POLICY FORUM: CONSERVATION

Wildlife Harvest in Logged Tropical Forests

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The international community has responded to the steady loss of tropical rainforests (*1*) by adopting policies that, rather than strictly protecting these forests, promote their sustainable use (*2*). Although there are deep concerns about this approach (*3*, *4*), there remains a broad consensus that tropical forestry, if modified through policy and technical adjustments, can serve as a conservation strategy by discouraging the conversion of forest lands (*5*). However, the increased access to the world's tropical forests has generated a very significant harvest of another resource: wildlife.

This loss of tropical forest wildlife has a direct impact on forest-dwelling people. Ever since they first inhabited rainforests some 40,000 years ago, people have hunted animals for food, and even today most tropical forests are hunted by local peoples (*6*–*8*). The largely subsistence harvest in the Brazillian Amazon is estimated at 67,00 to 164,000 metric tons of wild meat per year (*9*). Many tropical forest peoples rely on wild meat for over 50% of their protein (*6*, *7*, *10*). Loss of wildlife resources threatens people's health and well-being and affects their cultural integrity (*11*, *12*).

The wildlife harvest, even when primarily for subsistence, affects the survival of forest-dwelling animals as well. The harvest in the Brazilian Amazon is estimated at 9.6 to 23.5 million mammals, birds, and reptiles (*9*). Almost all species with body masses greater than 1 kg, and sometimes even smaller, are harvested (*6*, *7*, *9*). Even light hunting in the absence of habitat disturbance can significantly depress wildlife populations, and heavy hunting can drive them to local extinction (*7*, *13*). Many large-bodied, slow-breeding species of special conservation concern [such as great apes, large carnivores, and elephants (*14*)] are especially vulnerable.

Finally, the loss of wildlife also threatens the sustainability of tropical forestry itself, because many of the species most affected by hunting are those that play keystone roles in maintaining tropical forests (*13*, *15*). Most timber-harvesting systems have no provision for regeneration other than natural processes which, in turn, depend on wildlife for tree pollination and seed dispersal. Especially in the neotropics, the seeds of many commercially exploited timber trees are dispersed by large-bodied mammal, bird, and reptile species (*16*). Recruitment of timber species depends on maintaining the integrity of these wildlife communities.

Truck carrying logging workers and freshly killed duikers to local markets in Northern Congo.

Commercial logging hugely increases the harvest of wildlife from tropical forests by opening up remote forest areas, bringing in people from other regions, and changing local economies and patterns of resource consumption. Every year, logging opens up an additional 50,000 to 59,000 km^2 (*17*, *18*). Logging operations create an extensive network of roads, which link to the national road system. These roads and the trucks that travel them become conduits for a vast commercial trade in wild meat. Meat is transported from remote, previously inaccessible forests for sale in towns. In the tropical forests of Africa, the annual harvest of bushmeat might exceed 1 million metric tons per year, much of it coming through such increased access to forests that are being logged (*19*). In kilograms per square kilometer, this harvest is 20 to 50 times greater than the largely subsistence harvest of the Brazilian Amazon. In the Malaysian state of Sarawak in 1996, the wild meat trade was conservatively estimated to be more than 1000 tons per year, with almost all of the meat coming out over logging roads (*20*).

Commercial logging also results in the immigration of large numbers of workers into the forest, where they often hunt for their own consumption. Such people are frequently outsiders, living in the area only temporarily, with no incentive to conserve the resource for the future. In Sarawak, for example, the annual catch by hunters in a single logging camp of about 500 people was calculated at 1149 animals, or 29 metric tons of meat per year (*20*). In a single logging camp of 648 people in the Republic of Congo, the annual harvest was 8251 individual animals, equivalent to 124 tons of wild meat (*21*).

Commercial logging also generates a cascade of changes within local communities that further exacerbate the impact on wildlife populations. Because wild meat has a high value per unit weight compared to other forest products, it is a valuable commodity. Other wildlife products such as horns, ivory, and skins have even greater value. Local forest communities are thus increasingly drawn into a market economy involving wildlife. Increased money allows hunters to take advantage of new hunting technologies (such as cartridges, guns, snare wires, outboard motors, and headlamps), which in turn allow more efficient harvests. Where logging activities stimulate the local economy, increased income drives up the demand for wild meat. For example, per capita harvest rates in local communities adjacent to logging roads in Congo were three to six times higher than in communities remote from such roads,

Logging trucks in Sarawak.

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and up to 75% of the meat (by weight) is sold (*21*); a similar situation has been documented in Bolivian camps (*22*).

Those of us concerned with tropical forests have focused on the loss of the trees and forest cover with little policy discussion of the harvest of wildlife. This has been due to a variety of factors: our cultural distaste for addressing issues involving dead animals, the moral and social complexity of a problem in which local forest people were doing much of the hunting, and the lack of information. Identifying a solution is also difficult because most of the hunting in tropical forests is not heavily capitalized or industrialized, and it is difficult to impose regulatory mechanisms on an activity that is so multifaceted and diffuse.

To date, attempts to regulate the harvest of tropical forest wildlife have focused on national government attempts to regulate and educate individual hunters. However, most countries with tropical forests lack governmental institutions to manage the activities of hunters, making it impractical to control snare or shotgun use, establish hunting quotas or seasons, regulate what ages and sexes of animals are hunted, or educate individual hunters.

As commercial forestry has directly and indirectly created the conditions for increased wildlife harvests, regulatory mechanisms should focus on timber companies and forest concessionaires. In remote forest areas, these companies are almost always the only significant institutional presence and are the institutions best equipped to address the problem. National legislation has begun the process of involving logging companies in the management of wildlife populations. In Sarawak, a recent law bans all commercial trade in wildlife and wildlife products taken from the wild (*23*). Although government agencies can enforce the law in urban areas, in rural areas, logging companies have been instructed to enforce the trade ban in their own concessions. They are not to allow their vehicles to carry wild meat or their staff to hunt (*24*). In addition, the companies have to ensure that domestic animal protein is brought into logging camps for the workers. Similar legislation has been enacted in Bolivia (*25*), and the 1996 Bolivian Forestry Law requires detailing of specific actions by logging companies, as well as the establishment of "ecological easements" and nature reserves within concessions (*26*).

Although national legislation can provide both negative and positive incentives, ultimately the move toward sustainable forestry will depend on a cultural shift within the logging industry. The industry must acknowledge that current logging practices are rarely sustainable (*4*) in terms of the trees themselves, let alone in terms of the forest animals. If sustainable forestry is to become the conservation tool that has so often been touted, it must address the sustainability of all elements of the rainforest ecosystem.

Evidence for positive change can be found in the participation by some corporate executive officers of forestry product companies in a continuing ad hoc forum with environmental nongovernmental organizations and the World Bank (*27*). "Green labeling" and independent third-party certification can provide an additional positive incentive to commercial forest managers and companies to support good practices (*28*). Nevertheless, progress on a world scale has been miniscule, and in only a tiny fraction of forests presently being logged have companies demonstrated any concern for long-term stewardship of resources or for the sustainability of tropical forestry (*4*).

Policy discussions and industry standards for the sustainability of tropical forestry must include consideration of wildlife. All involved must recognize that logging at almost any intensity will drive some components of rainforest biodiversity to local extinction (*29*). Conservation of these elements will have to be based on areas of strict protection. If we do not see the animals for the trees, the wildlife on which both the local people and the long-term health of the forest depend will be lost.

References and Notes

1. N. Myers, *Conversion of Tropical Moist Forests* (National Academy Press, Washington, DC, 1980); *Forest Resource Assessment 1990: Tropical Countries* [*Forestry Paper 112*, Food and Agriculture Organization of the United Nations (UN), Rome, Italy, 1993]; *World Bank Atlas 1998* (World Bank, Washington, DC, 1998).
2. International policies supporting "sustainable" or "managed" logging include the World Conservation Strategy (1981), the Tropical Forest Action Plan (1985), the International Tropical Timber Agreement (1986), the Brundtland Commission Report (1987), Agenda 21 of the UN Conference on Environment and Development (1992), and the Convention on Biological Diversity (1993).
3. D. Ludwig, R. Hilborn, C. Walters, *Science* **260**, 17 (1993); R. Rice, R. Gullison, J. Reid, *Sci. Am.* **276**, 34 (April 1997).
4. I. Bowles, R. Rice, R. Mittermeier, G. Fonseca, *Science* **280**, 1899 (1998).
5. T. Panayatou and P. Ashton, *Not by Timber Alone: Economics and Ecology for Sustaining Tropical Forests* (Island Press, Washington, DC, 1992); N. Johnson and B. Cabarle, *Surviving the Cut: Natural Forest Management in the Humid Tropics* [World Resources Institute (WRI), Washington, DC, 1993]; G. Hartshorn, *Ann. Rev. Ecol. Syst.* **26**, 155 (1995).
6. W. Vickers, *Interciencia* **9**, 366 (1984); K. Redford and J. Robinson, *Am. Anthropol.* **89**, 412 (1987); C. Hladik *et al.*, *Tropical Forests, People, Food: Biocultural Interactions and Applications for Development* (UN Educational, Scientific, and Cultural Organization, Paris, France, 1993).
7. J. Robinson and E. Bennett, Eds., *Hunting for Sustainability in Tropical Forests* (Columbia Univ. Press, New York, 1999).
8. Even in the absence of logging, wildlife harvesting is significant: Average rates of hunting of large mammals (>1 kg adult body mass) in tropical forests are about 6.0 animals/km^2/year in Southeast Asia (n = 2 studies), 17.5 animals/km^2/year in Africa (n = 2 studies), and 8.1 animals/km^2/year in Latin America (n = 5 studies) [in (*7*)].
9. J. Robinson and K. Redford, Eds., *Neotropical Wildlife Use and Conservation* (Univ. of Chicago Press, Chicago, IL, 1991); C. Peres, *Conserv. Biol.*, in press.
10. B. Nietschmann, *Between Land and Water* (Seminar Press, New York, 1973); R. Hames and W. Vickers, *Adaptive Responses of Native Amazonians* (Academic Press, New York, 1983); K. H. Redford, R. Godshalk, K. Asher, *What About the Wild Animals? Wild Animal Species in Community Forestry in the Tropics* (Food and Agriculture Organization, Rome, 1995).
11. N. Kwapena, *Environmentalist* **4**, 22 (1984); J. Brosius, *Sarawak Mus. J.* **36** (no. 57, new series), 173 (1986).
12. A. Stearman, in (*7*).
13. K. Redford, *BioScience*, **42**, 412 (1992); J. Robinson and R. Bodmer, *J. Wildl. Manage.* **63**, 1 (1999).
14. J. Mills and P. Jackson, *Killed for a Cure: A Review of the Worldwide Trade in Tiger Bone* (Traffic International, Cambridge, 1994); S. Nash, *Still in Business: The Ivory Trade in Asia, Seven Years after the CITES Ban* (Traffic International, Cambridge, 1997); Ape Alliance, *The African Bushmeat Trade—A Recipe for Extinction* (Ape Alliance, London, 1998).
15. M. Powers *et al.*, *BioScience*, **46**, 609 (1996).
16. H. Howe and G. Vande Kerckhove, *Ecology* **62**, 1093 (1981); A. Gautier-Hion *et al.*, *Oecologia* **65**, 324 (1985); M. Willson, A. Irvine, N. Walsh, *Biotropica* **21**, 133 (1989); C. Tutin, E. Williamson, M. Rogers, M. Fernandez, *J. Trop. Ecol.* **7**, 181 (1991).
17. T. Whitmore and J. Sayer, in *Tropical Deforestation and Species Extinction*, T. Whitmore and J. Sayer, Eds. (Chapman & Hall, London, 1992); WRI, *World Resources 1994–1995* (Oxford Univ. Press, New York, 1994).
18. In Asia, Africa, and Latin America, an estimated 58, 19, and 28%, respectively, has already been logged by commercial enterprises [A. Grieser Johns, *Timber Production and Biodiversity Conservation in Tropical Rain Forests* (Cambridge Univ. Press, Cambridge, 1997)].
19. D. Wilkie and J. Carpenter, *The Impact of Bushmeat Hunting on Forest Fauna and Local Economies in the Congo Basin* (unpublished report, WCS, Bronx, NY, 1998).
20. WCS/Sarawak Forest Department, *A Master Plan for Wildlife in Sarawak* (Sarawak Forest Department, Kuching, Sarawak, Malaysia, 1996).
21. P. Auzel and D. Wilkie, in (*7*).
22. D. Guinart, *Los Mamiferos del Bosque Semideciduo Neotropical de Lomerio* (*Bolivia*). *Interacción Indigena*, thesis, Universitat de Barcelona (1997); D. Rumiz and L. Solar, *La caza, su impacto y aporte económico en una concesión forestal del Bajo Paraguá* (BOLFOR, Santa Cruz, Bolivia, 1996).
23. State Government of Sarawak, *Wild Life Protection Ordinance*, Sarawak Government Gazette, Vol. VI (NS), No. 2 (1998)
24. Rural communities and their leaders have given strong support to the trade ban because hunting for subsistence is still allowed and they see these measures as conserving their wildlife resources [State Government of Sarawak, *Proceedings of the Dewan Undangan Negeri, First Sitting* (Kuching, Sarawak, Malaysia, 1998)].
25. Government of Bolivia, *Historical Ecological Pause* and its regulations (DS 22407, La Paz, Bolivia, 1990).
26. Government of Bolivia, *Forestry Law 1700* and its regulations (DS 24453, La Paz, Bolivia, 1996).
27. Some companies are actively collaborating with conservation programs to establish best practices for wildlife management on concessions—for example, the Congolaise Industrielle des Bois in Congo and the Samling Strategic Corporation in Sarawak are collaborating with WCS field programs. Another encouraging sign is an initiative involving the World Wildlife Fund (WWF) and the World Bank that promotes sustainable commercial forestry [*The World Bank/WWF Alliance for Forest Conservation and Sustainable Use*, fact sheet, 29 April 1998].
28. V. Viana *et al.*, *Certification of Forest Products: Issues and Perspectives* (Island Press, Washington, DC, 1996); Forest Stewardship Council, *Principles and Criteria for Forest Management* (Oaxaca, Mexico, 1996).
29. P. Frumhoff, *BioScience*, **45**, 456 (1995); I. Noble and R. Dirzo, *Science* **277**, 522 (1997); K. Bawa and R. Seidler, *Conserv. Biol.* **12**, 46 (1998).

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