

AMERICAN ASSOCIATION FOR THE  
ADVANCEMENT OF SCIENCEJoin today and get 51 issues of *Science*.

the easiest way to do electrophoresis

SCIENCE ONLINE | SCIENCE MAGAZINE HOME | SCIENCE NOW | NEXT WAVE | STKE/AIDS/SAGE | SCIENCE CAREERS | E-MARKETPLACE

PHILIP M FEARNSTIDE | [Change Password](#) | [Change User Info](#) | [CiteTrack Alerts](#) | [Subscription Help](#) | [Sign Out](#)**Science**  
magazine

HELP | SUBSCRIPTIONS | FEEDBACK | SIGN IN | AAAS

SEARCH

BROWSE

▶ ORDER THIS ARTICLE

## Issues in Amazonian Development

Daniel Nepstad and colleagues highlight some laudable improvements in environmental protection, legislation, and public attitudes in Brazilian Amazonia in their Policy Forum "Frontier governance in Amazonia" (25 Jan., p. [629](#)), and they say that such efforts hold the key to sustainable development in the region. Although the authors provide an important perspective on a complex and contentious issue, some of their assertions are misleading and perhaps even dangerous.

Our greatest concern is that, by suggesting that many of the planned infrastructure developments in the region--including an unprecedented expansion of paved highways and river channelization projects--are "inevitable," Nepstad *et al.* could be creating a self-fulfilling prophecy. Many proposed projects are far from inevitable and are likely to have enormous environmental costs. For example, the two largest river channelization projects (the Tocantins-Araguaia and Tapajós waterways) are the subject of ongoing legal battles and could have severe impacts on aquatic habitats and indigenous peoples ([1](#)).

Nepstad *et al.* correctly emphasize that many gains in Amazonian environmental protection are fragile, but we believe that they go too far in implying that such improvements could realistically control the impacts of massive new infrastructure developments. Our view is supported by negative trends like the significant acceleration of Amazonian deforestation during the past decade ([2](#)), rampant illegal logging and gold mining ([3](#)), and a panoply of destructive activities in southern Pará ([4](#)). Several proposed projects, including major highways that would bisect large forest tracts, are likely to promote large-scale invasions by farmers, loggers, and hunters and dramatically increase rates of forest loss and fragmentation ([5-7](#)). Such projects could easily open a Pandora's box of exploitive activities that are beyond the government's capacity to control.

Economic development is indeed needed in Amazonia, but many proposed megaprojects, such as paving the Cuiabá-Santarém highway, would mainly benefit wealthy soybean exporters in central

- ▶ dEbate: [Submit a response](#) to this article
- ▶ Similar articles found in: [SCIENCE Online](#) [ISI Web of Science](#)
- ▶ Search Medline for articles by: [Laurance, W. F.](#) || [Diaz, M. d. C. V.](#)
- ▶ Search for citing articles in: [ISI Web of Science \(1\)](#)
- ▶ Alert me when: [new articles cite this article](#)
- ▶ [Download to Citation Manager](#)

Brazil, not the Amazonian poor ([1](#)). Nepstad *et al.* also stretch plausibility to suggest that much of the US\$70 million that the soybean exporters expect to save annually would find its way, through highway tolls or taxes, to frontier governance in Amazonia.

Finally, Nepstad *et al.* suggest that recent interministerial seminars in the Brazilian Congress could signal a shift in government attitudes toward Amazonian infrastructure development. However, there is no compelling evidence that the planning process has fundamentally changed ([1](#), [2](#)), and the threats to Amazonian ecosystems remain very real.

**William F. Laurance,**  
Smithsonian Tropical Research Institute,  
Apartado 2072, Balboa,  
Republic of Panamá.  
Biological Dynamics of Forest Fragments Project,

**Philip M. Fearnside**  
Department of Ecology,  
National Institute for Amazonian Research,  
Caixa Postal 478,  
Manaus, AM 69011-970,  
Brazil.

E-mail: [laurancew@tivoli.si.edu](mailto:laurancew@tivoli.si.edu) and [pmfearn@inpa.gov.br](mailto:pmfearn@inpa.gov.br)

## References and Notes

1. P. M. Fearnside, *Environ. Conserv.* **28**, 23 (2001).
2. W. F. Laurance, A. Albernaz, C. Da Costa, *Environ. Conserv.* **28**, 305 (2001).
3. W. F. Laurance, *Trends Ecol. Evol.* **13**, 411 (1998).
4. P. M. Fearnside, *World Devel.* **29**, 1361 (2001).
5. W. F. Laurance *et al.*, *Science* **291**, 438 (2001).
6. *Avança Brasil: Os Custos Ambientais para a Amazônia* (Instituto de Pesquisa Ambiental da Amazônia, Belém, Brazil, 2000 <http://www.ipam.org.br>).
7. G. Carvalho, A. Barros, P. Moutinho, D. Nepstad, *Nature* **409**, 131 (2001).

---

## Response

Laurance and Fearnside are correct in restating the difficulty of regulating land use along new Amazon corridors. However, their comments misrepresent several aspects of this issue and potentially undermine a historical opportunity for science to strengthen Brazil's fragile steps toward frontier governance.

Many transportation infrastructure projects are, indeed, inevitable (or complete), as we confirmed during recent expeditions along 5000 km of proposed highway corridors. For example, the Manaus-Caribbean corridor was completed in 1998, and the Transamazon highway paving will reach Altamira later this year (400 km), as will the first corridor linking Brazil to the Peruvian Amazon. Three paving companies are working on the Cuiabá-Santarém highway, and the Capim River has already been channelized.

Research is needed to compare the potential costs and benefits of alternative economic corridor investments, to help design regional planning approaches that reconcile forest conservation with socioeconomic development, and to identify those planned investments that should not be made (1-3). This opportunity is lost when investments in new economic corridors are condemned generally (3, 4). As a working example of this process, the government's railway, highway, and river channelization proposals for moving soybeans to the Amazon port of Santarém are economically redundant. Paving of the existing road, along which 170,000 people reside, holds the greatest potential to maximize social and economic benefits while minimizing environmental and social costs under a scenario of frontier governance. It is the only alternative that has moved beyond the planning stages.

Regarding deforestation trends, Brazil's satellite-based deforestation estimates provide no information on the occurrence of fire, which dropped sharply since 1999, or on logging, as we reported previously (5). Moreover, to interpret the "acceleration of Amazonian deforestation during the past decade" as evidence that frontier governance is unrealistic seems to ignore the simplest explanation of this trend, which is the economic recession that preceded the Brazilian economic plan Real of 1994 (6). The highest deforestation was in 1995. The best measure of frontier governance is the enforcement of Brazil's ambitious environmental regulations on the active agricultural frontier, as Mato Grosso state has begun to achieve in the target areas of its deforestation regulation program.

As for Laurance and Fearnside's comment that the idea of a highway toll on the Cuiabá-Santarém highway does "stretch plausibility," this idea comes from soy producers themselves. We have discussed with them the possibility of using part of such a toll to finance conservation and development activities along the corridor.

In conclusion, the Brazilian government has taken historical steps toward frontier governance that must be evaluated and reported by the scientific community, even as continuing environmental and social problems are analyzed and documented. The scientific challenge is to move beyond sweeping condemnation of infrastructure investments that are already made, and being made, or risk fostering a self-fulfilling prophecy of business-as-usual forest destruction.

**Daniel Nepstad,\***

Woods Hole Research Center,  
Woods Hole, MA 02543-0296, USA.

Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré,  
669 Bairro, Nazaré,  
66035-170 Belém, Pará,  
Brazil.

**David McGrath,**

Woods Hole Research Center,  
Woods Hole, MA 02543-0296, USA.

Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré,  
669 Bairro, Nazaré,  
66035-170 Belém, Pará,

Brazil.

Universidade Federal Do Pará,  
Avenida Augusto Corre, nº 01,  
Campus da Universidade--Guamá,  
CEP 66.059, Belém, Pará,  
Brazil

**Ane Alencar,**  
Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré,  
669 Bairro, Nazaré,  
66035-170 Belém, Pará,  
Brazil.

**Ana Cristina Barros,**  
Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré,  
669 Bairro, Nazaré,  
66035-170 Belém, Pará,  
Brazil.

**Georgia Carvalho,**  
Woods Hole Research Center,  
Woods Hole, MA 02543-0296, USA.  
Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré,  
669 Bairro,  
Nazaré,  
66035-170 Belém, Pará,  
Brazil.

**Marcio Santilli,**  
Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré, 669 Bairro, Nazaré,  
66035-170 Belém, Pará,  
Brazil.

**Maria del C. Vera Diaz**  
Instituto de Pesquisa Ambiental da Amazônia (IPAM),  
Avenida Nazaré,  
669 Bairro, Nazaré,  
66035-170 Belém, Pará,  
Brazil.

\*To whom correspondence should be addressed.  
E-mail: [dneptad@whrc.org](mailto:dneptad@whrc.org)

## References and Notes

1. D. Nepstad *et al.*, *For. Ecol. Manag.* **154**, 395 (2001).
2. *Avança Brasil: Os Custos Ambientais para a Amazônia* (Instituto de Pesquisa Ambiental da Amazônia, Belém, Brazil, 2000, <http://www.ipam.org.br>).
3. G. Carvalho *et al.*, *Nature* **409**, 131 (2001).
4. D. Nepstad *et al.*, "Science and the future of Amazon policy," *Science dEbates* [online] (18 July 2001), available at <http://www.sciencemag.org/cgi/eletters/291/5503/438#335>
5. D. Nepstad *et al.*, *Nature* **398**, 505 (1999).
6. D. McGrath, unpublished data.

- ▶ dEbates: [Submit a response](#) to this article
- ▶ Similar articles found in:  
[SCIENCE Online](#)  
[ISI Web of Science](#)
- ▶ Search Medline for articles by:  
[Laurance, W. F.](#) || [Diaz, M. d. C. V.](#)
- ▶ Search for citing articles in:  
[ISI Web of Science \(1\)](#)
- ▶ Alert me when:  
[new articles cite this article](#)
- ▶ [Download to Citation Manager](#)

Volume 295, Number 5560, Issue of 1 Mar 2002, pp. 1643-1644.

Copyright © 2002 by The American Association for the Advancement of Science. All rights reserved.

Functional Genomics

Career Resources  
for Europe's Scientists



FREE ACCESS FOR ALL OF EUROPE!