

## AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

*Science* serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

### Editorial Board

1977: WARD GOODENOUGH, CLIFFORD GROBSTEIN, H. S. GUTOWSKY, N. BRUCE HANNAY, DONALD KENNEDY, NEAL E. MILLER, RAYMOND H. THOMPSON

1978: RICHARD E. BALZHISER, JAMES F. CROW, HANS LANDSBERG, EDWARD NEY, FRANK W. PUTNAM, MAXINE SINGER, PAUL E. WAGGONER, F. KARL WILLENBROCK

### Publisher

WILLIAM D. CAREY

### Editor

PHILIP H. ABELSON

### Editorial Staff

#### Managing Editor

ROBERT V. ORMES

#### Assistant Managing Editor

JOHN E. RINGLE

#### Business Manager

HANS NUSSBAUM

#### Production Editor

ELLEN E. MURPHY

*News and Comment:* BARBARA J. CULLITON, *Editor*; LUTHER J. CARTER, CONSTANCE HOLDEN, DEBORAH SHAPLEY, R. JEFFREY SMITH, NICHOLAS WADE, JOHN WALSH. *Editorial Assistant*, SCHERRAINE MACK

*Research News:* ALLEN L. HAMMOND, *Editor*; RICHARD A. KERR, GINA BARI KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, WILLIAM D. METZ, ARTHUR L. ROBINSON. *Editorial Assistant*, FANNIE GROOM

*Associate Editors:* ELEANORE BUTZ, MARY DORFMAN, SYLVIA EBERHART, JUDITH GOTTLIEB

*Assistant Editors:* CAITILIN GORDON, RUTH KULSTAD, LOIS SCHMITT

*Book Reviews:* KATHERINE LIVINGSTON, *Editor*; LINDA HEISERMAN, JANET KEGG

*Letters:* CHRISTINE KARLIK

*Copy Editors:* ISABELLA BOULDIN, OLIVER HEATWOLE

*Production:* NANCY HARTNAGEL, JOHN BAKER; YA LI SWIGART, ELEANOR WARNER; JEAN ROCKWOOD, LEAH RYAN, SHARON RYAN

*Covers, Reprints, and Permissions:* GRACEY FINGER, *Editor*; CORRINE HARRIS, MARGARET LLOYD

*Guide to Scientific Instruments:* RICHARD SOMMER

*Assistant to the Editors:* RICHARD SEMIKLOSE

*Membership Recruitment:* GWENDOLYN HUDDLE

*Member and Subscription Records:* ANN RAGLAND

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Area code 202. General Editorial Office, 467-4350; Book Reviews, 467-4367; Guide to Scientific Instruments, 467-4480; News and Comment, 467-4430; Reprints and Permissions, 467-4483; Research News, 467-4321; Cable: *Advances*, Washington. For "Instructions for Contributors," write the editorial office or see page xi, *Science*, 26 March 1976.

BUSINESS CORRESPONDENCE: Area Code 202. Business Office, 467-4411; Circulation, 467-4417.

### Advertising Representatives

*Director:* EARL J. SCHERAGO

*Production Manager:* MARGARET STERLING

*Advertising Sales Manager:* RICHARD L. CHARLES

Sales: NEW YORK, N.Y. 10036: Herbert L. Burkland, 11 W. 42 St. (212-PE-6-1858); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-DE-7-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581)

ADVERTISING CORRESPONDENCE: Room 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE-6-1858.

## Soil and Coal: A Cost-Benefit Inquiry

The Secretary of Interior has proposed a moratorium on strip mining of "prime" agricultural land. Even though the recently passed strip-mining bill does not incorporate this specific proposal, its discussion raises some fundamental questions which should be of concern to conservationists, economists, and scientists generally, as well as to lawyers and politicians.

- Is society really faced with a choice between food and energy, or is this a false issue? More likely, the choice is between more coal and a loss of topsoil (permanent or temporary, depending on the degree of restoration).

- To make a rational rather than emotional choice, can one establish the short-term and long-term values to society of both soil and coal?

- Are these values properly expressed by the price of coal and farmland?

- If the market price does not fully express the long-term value of farmland to society, how should this value be determined?

- How much farmland would have to be diverted before its value rises?

- How is prime land defined, and why should a moratorium be limited to it?

- How can we identify and minimize any damaging side effects of mining?

Another set of questions is concerned with fair treatment of mining as one of the important uses of land.

- Does the proposal constitute a "taking" of property rights (in a constitutional sense) by depriving the landowner of mineral royalties?

- Why is there no comparable moratorium on other land uses that would divert farmland permanently, such as housing developments and highway construction?

- By the same token, should one not prohibit agricultural over-exploitation of land, which causes substantial soil loss by erosion and thereby represents mining of the soil?\*

A third set of questions recognizes that the agricultural value of strip-mined land can be at least partially recovered with proper restoration measures.

- What is the right amount to spend on land restoration?

- Should the amount be related to the total value of the minerals extracted, or to the value (and price) of the land itself?

For example, prime wheat land in North Dakota sells for up to \$300 an acre. The value of the mined lignite may be as high as \$300,000 an acre. Depending on the degree of restoration, the cost may range from a few hundred to several thousand dollars per acre. A major mining company in New Mexico has been spending \$4000 to \$5000 per acre, on land selling for \$55 per acre, merely to speed up natural seeding and restoration. Some additional questions are raised by this discussion.

- Since costs rise very rapidly with the degree of restoration, how does one determine the optimum degree?

- Can the benefits from restoration exceed the original value of the land so as to justify these very high restoration costs?

- What would be the best social use of the funds earmarked for restoration: restoration of strip-mined land in other areas; restoration of eroded farmland; or restoration of city slums?

This discussion has broader implications—for example, to the mining of minerals on public lands and even in national parks and wilderness areas. It is well to keep in mind that while coal mining disturbs more land than other mining activities, the areas involved can be quite small. As an example, if the total U.S. coal production, 600 million tons per year, were concentrated in the deep beds of Wyoming's Powder River Basin, the amount of land disturbed would be only 10 to 20 square miles a year. This example points to the need for guidelines that can be used to decide the circumstances under which a mineral deposit is more unique and valuable than a piece of farmland or of wilderness area.—S. FRED SINGER, *Department of Environmental Sciences, University of Virginia, Charlottesville 22903*

\*C. H. M. van Bavel, *Science* **197**, 213 (1977).