

## POPULATION PRESSURE AND THE PHYSICAL AND CULTURAL EVOLUTION OF MODERN MAN

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Ecology has been described as a study of "working relationships" between living organisms and their environment. The importance of these "working relationships" is being emphasized today in many articles and conferences on problems of pollution, social unrest, aggression and war. The opinions of ecologists are being sought on some of the most pressing and controversial issues of our day. The isolation from social problems, previously enjoyed by professional ecologists, is rapidly breaking down as awareness of the vital importance of ecological understanding is diffused through our societies. For these reasons, there is a growing need for ecologists to look beyond their more immediate areas of research and to consider the relevance of their science to the broader problems of mankind.

The word "ecology" is derived from the Greek words *oikos* and *logos*, which mean "house" and "reason". Ecology, in this sense, is "house study" or "household study". There are distinct sociological implications in the very origin of the word, but ecology is known primarily as a study of non-human interrelationships. Lines are drawn between ecology and sociology, just as lines are drawn between "biology" and sciences related more directly to man. There is still a strong tendency to think of ourselves as somehow distinct from the rest of nature, but this ancient point of view is giving way before our rapidly proliferating problems. In the Green Version of the B.S.C.S. *High School Biology* textbook (Rand McNally 1963), ecology is described as a study of working relationships, "somewhat like the kind of relationships that exist between you and your classmates, your doctor, your grocer". Attention is then quickly shifted to the Alaska brown bear and the polar bear, but many young people will remember this brief and indirect application of ecology to human social problems.

Competition has always been a vital factor in ecological "working relationships" and in the organic evolution which emerges from them. Darwin strongly emphasized competition as the driving

force of evolution. He did not belittle the savage intensity of the struggle for existence, in which only the "fittest" survived. Social Darwinists applied this survival-of-the-fittest emphasis to human affairs and used it to justify ruthless colonial, business and international activities. World Wars I and II brought a strong reaction against this concentration on the more savage and violent aspects of the evolutionary process. Students, in recent decades, were taught that evolutionary success is determined not so much by mortal combat as by reproductive success — and they now chant the slogan: "make love, not war". This slogan, however, can neither evade nor remove the struggle for existence. Darwin's emphasis on competition is as valid now as it was a century ago; confrontations between students and police are themselves a form of competition.

Certain broad patterns of plant and animal distribution suggest a series of waves of evolutionary innovations in the form of proliferating families of genera and species which radiated outward from centres of high competition. The diffusion of cypriniform freshwater fishes from southern and central Asia to America, Europe and Africa is one example; another is the successive dispersal of three families of frogs from Old World tropics through Eurasia to the Americas, and across the East Indies to Australia and New Zealand. The spread of marsupials from Asia and North America to Australia and South America is another example, and the swift extinction of many South American marsupials which followed the re-establishment of land connections with North America is one of the most impressive known examples of the role of competition in evolution. The word "competition" recurs frequently in zoogeographical literature.

Successive waves of new forms have been successful in competition with older forms, and as the older forms approach extinction they often break up into isolated pockets called, very expressively, "refugia". Obsolete plants and animals, like the New Zealand tuatara, survive where they find a

refuge from the savage struggles for existence in more competitive regions. They are, however, doomed—for waves of evolutionary innovation eventually reach and eliminate them.

The problem of reproductive success has never been as straightforward as the slogan "make love, not war" implies. Making love often results in the production of offspring which have to find shelter and food in competition with other offspring. These competitions often involve direct, physical contact. "Territories" have to be defended, predators avoided, and prey captured, killed and eaten. Complete avoidance of the struggle brings starvation; and slow starvation may be as unpleasant as swift death in the jaws of a predator. Even plants compete directly and physically; we aptly speak of gardens being "choked" with weeds. We cannot hope to understand ecology, the evolution which emerges from it or such results of evolution as ourselves, by turning our eyes away from the more unpleasant aspects of those waves on waves of ruthless competition which created the forms of life we see around us now, and human evolution has been exceptionally competitive. Man is the only mammal capable of highly organized and frightfully destructive warfare.

Successive waves of ever newer and more successfully competitive forms have not been confined to non-human organisms. Australopithecines and *Homo erectus* are now extinct. Some 40,000 years ago Neanderthal man became extinct when waves of people like ourselves swept over western Europe. During historical times, waves of people have replaced or absorbed other peoples on several continents, including the Americas and Australia.

Human competition is unique in a very significant respect: success usually depends on the effectiveness of conscious co-operation. The implications of this great evolutionary innovation have yet to be fully explored. The interdependence of competition and co-operation is not immediately obvious. We tend to think of these two aspects of ecology in separate mental compartments, because they seem to be antithetic rather than complementary. We reject the possibility that our capacities for co-operation were evolved in response to the demands of warlike competition as a logical contradiction. However, when we pause to reflect, we note that some of mankind's most impressive achievements in co-operation have been responses to demands of competition.

In my recent book (Bigelow 1969) I tried to integrate these two aspects of human ecology and show how their interactions may have accounted for the threefold increase in the average size of the human brain during the Pleistocene. Early humans lived in social groups, and the biological advantage of the co-operation within these groups was probably the protection of infants—just as it is known to be in modern baboons. When early humans mastered lions and other large predators, the greatest threat to human survival became other human groups (we know this happened sometime in the prehistoric past because it has been obvious throughout the course of history). With this important change in human ecology, the survival value of co-operation within groups was greatly increased. Co-operation requires communication, which requires brains, which are the products of interacting genes. Those groups with the most efficient brains, and hence the most effective communication and co-operation, most often prevailed in the inter-group competitions for fertile regions. Those with the least effective brains were either eliminated or forced into such "refugia" as deserts and tropical jungles. Australopithecines, *Homo erectus* and many other humanoid and human groups survived for a time in such refugia, then became extinct. Continued over several million years, this process trebled the average size of the human brain—and more than trebled human capacities for communication and co-operation.

Paradoxically, the result of several million years of human warfare may have been a vast increase in man's ability, and propensity, to co-operate. Advanced modern nations are now co-operating on a semi-global scale. Communication has become not only global, but also "inter-global". Millions have heard men on the earth conversing with men on the moon; but this very increase in our capacities for communication has greatly increased the complexity of human ecological problems. These problems are not only growing in complexity but also in diversity, and thanks to our capacities for global communication, we are so rapidly bombarded with such a host of seemingly insoluble problems that we must be forgiven if we feel despair from time to time. Despair and anxiety, however, are among the most potent sources of effective thought. We are descended from ancestors who faced problems which, to them, gave as much or more reason for despair—and yet survived. The entire tragic and exhilarating drama of

human evolution suggests that our generation also will face its problems and, with luck, survive. Extinction has been the rule of evolution, not the exception, but we are a very exceptional species.

If we succeed in solving our proliferating ecological (social) problems—that is, if we survive—we will do so by increasing our capacities for co-operation, communication and integration. We will continue to integrate not only people and nations, but also ideas. Statesmen will seek the opinions of ecologists, and ecologists will recognize psychology and sociology as branches of ecology. Specialists in many fields will undertake interdisciplinary research, and the ecological approach to biological problems will become more widely used. The major problems of mankind are now biological problems—including those of our overcrowded cities, our growing piles of technological wastes, our racial and international violence, our

struggles between “haves” and “have-nots”. Solutions to all these problems will require a deeper and broader grasp of ecological “working relationships” than we now possess. Our species has arrived at a very crucial stage of evolution. We are faced with co-operation and communication problems far more subtle and complex than those of our ancestors. If we cannot solve them intelligently, with those products of biological evolution we call brains, the Four Horsemen of the Apocalypse will “solve” them for us, as of old.

#### REFERENCES

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