

Letters to the Editor

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Deforestation in Amazonia

IN RECENT YEARS, WE AND OTHERS HAVE identified critical threats posed to the forests of Amazonia by the Brazilian government's plans to dramatically expand highways and other major infrastructure projects in the region (1–6). Our conclusions have been disputed by elements of the Brazilian government (7–10), which assert that a key assumption of our spatial models—that new roads and highways will continue to promote large-scale Amazonian deforestation, as they have done in the past—no longer applies. This is so, they argue, because of improvements in frontier governance and environmental-law enforcement, as well as changes in Brazilian public attitudes toward forests (7–10). As a consequence, the Brazilian government is proceeding with the largest expansion of highways, roads, power lines, gas lines, hydroelectric reservoirs, railroads, and river-channelization projects in the history of the Amazon (1–6).

In 2002 and 2003, the rate of deforestation in Brazilian Amazonia climbed to nearly 2.4 million hectares per year (see figure)—equivalent to 11 football fields a minute. This increase mostly resulted from rapid destruction of seasonal forest types in the southern and eastern parts of the basin; relative to preceding years (1990–2001), forest loss shot up by 48% in the states of Pará, Rondônia, Mato Grosso, and Acre (11). The increase was evidently driven by rising deforestation and land speculation along new highways and planned highway routes (12), and the dramatic growth of Amazonian cattle ranching (13) and industrial soybean

farming (6, 14). Soybean farms promote some forest clearing directly, but have a much greater impact on deforestation by consuming cleared land, savanna, and ecotonal forests, thereby pushing ranchers and slash-and-burn farmers ever deeper into the forest frontier. Equally important, soybean farming provides a key economic and political impetus for massive infrastructure projects, which accelerate deforestation by other actors (6, 14).

Anticipating public alarm about the new deforestation figures, the Brazilian government recently announced new measures designed to slow Amazon forest loss. These measures include increased satellite monitoring of deforestation and the involvement of additional ministries—not just the Ministry of Environment—in efforts to reduce illegal deforestation and forest burning (12). These measures, in concert with the establishment of new protected or multiple-use areas in Amapá, Amazonas, and Acre, are a move in the right direction.

The new measures do not go far enough, however. They fail to address one of the most critical drivers of forest destruction: the rapid proliferation of new highways and other infrastructure, which greatly increases physical access to the Amazonian frontier. The Brazilian government plans to create interministerial working groups to

recommend ways to reduce or mitigate project impacts, but is not considering the cancellation or significant delay of any major project. Indeed, just days after announcing the new anti-deforestation package, Brazilian President Lula demanded that his federal ministers find ways to circumvent environmental and other impediments to stalled infrastructure projects throughout the country, including 18 hydroelectric dams and 10,000 km of highways (15).

In the Amazon, new transportation projects frequently lead to a dramatic rise in illegal deforestation, logging, mining, and hunting activities (1–6). If Brazil crisscrosses the basin with thousands of kilometers of such projects, the net result, our models suggest, will be not only further

increases in forest destruction, but fragmentation of surviving forests on an unprecedented spatial scale (1, 5). Many of the government's recently announced measures to slow forest loss are positive steps, but if it does not curtail its aggressive plans for infrastructure expansion, Brazil will fail to address one of the most critical root causes of Amazonian deforestation.

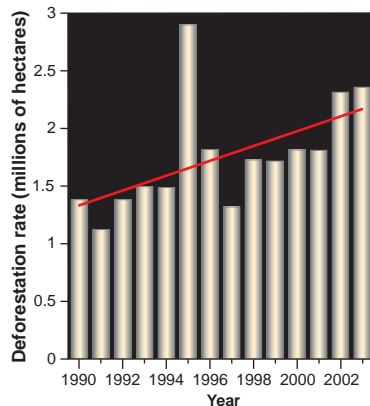
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References and Notes

- W. F. Laurance *et al.*, *Science* **291**, 438 (2001).
- W. F. Laurance, A. K. M. Albernaz, C. Da Costa, *Environ. Conserv.* **28**, 305 (2001).
- G. Carvalho, A. C. Barros, P. Moutinho, D. C. Nepstad, *Nature* **409**, 131 (2001).
- D. C. Nepstad *et al.*, *Forest Ecol. Manage.* **154**, 295 (2001).
- W. F. Laurance *et al.*, *J. Biogeogr.* **29**, 737 (2002).
- P. M. Fearnside, *Environ. Manage.* **30**, 748 (2002).
- D. Weber, "Ministério contesta estudo sobre devastação," *O Estado de S. Paulo*, 21 January 2001.
- S. S. do Amaral, "Threat to the Amazon," *The Independent*, 26 January 2001.
- R. Goidanich, *Science* **291**, 438 (2001) (www.sciencemag.org/cgi/letters/291/5503/438).
- J. P. Silveira *et al.*, *Science* **292**, 1651 (2001).
- The net deforestation rate in these four states increased from 1.43 million ha year⁻¹ from 1990–2001 to 2.12 million ha year⁻¹ in 2002–2003, based on data from the Brazilian National Space Agency (www.inpe.br). Deforestation data for 2003 are a preliminary estimate.
- Grupo Permanente de Trabalho Interministerial para a Redução dos Índices de Desmatamento da Amazônia Legal, *Plano de Ação para a Prevenção e Controle do Desmatamento da Amazônia Legal* (Presidência da República, Casa Civil, Brasília, 2004).
- D. Kaimowitz, B. Mertens, S. Wunder, P. Pacheco, *Hamburger Connection Fuels Amazon Destruction* (Tech. Rep., Center for International Forest Research, Bogor, Indonesia, 2004).
- P. M. Fearnside, *Environ. Conserv.* **28**, 23 (2001).
- "Lula quer a retomada de obras paralisadas," *Amazonas em Tempo* (Manaus, Brazil), 21 March 2004.



Deforestation in Brazilian Amazonia since 1990. Data are from Brazil's National Space Agency (the fitted regression line shows the overall trend). The increase in annual deforestation is significant by both parametric ($F_{1,12} = 8.22$, $R^2 = 40.7\%$, $P = 0.014$; linear regression with log-transformed deforestation data) and nonparametric ($R_s = 0.717$, $P = 0.004$; Spearman rank correlation) tests.

Painful Deception

IN THEIR RESEARCH ARTICLE "PLACEBO-induced changes in fMRI in the anticipation and experience of pain" (20 Feb., p. 1162), T. D. Wager *et al.* report results from two elegant experiments on placebo analgesia. The research raises ethical concerns that are not addressed in either the article or the Supporting Online Material (SOM). Research participants were deceived about the nature of the studies and the procedures

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used. For the first experiment, the authors state, "Participants were told that they were taking part in a study of brain responses to a new analgesic cream." In reality, they were treated with a placebo cream for the purpose of investigating the placebo effect. The second experiment used the same deceptive design and also misled the subjects about the intensity of painful thermal stimuli. Regarding the first experiment, the authors state in the SOM, "Informed consent was obtained from all participants after the nature and possible consequences of the study were explained." Unless the participants were informed in advance about the use of deception, it is difficult to see how they provided informed consent. Neither the article nor the SOM reports that the research was reviewed and approved by an institutional review board. Nor is it clear whether the subjects were debriefed about the use of deception, and no data are presented about how they responded to the deception. Although space constraints may preclude detailed discussion of the rationale for deception and appropriate ethical safeguards in published scientific articles, the use of supporting material available online provides an opportunity to address these issues (*1*). In such research, consideration should be given to having the prospective

subjects authorize the deception in advance by including a statement in the informed consent documents to the effect that the nature of the study and the procedures employed will not be described accurately, but subjects will be given accurate information after completion of the study (*2*).

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*The opinions expressed are the author's and do not necessarily reflect the policies of the U.S. government.

References

1. F. G. Miller, D. L. Rosenstein, *Lancet* **360**, 1326 (2002).
2. D. Wendler, *Milbank Q.* **73**, 87 (1996).

Response

OUR RESEARCH WAS REVIEWED AND APPROVED by Institutional Review Boards (IRBs) at Princeton University and the University of Michigan. Although this review is a necessary prerequisite for conducting all human subjects research, our SOM was not explicit enough about this issue.

We should have included a more thorough description of the debriefing. Participants were debriefed at the end of the study and told about the deception and the nature of the experiment, in accordance

with IRB procedures. No participant showed evidence of dissatisfaction at the deception. Some common responses were (to paraphrase), "Wow, I can't believe it... the placebo cream really hurt less," or, "I guess I could... see that the creams weren't really that different."

Under some circumstances, the use of deception is accepted under the ethical guidelines published by the American Psychological Association and Office of Human Subjects Research and can fall under the rubric of "informed consent." Broadly speaking, these cases occur when the use of deception is necessary for the research and when the benefits outweigh the risk of harm. In this case, the reviewing IRBs judged that the deception posed minimal risk. The stimuli delivered in placebo (which participants were told was an analgesic) and control conditions were identical, and the purpose of the deception was to relieve pain by inducing an expectation of pain relief. Although participants were misled about the intensity of painful stimuli, the stimuli were always as intense as or less intense than expected.

Limited use of deception is common in research in which full disclosure changes participants' behavior, and both researchers

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Bismuth Decays

IN HIS ARTICLE "NEW CHEMICAL ELEMENTS probe the shoals of stability" (News of the Week, 6 Feb., p. 740), Adrian Cho reports on the production at the accelerator facility at Dubna, Russia, of the highest atomic number $Z = 115$ element, which then decays by alpha radioactivity to element $Z = 113$. This mode of decay, instead of fission, implies that the new element is approaching a new "island of stability." He indicates, quite correctly, that lead, with mass number 208, is "doubly magic" (particularly stable) with $Z = 82$ and neutron number $N = 126$. He then states that bismuth, with one more proton, "is the heaviest element that doesn't undergo radioactive decay." It may be nit-picking, but this is incorrect. With use of low-temperature calorimetry (1), de Marcillac *et al.* determined recently (2) that bismuth-209 decays by emission of a 3.137-MeV α particle, with a radioactive half-life of 1.9×10^{19} years.

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References

1. N. Coron *et al.*, *Nature* **314**, 75 (1985).
2. P. de Marcillac, N. Coron, G. Dambier, J. Leblanc, J.-P. Moalic, *Nature* **422**, 876 (2003).

and review boards are very careful to ensure that the risk of adverse outcomes, psychological and physical, is minimized.

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Wisdom in Self-Scrutiny

ARTHUR CAPLAN'S POLICY FORUM "IS biomedical research too dangerous to pursue?" (20 Feb., p. 1142) oversimplifies recent literature addressing the ethical dimensions of biomedical research. Much of this work can be situated within the framework of utilitarianism, although the exploration of potential benefits and harms in the literature is often deeper and more expansive than what typically occurs in biomedical research.

Some of the material cited by Caplan considers appropriate research priorities, a topic the scientific community itself has frequently debated (1). Some writers ask whether industry sponsors or individual researchers have exaggerated the ability of certain investigational interventions to produce appreciable health benefits. Some work evaluates various research aims and

the risks entailed in pursuing those aims. Underlying this material is an inquiry into the ethical justification for research that can expose human subjects to harm and consume time and money that could be devoted to other projects. Wise use of limited financial resources and scientific talent is a major goal of these discussions.

Authors in this group primarily raise questions and express concerns; they seldom call for bans or prohibitions on research. This literature and the responses it generates can advance our understanding and, one hopes, contribute to thoughtful science policy. Indeed, the exchange offers opportunities for scientists to express their views on ethics and policy issues. Both science and science criticism are part of the intellectual enterprise we should celebrate. What Plato said about life is true about science, too: To be worthwhile, it must be examined.

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Reference

1. Institute of Medicine, *Scientific Opportunities and Public Needs: Improving Priority Setting at the National Institutes of Health* (National Academy Press, Washington, DC, 1998).