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**SCIENCE FOR SOCIETY: A Bibliography**

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for  
The Commission on Science Education  
American Association for the Advancement of Science

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## **FOREWORD**

Many people are deeply concerned about the future of man. There are several valid reasons for this apprehension. Atomic, radiological, chemical, and biological means for warfare threaten swift escalation, in a mistrustful world of international anarchy and massive annihilation for upwards of a billion individuals. There are approximately thirty tons of T.N.T. equivalent in atomic weapons for every man, woman and child on earth. These are widely distributed and mounted in many different weapons systems with many different means for delivery. No individual, no group of individuals, no nation, and no group of nations can insure life, liberty, and well-being, locally or generally. Nations do not seem to be moving generally toward reduction of tensions and elimination of risks; they are instead continuing to move apparently willy-nilly in the opposite direction. No armaments can contribute to man's welfare except perhaps to buy time. It is what is done with the time that counts.

Famine with its companion, disease, stalks many parts of the world at this moment. Malnutrition provides the world's most extravagant spoilage of physical development and intelligence. Millions now living are consigned to starvation to death unless something drastic is done immediately about food production and distribution.

On a somewhat less compelling scale of risks lies the very real possibility of ruining the whole biological and ecological balance of the world through mismanagement and pollution. This is affecting initially mainly the most civilized regions, but unless put in check promptly it will inexorably engulf all habitable areas of the globe.

Imbalance of resources and wealth, erosion of old cultures, corrosive poverty, political rigidity, and racial conflicts all bear upon mankind in the context of a growing realization that changes for the better are not only possible but can, potentially, be achieved in time to preclude any of these tragedies from overwhelming the world.

Men have had to think their way out of difficulties since time immemorial, on lesser scales of territory, intensity, and complexity and on a generally longer scale of time. It is the human brain that must do the work. It is necessary for many individuals in many lands to recognize the difficulties, to imagine achievable solutions, and to translate these solutions into substantial means for constructive adaptation on a world-wide scale. Nothing short of this will do.

It remains to be seen whether evolution has succeeded in producing an unsuccessful freak of nature, man, who will die out of his own confounding and drag along in his self-destruction much of the rest of evolution, or whether mankind will cross the threshold to eliminate the greatest risks and perturbations in favor of all mankind being able to enjoy a secure life with improved qualities in all of its dimensions. Within one generation, for the first time since the origins of the earth, both the most dreadful and the most vaunted potentialities for life have become achievable. What will you have?

Professor John Moore has undertaken to help students and teachers discover for themselves the present state of the human condition and to inquire for themselves concerning the evolutionary experiment now ongoing involving the transition between

man being mainly *Homo faciens*, the doer, the manufacturer, and *Homo sapiens*, the wise one, a name that we have aspired to but which we have not yet achieved except occasionally. The Commission on Science Education defines education in relative terms: one person being more educated than another on grounds that he knows to a fuller extent what may be the consequences of events. Any given individual is likely to have some areas of particular individual competence. Even the best educated individual is likely to have notable weaknesses. The Commission claims that education is not enough. We define a wise person also in relative terms: one person being wiser than another on grounds that he knows, and is positively empathic towards, the social consequences of events.

The Commission, in all of its undertakings, seeks to improve not only science education but the wise utilization of science and technology. Professor Moore has assembled an impressive bibliography, mostly from his own holdings. Making this bibliography widely available should help many of us to become better educated and wiser in respect to the present predicaments and present options facing mankind. Professor Moore, with the Commission standing behind him, launches this volume in the hope that others will contribute to its improvement in subsequent editions and updatings. We do so in the trust that students and teachers alike will be enabled to throw their weight in the balance favoring the long range advantages for all mankind.

April 7, 1970

Robert B. Livingston, M. D.  
Chairman  
Commission on Science Education

## PREFACE

As man's population density and affluence increase, his difficulties in living with himself, with his neighbors, and with the living and nonliving world also increase — and at an alarming rate. Many thoughtful men believe that *Homo sapiens*, the "wise man", must put his wisdom to good use if he is to avoid a catastrophe to his civilization. Few would deny that man now has sufficient information to make the world a satisfying home. But very few believe that it will ever be unless he radically alters his actions, plans, and prejudices. Science and technology may be able to suggest ways to solve man's problems but, unless these ways are accepted, there will be no solutions.

Teachers must bear a heavy responsibility for insuring the use of scientific knowledge for the benefit of man. They must join the ever-increasing group of scientists, technologists, and concerned laymen who are giving serious thought to problems of population, food, pollution, race, aggression, and the quality of life. In an effort to assist the teacher and others interested in increasing their knowledge of these problems, we offer the following bibliography.

There are two main classes of references in this list. First, books — with an emphasis on paperbacks that are inexpensive and easy to obtain. Second, articles that have appeared in various scientific journals and popular magazines. The articles forming the core of the list appeared in *Science* and the *Scientific American* in the decade 1960-1969. These two journals are outstanding in the amount of attention they devote to the subject of science and society and they are usually available in school libraries and public libraries. In addition, the following have been checked for appropriate references: *American Scientist* (1965-1969), *Atlantic* (1965-1969), *Bioscience* (1967-1969), *Bulletin of the Atomic Scientists* (1965-1969), *Center Magazine* (1967-1969), *Daedalus* (1961-1969), *Environment* (1965-1969), *Esquire* (1967-1969), *Fortune* (1968-1969), *Harper's* (1965-1969), *Natural History* (1960-1969), *New Republic* (1969), *New Scientist* (1968-1969), *New York Review of Books* (1969), *Perspectives in Biology and Medicine* (1965-1969), *Saturday Review* (1968-1969).

Our goal has been to provide teachers with current references and, from these, easy access to the older literature. Even though more than 100,000 pages have been scanned, this bibliography is far from complete.

Both *Science* and the *Scientific American* have valuable information that has not been included in this bibliography. Each issue of *Science* has a section "News and Comment" that consists almost entirely of material relating to science and society. And do not overlook the weekly editorial in *Science*: it is nearly always humane, thoughtful, and pertinent. The *Scientific American* has a smaller and somewhat similar section "Science and the Citizen." The "Features and News" section of *Bioscience* should also be consulted.

Articles in *Science* and the *Scientific American* are often on controversial subjects. This is not surprising since, after all, they are dealing with unresolved problems. Both journals allow the dissenting reader his say; thus, should you be interested in an article, be sure to examine the next few issues for you will generally find valuable appraisals of

the original article. For example, *Science* for May 2, 1969, contained an article by Judith Blake on population policy. The July 11 issue carried comments and criticisms by several readers, with replies by Dr. Blake. On July 25 a long article criticizing Dr. Blake's views was published together with her reply.

**Keeping up to date.** The flood of articles appearing in nearly all magazines and newspapers would seem to suggest that man derives vicarious gratification from reading about his collective articles that mess up the world. Or possibly it is no more than an age-old fascination with a *danse macabre*. But more often than not, articles in the popular press about pollution, population, and so forth lack balance, scientific accuracy, and sufficient information for teachers.

Probably the single most useful source of current information for the teacher is *Science*, with its general articles, "News and Comment" section, and book reviews. But there are many other sources that are exceedingly important. The following information is given in case you might find it easier to keep informed by reading your own copies of journals rather than the library's.

*Science*. Published by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, Washington, D.C. 20005. Weekly. Annual subscription \$12.00. Free to members of the AAAS.

*Scientific American*. 415 Madison Avenue, New York, N.Y. 10017. Monthly. Annual subscription \$10.00.

*Bioscience*. Published by the American Institute of Biological Sciences, 3900 Wisconsin Avenue NW, Washington, D.C. 20016. Sent to members of the AIBS and some of the affiliated societies. Institutional subscriptions are \$18.00 a year (\$20.00 outside of the Americas).

*Daedalus*. Published by the American Academy of Arts and Sciences, 280 Newton Street, Brooklyn Station, Boston, Mass. 02146. \$7.50 a year. Four issues a year, each 200-300 pages. Each issue generally considers a single topic in great depth, such as "Color and race", "The American Negro", "Utopia", "Science and culture"; "Science and technology in contemporary society".

*Bulletin of the Atomic Scientists. A Journal of science and public affairs* (935 E. 60 Street, Chicago, Ill. 60637). Ten issues a year \$8.50.

*The Center Magazine*. Published six times a year by the Fund for the Republic, 2056 Eucalyptus Hill Road, Santa Barbara, California 93103. Available to all associate members of the organization. Annual dues \$10.00. Members receive other publications as well. A scholarly journal dealing with general problems of society.

*Environment*. Published by the Committee for Environmental Information, a group that has done pioneering studies on pollution and misuse of the

environment. Ten issues a year for \$8.50. Orders may be sent to *Environment*, 438 North Skinker Boulevard, St. Louis, Missouri 63130.

*Nature*. (Subscription Department, Macmillan (Journals) Ltd. Brunel Road, Basingstoke, Hampshire, England. \$48.00 by air). This English weekly journal has articles and comments relating to science and society.

*New Scientist*. Another English weekly. Less technical than *Nature*. Annual subscription \$16.00. New Scientist, 128 Long Acre, London WC2, England.

Of the more general periodicals, *Atlantic*, *Harper's*, *Life*, *Look*, *Newsweek*, *Saturday Review*, and *Time* (with its special section "Environment") frequently contain articles in the general area of science and society.

In addition to the standard scientific abstracting journals (*Biological Abstracts*, *Chemical Abstracts*, etc.) the *Reader's Guide to Periodical Literature* should be consulted. It lists articles under headings such as Population, Pollution, Conservation, and Race, that appear in the general periodicals and more popular scientific journals.

**Getting started.** For those teachers who desire a general introduction to the subjects covered by this bibliography, and who have a limited time to devote to the project, may I suggest these books as a start — and in the order given:

Brown, Harrison. 1954. *The Challenge of Man's Future*. New York: Viking Compass Edition. \$1.65.

National Academy of Sciences. 1969. *Resources and Man*. San Francisco: W. H. Freeman. \$2.95.

Udall, Stewart. 1968. *1976: Agenda for Tomorrow*. New York: Harcourt, Brace & World. \$3.75.

Greenberg, Daniel S. 1967. *The Politics of Pure Science*. New York: The New American Library. \$7.95.

Ehrlich, Paul. 1968. *The Population Bomb*. New York: Ballentine. \$0.95.

Scientific American Readings. 1969. *Science, Conflict and Society*. San Francisco: W. H. Freeman. \$5.75.

**Classification of topics.** It is becoming ever clearer that the problems of man and his environment are closely interrelated and depend largely on his numbers. He needs more food because he is becoming more numerous. The more there are of him, the greater the pollution and devastation of the environment. As he crowds into cities, problems of crime, racial tension, and health increase. Many of the references listed deal with these and related subproblems; in an effort to aid the teacher, an attempt has been made to arrange the references under the descriptive subject headings given in the Table of

**Contents.** The references under each heading are divided as **books and articles**. In the case of symposia, the listing is by the first author (plus "and others") and the name of the symposium.

**Acknowledgments.** I am deeply grateful to the following individuals for comments on the manuscript of this bibliography: Bernard Barber, Jerry S. Carlson, Marian Carpelan, Eugene H. Cota-Robles, Sally Gall, Robert Glaser, William T. Kabisch, Edward J. Kormondy, William V. Mayer, Don E. Meyer, Betty C. Moore, James A. Oliver, Ingrith Olsen, Melba Phillips, and James T. Robinson.

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John A. Moore

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THE NATURE OF SCIENCE AND TECHNOLOGY  
IN THE 21ST CENTURY  
A REPORT FOR THE NATIONAL RESEARCH COUNCIL ON SCIENCE AND TECHNOLOGY  
OF THE NATIONAL ACADEMIES OF SCIENCES

# 1. GENERAL REFERENCES

## GENERAL REFERENCES/books

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- Bresler, Jack B. Editor. 1968. *Environments of Man*. Reading, Mass.: Addison-Wesley. An anthology of 24 articles on a broad variety of topics concerned with man, his environment, and his society. \$3.95.
- Brown, Harrison. 1954. *The Challenge of Man's Future*. New York: Viking Compass Edition. \$1.65. One of the outstanding books on the relation of population size and available resources. Possibly the best introduction to the field.
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- Dubcs, René. 1968. *So Human an Animal*. New York: Scribner's. \$2.25. A scientist and humanist considers man's demunization.
- Ehrensaft, Philop and Amitai Etzioni. 1969. *Anatomies of America: Sociological Perspectives*. New York: Macmillan. \$4.95. An anthology of 53 papers, including ones on race, cities, drugs, and population.
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- Hardin, Garrett. 1969. *Population, Evolution, and Birth Control*. A collage of controversial ideas. San Francisco: Freeman. \$2.95. (123 selections — an excellent source.)
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- Jackson, Ellen. 1968. *Subject Guide to Major United States Government Publications*. Chicago: American Library Association. \$5.50.
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- Mead, Margaret. 1970. *Culture and Commitment. A Study in the Generation Gap*. New York: Doubleday. Natural History Press.
- Michael, Donald N. 1968. *The Unprepared Society: Planning for a Precarious Future*. New York: Basic Books. \$4.95.
- National Academy of Sciences. 1969. Committee on Resources and Man of the Division of Earth Sciences. *Resources and Man*. San Francisco: W. H. Freeman. \$2.95. Discusses man's ecology, population, food, minerals, energy.

Osborn, Fairfield. 1948. *Our Plundered Planet*. Boston: Little, Brown. \$1.95.

Rienow, Robert and Leona T. Rienow. 1967. *Moment in the Sun*. New York: Ballentine Books. \$.95.

Scientific American. 1969. *Science, Conflict, and Society*. Introductions by Garrett Hardin. San Francisco: W. H. Freeman. \$5.75. Articles from the Scientific American assembled under these topics: Scientists and Society, The Roots of Social Behavior, Population and Heterogeneity Problems, What Price Progress?, War.

Shepard, Paul and Daniel McKinley. Editors. 1969. *The Subversive Science*. Essays toward an ecology of man. Boston: Houghton Mifflin. \$8.95.

Stewart, George Rippey. 1968. *Not So Rich as You Think*. Boston: Houghton Mifflin. \$5.00. Population, garbage, air pollution, etc.

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Crewe, Albert V. 1967. Science and the war on... *Physics Today*, October 1967, p. 25-30. How science can aid in solutions of problems such as pollution and crime.

Crowe, B. L. 1969. The tragedy of the commons revisited. *Science*, **166**: 1103-1107. Refers to Hardin 1968.

Darling, Frank Fraser and Raymond F. Dasmann. 1969. The ecosystem view of human society. *Impact*, **19**: 109-121.

Darling, Frank Fraser and others. 1969. Human-engineering the planet. *Impact*, **19**: 105-219. A group of articles on ecosystems and man, space research, water, climate, cities, land use.

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Ehrlich, Paul and others. 1969. The biological revolution. *Center Magazine*, November 1969, p. 28-49. The report of a conference that discussed the implications of the biological revolution such as "Medical Ethics", "Human Decision and Human Dignity", "Assessment of Technology and Science", "Environment and the Law", "Is it Science or Technology", "Law or Education", "Recommendations and Conclusions".

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- Neisser, U. 1963. The imitation of man by machine. *Science*, 139: 193-197.
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## 2. POPULATION PROBLEMS

### POPULATION PROBLEMS/books

The references in Section 2 emphasizes the problems of over-population in man and, to a lesser degree, in other organisms. This section has two subsections, *2A. Cities* and *2B. Crowding and Aggression*. References to medical aspects of birth control are in Section 5. For related articles see also Sections 1 and 3.

Applebaum, Philip. 1966. *The Silent Explosion*. Boston: Beacon Press. \$1.95.

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## 2A. Cities

### CITIES/books

The agonizing problems of the cities demand special consideration. Civilization is the product of cities. Sustained progress in the arts and science requires vigorous interaction among men and, until recently, this was possible only where many men lived close to one another. Modern methods of transportation and communication have lessened the need for density to assure progress; nonetheless, cities remain sites of great creativity. Yet today man's problems are most acute in the city. A city may be huge, but as long as its citizens can find suitable employment and lead satisfying lives, there is no population problem. If they cannot, we observe the grim results of an excess of individuals above the carrying capacity of the community: enormous waste of human potential and tragic increases in crime, pollution, disease, poverty, and tension.

One of the best books for background information is Mumford's (1961). Isenberg's (1968) book is a collection of articles that would appeal to students. Tyler takes a tough look at the problems of cities in his 1969 article.

Refer also to Sections 1, 2, 2B, 4, 7, and 10.

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## 2B. Crowding and Aggression

### CROWDING AND AGGRESSION/books

Aggression and other abnormal behavior in animals may result from crowding, that is, when the number of individuals exceeds the capacity of the environment to sustain them. Some observers believe that the crowding of man, especially in cities, is one important cause of his antisocial behavior. If this is so, increases in population will be paralleled by increases in antisocial behavior. See also Sections 7 and 11.

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### 3. AGRICULTURE, FOOD, NUTRITION

#### AGRICULTURE, FOOD, NUTRITION/books

One of the tragic results of overpopulation is that food in sufficient quality and quantity for the world's population is not available. The references in this section relate not only to the general problems in food production and nutrition but also to studies of what should be done to close the gap between demand and supply of food. See also Sections 1, 2, and 6. References to the role of pesticides in agriculture are in Section 4.

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## 4. POLLUTION OF AIR, WATER AND FOOD; PESTICIDES

### POLLUTION/books

As man increases in numbers and affluence, so do his waste products. The technology necessary to clothe, feed, house, move, and entertain him has led to a rapid increase in air pollution (from automobiles, heating, industry, and smoking), water pollution (from sewage and industry), and in food pollution (from pesticide residues, radioactive substances, and harmful chemicals). The more advanced the civilization, the greater the garbage. These books and articles deal with many types of pollution of the environment, including a kind that may seem less obvious than the others: excessive noise, which impairs the purity of the air. See also Sections 1, 6, 10, and 11.

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## 5. MEDICINE, HEALTH, DRUGS

### MEDICINE, HEALTH, DRUGS/books

These references largely relate to the sociological aspects of medicine. Refer also to Section 2 for some of the medical aspects of birth control, even though most of the references for this topic are here. In Section 3 there are some references to food and nutrition that are pertinent to health. Section 4, with its references to pollution, also contains references that relate to health. Biological engineering has obvious implications — the references to this topic are in Section 8. And, as always, some of the references in Section 1 will contain relevant material.

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## 6. NATURAL RESOURCES, CONSERVATION

### NATURAL RESOURCES, CONSERVATION/books

Natural resources are the products of nature used by man. They can be consumed by him (air, food, water, etc.), employed in his technology (minerals, forests, water, air, etc.), used by him for homes, factories, transportation, waste disposal (land, rivers, oceans, air, etc.), or just enjoyed (natural areas for rest, recreation, and health). Population size and affluence are directly related to the demands for natural resources and to the rate of their destruction. Problems of conservation of natural resources are more general than is indicated by the references in this section. Refer especially to Section 4, where questions of pollution of natural resources are considered, and to Section 10 as well. An excellent introduction to the field is the National Academy of Sciences' (1969) "Resources and Man." Conservation of natural resources will be such an important task for man throughout the foreseeable future that some special remarks are in order.

**Conservation.** During this century enormous strides have been made in this country in preserving areas of great natural beauty where wildlife is protected. National Parks, National Seashores, National Monuments, Wilderness Areas, National Wildlife Refuges, as well as similar state and local preserves are under the protection of governmental agencies. In these areas nature has, at least in theory, equal rights with man.

As population increases, the demand for living space, cultivated land, and the exploitation of natural resources will also increase. Thus, conservationists must intensify their efforts if natural areas are to be protected and expanded. If you wish to support such efforts, there are many organizations you may join. Two prominent ones are The Sierra Club (1050 Mills Tower, San Francisco, California 94104. Annual membership \$17.00 the first year; thereafter \$12.00) and the National Parks Association (1701 18th Street, N.W., Washington, D.C. 20009. Annual membership \$6.50). Members of each receive an informative and most attractive magazine.

As our population becomes more urbanized, another problem is becoming increasingly more obvious: many city children have no familiarity with nature. When one's first-hand experience with the animal kingdom includes little besides pigeons, starlings, rats, mice, and roaches, and the only familiar plants are those springing from tiny circles in concrete, it is difficult to develop much appreciation of nature — a state that must be reached before one wishes to conserve nature.

Why should a person raised in a city wish to support National Parks? Teachers and others interested in conservation have an increasing responsibility for showing students that wild nature is important. Carefully planned field trips and visits to museums, zoological gardens, and botanical gardens will help. And do not overlook books, such as those published by the Sierra Club (listed below). These have outstanding photographs that carry the message: it is worthwhile to preserve nature. Some students might respond to the written message: try KILGON (1957) or Terry and Renny Russell.

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Chorley, Richard J. Editor. 1969. *Water, Earth, and Man: A Synthesis of Hydrology, Geomorphology, and Socio-Economic Geography*. London: Methuen (In U.S.A. Barner and Noble). \$2.50.

Ciriacy-Wantrup, S. V. 1968. *Resource Conservation: Economics and Policies*. Berkeley: Univ. of California. Division of Agriculture Sciences. \$4.00.

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## 7. RACE

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## 8. BIOLOGICAL ENGINEERING, EUGENICS

### BIOLOGICAL ENGINEERING, EUGENICS/books

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## 9. THE NATURE OF SCIENCE AND SCIENTISTS

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# 10. SCIENCE, TECHNOLOGY, AND SOCIETY

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The references in this section concern the interrelations of science and technology on the one hand and of science and society on the other. Refer to the remarks at the beginning of Section 9. Sections 1 and 11 have related references and, should you wish even more, refer to Caldwell (1968) below.

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# 11. WAR AND PEACE

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