and we stand by our analysis and our conclusion that it has reduced the likely range of the CO_2 release from tropical forests. Over the past decade, our research has confirmed our preliminary estimate that the destruction of tropical forests released probably less than 2 GT of carbon in 1980 (*2, 3, 12*). During this period, the estimates by Woodwell, Houghton, and their colleagues of the release from the tropics in 1980 have decreased from 1 to 7 GT to 0.9 to 2.5 GT (*5–7, 13*). Both groups have contributed to reducing the uncertainty. Nevertheless, it appears that part of the reduction in their estimate results from two ideas we incorporated into our work first: the importance of distinguishing between temporary and permanent clearing and the likelihood that early estimates of tropical forest biomass were too high. The second idea was a consequence of our collaboration with Brown and Lugo, whose work on tropical forest biomass has reduced much of the uncertainty about the size and extent of tropical forests.

The issues concerning temperate and boreal forests that Sedjo has raised are interesting. As our focus was the role of tropical forests in the carbon cycle, we did not address these issues in our article beyond citing several studies that discussed them (*1*, references 18, 19, and 53). Predicting the consequences of climate change is even more risky than trying to balance the carbon budget, but also, perhaps, more important.

Finally, our original conclusion (*1*, p. 46) bears repeating:

> Thus, there is some possibility, *how large we cannot say*, that the global carbon budget can be balanced without postulating another sink *if* the actual oceanic uptake is closer to Takahashi's estimate than to those of the other geochemists. If the other geochemists are correct, however, we must find a sink that can accommodate not only 0.1 to 1.1 GT of fossil-fuel carbon in 1980 but also 0.3 to 1.7 GT of carbon from forests [emphasis added].

This, to our minds, is neither an assertion that the carbon budget *is* balanced, nor an argument for accepting continued uncertainty, forest destruction, or increasing levels of atmospheric CO_2.

R. P. DETWILER
Covington & Burling,
1201 Pennsylvania Avenue NW,
Washington, DC 20044
CHARLES A. S. HALL
College of Environmental
Sciences and Forestry, Illick Hall,
State University of New York,
Syracuse, NY 13210

REFERENCES AND NOTES

1. R. P. Detwiler and C. A. S. Hall, *Science* **239**, 42 (1988).
2. R. P. Detwiler, *Biogeochemistry* **2**, 67 (1986).
3. R. P. Detwiler, C. A. S. Hall, P. Bogdonoff, *Environ. Manage.* **9**, 335 (1985).
4. C. A. S. Hall, R. P. Detwiler, P. Bogdonoff, S. Underhill, *Environ. Manage.* **9**, 313 (1985).
5. R. A. Houghton *et al.*, *Nature* **316**, 617 (1985).
6. ———, *Ecol. Monogr.* **53**, 235 (1983).
7. G. M. Woodwell *et al.*, *Science* **222**, 1081 (1983).
8. S. Brown and A. E. Lugo, *Biotropica* **14**, 161 (1982).
9. ———, *Science* **223**, 1290 (1984).
10. W. Seiler and P. J. Crutzen, *Clim. Change* **2**, 207 (1980).
11. Food and Agriculture Organization, *Los Recursos Forestales de la America Tropical* (FAO/UNEP Tropical Forest Resources Assessment Project, Rome, 1981); *Forest Resources of Tropical Africa* (FAO/UNEP Tropical Forest Resources Assessment Project Rome, 1981), parts 1 and 2; *Forest Resources of Tropical Asia* (FAO/UNEP Tropical Forest Resources Assessment Project, Rome, 1981).
12. R. P. Detwiler and C. A. S. Hall, in *The Role of Tropical Forests on the World Carbon Cycle*, S. Brown, A. E. Lugo, B. Liegel, Eds. (U.S. Department of Energy, CONF-800350, NTIS, Springfield, VA, 1980), pp. 140–156; R. P. Detwiler, C. A. S. Hall, P. Bogdonoff, in *Global Dynamics of Biospheric Carbon*, S. Brown, Ed. (U.S. Department of Energy, CONF-810131, NTIS, Springfield, VA, 1982), pp. 141–159; R. P. Detwiler, C. A. S. Hall, P. Bogdonoff, C. McVoy, S. Tartowski, in *Energy and Ecological Modelling*, W. J. Mitsch, R. W. Bosserman, J. M. Klopatek, Eds. (Elsevier, Amsterdam, 1981), pp. 69–90.
13. G. M. Woodwell *et al.*, *Science* **199**, 141 (1978).

Being the lead author of the two most frequently cited papers (*1, 2*) on the topic of biomass of tropical forests, I would like to add my comments to those of Houghton and Woodwell and the response by Detwiler and Hall.

A major point of discussion between Detwiler and Hall and Houghton rests on the values of tropical forest biomass based on direct sampling. The source of data used for these estimates is (*1*). In this paper we grouped biomass of tropical forests into six types on the basis of the life zone system that relates to climate but not to geographical region. Houghton and his colleagues (*3*) regrouped these data into nine types on the basis of climate and continent. Because I am familiar with the data base, I was able to divide the data up into the same groups as those of Houghton *et al.*, and I obtained the following results for the carbon contents of tropical forests, in tons of carbon per hectare (using 0.45 to convert biomass to carbon, as does Houghton).

Forest type	America	Africa	Asia
Moist	155	187	160
Seasonal	none	178	105
Dry	27	63	27

Houghton *et al.* (*3*) obtained the following results from the same data base.

Forest type	America	Africa	Asia
Moist	176	210	250
Seasonal	158	160	150
Dry	27	90	60

It is clear that we do not obtain the same results. I report no data for seasonal forests in America, and the mean values for moist forests in all three areas that I obtain are more like those Houghton *et al.* used for seasonal forests. I have not been able to obtain any of the high values that Houghton *et al.* reported. In fact the highest value that I reported in (*1*) was 242 tons of carbon per hectare for a moist forest in Africa.

I believe that values of the carbon content of tropical forests used by Detwiler and Hall in their model are more defensible than those of Houghton *et al.* because Detwiler and Hall conferred with me many times to ensure that they had interpreted the data correctly. Thus it is not surprising that Houghton *et al.* and Detwiler and Hall disagree on the upper end of the range of the carbon flux to the atmosphere from tropical deforestation. Use of the high but unsubstantiated numbers given above by Houghton *et al.* in their models would account for most of the discrepancies between the two groups.

Of more importance to resolving the role of tropical forests in the global carbon cycle is the need for accurate and precise data on the carbon content of the forests actually being cleared. New approaches to this problem are now being initiated by Hall, Houghton, Woodwell, and me, working as a group, and it is hoped that significant progress will be made in resolving these issues on tropical forest biomass.

SANDRA BROWN
Department of Forestry,
College of Agriculture,
University of Illinois at
Urbana-Champaign,
Urbana, IL 61801

REFERENCES

1. S. Brown and A. E. Lugo, *Biotropica* **14**, 161 (1982).
2. ———, *Science* **223**, 1290 (1984).
3. R. A. Houghton *et al.*, *Nature* **316**, 617 (1985).

Cataract Removal

Robert Pool, in his article "Trapping with optical tweezers" (Research News, 26 Aug., p. 1042) summarizes some of the uses of lasers. However, lasers are not used to "burn off cataracts in eye surgery." This is a common misconception of the lay public. Lasers can be used to create a posterior capsulotomy after cataract surgery. However, they cannot be used to remove a cataract, which is a significant chunk of tissue.

RANDOLPH L. JOHNSTON
Johnston Eye Clinic,
Post Office Box 249,
Cheyenne, WY 82003