *Trans. Inst. Br. Geograph.* **45**, 1 (2020).
4. A. Jorgenson, B. Clark, J. Kentor, *Glob. Environ. Politics* **10**, 7 (2010).
5. J. Stellman et al., *Nature* **422**, 681 (2003).
6. P. Hashey, *N. Engl. J. Intl. Comp. Law* **291**, 299 (2011).
7. Y. Woo, *Southeast. Environ. Law J.* **15**, 577 (2007).
8. C. Waters et al., *Earth-Sci. Rev.* **178**, 379 (2019).
9. M. Klare, *All Hell Breaking Loose: The Pentagon's Perspective on Climate Change* (Metropolitan Books, New York, 2019).
10. 116th Congress, H. Res. 109 (www.congress.gov/116/bills/hres/109/BILLS-116hres109ih.pdf).
11. The Paris Agreement (<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>).

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Brazilian national parks at risk

Brazilian national parks could be seriously threatened if pending legislation [draft bills 984/2019 (1) and 61/2013 (2)] is approved. These two bills aim to change the federal law [9.985/2000 (3)] that created Brazil's national system of conservation units and instead create a new category of conservation unit called "park-road." Beyond this, the bills would reopen the Colono Road, an 18-km-long road closed more than 30 years ago that bisects the famed Iguacu National Park (4) and Brazil's largest remnant of the Atlantic Rainforest, a global biodiversity hotspot (5).

"Park-roads"—roads for vehicular traffic that traverse parks—are not currently regulated as a conservation-unit category in Brazil. Brazil's proposed bills are designed to allow roads for traveling through the parks, even if they serve no other purpose, such as allowing access to points of scenic, historic, or scientific importance. Reopening the Colono Road would expose Iguacu National Park to problems such as poaching, illegal deforestation, wildlife trafficking, and vehicle roadkill of wildlife (4). Opening roads would also increase habitat fragmentation, one of the main causes of the contemporary biodiversity crisis (6), which alters many aspects of forest ecology and composition (7–11).

Brazil has more than 70 national parks occupying over 25 million hectares across different biomes (12), including the imperiled Atlantic Forest, Cerrado ecosystems, and Amazon rainforest. The proposed bills could set an alarming precedent for opening new roads inside these and other protected areas. Such action could cause irreparable damage to biodiversity and the climate-stabilization services of intact forests (9, 10), which could affect not only Brazil but also the entire planet. Brazilian citizens and decision-makers must consider the consequences of such bills for Brazilian national parks and make their concerns about irreversible environmental impacts known to policymakers.

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REFERENCES AND NOTES

1. Projeto de Lei N° 984 (2019); www.camara.leg.br/proposicoesWeb/fichadetramitacao?idProposicao=2192602 [in Portuguese].
2. Projeto de Lei da Câmara N° 61 (2013); <https://www25.senado.leg.br/web/atividade/materias/-/materia/114299> [in Portuguese].
3. Lei N° 9.985 (18 July 2000); www.planalto.gov.br/ccivil_03/leis/L9985.htm [in Portuguese].
4. R. A. Ortiz, *Ambientalia* **1**, 141 (2010).
5. World Wildlife Fund, "Guia de Fauna do Parque Nacional do Iguacu" (2014); https://d3nehc6yl9qzo4.cloudfront.net/downloads/guia_fauna_parna_iguacu.pdf [in Portuguese].
6. W. F. Laurance, I. Arrea, *Science* **358**, 442 (2017).
7. V. Arroyo-Rodríguez et al., *Ecol. Res.* **32**, 81 (2017).
8. D. A. Saunders et al., *Conserv. Biol.* **5**, 18 (1991).
9. W. F. Laurance, *Phil. Trans. Royal Soc. B* **359**, 345 (2004).
10. N. M. Haddad et al., *Sci. Adv.* **1**, e1500052 (2015).
11. D. Lesbarrères, L. Fahrig, *Trends Ecol. Evol.* **27**, 374 (2012).
12. Brasil, MMA/ICMBio, "Ministro anuncia concessões em parques nacionais" (2016). www.icmbio.gov.br/porta/ultimas-noticias/20-geral/8569-ministro-anuncia-concessoes-em-parques [in Portuguese].

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