el. Possibly the mean age of English women at first marriage was falling slightly in the late 18th and early 19th centuries in contrast to trends in many Continental countries at the time, but the evidence at present available allows only a very gradual decline, certainly insufficient to justify strong expressions like "the breakdown of institutional checks." There is some evidence that women in areas of domestic industrial employment married earlier than the national average, and domestic industrial workers were certainly becoming proportionately more numerous in Malthus's England. But we know nothing as yet of the trends in nuptiality and fertility of other occupational groups that were also increasing in relative importance, like farm laborers and factory workers, and, given the very slight downward trend in mean age of women's first marriage, it would clearly be unwise at the moment to accept Petersen's "breakdown" of institutional controls as fundamental to Malthus's thinking. Inevitably, Petersen can produce little evidence of the "breakdown," certainly none of a statistical nature, and he may therefore run the risk here of putting an unjustified gloss on Malthus's thought processes between 1798 and 1803.

In another area, also fundamental to Malthus's model, Petersen is particularly interesting in exploring the dichotomy between Malthus's acceptance of North America's capacity to double its population every 25 years and his warning that such a rate of growth in Europe must inevitably outstrip the rate of growth of resources. In the North America of Malthus's day there was abundant land and a virtual absence of primogeniture; it was because Europe lacked these conditions, Malthus argued, that its population growth must be more constrained. Petersen is right to draw our attention to the fact that Malthus never really reconciled his acceptance of the viability of these rates in one continent with their unviability in another. It is surely correct to emphasize the key place of American population in Malthus's theoretical structure, though in picking upon North America Malthus was merely looking for a verifiable example of something like a maximum human population growth rate in order to show what could be possible without checks, positive or preventive, in a European context. Exactly the same didactic method is employed, as Petersen shows, by the Princeton demographers today: they use Hutterite fertility as a gauge of maximum human fertility against which fertility rates in other societies may be assessed. It is a pity that Petersen went to press just too soon to take advantage of Ansley Coale's revelation in *Population Studies* for July 1979 of Malthus's quite brilliant statistical analysis of the United States population in support of his assertion that that population was increasing at a rate that would double it within 25 years.

While Petersen, like Patricia James, succeeds in ample measure in revealing the wisdom, subtlety, and humanity of Malthus's thought in a wide area and in bringing out its contradictions and obscurities, he is possibly less successful in sketching in the immediate economic and social background to Malthus's thought. There is a whole world here of history, much of it currently under revision, which it would perhaps be unreasonable to expect a demographer to take in his stride; but the pages on English agricultural history, for example, fail to do justice by a long way to the present state of knowledge in this field, and in a book of such high intellectual standards elsewhere Petersen should not have relied on Trevelyan's *English Social History* of 1942 for his source. The sections on the demography of England in Malthus's day, too, would have been the better for more awareness of the important progress that is currently being made on this subject. Work by the modern techniques of family reconstitution and aggregation is at last freeing us from dependence on the unreliable Rickman "Parish Register Abstracts." Similarly, fuller reference to Razzell's work might have persuaded Petersen to revise his views on the contribution of the practice of inoculation to the decline of mortality from smallpox.

These are quibbles, however, and detract hardly at all from the pleasure and instruction given by a book that is always thoughtful and stimulating. Malthus had a remarkable gift for hitting the nail on the head with a telling phrase or analogy; Petersen's objectivity and precision of style reflect this quality admirably.

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Environmental Issues: The Soviet View

The Biosphere and Politics. G. KHOZIN. Translated from the Russian edition (Moscow, 1976). Progress Publishers, Moscow, 1979 (U.S. distributor, Imported Publications, Chicago). 230 pp. Paper, $4.

Grigori Khozin's *The Biosphere and Politics* is another in a series of studies focusing on society and the environment that have been translated from the Russian into English and published by Progress Publishers. Like its predecessors (K. Ananichev's *Environment: International Aspects*, I. Laptev's *The Planet of Reason; Society and the Environment: a Soviet View*, and *Man, Society and the Environment*, edited by the well-known Soviet geographer I. P. Gerasimov), the book is intended to acquaint the reader with the official Soviet line on the current global environmental crisis, who is to blame, and which social system is capable of solving it.

The book begins by discussing the relationship between the environment (or the "biosphere," in Soviet scientist Vladimir Vernadsky's terminology) and society in the modern world. Whereas in previous periods of history nature was the silent repairer of mankind's pollution and destruction of surroundings, in today's heavily populated technocratic world humans must become nature's caretakers and maintain ecological balance. In the next chapter, the ecological crisis is presented as sharpening the ideological struggle between capitalism and socialism, since socialism alone, because of its public ownership of the means of production and comprehensive planning, enables society to husband natural resources for the benefit of the people. Under capitalism (chapter 3) the private drive for profit has produced and will continue to produce irresolvable contradictions between nature and production, resulting in the squandering of natural resources on the few. In chapter 4, the arms race is described as a terrible threat to nature, encouraged by the arms merchants of capitalism and braked only by the peaceful forces of socialism (the U.S.S.R.).

Chapter 5 is perhaps the most interesting in the book. Half of it is devoted to a review of international efforts to solve environmental problems and half to a presentation of the Soviet view of what is perceived as the new U.S. drive to dominate the world through "technological diplomacy." As the Soviet Union reached nuclear parity with the United States, the United States sought to maintain its dominant world position by promoting American scientific and technological know-how as "the most adequate means of building up a rational future, in which environmental prob-

lems" can be solved. Certain American scientists, it is alleged, "make out that the unique scientific and technological potential at the command of the United States enables it to lay claim to the role of sole leader in the contemporary world." Rule by force is giving way to a diplomacy of power through technology. Chapter 6 reviews Soviet-American cooperation under the 1972 Soviet-American Agreement on the Protection of the Environment. Chapter 7 contains the well-known Soviet attack on the Club of Rome and the "limits to growth" theory. The book ends on the optimistic note that the scientific-technological revolution contains unlimited possibilities for the protection of the biosphere and the U.S.S.R. leads the countries of the world in showing the way.

The book represents no new departure from the official position that has held sway in the Soviet Union for most of the '70's, but it is the most concise presentation of this position available in English and will be of value to those who have not the time or interest to work their way through the more scholarly discussions of the same material available in English translations of Soviet periodicals or who have not the Russian at their command to search out the primary literature.

In being a good overview of official Soviet thinking *The Biosphere and Politics* has its merits and its demerits. On the one hand, as in most Soviet studies, criticism and insight into the problems of environmental regulation and abuse in the capitalist system proliferate, supported by more or less credible source references. There is no criticism of the Soviet system nor any discussion of the problems the Soviet Party and government have encountered in this area. Yet the Soviets have admitted that they do have serious environmental problems, to which the Soviet mass media and scholarly journals frequently call attention. For an appreciation of the less attractive side of Soviet environmental planning, the reader might supplement this book with Western studies such as Marshall Goldman's *The Spoils of Progress* or Malcolm Pryde's *Conservation in the Soviet Union*. Both these books address the issue of kinds of problems that are inherent in environmental management in a planned society.

One conclusion reached by both Western authors is the difficulty of enforcement. Although there are many regulatory laws on the books in the U.S.S.R. and many of these are stricter than similar legislation in the United States, there is no independent regulatory agency, such as the U.S. Environmental Protection Agency, to monitor their implementation. Anther finding suggests that there may be an advantage in separating business from government. Goldman and Pryde argue that the subordination of the economy to the government has developed an institutional preference in the Soviet system for economic development and increased production, which militates against an enterprise's being rewarded for sound environmental practices. Other problems found by those authors include the fact that natural resources are regarded as free, a point of view that encourages wastage of them, and the rivalries between central and regional administrative and economic bureaucracies.

On the positive side, Khozin's book sets forth the Soviet Union's record in international environmental cooperation, a record that compares favorably with that of the other highly industrialized nations. Indeed, the U.S.S.R. has probably participated more consistently in U.N. environmental programs and has made its voice heard more constructively in the international conventions on the Law of the Sea than it has in other international cooperative endeavors. Second, the U.S.-U.S.S.R. environmental agreement is reassuring evidence that both superpowers are aware of the seriousness of global environmental issues and of their joint responsibility in dealing with them.

Finally, the book presents an alternative and by no means wholly invalid interpretation of the current environmental crisis that Americans would do well to ponder. As defined in *The Biosphere and Politics*, international cooperation means cooperation between equal and sovereign nation states, not "global interdependence," which should alert us to the danger inherent in trying to solve global environmental problems by transgressing national sensitivities. And the Soviets' rejection of the "limits to growth" theory is a warning that the U.S.S.R. is unlikely to permit its own or the Third World's economic development to stand still for the sake of a cleaner world advocated by American "technological diplomacy." A clearer understanding of the Soviet position helps shape our own options in defining a global environmental strategy whose aims and methods must be shared by all nations if mankind is to survive.

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Insect Strategies

Bumblebee Economics. BERND HEINRICH. Harvard University Press, Cambridge, Mass., 1979. x, 246 pp., illus. + plates. $17.50.

This small book (whose information content and provocative nature make it seem much larger) is a remarkable exercise in anthropomorphics, starting with the title, which does not refer to the cost of keeping bumblebees (although the reader will find a fascinating essay on how to do so in the appendix). It is the reader, not the author, who will introduce most of the human analogies. The bumblebee behavior described here has been shaped by 80 million years of evolution into forms that are familiar in the human marketplace.

The title refers to how bumblebees produce, distribute, and consume wealth. Bumblebee wealth, nectar and pollen, is produced by foraging at flowers and is consumed to propagate a new bumblebee colony next year. This economic system has its counterpart in flowering plants. Their wealth of nectar and pollen is used to pay bumblebees for pollinating other plants. Bumblebees and their kin use various tactics to wrest wealth in excess of costs from flowering plants, which have their own tactics for obtaining the services of bumblebees without paying excessively.

Heinrich organizes the complex coevolution of bumblebees and flowering plants first with a description of the annual cycle of a bumblebee colony followed by a presentation of experimental results that describe the energetic costs of foraging. Then he presents field observations and experiments of his own and others that illustrate how bees and flowers interact. The bumblebees he studied keep their flight muscles at a temperature of 30°C or more while flying, although they may fly at air temperatures of 0°C. A high metabolic rate and a hairy, insulated thorax are responsible for the large temperature difference. Insulation is adjusted by controlling the amount and timing of blood flow to the nearly naked abdomen. The queen bumblebee can produce heat at a high rate without flying and keeps her brood of eggs and larvae warm by incubating them. All this requires nectar for fuel plus fat and protein from pollen for the growing larvae. To bring home adequate supplies, the bees must juggle a number of variables: fuel aboard at takeoff, flight time to destination, flowers selected relative to nectar content and ease of gathering, air temperature, whether to hover or perch,