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Man and His Environment: The Ecological Limits of Optimism

R. S. Miller

G. M. Woodwell

W. R. Burch

P. A. Jordan

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YALE UNIVERSITY : SCHOOL OF FORESTRY

BULLETIN No. 76

**MAN AND HIS ENVIRONMENT:
THE ECOLOGICAL LIMITS OF OPTIMISM**

by

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G. M. WOODWELL

W. R. BURCH

P. A. JORDAN AND R. L. MEANS

Edited by FRANÇOIS MERGEN

NEW HAVEN : YALE UNIVERSITY

1970

A Note to Readers

2012

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To celebrate the centennial of publishing at the school, the long out-of-print Bulletins 1-97 were scanned to make them available as pdfs to a broader audience. *A caution: the scanning process is not perfect, especially for print documents as old as some of these, so the readers' indulgence is requested for some of the anomalies that remain despite our best efforts to clean them up.*

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MAN AND HIS ENVIRONMENT: THE ECOLOGICAL LIMITS OF OPTIMISM¹

INTRODUCTION

by

François Mergen

Dean and Pinchot Professor of Forestry
Yale School of Forestry

IT IS A distinct honor for me to introduce to you the lecture series on "Man and His Environment: The Ecological Limits of Optimism." This series is based on presentations by members of the Yale Forestry School Faculty at the Thirteenth Annual Yale Alumni Seminar held at New Haven June 10-13, 1969¹ This is the first time that the faculty from the Yale School of Forestry was invited to participate in these seminars. One might be puzzled by the fact that members of a forestry school faculty show interest and competence in this subject. Although the Forestry School still devotes substantial energy to specialized problems related to forest management and forest administration, our programs have expanded to include many aspects of man's environment. The goal of our School is to provide a center within Yale University where students can learn to deal with natural resource problems on either a specialized or generalized level. Further, the aim is for all faculty members to view their specialities as elements in broader biological and social systems and to give this perspective to the students.

We consider our activities in their broadest sense as being concerned with the scientific and long-term management of biological ecosystems for human benefit. Successful natural resource management consequently requires understanding of both the ecosystem and the socio-economic system so that forest and related land use can be placed on a sound and enduring basis enabling our

¹ Publication of these lectures was made possible with funds from the Ford Foundation.

MAN AND HIS ENVIRONMENT

society to use and yet maintain our rich heritage of natural resources. In so doing, the School has both contributed to and benefited from the growing national concern for the environmental problems that threaten the quality and the existence of human life.

With increased population and industrialization in the years since World War II, the despoilation of natural resources has become apparent to politicians as well as to conservationists. The field of ecology provides an inclusive and logically consistent structure for perceiving the world we live in and it also attempts to account for the behavior of man within the world structure.

The first lecture asks the question "**How Many People?**" It was presented by Professor Richard S. Miller. Professor Miller is a native of Cleveland, Ohio and is a graduate of the University of Colorado and Oxford University, where he received a D. Phil. in 1951. He has served as an instructor at Harvard University, an Associate Biologist at Colorado State University, as an Assistant and Associate Professor at the University of Saskatchewan, and since 1967 has been Professor of Wildlife Ecology at the Yale School of Forestry. He currently holds the Oastler Chair in Wildlife Ecology.

Professor Miller is the author of numerous research publications and was a recipient of a Fulbright Scholarship to Oxford University, the Phi Sigma Award of the University of Colorado, and he has been working under research grants from the National Science Foundation, the National Research Council of Canada and the American Academy of Arts and Sciences. He is well known internationally for his contributions to action programs in environmental management.

In his paper Professor Miller considers some of the advantages that modern technology has produced for the quality of human life. In so doing technology has created a spectrum of environmental problems that is leading to serious deterioration of the total human environment. Because of the demands by rapidly expanding populations for more and more of the material benefits of technology, and because of the large demands that a technological society places on the world's natural resources, we are faced with the need to arrive at an optimum size of human population through effective planning and population goals. Without such a decision, we must inevitably expect serious deterioration in the quality of human environments.

The second paper was prepared by Dr. George M. **Woodwell** on "What Level of Life?" Dr. Woodwell is a native of Cambridge, Massachusetts and he is a Lecturer in Forest Ecology at the Yale School of Forestry and Senior Ecologist at Brookhaven National Laboratory on Long Island. He holds an A.B.

THE ECOLOGICAL LIMITS OF OPTIMISM

degree from Dartmouth College, and A.M. and Ph.D. degrees from Duke University in 1956 and 1958 respectively. He has served on the faculty of the University of Maine as an Assistant and Associate Professor of Botany. Dr. Woodwell has authored some 40 research publications which have appeared in such journals as *Radiation Botany*, *Ecology*, *Soil Science* and the *American Journal of Botany*. He is an Advisory Member of the New York State Pesticides Control Board and a member of the Scientific Advisory Panel of the U.S. Senate Committee on Public Works.

Dr. Woodwell considers the fact that at some point in the growth of populations the advantages of increasing numbers are outweighed by the disadvantages of increasing competition for essential resources such as air, land and water. As the competition becomes more acute, the resources are degraded. The problem was less serious as long as the changes were local and confined to urban and industrial areas, and certain streams and limited number of lakes. There are several pollution problems now that affect the entire earth and potentially degrade the biological systems that sustain the earth as a place for life as we know it. The changes in living systems that are occurring earth-wide fall into a pattern that is predictable, and they have profound implications for the level of human life that the planet can support.

The third discussion by Professor William R. Burch, Jr. considers the topic "Fishes and Loaves: Some Sociological Observations." Professor Burch is a native of Portland, Oregon and he is presently Associate Professor of Forest Sociology. He received a B.S. and M.S. degree from the University of Oregon in 1955 and 1957 respectively, and a Ph.D. degree from the University of Minnesota in 1964. He has served on the faculties of the University of Missouri, University of Minnesota, Victoria University of Wellington in New Zealand and Syracuse University.

Professor Burch has published extensively in his field of specialization and he attempts to trace the social origins of our present environmental problems by considering some miracles, some disenchantments and some responsibilities. He considers how our surplus of information and our surplus of junk are monuments to rationality. He discusses in some detail how the major metaphors of western society — market, economics and frontier expansion — are prime contributors to present environmental problems. To illustrate the extent of social transformation required for a solution, he also considers problems of population control.

The final paper is a joint effort by Professor P. A. Jordan and Professor R. L. Means entitled "Freedom and Responsibility: An Environmental Di-

MAN AND HIS ENVIRONMENT

lemma." Professor Jordan was born in Oakland, California and was educated at the University of California where he received his B.A. and Ph.D. degree in 1955 and 1967 respectively. He is presently Assistant Professor of Wildlife Ecology and he has served on the faculties of the University of California at Berkeley and at Purdue University. He is well known for his research work on the ecology of moose and wolves in Isle Royale.

Professor Means is a native of Detroit, Michigan and he was a Visiting Lecturer in Forest Sociology at our School during the 1968-69 academic year. He is now Associate Professor of Sociology and Anthropology at Kalamazoo College in Michigan. Professor Means holds degrees from Kalamazoo College, the Colgate Rochester Divinity School and Cornell University, where he received his Ph.D in 1964. He has served as Associate Congregational Chaplain at Cornell University.

He has published articles dealing with Sociology, Biology and History.

Professor Jordan delivered the lecture that deals with the fact that ecologists are becoming increasingly presumptuous in public pronouncements on matters of economics, engineering, law, politics, sociology and moral philosophy. Although the ecologists neither claim specialized competence nor seek professional involvement in these areas, they see the evidence and implications of a deteriorating relationship between man and his environment and find that experts in human affairs are apparently unaware or unconcerned about this deterioration. In order to transpose ecological issues into socio-economic terms, it is helpful to define the system in which thought and action must take place. This is attempted with a multi-dimensional interaction matrix of human ecology.

HOW MANY PEOPLE?

Richard S. Miller
Yale School of Forestry

INTRODUCTION

IN 1798 Thomas Robert Malthus published the first of seven editions of his "Essay on the Principle of Population." This famous or infamous work, depending on your political philosophy, was written in opposition to the political-economic schools of mercantilism and revolutionary utopianism that were current at that time, but it also provided the beginning of modern population theory and, in fact, gave Charles Darwin a major clue to his now famous principle of natural selection. It was a prime tenet of mercantilist theory that nations can only benefit at the cost of others, and that a state should hoard both gold and people to increase its economic, political and military power. The French philosophers of the 18th century retained this notion, as many countries do today, that strong states need large populations and that the misery of people is the result of social institutions and can never be produced by over-population. Saint-Just stated that nature can be depended on "**never** to have more children than teats" and that it was the function of the state to maintain high levels of population growth. He, therefore, advocated not only that marriage should be encouraged by state loans, but also that couples who do not produce children within seven years after marriage should be forcibly separated and the Republican government later introduced differential taxation, so that single persons over 30 years old paid 25% more taxes and legislation was enacted against celibacy. To varying degrees these attitudes, along with corresponding legislation and taxation, are still widespread throughout the world today; incentives to population growth are regarded as keys to economic prosperity and political strength. I would suggest that we need to re-examine some of these ideas.

In spite of the many misinterpretations and denunciations of Malthus' essay, it was "**an** inquiry concerning the improvement of society", in which he stated that one great impediment in "**the** progress of mankind toward happiness"

MAN AND HIS ENVIRONMENT

is "the constant tendency in all animated life to increase beyond the nourishment prepared for it." In other words, Malthus asserted that there is a tendency for human populations to increase at a geometric rate while their means of subsistence, mainly food production, can only increase at an arithmetic rate. Many of the objections to Malthus' statements were due to his emphasis on man's biological nature. He was severely attacked by many contemporary clergymen as atheistic and immoral, and the clergymen preferred to accept Martin Luther's adage that "God makes children and he will also nourish them." Yet, in spite of the emotional outbursts of critics as far apart in philosophy as the clergy on one hand and Karl Marx on the other, the fact remains that Malthus' principle of population is an integral part of demographic theory and man, whether he likes it or not, is subject to the same laws of population growth that govern all species of plants and animals. The question, therefore, is not so much whether man is an animal- he is - but whether he chooses to govern his behavior in such a way as to use his higher intelligence and the benefits of a cultural history.

LAWS OF POPULATION GROWTH

The rate of growth of a population is determined by the ratio of births to deaths in the population. In human populations this rate is usually expressed as the Mean Annual Growth Rate (M.A.G.R.) and is based on the number of births and deaths per thousand individuals. Thus, the world birth rate in 1968 was .34 per thousand and the death rate was 14 per thousand, so that the rate of population growth was:

$$\text{M.A.G.R.}\% = \frac{34 - 14}{1000} = 2.0\%$$

Change in population size is, therefore, the product of the rate of population growth and the number of individuals in the population, and when there are no constraints on the growth rate the result is an exponential, or geometric increase. This is the form of population growth we would expect in an unlimited environment. For example, a bacteria may divide to produce 2 individuals, which in 20 minutes may themselves divide to produce 4 individuals, and so on. At this rate, there would be a colony of bacteria one foot deep over the entire face of the earth in a day and a half; an hour later the colony would be over our heads; and in a few thousand years would weigh as much as the visible universe and **would** be expanding at the speed of light! As ludicrous as this kind of projection may seem, it does establish two points: (I) the

HOW MANY PEOPLE?

potential for increase in animal populations is extremely high and (2) the fact that such increases are not realized is because all organisms live in limited environments where external constraints are placed on population size.

If, instead of calculating these kinds of theoretical projections, we observe the growth of a natural population in a limited environment, we find that population growth tends to follow an S-shaped curve. The increase in population size is slow at first, because of the small number of individuals in the initial population, but becomes more rapid as numbers increase. However, as the population size begins to approach its environmental limit, the rate of increase slows until it eventually reaches zero and there is a balance between births and deaths. Thus, for any population and environment, there is a limit to the number of individuals that can be sustained on the resources that are available, and this is referred to as the "carrying capacity" of the environment for that population. These are fundamental properties of all natural populations and environments, and since infinite population growth is impossible, a population has two alternatives available for self-regulation of its numbers in relation to the ultimate carrying capacity of the environment: (1) the birth rate has to decrease or (2) the death rate has to increase, until these two values are in balance.

HUMAN POPULATION

How do these basic laws of population growth apply to man? First, we must acknowledge that we live in a finite environment and, even though we do not yet know its numerical value, there is a limit to the number of people the world can support. Secondly, for any value we establish as the carrying capacity of the earth for human populations, there will be a definite quality of life associated with it. It is conceivable, for example, that we could cover much of the earth with skyscrapers and feed its people on tablets containing essential nutrients and energy, but would this constitute a satisfactory quality of life? Finally, we must decide whether our population growth and its ultimate level of numbers will be planned or unplanned - whether we will let birth rates and death rates and the density of human populations find their own levels, as in most animal populations, or whether we will use our intelligence and resources to produce a more ethical solution that preserves human values.

Table 1 shows a selection of population statistics for the world and for two contrasting sets of nations and regions. In 1968, the population of the world was estimated to be slightly less than 3.5 billion people and on the basis of a rate of population growth of 2.0 per cent, we can also estimate the world will

MAN AND HIS ENVIRONMENT

TABLE I. SELECTED WORLD POPULATION DATA (FROM POPULATION REFERENCE BUREAU, WORLD DATA SHEET, 1968).

Region and Country	Population Estimate for 1968 (millions)	Current Rate of Population Growth	Number of Years to Double Population	Birth Rate per 1000 Population	Death Rate per 1000 Population	Life Expectancy at Birth	Percent Illiteracy 15 years and over	Per Capita National Income
WORLD	3479	2.0	35	34	14	53	39	493
UNITED STATES	201	1.1	63	18	9	71	0.3	2893
EUROPE	455	0.7	100	18	10	70	5	1069
JAPAN	101	1.1	63	14	7	71	0.2	696
AFRICA	333	2.3	31	45	22	43	82	123
ASIA	1943	2.2	32	39	17	50	54	128
LATIN AMERICA	268	3.0	24	40	10	60	34	344

double its size in 35 years. Therefore, if present trends continue, we expect the world population to be about 6.5 billion people by the year 2000.

If, however, we contrast the population statistics for the United States, Europe and Japan with those for Africa, Asia and Latin America, it is evident that there are wide differences between nations and regions, and that areas of low or high population growth tend to have certain identifying characteristics. For example, the rates of population growth for the United States, Europe and Japan vary from 0.7 to 1.1 per cent with "doubling times" of 63 to 100 years, while Africa, Asia and Latin America have rates of population growth of 2.2 to 3.0 per cent and relatively short doubling times of only 24 to 32 years. It is important to note, also, that these values are derived from moderate to low birth and death rates in the United States, Europe and Japan and high birth and death rates in Africa, Asia and Latin America. Consequently, life expectancy at birth in the former group of countries is high and in the latter is quite low.

The "doubling time" of a population is an extremely important factor in any kind of local, regional or national planning. If we consider that the world population is expected to double in 35 years, we must in this period double

HOW MANY PEOPLE?

world food production, all goods and services, schools, transportation facilities, etc. just to maintain the present standard of living, which is even now inadequate in many areas. This may be a relatively easy task for East Germany, where the rate of population increase is only 0.5 per cent and the population doubling time is 139 years, but Latin America, with a doubling time of 24 years, faces an extremely dismal future. Poverty and malnutrition are already widespread, the agricultural potential of the tropics is low, the population projection is one of increasing, rather than decreasing growth rates, and the political instability of most of Latin America makes it unlikely that effective population and social planning will be instituted in time to avoid disaster.

Optimists who are not alarmed by world population growth point out that population projections are often wrong. This is quite correct; most projections of future population size have been wrong, but the error has almost been on the conservative side by way of underestimates. Table 2 gives examples of some population projections for the U.S. and the world. In 1936 Pearl and Gould estimated that the population of the world would level off at 2.6 billion by the year 2100; today the world has already reached a population of 3.5 billion with a projection of 6.6 billion by the year 2000, and there is no indication, whatever, of a decrease in rate of population growth toward a constant population size. Similarly, Pearl and Reed (1920) predicted that the population of the United States would reach a constant size of 197 million by the year 2100 and Pearl, Reed and Kish (1940) later predicted a level of 184 million by the same date. The population of the United States today is 201 million, again with no levelling off in sight. The basic reason for the error in these population projections is that they assumed that the rate of population growth would soon begin to decrease when, in fact, as shown in Table 3, the mean annual growth rate has consistently increased throughout the history of world population growth. All of the available evidence indicates that this trend will continue until, by the year 2000, the world population growth rate will be 3.4 per cent with a doubling time of only about 20 years!

It is also argued that the world population problem is not numbers of people, but how they are distributed throughout the regions of the world. This argument is partly correct, in that poverty and malnutrition tend to be most acute in regions of high population increase, but there is small comfort in this correlation. Immigration policies are dictated by national interest and not by a desire to house and feed "The wretched refuse of your teeming shore." The immigration laws of most "have" nations discriminate against the "have-nots" on the basis of job skills or country of origin, and there is no evidence to sug-

MAN AND HIS ENVIRONMENT

TABLE 2. POPULATION PROJECTIONS FOR THE UNITED STATES AND THE WORLD

UNITED STATES		
AUTHORITY	POPULATION ESTIMATE Year	POPULATION ESTIMATE Millions
Pearl and Reed (1920)	2100	197.3*
Pearl, Reed and Kish (1940)	2100	184.0*
Population Reference Bureau (1968)	1968	201.3

WORLD		
AUTHORITY	POPULATION ESTIMATE Year	POPULATION ESTIMATE Billions
Pearl and Gould (1936)	2100	2.6*
Population Reference Bureau (1968)	1968	3.5
Population Reference Bureau (1968)	2000	6.6
United Nations (1968)	2000	6.1

*Projected upper of population size to be reached by year 2100

gest that the "have" nations will aggravate their own population and social problems, however moderate they may be, to alleviate the more serious problems of the "have-not" nations. In the meantime, the disparity between numbers of people and the distribution of the world's resources is worsening. In 1900, when the total population of the world was 1.6 billion people, 1/3 of these people lived in Europe and North America and 2/3 in Africa, Asia and Latin America. By 1965, when there were 3.3 billion people in the world, 1/4 of them lived in Europe and North America and 3/4 in Africa, Asia and Latin America. By 2000, when we expect a world population of 6.6 billion people, the distributions between these two sets of regions will be 1/5 and 4/5 respectively. In other words, 85% of the world population increase of 3.3 billion between 1965 and 2000 is expected to occur in Africa, Asia and Latin America, where malnutrition and starvation are already serious, and where severe food shortages and widespread famine are predicted for the future.

The basic problem of human population growth is the time-lag that normally occurs between a decrease in death rates and a decrease in birth rates as social and economic changes carry a population through what is known as the "dem-

HOW MANY PEOPLE?

TABLE 3. WORLD POPULATION GROWTH SINCE 1650.

Period	Population at End of Period (Millions)	Actual Increase	M.A.G.R. %
1650-1750	694	224	0.5
1750-1850	1091	397	0.6
1850-1900	1550	459	0.8
1900-1950	2454	904	1.2
1950-2000	6577	4123	3.4

ographic transition". This is shown in Table 4 for England and Wales. Until 1750, the birth and death rates in England and Wales were about 35 per thousand and the population increase was slow and irregular. Between 1750 and 1880, there was a decrease in the death rate from 35 to 21 per thousand, while the birth rate remained at about its previous level, and the population tripled in size. Between 1880 and 1930, there was a further decrease in the death rate from 21 to 12 per thousand, but this was accompanied by a decrease in the birth rate from 34 to 16, and the population increased by only 1/2 during this period. Since 1930, the birth and death rates have not changed appreciably, and there has been a slow, steady increase in population size, except for a temporary acceleration with the "baby boom" of World War II. Thus the demographic transition from high to low death and birth rates took approximately 130 years in England and Wales before the population stabilized to its present rates of growth.

The reason for the time-lag between a decline in death rate and a corresponding decline in the birth rate in the demographic transition of a population

TABLE 4. STAGES OF POPULATION GROWTH IN ENGLAND AND WALES.

Stage	Period	Birth Rate	Death Rate	Population Increase
I	-1750	± 35	± 35	Slow, Irregular
II	1750-1880	35 — 34	35 — 21	X3
III	1880-1930	34 — 16	21 — 21	+ 1/2
IV	1930-	16	12	Slow, Steady

MAN AND HIS ENVIRONMENT

is that death rates are relatively easy to control, and their control is socially acceptable and desirable in modern society, while birth rates are more difficult to influence. The absolute maximum longevity of humans has not changed significantly in historical time and is still about 110 to 120 years. We occasionally read of someone celebrating his 110th birthday surrounded by several generations of offspring, and are usually treated to a discourse on how to live past 100. These prescriptions for longevity vary from wholesome food and "clean living" to strong whiskey and black cigars but, in either event, it is obvious that modern science has not created a new biological race of long-lived people, and it is doubtful that it will. However, we have been able to modify the human environment and improve health conditions sufficiently to increase the average life expectancy considerably. The average life expectancy of man from Neanderthal until the last century was probably about 25 years, but it is now 70 years in many advanced countries and the world average is 53 years (Table I). The major sources of human mortality have shifted from diseases of infancy and middle years to those of old age, and it is highly unlikely that communicable diseases will ever again play a major role such as the Black Death of 1348. Infant mortality is especially easy to control with modern medicine. In 1900 the infant mortality rate in the United States was 143 per thousand, but by 1968 it was down to only 23 per thousand. However, when mortality rates are drastically reduced without a corresponding reduction in birth rates, a population explosion must inevitably follow. Thus, the high rates of population growth (Table I) and the poverty and malnutrition that now exist in Africa, Asia and Latin America will become even more explosive as the death rates of these areas are reduced to values more nearly comparable to those in more advanced countries.

THE CASE OF JAPAN

A popular cause for optimism is "The Case of Japan", where remarkable progress was made in reducing the birth rate in a relatively short period of time. When the Tokugawa dynasty was established after several civil wars, there followed a long period of peace, during which Japan was essentially a closed population system with no emigration or immigration. During this period, all adults except Sumari and their servants had to be registered at the temples every six years. From the data provided by these registrations, we know that the population of Japan grew rapidly at first, but after 1720 it stabilized and remained more or less constant, as an agrarian society, for over a century. With the spread of the industrial revolution from Europe to Japan

HOW MANY PEOPLE?

about 1850, there followed a very rapid population increase which continued until World War II. The U.S. occupation forces sponsored a birth control program with the cooperation of the Japanese government after World War II, and in 1948 legalized abortion was introduced. The result was dramatic. Birth rates fell from as high as 38 per thousand to 16 per thousand in 4 years in many villages, and Japan has now reached a birth rate of about 14 per thousand and a death rate of only 7 per thousand and a rate of increase the same as the United States, and a doubling time of 63 years. However, although Japan is viewed by many demographers as an example of success in population control, it is a questionable success. For example, a population doubling time of 63 years is only enviable in a relative sense — Japan just looks good in a world that will double its population in 35 years. Japan imports almost as much food as it raises, so that it is far from self-sufficient. More importantly there are factors in the case of Japan which make it a far different proposition from the problem areas of Africa, Asia and Latin America.

Voluntary decreases in birth rate are influenced by a number of factors, including population density and the proportion of the total population that lives in urban and rural areas. Effective decreases usually occur in urban areas where the population density is high, and are difficult to achieve in rural areas of low population density. In Japan, approximately one third of the population lives on farms, while in Africa, Asia and Latin America two thirds of the population is rural. The population density of Japan is 695 per square mile; the population density of Brazil is 24 people per square mile. Literacy is another factor which influences the effectiveness of population control programs. The literacy rate of Japan is over 99 per cent and, in fact, illiteracy is so negligible that this statistic is no longer included in the census. The literacy rate of Asia as a whole is 46%, Africa 18% and Latin America 66%. The Latin American figure represents an increase of about 40 per cent in the past several years, but percentages are deceptive. Because of the huge population increase, the absolute number of illiterates in Latin America has increased dramatically during this same period. The availability of medical services and trained physicians is obviously important. In Japan there is a ratio of one physician for every 900 people; in Brazil the ratio is 1:2500, Pakistan 1:1100 and in Nigeria 1:27000. It has been estimated that, if every woman of reproductive age in India were to consent to the use of an intrauterine device, and all of the available medical personnel in India were assigned to this task, they could not keep up with the current additions of reproductive females to the population.

MAN AND HIS ENVIRONMENT

In other words, the success of Japan's program of population control was due to factors which are not present throughout Asia, Africa and Latin America, and it would be foolish to expect that such rapid decreases in the birth rate and rate of population growth can be bought about as easily, if at all.

THE AMERICAN SCENE

To what extent should we in the United States be concerned about the fact that four babies are being born in the world every second, that this represents a net gain of 2.2 per second, or 190,000 new individuals per day, or that the annual increase in the world population was only 72 million persons in 1939 compared with 200 million in 1969? There is little reason to be complacent about the fact that the rate of population increase in the United States is only about half the world average or one third the rate for Latin America. We have population problems in the United States which are real and will almost certainly get worse. Moreover, our standard of living depends very much on events in other parts of the world, and our affluence derives partly from the resources of other, less developed nations. The population of the United States today constitutes only one sixteenth of the world population, yet we consume over 50 per cent of the world's annual production of non-renewable resources. If our present rates of increase in production and consumption of natural resources continue, we will use even more of the world's annual production of raw materials by the year 2000, when our fraction of the world population will be even less. The average American consumes 1300 pounds of food per year, which includes 88 grams of animal protein per day and a daily diet of 3200 calories. The minimum requirement of a 165 pound man doing office work is calculated to be about 2800 calories a day, yet over two thirds of the people of the world receive less than 2250 calories a day and less than the minimum requirement of 8 grams of protein.

Our relationship to the rest of the world was recently summarized (Anon, 1969) as follows: "If all of the people in the world could be reduced proportionally into a theoretical town of 1,000 people, the picture would look something like this: In this town there would be 60 Americans, with the remainder of the world represented by 940 persons. This is the proportion of the population of the United States to the population of the world, 60 to 940. The 60 Americans would have half the income of the entire town with the other 940 dividing the other half. About 350 of these would be practicing Communists, and 370 others would be under Communistic domination. White people would total 303, with 697 being non-white. The 60 Americans would have 15 times as

HOW MANY PEOPLE?

many possessions per person as all the rest of the world. The Americans would produce 60 percent of the town's food supply although they eat 72 percent above the maximum food requirements. They would either eat most of what they grow or store it for their own future use at an enormous cost. Since most of the 940 non-Americans in the town would be hungry most of the time, it would create ill feelings toward the 60 Americans, who would appear to be enormously rich and fed to the point of sheer disbelief by the great majority of the townspeople. The Americans would also have a disproportionate share of the electric power, fuel, steel and general equipment. Of the 940 non-Americans, 200 would have malaria, cholera, typhus, and malnutrition. None of the 60 Americans would get these diseases or probably ever be worried about them."

We must acknowledge that the United States is merely part of a total world system of natural resources, and that we are not a self-sufficient nation — events in the rest of the world affect us and our way of life, and our actions, especially our use of natural resources and the many dimensions of our technology and economy, have far-reaching international implications. Our experiences in Korea and Viet Nam may, for example, lead us into a policy of greater political isolation, at least with respect to our military involvements in the internal affairs of other nations, but we cannot easily absolve ourselves of our responsibilities as a dominant force in international politics. We will continue to have a foreign policy, whatever it may be, and its success or failure will depend ultimately upon our ability to deal with the more basic problems of human populations and environment, both at home and abroad.

We must, in other words, realize that the quality of human life and, in fact, man's destiny on this earth is directly related to the basic equation of population growth in a limited environment, no matter how optimistic we may want to be, and that none of our plans for the future can escape this fact. When, for example, the State of California passed legislation to control pollution from automobile exhaust, the rate of pollution from this source was about 13,000 tons per day. Four years later they had only succeeded in reducing pollution to 12,000 tons per day, because of the increase in the number of automobiles on the state highways. The current national goal is a device which will control 70% of the pollution that is now produced by automobile exhaust, but we also expect a 70% increase in the use of motor vehicles by 1980 so that, even if our technological goal is achieved, we will experience more pollution than we do now. The Aswan Dam and the agricultural lands it was designed to irrigate was considered to be the answer to Egypt's problem of food shortage, but by the time the dam was completed the population had

MAN AND HIS ENVIRONMENT

grown so rapidly that malnutrition and starvation are more widespread in Egypt now than when the dam was begun.

In 1949 William Vogt wrote in his book "**Road** to Survival" that the curves of environmental deterioration and population increase have long since crossed, and that unless "**man** readjusts his way of living, in its fullest sense, to the imperative posed by the limited resources of his environment - we may as well give up all hope of continuing civilized life." Vogt's arguments were severely criticized and were countered by optimistic agriculturalists who predicted that the solution to the world's food problems was just around the corner. They seemed to feel then, as many do now, that supposedly insignificant amounts of environmental pollution can be tolerated and that an expanding population is essential to economic growth. Today we have the bloated bellies of the children of Biafra, and even malnutrition and starvation in the United States, to remind us that William Vogt was not entirely wrong in his predictions. The agricultural abundance that was optimistically forecast by Vogt's critics has still not caught up with the world population and, in spite of some temporary gains in the recent past through the opening of new lands to agriculture and the use of fertilizers, is beginning to fall farther and farther behind. I think we can also agree that the quality of the human environment is in many ways worse, not better, than it was in 1949. We have reached a point where the atmosphere and entire lakes and river systems are so seriously polluted that they have become environmental catastrophes. In many cases, environmental pollution has already placed a limit on the use of critical human resources. We are, in fact, well into an environmental crisis compounded of the forces of population growth and environmental deterioration, and this equation will not reach a happy solution without considerable effort and re-planning of the human environment and, unfortunately, a good deal more human misery.

It seems painfully evident that there is an urgent need of broad national policies on human environment which include a recognition of the need for population control. Such policies will require drastic revisions in attitude and in national and international priorities. We will have to learn to recognize the facts and the dangers of unlimited population growth, and the need to adjust our economic and social policies to a constant population size, without contrasting unlimited population growth, on the one hand, with bizarre schemes of infanticide or estrogen in our drinking water as the only other alternative. Nor can we continue to give credence to the argument that population control is an affront to human dignity - there is very little dignity to starvation. We may also question whether our present social institutions and political systems

HOW MANY PEOPLE?

are adequate to deal with today's problems - they are slow and cumbersome and a local constituency or regional need may not necessarily represent the national interest, especially with respect to some of the more urgent problems of human environment. Nevertheless, the alternative does not have to be anarchy. There are undoubtedly solutions which have yet to be explored, and at the very least we must acknowledge that human population growth is a problem that requires our immediate attention and a more generous allocation of our resources.

Our current expenditures on research on pollution control in the United States are roughly equivalent to what it costs to run the Pentagon for 2 1/2 hours. It costs more to fly two B52 bombing runs in Viet Nam than we spend annually on population research. It would, of course, be naive to argue that every dollar cut from the military budget could then be directly applied to population research, but it is also evident that our present system of priorities leaves a lot to be desired. We are, quite *simply*, a crisis-oriented society. We are willing to spend vast sums to achieve what appear to be relatively simple, immediate objectives such as building an atomic bomb, putting a man on the moon, or stopping "the spread of Communism", but we are reluctant to put an equal effort into long-term goals with deferred consequences, no matter how important they may be. We respond more readily to riot and violence than we do to logic and reason, so that we let inequity persist until it explodes. However, we may be facing a crisis of unprecedented proportions which is relatively subtle in its development but far more disastrous in its consequences than anything in the history of man, and the future quality of the human environment **and** possibly our future on this earth will require realistic intellectual and economic commitments to meaningful long-term goals of population and environment which insure a satisfactory and equitable solution of the human environmental equation of numbers and resources.

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WHAT LEVEL OF LIFE?*

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SCIENTISTS and academicians in general usually try to avoid words like "crisis" believing that they prejudice thoughtful analysis with a demand for decision and action. But scientists, too, attach a sense of urgency to environmental problems these days, having watched them grow in this decade to dimensions that even the most conservative among us agree demand decision and action. But what decisions and what actions? Should we stop producing people? oil? cars? pesticides? ghettos? students? How should we do these things? There are answers, of course, many of them, too many of them. Answers that by their numbers alone make them more of an aggravation than a palliative, and even when they are good, often more palliative than cure. Building new cities for the new millions sounds attractive and is consistent with the American Dream, but it doesn't solve the problem of today's cities. And it's today's cities that are burning, promising that tomorrow's millions, bred in today's cities, will only make the fires hotter, throwing in not the gymnasium at CCNY but the library at Yale. And while it may seem far-fetched to connect the wrecking of the universities to the environmental crisis, there's a strong belief among ecologists that the two are more closely connected than we might at first guess. Surely the fact that there are many Cassandras today, and many in high places, has a dominating influence on philosophy and on human activities. Fortunately, all the Cassandras can't be right; unfortunately, only one need be right. Small wonder that the young question the institutions of their fathers . . . and that scientists acknowledge that environment is in crisis.

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WHAT LEVEL OF LIFE?

I want to step back a few paces to gain a perspective of the broad dimensions of the set of problems that make the Environmental Crisis. I propose to back away from the myriad cures and deliberately to simplify the issues in an attempt to lay the context of the crisis bare. In proportion as we succeed in sharpening our view of the context, then planning and specific solutions become real possibilities. Otherwise we tend to be driven as now by competing cures for immediate crises, not by plan.

Having accepted the burden of simplification and opened myself to all of the beads that can be drawn on one who tries such a rash trick, it's tempting to go the whole course and lay it all to a single factor. But ecologists have learned otherwise: there are a few single factor systems in real life. We can't simply say it's all due to population, nor all due to technology, nor all due to failures in government. It's not, but these are the issues: numbers of people, resources and the rules that relate people and resources.

There are a few these days who will argue that density of population, simply numbers of people, is not a central issue in the environmental crisis. The Paddocks, the Days, Paul Ehrlich, Richard Miller, and others have made the exponential curve of population growth newspaper jargon. Doubling times for population appear weekly these days in the Times . . . with pleas that Government do something toward developing a policy on population. It's common knowledge that we can expect the present 3.5 billions of the world to approach 7 billions by the year 2000. In the wealthy part of the world, in the industrialized countries, the doubling time for the population is longer, but still only about twice that for the world as a whole or about 65 years. Thus while the wealthy nations are not experiencing the same growth rates and by dint of their technology and wealth are better able to handle the increase and even to slow it, their populations are still doubling within a few decades - and their welfare cannot be separated from that of the poorer nations that have the highest growth rates and can be expected to be churned by a growing series of crises as their populations increase.

The implications of the present rates of growth of population are almost incomprehensible - and will lead in a time that is short, within our own lives or the lives of our children now living, to results that would be absurd if they did not have such tragic implications. The only question is: what will stop this growth? Will the limit be Malthusian? Food? Or something else? If so, what?

Other conspicuous possibilities are three: first, by *plan*, evolved through deliberate action by society; second, by a *wave of -personal choice* generated by

MAN AND HIS ENVIRONMENT

mechanisms that are still largely mystical; or third, by some such generalized disaster as war or other world-wide catastrophe. It is widely, but not universally, assumed that the Malthusian limits apply — at least for much of the world and governmental policies at the moment put emphasis on food. It is significant that we are not building Utopias in India. We are wondering whether in the next decades there will be enough food to feed the poor nations.

The answer is not clear. Our best predictors, such as Buckminster Fuller, claim vision good for 20-25 years. Within that period optimists offer a qualified *yes*; pessimists, a resounding no. Even the optimists agree that malnutrition is a current problem and will grow, admitting a degree of defeat now. But new strains of rice, new cultural techniques, offer hope of higher yields and are widely welcomed as at least a temporary solution. The problems, however, are big: even IR8 and IR10, the new strains of rice developed in the International Rice Research Institute in the Philippines, require persistent pesticides that are causing serious threats to important segments of the biosphere, as we shall see in a moment.

The Malthusian limit may indeed apply to most of the people of the world, which includes the poor nations. The hope is that time and wealth gained by introducing technology in the next few years will yield an opportunity to plan. The optimists think so and there is no acceptable alternative. But what about the richer, industrialized states? Here rates of population growth are lower and there are small clues that population growth rates may be dropping. There is antipathy toward governmental controls. Here there is at least some shred of evidence that population growth rates will drop in time without unpopular governmental action. The dominant philosophy and the present operating assumption is one of unlimited growth. This is the current policy on population in the United States and in many areas of the world. Without pretending to analyze this fully, I would point to one powerful reason, among several powerful reasons, why we are not working rapidly toward adopting a national policy different from this.

The reason is simple: we have a national policy of unlimited growth: growth in all sectors of the economy, growth of the gross national product, growth of business, large and small, growth of government, growth of schools, universities and opportunities for education, growth of values of land, resources, growth in use of resources and growth of population. Thus, there are diffuse but powerful forces at work against any restriction in the growth of population and specifically against any national or governmental policy that would restrict it. And these forces are not only those commonly cited: the Catholic Church,

WHAT LEVEL OF LIFE?

personal attitudes, ethnic groups - they are powerful economic forces, some of the same forces that drive our technology and provide the riches of the industrialized nations.

It **remains** to be seen whether the optimists are correct in their assertions that population in the industrialized states will become stabilized without some form of moral or political persuasion as advocated by Garrett Hardin and others. The evidence that it will is feeble; the forces against it are strong.

These points are clear:

1. Doubling times for population in the United States and in most other countries of the world is of the order of decades, even in the industrialized nations. Such growth rates are very rapid.

2. The operating assumption of the industrialized countries is that some mystical force, a product of the free **enterprise** system, perhaps a gadget, will somehow restrict population growth to some level that will assure continuance of high standards of living. The evidence for the emergence of this control is small, but as we have seen, changes come rapidly these days.

3. Within broad limits, social problems increase with the number of contacts between people. The number of contacts is increased by: (a) the number of people; (b) by urbanization, an accentuating pattern in the industrialized nations; (c) by technology, which increases each person's command of resources. A man who has a car obviously takes up more space, uses more air and other resources and has a greater opportunity to interact with other people than the man who walks.

And this brings me to a consideration of my main topic, resources.

Resources are, of course, almost infinitely numerous and complex. For simplicity I choose at the moment to overlook the complexities, including technology with all its versatility in providing new resources and to consider only air, water and land. These basic resources exist with certain qualities that are essential for life as we know it. Air is approximately 80% nitrogen, 20% oxygen and .03% CO₂. Water is fresh or salt, clean or dirty, rich or poor in mineral elements. And land, too, exists with a wide range of qualities.

The qualities of air, water and land have in surprising degree been shaped by living systems, living systems that have the remarkable capacity of evolving into an ever better fit in an environment that they build as they evolve. Here we have a strange, continually evolving, feed-back system, with changes in environment caused by biological evolution bringing further evolution to exploit the changed environment, the whole process occurring over perhaps 4.5 billion years or so. The result is the world we know, with its present

MAN AND HIS ENVIRONMENT

qualities of air, water and land; its present temperature, its present capacity to reradiate solar energy, to fix carbon and to regenerate oxygen into the air. Perhaps if we were patient enough, we could identify a list of essential resources, essential to support life as we know it, essential to continuance of the earth's present level of life. High on the list would be those I've mentioned. We might call the systems that control these factors: Life Support Systems, borrowing on a popular and appropriate analogy started apparently by Barbara Ward's splendid title "Spaceship Earth."

Let's look at these *life-support systems*. We say, somewhat glibly, that they are the product of biological evolution spanning some billions of years. Without attempting to recapitulate the year-by-year account, it seems fair to say that the general tendency of evolution appears to be a continuing division of resources among an ever-increasing number of different kinds of users. Each kind of user is what we call a *species*. Thus, the evolution of living systems is toward diversity in form and function, toward increased complexity as represented by increased numbers of species that become a part of the resources of the system and thereby aid its evolution. Biological evolution is a continuing, self-augmenting process, feeding on itself and adding to itself, building-in ever more complex ways of exploiting resources to sustain life.

Clearly, the numbers of organisms, the sizes of populations and their fluctuations in numbers are not random. They **are** controlled. But how? And of what importance is it?

There are many ways of examining the structure of natural communities. One of the most useful is on the basis of energy distribution: their structure seems to be governed by what one might call "**the 10% law.**" About 10% of the energy entering any trophic level is available for transfer to the next trophic level. Thus 10% of the energy fixed by the plants is available to herbivores' and 10% of the energy entering the herbivores is available to the first level of carnivores and so on. Clearly, on the basis of energy exchange alone there are quantitative relationships between trophic levels and any disturbance of one of these affects the others.

This is a small glimpse of the living **systems** that have built the biosphere, and we ask now to what extent the biosphere remains dependent on the integrity of these life-support systems. The best answer is that we don't know. We do know, however, that:

1. Such systems, natural communities or natural ecosystems, **have** dominated the earth for all of time. Their occurrence and their effects on the biosphere

WHAT LEVEL OF LIFE?

have been very large in proportion to the effects of man or any other single species.

2. There is evidence now that the structure of natural communities all over the world is being lost due to the activities of man.

The evidence of change is precisely what one might expect: highly specialized top carnivores are disappearing all over the world, due not merely to a reduction of habitat but due to the accumulation of toxic metabolites of civilization, in this case, the persistent pesticides. As a result we have lost the peregrine falcon in the Northeast and are losing the osprey and the bald eagle. And we are losing as well the Bermuda petrel, the brown pelican, the cormorant and others in diverse parts of the world, the conspicuous signs of drastic changes in the structure of natural ecosystems. These signs are conspicuous because birds are conspicuous and naturalists have kept records spanning many years on some of the rarest birds. The changes are conspicuous also because they are occurring rapidly — in this decade. The cause is known — the mechanism is known — at least in sufficient detail to confirm the field observations. Quite simply, residues of the so-called persistent pesticides, of which DDT is the most commonly used but including also aldrin, endrin, lindane and dieldrin among others, appear to have much longer lives in nature than anyone had guessed previously. Once DDT residues enter living systems it appears now that it takes more than ten years for one half the original application to be chemically degraded. This means that the residues accumulate and, being very soluble in fat and not very soluble in water, they accumulate in the earth's biota: in birds, fish, animals and man; in any body that contains fat. Once they've entered, they are passed along through food chains, accumulating in carnivores and affecting them, but not only them. Organisms all along the line are affected, less conspicuously because the populations are less readily observed. So it is not at all surprising to find eggs of salmon in Maine infertile or moribund; similarly the Coho salmon of Lake Michigan do not reproduce and contain sufficient DDT residues (13-19 ppm) to render them unsuitable for shipment in interstate commerce according to the FDA; and lobsters off the East Coast contain increasing and potentially significant quantities — and brown trout in the Adirondacks have 100-200 ppm. Nor is it surprising that you, or at least your fat, contains too much DDT for the FDA to allow your shipment in interstate commerce.

The pattern of change in the structure of ecosystems caused by pesticides is significant. Highly specialized carnivores, existing as they do at the very

MAN AND HIS ENVIRONMENT

tops of food chains, appear to be especially vulnerable. The net effect of the pesticides is to shorten food chains, reducing the number of species in the ecosystem, favoring plant populations and rapidly reproducing herbivores. There is no question that the persistent pesticides alone are degrading diverse ecosystems all over the world. But it is also true that the pesticides are only one of the toxic metabolites of civilization circulating in the biosphere.

Until this century, perhaps even this decade, the biosphere has been dominated by natural ecosystems, complex, continually evolving. This condition prevailed as long as man was dependent on solar energy to run his technology. He was, of course, restricted this way until the middle of the last century — water mills, horses and man himself are all solar powered. But suddenly he discovered fossil fuels and built a magnificently versatile new technology, capable of the most fantastic exchanges of energy for other resources. Command over energy vastly increases the resources of the earth to the point where some believe they are infinite: that technology with its cheap fossil or nuclear power can solve all resource problems. It's an attractive, even a dominant philosophy and it is almost arrogantly asserted by the most enthusiastic exponents that technology can free man entirely from dependence on biological processes as life-support systems for spaceship earth.

Others doubt this guarantee — their concern based on the question of whether it is possible to upset some essential system of the earth in a way that would be self-regenerating, sudden, unpredictable, and uncontrollable. Would it be possible, suddenly, perhaps by releasing four shiploads of nerve gas or herbicide or even DDT into the North Atlantic to trigger a series of reactions that would progressively and irreversibly alter the composition of the atmosphere? The answer seems almost certainly *no* — but then, we aren't sure — and the number of people working on such questions at the moment is not very large, perhaps a score or so if we stretch our criteria to include those working on related questions. Under those circumstances, with even small uncertainties involving the entire earth, the decision of the National Academy's Committee that the Army should not dump four shiploads of nerve gas in the oceans seems wise.

Clearly, there *is* very real basis for concern that some product of technology, some thoughtless or even deliberate act of man will cause irreversible changes in the biosphere, degrading it significantly, and some precedent for concern. We have the pesticides story, known in its broadest dimensions for twenty years, predictable for ten years and with conspicuous effects substantiating the predictions for five years and longer. Yet, the agricultural and other pest-control

WHAT LEVEL OF LIFE?

technologists, supported by industry and by government have successfully maintained for twenty-three years that DDT is a threat neither to man nor to nature. As a result, we seem committed to drastic changes in the earth's biota, some of which are certainly irreversible. There is little chance of recovering the strains of the peregrine falcon that once nested in the northeastern United States, for instance. There is, nonetheless, reason for hope that the persistent pesticides will be dropped, outlawed for use in the out-of-doors, perhaps soon.

We are experiencing now the confrontation between technology and environment, and technology is having to yield, the broader costs of the "miracle" pest control techniques finally, after twenty-three years, having been proved almost to the point of defeating even the powerful alliance of business, industry and government that has supported them so effectively. But there are many other threats - hardly less serious than the pesticides or the SST: there are now PCB's, the polychlorinated biphenyls, a product of the plastics industry. There are also beryllium from rocket fuels, lead, CO, S-compounds, and others, unknown and uncontrolled.

These points are clear:

1. The biotic resources of the earth are no longer large in proportion to the demands man is making on them.
2. Demands on resources, biotic and abiotic, increase with the development of technology. Technology increases the fraction of the earth's resources commanded by an individual. This means that an individual takes up more space on earth if he has technology.
3. Technology increases competition or interference between people, increasing the need for manners or laws regulating behavior.
4. Technology, too, is increasing on an exponential curve. We can measure its doubling time on the basis of the use of fossil fuel, variously estimated as doubling every fifteen to twenty years. Consumption of fossil fuels is only loosely coupled to the increase in population and can be considered a crude measure of the extension of technology.

Clearly, the environmental crisis is due not simply to increase in numbers of people nor simply to the increase in technology, but to the product of these two exponential curves: population with a doubling time of decades and technology with a doubling time approaching one decade. The doubling time of the environmental crisis is thus measured not in decades but in years.

The environmental crisis is real, an enduring phenomenon, not simply due to population growth but also due to the growth of technology, a technology that is malignant in the sense that it develops its own resources, adding to its

MAN AND HIS ENVIRONMENT

momentum, speeding its own unplanned growth. Its success is unquestioned; it has added what sometimes seems to be an infinity of resources to western civilization, to the point where many ordinary optimists believe that it can make all resources infinite, thus solving the crisis of population. The fact is, however, that in many ways technology is itself a consumer in competition with man, growing on its own set of exponential curves, competing with each of us for its own monstrous share of the earth's oxygen, for its own rights to dispose of wastes in the common environment, for its own share of the earth's space. Technology, of course, progresses upward on its own growth curves, propelled by a series of individual decisions, many as trivial as the decision of the small boy to take his outboard for a spin on the lake. These, taken cumulatively, very quickly commit the earth to a significant pattern of changes in which the common interest is subordinated to the interests of the individuals exploiting the common resources, contributing to what Garrett Hardin has defined so eloquently as "the tragedy of the commons", the commons being what belongs to all.

There is, of course, no problem as long as resources are large in proportion to the demands made on them; as long as the lake is large and there are few boys with motors, but when the lake becomes crowded, regulation is necessary to protect the boys, to limit their numbers and to assure that swimmers and other users will have a chance. Clearly then, the role of government becomes one of mediating between competing users of resources that are in short supply, of defining niches or roles within the system, of limiting competition by establishing the rules. The tragedy arises when the regulations are not forthcoming or existing, failed by abuse. The rules come hard because they clearly limit the freedom of individuals, they necessarily restrain private enterprise in favor of the common good that is much less specific than the profit motive. Just as the need for them increases with each increment of population and technology, so does the difficulty of determining what the regulation should do: who is to be protected by regulations, where does the common interest lie? And the aggravation applies as well to the problems of enactment and enforcement.

With pressures on environment increasing exponentially and inexorably and with the problems of regulation becoming proportionately more difficult, there is real reason to question whether any government, including the United Nations, can sustain an impartial, wise or indeed any regulatory function that is appropriate to the needs. If it did, government would have to become sufficiently aggressive to be widely unpopular, thus risking losing all its powers in any society that grants power to government through the "consent of the governed."

WHAT LEVEL OF LIFE?

It is also too much, of course, to expect that government remain an impartial agent in the scramble for resources: government, quite properly taking on functions that private enterprise cannot, builds agencies with specific roles to exploit environment in the public good. These agencies, following some very simple evolutionary principles, soon become specialized, defining their niches in the bureaucracy and achieving an almost impregnable stability, supported by and supporting a large public clientele. We all know the story of the dam-builders and how they, having used almost all of the sites available for dams in natural rivers have, with imagination and characteristic vigor, turned now to building canals. Controlling the blessings conferred on the public by these agencies has become a major national problem as the competition for both role in society and a share of the earth's resources has become more acute.

There are, of course, many examples of the diverse alliances developed between government and industry in the interests of regulation. The alliance between government and the agricultural community that has developed around pesticides is an especially rich illustration. It is all the more complex in that the Department of Agriculture's role in promoting agriculture has been allowed to slip over into direct and indirect support for the pesticides industries, whose activities the Department of Agriculture also is expected to regulate under the Pesticides Labeling Act. It is extremely difficult, perhaps impossible, to challenge effectively even individual decisions, let alone the policies or the existence of such an alliance, once established. The standard response to a serious challenge of policy is appointment of a committee of distinguished experts, a majority from within the alliance, who reinforce the policy. This in itself is a sophisticated type of pest control (developed interestingly enough by Department of Agriculture scientists) involving filling the pest's niche with a sterile or harmless strain of the pest. Thus, conservationists can be controlled by diluting them with bureaucrats. And thus it is that, despite overwhelming evidence of world-wide secondary effects of a most serious sort from accumulation of persistent pesticides, it has been very difficult to obtain any binding restriction on their use beyond the tolerances on human foods set by the FDA. And the arguments in support of the current policy sound compelling: the pesticides are necessary for food production in a world that is becoming increasingly hungry. But the persistent pesticides clearly threaten oceanic fisheries — and there is concern that they threaten much more. Where does the common interest lie? Are the manufacturers and users of pesticides alone capable of deciding this important issue? If not, who should decide it? The bird watchers? Those who eat fish? Or a bunch of nervous-Nellie ecologists who think that man is changing the biosphere in ways that threaten life as we know it? Cer-

MAN AND HIS ENVIRONMENT

tainly pesticides are necessary in agriculture: we might say, "Let's just use them wisely and eliminate the problem." But remember, the current problems have resulted from what was considered "wise use" by knowledgeable experts. These problems seem, or until very recently have seemed, almost beyond control except by some extraordinary means, so thoroughly entrenched is the pattern of use and the alliance of business and government in support of it.

The agri-business alliance has even more in support of it than simply strong representation in government, a large clientele in the business community and a large public constituency; it has its own large and distinguished scientific community. The scale of this science is staggering; it reaches into every state through the agricultural colleges and experiment stations, through the Agricultural Extension Service, and through various other specialized agencies such as the Soil Conservation Service and the U.S. Forest Service. Clearly, in such a large scientific establishment there must be great diversity — and there is. But equally clearly, the context within which this science must operate is improved productivity for agriculture. And the criteria of production are the common market-place criteria of profit and loss within the limited sphere of agriculture. The profit from the use of pesticides is easily measured as fractional increase in yield; the costs of the use of pesticides are simply the dollar cost of the purchase; they do not include the costs borne by the public at large due to the leakage of pesticides out of agriculture into other ecosystems where they do great harm. These costs, of course, are extremely difficult to measure. The agricultural scientists, committed to research within agricultural ecosystems and to the traditional measures of success, have been blind to such possibilities, surprised when confronted with the reality, and understandably defensive of their wisdom. The defensiveness has led to utterances of such preposterous alternatives as "bugs or people" in defense of current use of pesticides. But worse than this, the "experts", the scientists of the alliance, have allowed their own limited studies to be presented in the context of the whole show, ignoring the larger questions of long-term stability of agriculture and of the possibility that their agricultural systems must be linked compatibly in the long run with the rest of the environment. In short, they have fallen, hook, line, and sinker, for the treadmill of what Alvin Weinberg calls the Technological Fix in its narrowest sense, each cure generating the need for further cures. It is this attitude, supported by a large captive science, and all of the power of the agri-business alliance, that has produced the now world-wide problem with persistent pesticides and allows a headlong rush into an analogous series of problems with herbicides.

WHAT LEVEL OF LIFE?

How can we control such problems? There are, of course, no simple solutions. Restraint in the application of such "fixes" is needed. But the problem is far more fundamental and requires a more basic approach. The context within which all solutions lie is very clear indeed and has been stated many times. The problems can be solved only within a context in which competition for resources is low; only when resources are large in proportion to the demands on them. Establishing and maintaining such a context must quickly become the policy of nations, for it is not only the central issue of conservation, but also central to preservation of an effective government and to sustaining a vital, rich and rewarding civilization that offers a reasonable standard of living for all. No single bureaucrat, no national party, no manipulation of technology, no clever reorganization of government, no educational effort, no actions in court can solve the multiple crises of environment and society without public acceptance of this basic fact. Its principal element, of course, is control of population, but we must also develop restraints on technology and on government consistent with both the noblest aspirations of man and a stable biosphere. The environmental crisis is developing with a doubling time of years, perhaps a decade, and is clearly a crisis — not only of population and resources — but a mounting crisis of government. It promises to dominate the last decades of the 20th Century and all the decades that remain for man. The question is not survival — man will survive — but at what level of life?

FISHES AND LOAVES:
SOME SOCIOLOGICAL OBSERVATIONS ON
THE ENVIRONMENTAL CRISIS

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I

ENVIRONMENTAL crises seem as American as cherry-pie. Probably no other people has had such a passion for living by crises nor such a penchant for firmly and dramatically shutting the door long after the horse has run away. Certainly, men of property and men of intellect in America did not give much attention to the environment until late in the 19th Century.

Perhaps 1864 is the crucial date. This was the year when George P. Marsh, a member of the New England gentry, published his book condemning man's role in changing the face of the earth. 1864 was also the turning point when the hopes for American agrarianism were thoroughly defeated by the triumph of the new industrial order. Twenty-one years later New York State would realize her primeval forests were gone and establish the Adirondack and Catskill Reserves. Five years after this action, in 1890, the Superintendent of the U.S. Census announced the end of the American frontier.

For men of property and men of intellect the limits of time and space were closing-in upon their higher visions. And periodically — the 1900's, the 1930's and the 1960's — Americans would re-discover the environmental crises. And, perhaps most significantly, at those moments of re-discovery men of the left rather than the right held political power.

Environmental issues are linked to the ebb and flow of political life because the origins of natural resources are to be found in society, not in the earth. And unlike nature the web of human society is woven of myth and rhetoric, of faith and persuasion, which filter and sort the meanings of man and nature. Therefore, environmental crises, like other social problems, emerge when the

FISHES AND LOAVES

traditional myths and rhetorics are questioned and new ones compete for their replacement.

In the 1960's optimism seems caged in despair. Daily we are reminded of pesticides in our life chain, uncontrolled population explosions, increasing dosages of radiation and CO₂, disappearing open spaces, rivers as sewers and the unspoken guilt of hydrogen and biological weapons.

And such problems seem particularly acute for Americans, perhaps, because, in this era, they alone have the wealth and power to do what they need not reflect upon. Tragedy has not been a common component of the American experience, therefore reflection upon the consequences of one's actions has been offered only in the breach of past error. We owe thanks to the ecologists and conservationists, the racists of all colors, and to those who are quicker with clubs and guns than thought, for it is they who have reminded us that tragedy occupies a central place in human life. Yet, I fear that tragedy, or rather its corruption — despair — may become such a classic pose that our comic hopes will fail to occupy equal status.

This is especially evident in the tendency to slip from the real problems of the environment into the now favorite notion that man is a weed, a pathogen gone wild, a spectre haunting the survival of the world. Fundamentalists who deplored the modern world when original sin went out of style should find some margin of satisfaction when biological science labors so long only to re-discover the Old Testament.

Not being confined by the sterner morality of science I feel free to consider some alternative perspectives. Like the botanist and poet, I tend to believe that an adaptable and long persisting weed, such as man, may have virtues and beauties yet undiscovered. Indeed there seems too much comfort in the notion that we are all guilty, for then, like the good Nazi, none of us is individually guilty. Consequently in this lecture I will consider some miracles, some disenchantments and some responsibilities.

II

I choose miracles because they, rather than conservation principles, have held central fascination for the masses of men. When the son of a Jewish carpenter set out to save the world his disciples were careful to build their new piety upon miracles of health and plenty. Wisdom would seem best served by remembering that the masses of men still share the hopes, if not the particular faith, of Christ's miracles of plenty. Charts on water pollution, or facts

MAN AND HIS ENVIRONMENT

on CO₂ increase or dwindling open spaces may, indeed, be persuasive to those who have already experienced rising miracles of plenty. To those less fortunately situated the hopes expressed in miracles of fishes and loaves will carry more appeal. The well fed should listen.

Then Jesus called his disciples to him and said, "I have compassion on the crowd, because they have been with me now three days, and have nothing to eat; and I am unwilling to send them away hungry, lest they faint on the way." And the disciples said to him, "Where are we to get bread enough in the desert to feed so great a crowd?" And Jesus said to them, "How many loaves have you?" They said, "Seven, and a few small fish." And commanding to the crowd to sit down on the ground, he took the seven loaves and the fish, and having given thanks he broke them and gave them to the disciples, and the disciples them to the crowds. And they all ate and were satisfied; and they took up seven baskets full of the broken pieces left over. Those who ate were four thousand men, besides women and children.

For men of intellect such notions seem quaint. Miracles are not in the fund of experience for intellectuals and when they turn to the arcadias of their past they seldom find other than a steadily deteriorating present. Yet if one shifts from intellectuals looking at the costs of economic progress to the worker looking at the fruits of economic progress then very different perspectives emerge. If we should move back three decades into the past and pick a man from the shop floor and paint for him a 1969 utopia of a home on the hill with electric servants churning clothes and dishes, two cars, a color television, flip top beer cans and a son rioting at the University he would stare at us in disbelief that such a wonderful world might be his happy fate. Yet, such a fate he has experienced. And who is to deny him when Resources for the Future economists, such as Harold Barnett and Chandler Morse (1963), argue that economically our resources are unlimited. They are unlimited because:

a strong case can be made for the view that the cumulation of knowledge and technological progress is automatic and self-reproductive in modern economics, and obeys a law of increasing returns. Every cost-reducing innovation opens up possibilities of application in so many new directions that the stock of knowledge, far from being depleted by new developments, may even expand geometrically. Technological progress, instead of being the adventitious consequence of lucky and highly improbable discoveries, appears to obey what Myrdal has called the 'principle of circular and cumulative causation,' namely, that change tends to induce further change in the same direction.

The economist's enthusiasm for the future is exceeded only by the poetry of industry. A recent Westinghouse booklet (1969) on the "infinite energy" of nuclear power tells everyman that automated hospitals of the future will

FISHES AND LOAVES

treat him as a head of state or astronaut and garbage will be converted to humus and electricity will turn salt water into fresh water. How can we help but believe that nuclear fission offers him: "Power seemingly without end. Power to do everything man is destined to do. We have found what might be called perpetual youth . . . and like children . . . will have the hope and exuberance of boundless energy." And given options on symbolic futures - the vanishing arcadias of intellectuals or the Westinghouse utopias of perpetual youth - who can deny everyman's inevitable choice? If we wish to understand the origins or environmental problems we must enter such a metaphorical tangle. We need to realize that our images do indeed tell us what we are. And rather than quarreling with our images we should quarrel with ourselves. We should realize that we deserve and get the kinds of glory and despair which are our New York Cities and Hudson Rivers.

We should first note that, though miracles **may** be promised by the technocrats at Westinghouse and her benevolent corporate sisters, these miracles are of an entirely different nature than the gifts from a son of God. The sincere efforts to surround corporate behavior with an aura of sacredness or calls for the defense of "peoples' capitalism" against all other sources of plenty, falter on their own lack of faith. For one thing, modern miracles of technocracy, unlike religion, only speak to us about the magnitude of gain rather than the magnitude of loss. Because our expectations are so structured we know that to sacrifice in the name of God is something quite different than sacrificing self in the name of General Motors or the People's Bureau of Transportation.

The loaves and fishes were sacred miracles universally in-tune with the bulk of human history, where myth and ritual soothed man's awareness of vast unknown *and* unknowable forces. Even science, as Toulmin and Goodfield (1965) argue, has spent the largest share of its history attempting to document those miracles already held by sacred authority. In our times the scientific investigation of God's grand design is no longer a guiding faith.

Today, whether in a capitalist or a communist social **system**, technology is the secular substitute for sacred miracles. Rationality, equality, individualism and materialism are the songs of our contemporary miracles rather than the arcadian virtues of passion, nobility, community and spiritual faith. In Max Weber's words, we are no longer enchanted with the world. Weber (1919) suggests that the modern man has little knowledge of his tools nor even the need to understand how these or the basic necessities of survival are produced. He argues that:

MAN AND HIS ENVIRONMENT

The savage knows what he does in order to get his daily food and which institutions serve him in this pursuit. The increasing intellectualization and rationalization do *not*, therefore, indicate an increased and general knowledge of the conditions under which one lives. It means something else, namely, the knowledge or belief that if one but wished one *could* learn it at any time. Hence, it means that principally there are no mysterious incalculable forces that come into play, but rather that one can, in principle, master all things by calculation. This means that the world is disenchanted. One need no longer have recourse to magical means in order to master or explore the spirits, as did the savage, for whom mysterious powers existed. Technical means and calculations perform the service.

Though the Madison Avenues of the world offer an unrequited stream of magic where motor cars bring virility, scented creams bring beauty, and carcinogenic smoke brings sophistication, still we know that in those higher glass towers are pygmies just like us. In this sense we have brought the world down to our scale. It is ours. It is as fallible, petty and glorious as we are. Yet we suspect that like us, the fishes and loaves of technology are tainted. When men not gods make miracles, the good works always contain the seeds of human terror and it is a terror all the more frightening because we feel we should understand it. Thus rationality tends to become the most terrifying of irrationalities. Though Weber, as Marx, applauded the triumph of rationalism over the superstition of the middle ages, Weber, (1904/1958) unlike Marx, saw in the triumph of rationalism the seeds of its own destruction.

No one knows who will live in this cage in the future, or whether at the end of this tremendous development entirely new prophets will arise, or there will be a great rebirth of old ideas and ideals, or, if neither, mechanized petrification, embellished with a sort of convulsive self-importance. For of the last stage of this cultural development, it might well be truly said: cSpecialists without spirit, sensualists without heart; this nullity imagines that it has attained a level of civilization never before achieved:

In Captain Ahab, Melville gave us a poetic view of the world Weber feared, where all the means are sane, the motive and object mad. The international weapons culture would seem to have long surpassed the insane rationality of Ahab.

As Richard Barnet suggests in a recent issue of *Science* (1968), "The accusation that the military mind lacks imagination is absurd, as readers of Air Force / Space Digest and its army and navy counterparts can testify. The threats that leap up from the pages of these journals are equalled in inspiration only by the reassuring panoply of instruments they recommend to burn, shock,

bore, disintegrate, poison, or blow apart those who dare to pose such threats. The logic of the arms race is utterly imperturbable; totally conflicting signals from the enemy produce the same results. In each case the analysis of the external political and military environment is different; in each case the prescription is the same: More."

But then the trained incapacity of the military has so wandered into the realm of heroism and tough mindedness that it is closer to poetry and therefore not an apt case. Better examples are furnished by conservation agencies.

Ashley Schiff (1962) documents how the U.S. Forest Service became so committed to preventing fires in the forest that it suppressed all empirical evidence as to the value of burning for timber stand improvement. It hasn't been until recent years, and then still reluctantly, that the Forest **Service** and the Park Service have recognized fire as a valuable silvicultural tool in preserving the health of redwoods and certain pine species. Thus present practice seems but a delayed recognition that the non-professional unlettered southern farmers at least had their empirical observations, if not their techniques in better control than the rational professionals.

Similarly, Charles Reich (1962) and others have argued that technicians in the Forest Service have so tied their interest to timber values that they have been unable to consider other uses of forests, such as recreation. Such trained incapacity is not a monopoly of the Forest Service. In a careful study of the TVA, Phillip Selznick (1949) documents how an organization founded in the name of conservation became so co-opted by dominant commercial interests that conservation has become less and less a guiding principle.

We could continue to list examples where regulatory agencies have gradually grown to reflect the views of the **industries** they were intended to regulate because survival of organizational rationality supersedes the value of the originally passionate goals. Or we could note the interesting competitions which occur when the Bureau of Reclamation is draining marshes for more agriculture while the Fish and Wildlife Service is attempting to save marshes for migratory wildlife, and the Department of Agriculture is paying for soil banks.

However, my intent is not to join in the now familiar and often misguided condemnation of bureaucracy. Rather what I am suggesting is that problems of the environment, as other social problems, are fed by the same forces which create the hopes and rewards of social life. By disenchanting ourselves, by rationalizing the world, we have created institutions competent to feed millions far beyond the expectations of Malthus, and to be equally competent in processing millions for gas chambers or sacrificing many more millions in games

MAN AND HIS ENVIRONMENT

of heroic nationalism. Life is multi-dimensional, but those dimensions are limited. Consequently we are constantly making trade-offs between individual freedom and social equality, or social stability and economic growth, or expectations and fulfillment. And the unintended consequence of attempting to rationalize the means to accomplish a desired goal is that a whole series of equally important goals no longer become viable alternatives. In such a way our modern surpluses of information and junk stand as significant monuments to rationality.

Western man, and particularly American man, has been prone to hold a faith that the greater the increase in the fund of information, the greater the increase in human well-being and progress. Now that we are caught in an ever widening circle of information we must wonder at our measures of progress. Information is not knowledge, in fact without analysis and action it is detrimental to the accomplishment of knowledge. In contrast the subsistence village or tribal society has a low level of information, but it also has clearly defined means of analysis and action for achieving its narrow range of goals. In such a setting though the margin for individual choice and variation is small, the social expectations and achievements seem modestly obtainable.

In urban-industrial societies we are faced with an ever expanding set of expectations — we not only desire more in the way of material goods, we desire more in the way of spiritual goods. The gods and their temporal representatives must be humane and involved in the pain of the human condition. Poverty, ugliness, tyranny, vulgar taste, war, brutality, hate and evil must be eliminated. To say nothing of eliminating water and air pollution, soil erosion, flood and bad weather. Husbands and wives must understand one another and have fruitful sexual and social encounters. Parents and children must develop warm relationships and mutual respect while maintaining individual rights of expression. Women and children, ethnic groups and deprived occupations must be given dignity and equality. The planes and trains must run safely and on time, the autos must be fast, safe and efficient, tooth decay eliminated, heart disease conquered. While the schools must be improved to give a firm grounding in the basic skills, but emphasize wholesome interest in the pupil needs, synthesize the new, adjust to the "community", prepare for tolerance, encourage pride, and make sure that the graduates have marketable skills, are humanely wise, and meet the needs of all of the people.

Perhaps our era is the first to reach the limits of information. Not only do we carry the information flow of village and tribal gossip, our electronic tongues carry us tales of tragedy and comedy from the region, the nation, the

FISHES AND LOAVES

international alliance - even, we are told, messages from the outer galactic nights. Every joy and sorrow, triumph and defeat in the kingdom of man is prepared for our emotional consumption. We ingest. We wait. The hair style of a rather expensive London prostitute or the wisdom of four young men from **Liverpool** crowd out the affair of the local grocer and distract us from the events of control to the events beyond our control. Moral outrage seems a cheap price to pay for avoiding action. While our internationalized information furnishes an easy, inflationary coin which keeps our homely discourse running, it soon bores and is further devalued. It matters not. For a thousand and one new names and places and events are waiting to slide through our mouths never to be heard from again.

In a sense it is progress for it lifts us from the trivia of our provincial lives and certainly there seems positive good in rising expectations. Yet by lifting our eyes we also increase our sense of powerlessness. We cannot impose sanctions directly upon the pesticide user, as we can upon the miscreant in our local village. We can encourage the mystique of law and lawyers to enforce their complex metaphysic, but the complexity has removed our sense of touch and of participation. Our souls are not with us, nor our bodies and barely our minds. The laws will come and they will corrupt our souls for their enactment will likely lead to unforeseen and unpleasant consequences which will require more mystique in the higher rhetoric of law and we are specialized out of it.

As exotic wars, and international monetary crises rise and fall we are spectators at events beyond reality, yet whose consequences have the greatest consequence for our personal survival. Information about the problem seems real, yet the problem itself seems unreal for it is beyond the range of our comprehension and control and we suspect it is likewise the same for the experts. And we feel that all the '**educational**' programs in the world will merely give us more information but no knowledge. We simply endure like passengers in a jet airplane who have all sorts of information about territories they are passing, elevations, speed, and those funny noises in the engine, but their very life support system seems beyond them.

In a pre-television study of the mass media, Paul Lazarsfeld and Robert Merton (1948) suggested that "**the** flood of information may serve to narcotize rather than to energize the average reader or listener." They reason as follows:

As an increasing meed of time is devoted to reading and listening, a decreasing share is available for organized action. The individual reads accounts of issues

MAN AND HIS ENVIRONMENT

and problems and may even discuss alternative lines of action. But this rather intellectualized, rather remote connection with organized social action is not activated. The interested and informed citizen can congratulate himself on his lofty state of interest and information and neglect to see that he has abstained from decision and action. . . . He comes to mistake *knowing* about problems of the day for *doing* something about them. His social conscience remains spotlessly clean. He *is* concerned. He *is* informed. And he has all sorts of ideas as to what should be done. But, after he has gotten through his dinner and after he has listened to his favored radio programs and after he has read his second newspaper of the day, it is really time for bed.

In the intervening two decades the problem has if anything become more intensified. In a recent study of mass society and mass culture, Harold Wilensky (1964) reports:

We must first grasp the fact that the mass media are the core of American leisure and that television has become the core of media exposure . . . The sheer arithmetic is striking. Nine in ten American homes average five to six hours daily with the TV set on. And it is not just turned on; it is generally being watched. Eight in ten Americans spend at least four hours a day in viewing television, listening to the radio or both . . . (and) . . . the trend is up. An increasing fraction of the daily routine is devoted to the products of the mass media. Mainly due to the rise of television, the media together and on the average now take up almost as much time as work; substantial minorities log more hours a year in TV viewing alone than in working.

As Wilensky notes the astonishing amount of exposure to the media are well known; what is less well known is the impact on the quality of American culture. He then proceeds to document that the trend is toward standardized, middle or low brow taste regardless of the person's occupational and educational attainments. In short, the consumption of middle and low brow advertising and media programming cuts across all classes. Wilensky concludes his study by noting: "*To be socially integrated in America is to accept propaganda, advertising, and speedy obsolescence in consumption.*"

It is well to note Wilensky's documentation that obsolescence is an American way of life for all classes including the intellectuals. Indeed it is a mark as to how far our fascination with the new has gone when we reflect that in other times and other societies conservatives would have been the most indignant critics of the desire for the new and the emphasis upon obsolescence. It is they who would have pointed out the costs for tradition, continuity and stability in the community. Yet in America it is most frequently men of the left, such as Thorstein Veblen, C. Wright Mills, and J. K. Galbraith, who have indignantly complained of the inefficiencies and the loss of traditional

FISHES AND LOAVES

continuity. The consequence is that junk, not progress, is our most important product.

Auto graveyards stretch across thousands of acres of the Western World, and Detroit in a fit of conscience may develop an equivalent of the Nobel Prize for the inventor of the super-car-eater. Yet our surfeit of junk is far overshadowed by the accelerating birthrates of machines and, perhaps, Presidential commissions and engineering committees to solve solid and fluid waste problems. Still our admiration for the new machines leaves us scarcely time for a parting tear, much less a thought about our accumulating mountains of technological junk. And if technology got us into this mess surely it will get us out. Yet at those rare interstices of contemplation we must vaguely sense that the junkpiles are symbolic of our times, like middens for future archaeologists, they speak to the future, meanings we do not clearly hear.

We do not hear because the minstrels of rationality loudly praise the accumulating waste of our times as proof that we are on the verge of reaching the apex of democracy - never have so many had so much to waste. Apparently waste is the new definition of democracy. A writer in the *New York Times* (Carthew, 1969) recently reported that often in Moscow there is a deliberate jamming of traffic so that the Russians can feel as suitably decadent and democratically successful as the West.

It is well to note such Russian inventiveness, for it may control our tendency to expand patriotic sentiments to include the notion that no society in the world can waste like the Americans with the inference that this is due to some sort of superior quality of American society or for the alarmists, some sort of superior demented quality. Nevertheless a boast that 'none could be as despicable as us', like the boast, 'none could be as great as us', have equally chauvinistic origins. We had best keep such matters straight. The world probably finds the praise of our faults as tiresome as the praise of our successes. Anyway when it comes to waste we have no specifically greater innate capacities.

The historical and ethnographic records offer fairly clear evidence that from the noble savage on through the arcadian Greeks, until the industrial order, excess and waste has been a characteristic of all human societies. The periodic gluttony of tribal feasts of the potlatch ceremonies where the magnitude of prestige is determined by the magnitude of possessions destroyed, suggest that scarcity and difficult survival conditions are no guarantee of efficiency in use or conservation of resources. But then as the Yerkes (1929) suggest, this is little different from our primate cousins. They say, "All of the anthropoids are careless eaters which in their haste to satisfy their appetite destroy and

MAN AND HIS ENVIRONMENT

waste more than they devour." Yet, we will deceive ourselves if we attempt to shift blame for our waste to the forces of the past or inherited genes.

Just as aggression between individual organisms is something quite different than the calculated, systematic destruction of one society by another, so is modern waste in contrast to tribal society. In tribal society waste was a periodic means of rising above the animal existence of subsistence life and of reaffirming the collective bond, much as the Roman saturnalia was a means of bringing light into the darkness of winter. In modern society waste is a daily, systematic devouring which brings neither the explosion of joy nor a strengthening of the social bond.

As any copywriter knows, "New" and the search for it is a major motive of our times. In pre-industrial societies youth imitated age, in post industrial societies age imitates youth. And yet, unlike the early European settlers of North America described by Bernard Bailyn (1960) there seems little utility, in the modern era, to ask about our future by searching the behavior of the young. The conditions of technological evolution are far more under the control of age than ever were the curiosities of the new world. Yet there it is, even the most self conscious of conservatives requires a new reasoned image and a new stoic personality to deal with the pressing problems of our "new" times. Like the adman's notion of junking the old mechanical system before repair costs mount up we have many an applauded rationalization for increasing the magnitude of waste. Practically every journalist and political leader has had a go at junking American public education and substituting a new modern system with teaching machines, windowless buildings and jet age local control. And for a generation leading a revolution fired by the latest electronic gear, the hottest Mustangs, and primed by the fervor of a Madison Avenue slogan creator — the new seems as widely voiced as the latest breakthrough in detergents. The appeal to the new is a well cultured gift given youth by the tribal elders. For all is combined with a perplexing admiration of the unknown future which today's youth will inherit — and since it is unknown and since it belongs to youth — we seem to look to them to tell us what it shall be. The absurdity of the logic seems to escape reactionary and radical alike.

The future never belongs to the youth but belongs to the impotence of the individual caught in the cumulation of trivial decisions. The riots in American cities today are the product of smallpox plagued Amerindians unwilling to labor in cash agriculture, 15th century European colonial policies, peculiarities of geography and climate in the Southern American colonies, the aim for

FISHES AND LOAVES

equality on a moving frontier where social control depended upon outward homogeneity and a variety of intended and unintended actions too numerous to be sensibly mentioned here. The point is that the trajectory of the future is not determined by the future but by our present conception of it and that conception is determined by those who have such power to formulate, initiate and direct present action. Only in this way does a society manage the problems given them by previous generations and in the process of such management create a fair share of similar and unique problems for their successors. By now the 20th century and Darwin should have taught us that if the emerging new systems are to survive they must retain some resemblance to the old systems they have displaced.

I am suggesting something more than all is change but all remains the same. The abdication of the tribal elders from the responsibility for shaping the conception of the future is a significantly vexing retreat. The quest for the "new", the easy guiltless discarding of goods and ideas at the midpoint of their life cycle, the raising of waste to a high point of morality and patriotism, the looking to youth for solutions and then condemning them for applying the logic of the "new" have fundamentally different conceptual properties than are found in previous civilizations and large numbers of contemporary cultures outside the industrial west.

The quest for the new seems to be paralleled by recurring searches for conspirators — whether "capitalistic fascist pigs" or "atheistic communist devils." The "people" are always fundamentally good, they want peace, would never tolerate gas chambers, and love their fellow man — only they are led astray by profit driven capitalists or driven to war and rebellion by deceitful communists. The conservation-environmental crisis has much of this familiar shrillness and searching to control and extirpate the evil influence. When those as far apart in life style as Russell Train or Laurence Rockefeller and middle-aged beatniks such as Gary Snyder or Alan Ginsberg agree on the ecological crises; and when corporations such as American Motors, Standard Oil and Georgia Pacific wax poetic over nature, then we are in the realm of a sacred crusade.

However a concern with purifying nature and saving Man's environment may be no simple salvation. Perhaps, as Daniel Bell (1961) suggests we are at the end of ideology. The tired faces of communism and capitalism blend more and more, until it seems certain they shall rediscover their shared parentage. It is only these ideologies which are dead, the need for ideology remains. And nature in all her Wordsworthian glory seems one of the most

MAN AND HIS ENVIRONMENT

likely sops to absorb our search for ideology. I suspect that Nature is oversaturated by such demands.

As Weber noted in 1918:

If we attempt to force and to 'invent' a monumental style of art, such miserable monstrosities are produced as the many monuments of the last twenty years. If one tries intellectually to construct new religions without a new and genuine prophecy, then, in an inner sense, something similar will result, but with still worse effects. And academic prophecy finally will create only fanatical sects but never genuine community.

Environmental problems from population explosions to air pollution seem very much a form of academic prophecy, which implicates all men, but seldom re-arranges the leadership classes or creates a sense of community. We are already accustomed to such crusades. Great debates over the fate of the world and of the individuals who will pay supreme sacrifices seldom include the world nor those individuals. Who in Belgium or Poland decided that missile systems should be erected to defend the free world or people's socialism, both of which are already lost by the construction of these systems? Who directed that a roadway should run through our neighborhood and not theirs? Who directed that one should die in a lost jungle in a lost world while others talk of socialist heroism and democratic institutions?

The wealth of the world is squandered and spent while never including our conscious choices for we are never given alternatives but merely the yes or no counters of the economic and political markets. The sacred world of nature can be no diversion from fundamental questions concerning the distribution of authority and decision making, of expertness gone sour, or science pleading amorality for its immoral decisions. To talk of the need to chew up automobiles (Carr, 1969) because their birth rates are high and their life cycles short or that technology must be designed to minimize pollution from automobile exhausts are false questions for they treat such events as if they were eternally fixed by the fateful stars. Detroit, highway engineers, construction men, and the thousand other obstetrical, maintenance and grooming services devoted to the love of autos may wish that such desires were eternally fixed. Yet can they have it both ways — to tell us that millions of tax-deductible dollars must be spent to persuade to buy automobiles — and then later tell us that the problem of auto birth rates merely reflects public demand and therefore is not their responsibility.

We assume that present margins of error are not diminishing, that the impersonal regulative factors characteristic of urban areas and market eco-

FISHES AND LOAVES

nomics will persist far into the future, that fail safe tactics, and ballistic missile checks are perfected and eternal. Yet all of these seem the height of absurdity, if anything the margins of error are diminishing. We find that anti-pollutant mufflers on autos in the Los Angeles area are not accomplishing the goal of smog free desert air, for the population growth of automobiles continues its explosion so that though individual autos are now cleaner, the increased number of autos maintains the high levels of emission. We stand poised, as the racing car driver who has converted danger into routine, yet find that the routinization of terror is the quickest route to death. No more than smog is cleared with cheap and simple technological manipulations is peace waged with orwellian slogans while fragile humans guide their missiles. This, of course, is the choice we are given . . . to continue in the same way and destroy ourselves, or to transform ourselves so that we no longer continue in the same way. I state this extremely for we need to fully view the social implications of what the ecologists direly remind us. If we must be concerned with population explosions of human beings, let us be even more concerned with the population explosions of automobiles, missiles and the other bed-rock junk of our industrial growth. To point at the automobile and war industries is to consider the two most significant providers of jobs, living standards, mobility and adman eroticism in industrial societies, it is also to point at two of the least important and least significant activities yet invented by man. There is no crucial need to make sure Americans, Russians, Chinese or whomever are killed 10 times over, nor is there any survival need to speed through 10 national parks in 5 days. These are old, almost trite issues and given our passion for the new, they merely arouse impotent yawns rather than crusading zeal. Yet, I bring these dead issues up once again to illustrate the limitations of our alleged moral concern for the environment.

Since 1948 various peace movements have been storming the Pentagon and planners have been shaking their heads in horror over Los Angeles. The environmental crisis was just as close in 1948 as now, yet the autos continue to proliferate and the missiles to spread their tips in the face of all reason, logic and humane desire. We seem unwilling to recognize the reality of society in that we assume that individuals play a full share in its direction, while ignoring the chains of social development which bind all individuals to the programmed decisions made in collective triviality and doubt. Decisions of motorized cities and sophisticated weaponry start from hopeful and mistaken assumptions, soon acquire the virtue of tradition and the weight of vested routine. When caught in the tangle of good ideas routinized into bad events the traditional American

MAN AND HIS ENVIRONMENT

solution has been to run off for some new uncontaminated territory. The clean prairie occupied only by migratory tribesmen, or the valleys and mountains settled by technologically weak locals were inviting settings for ignoring the mess left behind and getting the next social experiment started; for recouping losses, for dispersing second and third sons. It was the new beginning. Colonialism has that crisp virtue of starting afresh and it is a virtue not to pass lightly into the rhetoric of the new left without an awareness as to how much colonial values are essentially part of the new left. For the goal of taking old institutions and indiscriminately scrapping them is not much different than creating automobiles for profit and leaving their inherent problems for others to clean up.

The origins of these attitudes seem best accounted for by two events: 1) the transformation of European feudal society into a market economy; and 2) the European's discovery of a frontier. We will first consider Karl Polanyi's (1944) discussion of the causes and consequences of the developing market economy and then we will consider the frontier. Polanyi argues that in antiquity and feudal times the great mass of men made no separation of economy from society. Within the feudal community men had reciprocal rights and obligations towards one another, and, though avarice was by no means absent, money-making was a marginal rather than a central life interest.

The market society was a completely new social form which, he says, involved "no less a transformation than that of the natural and human substance of society into commodities." Later he argues,

The crucial point is this: labor, land, and money are essential elements of industry; they also must be organized in markets; in **fact**, these markets form an absolutely vital part of the economic system. But labor, land, and money are obviously *not* commodities; the postulate that anything that is bought and sold must have been produced for sale is emphatically untrue in regard to **them**. In other words, according to the empirical definition of a commodity they are not commodities. Labor is only another name for a human activity which goes with life itself, which in turn is not produced for sale but for entirely different reasons, nor can that activity be detached from the rest of life, be stored or mobilized; land is only another name for nature, which is not produced by man; actual money, finally, is merely a token of purchasing power which, as a rule, is not produced at all, but comes into being through the mechanism of banking or state finance. None of them is produced for sale. The commodity description of labor, land, and money is entirely fictitious.

He notes that the consequences of establishing a social order upon such fictions were grave.

FISHES AND LOAVES

To allow the market mechanism to be sole director of the fate of human beings and their natural environment, indeed, even of the amount and use of purchasing power, would result in the demolition of society. For the alleged commodity <labor power' cannot be shoved about, used indiscriminately, or even left unused, without affecting also the human individual who happens to be the bearer of this peculiar commodity. In disposing of a man's labor power the system would, incidentally, dispose of the physical, psychological, and moral entity <man' attached to that tag. Robbed of the protective covering of cultural institutions, human beings would perish from the effects of social exposure; they would die as victims of acute social dislocation through vice, perversion, crime, and starvation. Nature would be reduced to its elements, neighborhoods and landscapes defiled, rivers polluted, military safety jeopardized, the power to produce food and raw materials destroyed. Finally, the market administration of purchasing power would periodically liquidate business enterprise, for shortages and surfeits of money would prove as disastrous to business as floods and droughts in primitive society. Undoubtedly labor, land, and money markets *are* essential to a market economy. But no society could stand the effects of such a system of crude fictions even for the shortest stretch of time unless its human and natural substance as well as its business organization was protected against the ravages of this satanic mill.

However, countervailing forces to escape from the satanic mill were largely meliorative modification rather than fundamental change. Perhaps, fundamental **change** was avoided because, as Walter Prescott Webb (1951) argues, European civilization is only now coming down from a 400 year frontier boom. He suggests that when the European looked out from the Middle Ages and discovered a world populated by indigenous peoples whose religion and technological means of warfare made them imminently exploitable, then the frontier, for Metropolitan Europe opened. And with such discovery came the wonders and wealth which we attribute to our own ingenuity and institutions. Webb suggests we too quickly congratulate ourselves.

He notes that: . . .

.in 1500 the Metropolis had a population of 100 million people crowded into an area of 3,750,000 miles. The population density for the entire Metropolis was 26.7 persons per square mile. For each person there was available about twenty-four acres, a ratio that changed little from 1300 to 1650. The opening of the frontier upset the whole situation by destroying the balance that had been struck between land and man. A land excess of nearly 20 million square miles became available to the same number of people reducing population density to less than five, increasing the average area per individual to 148 acres instead of 24.

MAN AND HIS ENVIRONMENT

It was not simply a windfall of land but also a fantastic and dramatic increase in money. "Taking the 200 million dollars of 1492 as a base, we find that by 1600 the amount had increased eightfold, by 1700 it had risen nearly twentyfold, by 1800 it stood at thirty-sevenfold, and by 1900 at a hundred and fourfold over what was on hand when the frontier was opened.

At this time the European population, both in Europe and on the frontier remained relatively static, (. . . it was not until the 19th century that there was a large increase in the population) . . . so that by 1940 the enlarged Western world was more crowded than the small world of Europe was in 1500.

Webb feels that the major importance of the 400 year boom was the emphasis upon the individual. He was given the opportunity of ruling himself, enriching himself and saving his own soul on his own hook . . . these freedoms were institutionalized in Protestantism, capitalism and democracy. Webb argues that the frontier compelled the self-government which freedom imposes. And that it was only in the presence of great abundance that such a free-for-all system of wealth-getting, as capitalism, could long operate. He concludes:

There is an unpleasant logic inherent in the frontier boom hypothesis of modern history. We come to it with the reluctance that men always have when they come to the end of a boom. They look back on the grand opportunities they had, they remember the excitement and adventure of it, they tot up their accounts and hope for another chance. Western civilization today stands facing a closed frontier, and in this sense it faces a unique situation in modern times.

If we grant the boom, we must concede that the institutions we have, such as democracy and capitalism, were boom-born; we must also admit that the individual . . . attained his glory in an abnormal period when there was enough room to give him freedom and enough wealth to give him independence. The future of the individual, of democracy and capitalism, and of many other modern institutions are deeply involved in this logic . . .

Some years after Webb's work William Appleman Williams (1961) applied Webb's ideas to the historical development of the United States. Williams argues that Americans have deluded themselves into thinking that a frontier and later an expansionist conception of history did in fact produce democracy and prosperity. That is, rather than confronting the problems of technology and abundance, of unequal distribution of wealth, and the problems of reconciling individual freedom with social equality, America has left the untangling of such problems first to the frontier west and then to expanding her share of the world market. He argues that the first Americans to reject the frontier-

FISHES AND LOAVES

expansionist ideas were Martin Luther King's Montgomery association "who talked about the here and now rather than Kansas or Bust, or New York or Chicago. And what they really won was respect for themselves as men who no longer ran away. The frontier never had and never could give a man that kind of self-respect."

I believe Williams concentrates his attention on the U.S. because we have been the last to discover the finiteness of the world. And also, though he might deny it, because America still represents one of the best hopes for self transformation.

Yet every indication is that we have not come to terms with our loss of the frontier. We are promised expansion in space or science while advisory commissions to the President seriously recommend ignoring our old cities and starting clean and fresh with 110 new cities. Both historians would argue that the search for such new frontiers are simply distractions. The vast human and technical organization for the life support of astronauts precludes any opportunity for participation by the masses such as was offered by the first frontier. While the higher mystique of science seems the antithesis rather than the frontier for mass freedom, equality and capitalism. As Webb suggests:

I should like to make it clear that mankind is really searching for a new frontier which we once had and did not prize, and the longer we had it, the less we valued it; but now that we have lost it, we have a great pain in the heart, and we are always trying to get it back again. (yet) . . . there is no new frontier in sight comparable in magnitude or importance to the one that is lost. If the frontier is gone, we should have the courage and honesty to recognize the fact, cease to cry for what we have lost, and devote our energy to finding the solutions to the problems now facing a frontierless society.

To transform our market metaphors and to relinquish our frontier hopes so that we may discover ourselves will not be easy. In the remaining time I wish to examine a concrete case to illustrate something of the necessary difficulty and to suggest what will be required of the leadership class and its society in resolving environmental problems.

III

I will deal with the population explosion since we are told that it is the major source for all our environmental crises - from riots in the streets to hunger abroad. And since concern over population explosions, like conservation, seems to unite men of the deviant left and men of the established right.

MAN AND HIS ENVIRONMENT

In this discussion, let us leave aside the possibility that Colin Clark may be right in his argument that present population projections are severely wrong and that technological improvement will save us. Let us simply accept the now popular doomsday projections.

Most often discussions of population growth seem prime examples of the desire to simplify complexity and to hope for significant social change without any social upset. The ironies of compassion and simplified complexity seem clearest in biological discussions of poverty. Regularly savants send notes to the poor expressing compassion for their condition and sternly indicating the causes of their poverty — inferior genetic endowment, inferior nutritional planning, and an unbelievable interest in sex. The poor are emphatically told they have too many children and they should do something about it. The other part of the equation — that the rich get richer — is seldom mentioned.

Similarly, upper middle class planned parenthooders have long been surprised that the foreign and domestic poor resent their good intentions. To be sure population explosions are real to the masses of poor, after all they live much more tightly confined with their children than the suburban planned parenthood people do. The poor also realize that population explosions are useful distractions from identifying fundamental responsibilities and suggesting radical reconstruction of dominant institutions.

One of the prime responsibilities to note is that increases in population are as essential for the growth rates of the gross national product as are increases in obsolescence. The expansionist doctrine locks us into our own expectations whether it is the academic scientist grown accustomed to an annual increase of 15% in appropriations or the corporate manager anticipating success based upon an ever upward rise in dividends. Such logic is not lost upon the poor who see their future equally tied to growth.

This is even more apparent when the alternative proposed in some circles of higher intellect is to limit wants. However, the realistic goal seems to limit want while retaining unequal distribution of the scarce social rewards. Not surprisingly those with shockingly low incomes or even those of middling low incomes believe that a 20 or 50 per cent cut in their consumption will have less pleasant consequences for them than those on \$35,000 and better incomes. Further, large scale voluntary poverty never seems to have appealed to the masses of men. When given the option, subsistence societies and persons on low wages have given strong indication of their willingness to assume the burdens and misery of wealth.

In fact, one might note some historical precedents (such as the lead lined

wine barrels of Roman Aristocracy) and suggest that the best solution for the underprivileged is to let the elites destroy themselves through environmental destruction. Under these conditions, the poor who have long adapted to the norms of adversity are very likely to have the best chance of survival and therefore ultimate assumption of positions in the hierarchy of the new social order. Certainly it seems unwise to appeal to minorities such as the New Zealand Maori or the American Negro to use the vote but not the gun while at the same time demanding that they limit the numbers of their future voters. Persons of the underclass cannot be expected to hold a faith that a limited consumption world is any more certain a way towards a community of equal and free men than is a world of relative plenty.

Indeed, there seems considerable delusion in uncritically accepting the population theories of Ricardo and Malthus without realizing that these were primarily theories for rationalizing exploitation of man and nature by the market economy. A comparison of the almost stable populations in Europe and Japan with the former colonial areas or the areas of greatest population growth in the United States suggests that population explosions are rooted in hopelessness and that hopelessness is made in the dominant western economic centers, rather than by some immoral irresponsibility among the underclass.

Such delusions may reflect the fact that the dominant approach to human reproductive behavior has treated it as a strictly biological phenomenon. There is a charming desire to get at the real forces in human population growth by using detailed studies of insects and other non-human species as operative models of human reproductive behavior. It may be that the size of ant or deer populations reflect the coinciding patterns of maximum reproduction being checked by predators, food supplies and disease. Such species do seem to exhibit tendencies toward maximum reproduction. After all, these are populations which exhibit oestral cycles where reproduction must be crowded into intensive periods of time. However, primates with a minimized oestral cycle do not seem to maximize reproduction because the more elaborate social structure tends to impose reproductive limits rather than maximization. Certainly, **nonhuman** species exhibit relatively constant and universal behavior in regard to that specie's reproductive and mortality behavior. The same simply does not hold in human populations. Culturally varied human populations throughout history have practiced equally varied forms of population control all of which are determined by prevailing mythologies rather than biology.

Men have developed complex marriage, family and sexual institutions, and thus the transactions between females and males take on quite a different nature

MAN AND HIS ENVIRONMENT

than that of other species driven solely by sexual impulses. Who one is eligible to copulate with, the age, the time, the place are all specific upon the basis of social norms rather than biology. Certainly, no other species expends such vast amounts of energy creating works of art in story and picture designed solely to stimulate a flagging interest in copulation. Man has converted sexual behavior into an art, with all the normative constraints associated with effective art. To induce changes in his sexual behavior requires a significant rearrangement of his social order.

Thus a pioneering study by Hill, Stycos and Back (1959) indicates that in Puerto Rico family size is most often influenced by the imagined opinions of mothers-in-law and the failure by the male-female pair to develop a neutral vocabulary for discussing sexual decisions. Correspondingly in an earlier period of the United States, women were scarce and highly valued and therefore future wives were placed upon levels of higher morality. Young men delayed marriage, not because of ineffective biological drives, but because the prevailing norms demanded that a man must have a position of security to protect the more delicate woman. At this time children were both an economic asset and an announcement about a married couple's success in their relationship. As families were started later the average age of family completion was later. Today the average age of first marriage is considerably lower, yet still not at the biologically optimum point of puberty, while the average age of family **completion** is much younger.

Further the search for early marriage is not as likely to reflect a rampantly modern impulse for reproduction, as it is likely to reflect higher living standards, increasing interest in values of companionship, desire for personal security, escape from parents and other socially directed "**needs.**" While the offspring of these younger couples may be viewed as a conspicuous consumption far more reflective of higher social status than easy credit material possessions. In short, I am suggesting that population control requires something much more than malthusian desires to keep the underclass from overbreeding; nor do we gain a great deal of understanding by assuming that man's behavior is analogous to other animals.

A **recent** Nigerian study by P. O. Olusanya (1969) indicates the interlocking complexity involved in controlling human population growth. Olusanya found that two out of three Yoruba women believe sexual intercourse while nursing harms the mother's milk, therefore frequency of intercourse is limited by social beliefs, not biological facts. Social beliefs also determine why the Yoruba disapprove of any form of birth control beyond abstinence. There is

FISHES AND LOAVES

the belief that the possession of many children provides an insurance policy for one's old age. But more importantly is the immense value placed upon the virginity of brides and the faithfulness of married women. And these are virtues which would be threatened should women be able to control their own fertility without the husband's knowledge. Olusanya suggests that in a patriarchal society effective birth control must adjust to the realm of the present power system — and that is male, not female.

And these notions are not to be dismissed simply as the whims of a strange culture. A recent study by Judith Blake (1969) of birth control opinions held by white Americans suggests that most of our conventional wisdom on family planning represents the true whimsy. Some of the facts she found are: that for at least 30 years in the U.S. the poor have been aware of birth control knowledge; the poor have larger families than the affluent not because of unfamiliarity with birth control but because they desire larger families; in marked contrast to the upper classes, the poor do not think birth control pills should be available to all women on relief who are of childbearing age; few Americans desire birth control advice and devices for unmarried adolescents; and finally most Americans desire families larger than necessary for simple population replacement.

She concludes that workable birth control policies will entail a lifting of pressures to reproduce, rather than an imposition of pressures not to do so. The present policies regarding sex roles and family life insure that just about everyone will be propelled into reproductive unions, and that half of the population will enter such unions as a 'career' — a life's work. To gain control on population growth will require reducing marriage and parenthood to marginal rather than central sexual roles. It will also require the removal of restrictions upon abortion, upon sexual unions for pleasure rather than reproduction, and upon homosexual unions between consenting adults, while encouraging the development of viable careers other than motherhood for women.

These studies should indicate that control of human reproductive behavior requires manipulation of the entire social web. It is not simply a matter of better biological technology. In fact simply tampering with individuals is both trivial and ineffective. One must tamper with the entire system of marriage, parenthood and kinship — and be prepared to tolerate the consequences of such action. Indeed these are radical suggestions. They require not a simple return to arcadian harmonies of the ecological dream but a fundamental period of strife: as there will be required a fundamental restructuring of the world power order, significant changes in the domestic systems of social stratification,

MAN AND HIS ENVIRONMENT

the redistribution of collective wealth, and the transformation of fundamental family institutions. As Polanyi and Webb argue we must discard the myths of the individual and re-discover society.

IV

The necessity, the fragility and the beauty of society is seldom recognized until the sons of the "better sort" engage in rebellion. At such moments those seemingly strong threads of certainty and faith are painfully exposed. There are the well mannered and well clothed "future leaders" expressing a lost faith in the future. Such confrontation compels us to realize how dependent we all are upon the other behaving in expected ways.

We have justified our world upon the basis of freedom and equality while postponing issues of difference and ignoring that ultimately difference challenges the nature of equality. Some do, indeed, have more freedom than others, some differences do persist to confound the "melting-pot" theory. One need not call in the wisdom of the gods nor biology, for it should be apparent that the real question is not over the nature of difference but rather over which sorts of differences will be given authority. For disorder is as much a condition of man and nature as is order. Disorder always turns on questions of which sort of difference will be given authority. In the biological world, "natural selection" is seen as the means of assigning value to particular forms of difference. In the world of social man, various forms such as gerontocracy, monarchy, aristocracy, and democracy are means of assigning value. Chaos occurs when the prevailing means of assigning value to forms of difference are no longer acceptable. Such seems the temper of our times. The old metaphors of market and frontier are in disarray, and none but human and natural despair seems to ride in their place.

We are being asked to limit consumption of children and goods, to substitute for expectations of plenty, expectations of decreasing subsistence, and to so confine our actions that very often we must opt for death or at least emptiness rather than life. To save a world order we know and love we must consciously rearrange it beyond recognition, while we are given a sea of information but no knowledge as to who is to allocate options within this delimited set of margins. Can we place faith in the industrialist or the state bureaucrat? The technician seems more guilty than clean, and democracy is not likely to willingly provide the means for its extinction. Can we count upon our leader-

FISHES AND LOAVES

ship class to prepare for a transformation as great as the market society and the frontier forced upon the feudal lords? Are those in command of our social system likely to push the levers which, if not sending them to the underclass, at least deprives them of their customary range of power and action?

Perhaps the American revolution is a useful perspective for considering such questions. It was uniquely a case where the leadership class encouraged, shaped and led its people into the unknown of rebellion to transform itself. To venerate these rebels and ignore their method may be an untimely error.

These are hard days to be an American. It is not easy to have borne the burden of hope for everyman's dream only to find dreams turned into a nightmare of hate. It is not easy to have stretched toward the manifest destiny only to be caught on the limits of time, space and ideology. It is not easy to search for freedom and equality and get an environmental crisis instead. Hopefully our discovery of the limits to optimism may compel us to take up the problems at hand and let the future take care of itself. Yet one fears that like the actor removing his purple robes and still hearing the closing night's applause, we shall simply reflect upon how short is our turn at playing king, and how quickly the footlights dim into shadow.

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FREEDOM AND RESPONSIBILITY:
AN ENVIRONMENTAL DILEMMA

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FREEDOM AND RESPONSIBILITY: AN ENVIRONMENTAL DILEMMA

OUR ENVIRONMENTAL dilemma stems from real and growing environmental crises which are caused by man and which threaten all mankind. To draw together the physical, historical and sociological points presented earlier in this symposium, a sociologist and an animal ecologist have naively accepted the challenge to say things which are supposed to be left to the economist, to the political philosopher, and to the moral philosopher or theologian. At least the sociologist is not too far afield.

Our environmental dilemma may be thought of as mankind's failure to recognize and reckon with the things he is doing to his surroundings. Man is adapted to respond differently to different classes of crises. We show strong and emotional response to immediate, personally identifiable confrontations against self or community; we lack such response when the threat is vague or unidentifiable in personal terms, or is of incomprehensible enormity. For example, the religions which have, through history, been most successful are those which transformed vague and incomprehensible issues into contexts men can identify. Environmentalists today must put the facts of our environmental crises into contexts personally identifiable by the citizenry at large. The simultaneous impact upon all of nature of erupting human population and technological manipulations pose a threat which most men do not yet perceive.

MAN AND HIS ENVIRONMENT

The analysis of freedom and responsibility has a long and compelling history amongst Western philosophers. Even today the technical and linguistic meanings of these concepts are debated (Hook, 1961; Ofstad, 1961). For our purposes here, we simply seek a working definition of "freedom". Bertrand Russell (1945) frames the question of freedom in terms of political history — an approach particularly applicable for us. He points out that Western political philosophy from the time of the Greeks has oscillated between emphasis on *social cohesion*, in which the individual sacrifices self for the welfare of the community, and emphasis on *individual liberty*, in which the individual exercises his right to behave independently of community mores. Russell says further that this conflict, in changing forms, has persisted "down to the present day, and no doubt will persist for many ages to come."

Another element must be introduced, namely information. Through the early centuries during which Western political thought was developing, advances in knowledge of the sort which provoke changes in public attitudes, motivations, and actions, remained relatively negligible. As such it was not included as a key variable by the discussants of man's practice of freedom. During the past 400 years the impact of scientific progress upon philosophy has not been orderly; while knowledge has accumulated at an accelerating rate and with little obstruction, intellectually speaking, science and Western philosophic traditions have often been in conflict or have melded to produce unstable and detrimental value systems. Within recent decades science has not only precipitated a technological revolution greater than any before, it has precipitated an intellectual and perceptual one as well. This necessitates a fresh evaluation of the esoteric subject of freedom in our time; and in terms of our topic, the information variable assumes a critical role.

Freedom proceeds from individual awareness of self in relation to surroundings. No matter how keenly man perceives self, his attitudes and his consequent actions are products of this perception interacting with perceptions of other men and their works and of "nature." In fact, the degree to which he exercises free choice is related directly to his knowledge — hence ability to judge alternatives — of his own capabilities, of his aspirations, of the activities, beliefs and aspirations of other men, and, (though usually overlooked by philosophers) of the potentiabilities and the limitations of his environment. Kaplan (1964) writes:

"A free choice is not uncaused, but one whose cause includes in significant measure the aspiration and knowledge of the man who is choosing."

FREEDOM AND RESPONSIBILITY

It must be recognized that in this era of environmental crises, a major relationship exists between the state of the man-environment inter-action and the exercise of individual freedom. One is currently witness to a sudden and massive increase in man's impact upon the surface of the earth, and at the same time he notes that scientific understanding of ecological processes has itself increased many fold. The ecological revelations provide now a base from which national predictions can be made and upon which consequent solutions can be engineered, if society so chooses.

If a farmer does not recognize soil erosion when he sees it and does not know of its implications, his farming decisions are not complicated with questions of soil conservation. When he does learn about erosion, however, he must choose (whether he wants to or not!) among meaningful alternatives, the implications of which he understands. He now *is* free, so to speak, to decide whether or not to allow "his" soil to wash away.

Our discussion focuses on the United States. A very large part of the global crisis has been precipitated, unintentionally of course, either directly or indirectly from within the United States. Furthermore, the American colossus is so influential in the world that it is unlikely much change will occur elsewhere (except in Western Europe) before this nation itself sets the pattern of how its environment can be protected, of how its industrial development can be stabilized at a safe and optimum level, of how its resources as well as those of the whole world can be conserved before shortages are felt, and, most importantly, of how its own population growth can be stopped.

We maintain that never in history has freedom, in its broadest sense, been so available to so many members of a society as in the United States. We are not arguing that this availability has been uniform or complete, nor that freedom here has been exercised with consistent responsibility. The broadness of America's freedom includes, with some exceptions, freedom of practice and advocacy of unpopular or unfamiliar political and religious forms without fear of legal or economical sanctions. Beyond these are other freedoms, which **while** not classed as human rights *per se*, are of immense importance to the average citizen: choice and ability to move geographically, without suffering economic deprivation; choice and general ability of education - including higher education - and of profession; and finally a comparatively strong ability to move oneself across economic, ethnic, and social barriers. Evidence of these freedoms is in their exercise; no other society in history has witnessed such mobility in space and in economic status, educational or intellectual

MAN AND HIS ENVIRONMENT

achievements, social class, and ethnic "groups." We suggest that, while exercise of freedom leads in part to the dilemma considered here, freedom's widespread availability and use in this nation offers the potential for rapid changes in social values and life styles which will be necessary to cope with our dilemma.

Does individual freedom in a democratic society increase unendingly with increased education, technological achievements, and affluence? A quick glimpse may suggest the affirmative, but we believe the question is not answerable until the population picture is added. While post-World War II America has shown a positive correlation between affluence or education and personal freedom, there is growing evidence that increasing population — from 150 million in 1950 to over 200 million in 1969 — will reverse freedom's progress despite increasing or stable affluence and education. First, we have the simple estimate made recently by an ecologist, D. L. Allen (1969), that, in a given culture and technology, the number or intensity of personal interactions increases at a rate proportional to some large exponential function of the population increase. This accelerated increase of interactions, besides raising general irritability, must be met with accelerated legal controls to mitigate potentially harmful interactions. It might be added that, as knowledge about subtle environmental effects is also increasing, the level at which new controls are needed progresses still more rapidly than the interaction factor.

Beside legal controls, freedom of movement in space and through society is reduced on account of narrowing opportunities or intensifying competition — more intense than is healthy for a vigorous yet relatively content society. The challenge turns to a grind; the losers in each competitive bout have fewer alternate channels in which to try again. As density increases faster than new communities or niche complexes develop, the place of each individual within the value system of his fellow man depreciates. According to this notion, for a given society with a given economy, educational standard, and life-style expectations, there must be an optimum population density. That America in the late 1960's has pushed past its optimum is strongly suspected by many observers. A report in *Newsweek* magazine (October 6, 1969) on the state of growing discontent among middle and lower-middle class white Americans, proposes that this majority block is reacting to the "establishment-run" government, enforced civil rights, and student rebellions. However in reading the transcripts of the magazine's interviews, one can readily argue that crowding, environmental degradation, and overall devaluation of the individual as part of industrial and population growth may in fact be far more responsible for the unrest.

FREEDOM AND RESPONSIBILITY

Consider now, for the U.S., the strength of social cohesion, the other side of Russell's political equation. One might expect that sacrifice of self for the good of the community would not have been fostered in a young nation of rugged individualism and uninhibited competition. The frictions of varied cultural, ethnic, and racial mixings should have engendered individual isolationism and antagonisms; foreign threats did not compel cohesion for defense. Despite these factors, a strong spirit of cohesiveness, functional and versatile rather than traditional, did arise; it was engendered by fervored religious practice, by a common effort to subdue the wilderness, and by the pragmatic observation that endeavors are often better pursued by group effort. Grassroots political participation, including cohesion within parties, must have had important reinforcing value. Americans, when joined into armies, have displayed both the ability to cooperate in imaginative ways and the willingness, without coercion, to sacrifice self for country. Our people tend to display, sometimes with simplistic naivety, great pride in their country's accomplishments and its riches. Despite their traditions of individuality, Americans from the days of the colonies have been unusually adept at forming cohesive units for functional needs. Teamwork in our technologically complex society has long amazed observers from Western Europe.

We hold that when the influential majority of Americans clearly realizes the portentousness of our environmental crises, they will make personal sacrifices and will alter their values and life styles as is necessary to preserve the quality of life and freedom of opportunities. The move to halt environmental degradation and to achieve stability will best be accomplished through the same freely chosen cooperative processes which have produced the technological wonders. The awakening is, as we discuss below, now in progress. Its lateness reflects an information gap plus forceful competition and opposition from entrenched and insecure economic interests.

At this point the authors ought to pass on their personal estimate of whether or not today's accelerating environmental crises within the U.S. will be solved before a drastic decline in living standard, personal freedom, and quality of life occurs. Citizens can assume one of three attitudes, given that the situation is grave: (a) despair or apathy, concluding that there is no social mechanism for change because of widespread selfishness, ignorance, or apathy; (b) unbridled optimism, having blind faith that American intelligence and technology (or God) will recognize and solve each problem as necessity dictates; or (c) guarded optimism, seeing the problems as technologically solvable but requiring concerted effort to bring forth public motivation beforehand. We stand with the last alternative. We deplore despair (or apathy) in the informed

person as being irresponsible, and we question the judgment (or commitment) of those who advise us not to worry. We choose the last because current crises are developing at such a rapid rate that the probability of solutions being implemented fast enough to achieve stability is rapidly decreasing. Our optimism is a matter of necessity, since any other outlook is unacceptable; but beyond this we observe that American responsiveness has in the past met big challenges. There are actually current signs to reinforce this belief; some citizens first becoming informed, then concerned, have through their political action produced striking progress in reversing environmental threats.

To talk of solution requires some definition of the problems. Man's current environmental dilemma is so far-reaching that dozens of volumes are needed. It defies accurate delineation because virtually every physical activity or material need in all but the most isolated, truly "primitive" societies are in some sense operative. To delimit the system, we offer a diagrammatic scheme consisting of the three main dimensions: the major components of man's environmental impact in time and space; the ways in which he understands and relates these reactions to his own life and that of the community; and the level of human organization at which concerns and solutions are dealt with. Figure 1 illustrates the scheme: each dimension is broken into three categories giving a 27-cell matrix. Each cell could constitute subject matter for a chapter in a book on man in his environment. We do not defend our choice of categories as being the most functional or realistic. We did intend this in part to meet the claim that today's environmental dilemma is so complex that it defies description, much less analysis.

To illustrate the use of this matrix, apply it to the issue of the internal combustion engine. Focus first on the individual and consider his understanding, his qualitative evaluations, and his social responsibilities in relation to this device. The citizen needs to learn of the ecological and physiological implications of these vehicles - the amounts of non-renewable resources current production requires, the pollution which mining and processing of iron and petroleum products create, and, of course, the pollution produced from the engine's operation. Then he should understand what impact the highways necessary to carry all today's vehicles have on the land and on the cities. Essential to this understanding is a review of alternatives such as public transportation, rail vs. highway, smaller vehicles, substitutes for the internal combustion engine, and redesign of communities to prevent vehicular traffic from dominating every phase of life. Next, the individual can weigh the aesthetic impact of cars on the quality of life in urban areas, with speculations

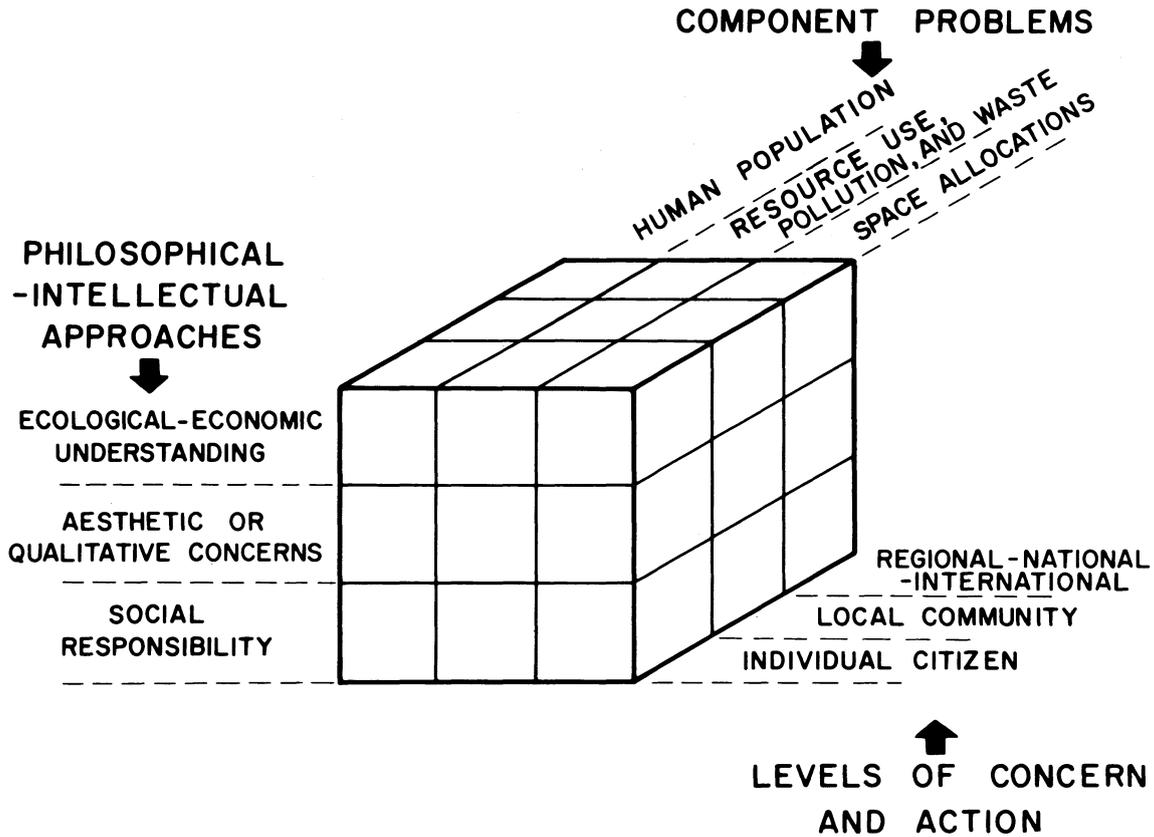


FIGURE 1. A scheme for defining some dimensions of the interaction between man and his environment.

MAN AND HIS ENVIRONMENT

about workable alternatives. Having informed himself and having reached certain conclusions about the wisdom of change, the individual's social responsibility leads to a search for solutions. These solutions differ at each level of action. The individual (or family) can, through his own action, exercise social responsibility: limit his number of miles, adapting for example to public transport, walking, or cycling when practical; installing anti-pollution devices; using lead-free gasoline; owning one rather than two cars, and owning a car no larger than needed. Some of these possibilities represent financial sacrifice, most of them savings, but all involve slight alterations in life style and conformity. One individual's efforts are minute, although not immeasurably so when we consider that each auto mile at 25 m.p.h. produces $1/6$ pound of the poison, carbon monoxide, and at 10 m.p.h. produces $1/3$ pound (Goldsmith and Landau, 1968). The individual's personal commitment is essential, however, if he expects the whole system to change.

At the local community level, the concerned citizen can argue for improved public transit and other measures to promote or compel reductions in auto usage as well as working for reduction of all the ugliness attributable to the auto. In New Haven, for example, a citizens' group found legal means to halt the State of Connecticut from building a highway directly through the city's most scenic park.

Large numbers of citizens, concerned and informed, exert influence upon the industries which set patterns on a regional, national, or international scale. In our country, autos are engineered to serve as man's ego symbols: little pressure is exerted by public forces upon industry to design cars with less environmental impact. A shift in public attitude doubtless would directly affect the auto industry, but more importantly these changes can facilitate action via the federal government, to force substitution of less obnoxious machines for private travel, and also to provide research and subsidies for alternate systems, particularly high-speed, ground transport.

We believe that among the 27 cells of the matrix those which represent social responsibility at the level of the individual are singularly critical in social change and therefore deserve further commentary. While every cell defines an arena within which changes must eventually occur, the point at which individual citizens turn their feelings of social responsibility into action is that pivotal juncture from which changes devolve. The first step in this occurs when the individual experiences a feedback between social responsibility and relevant information: once he has reason to believe that crises do exist, social responsibility dictates that he become better informed. The actual

FREEDOM AND RESPONSIBILITY

manifestation of this phase has, just in the past year or so, become very evident to us at the School of Forestry, the focal point for environmental science and management studies on the Yale campus. An unusual number of requests have come from other sectors of the campus as well as from outside for special courses, seminars, and guest speakers. The heavy turnout for this session of the Yale Alumni Seminar is a case in point.

Once sufficiently informed, the concerned citizens probably ask "What can I do?" In a free society, the only real change is that which emanates from individuals' actions. In this case the individual, in light of his social responsibility, is truly obliged to find some means of active response, some contribution. For example, all Americans are party to the appalling level of waste, as we interact, through commerce, with natural resources. If one receives the *New York Times* every day, 14 pounds of paper accumulate in the house each week. Instead of following the routine of sending some 728 pounds of paper each year to be burned or to help fill in marshes or otherwise cover the landscape, the individual may channel the paper into reuse via one of the volunteer agencies. (The U.S. reuses but 15% of its paper while affluent West Germany reuses 40%). Volunteer agencies, incidentally, are good avenues for recycling and prolonging usefulness of innumerable goods. We treat most metal as though it were a renewable resource; there is little or no concern for recycling once metal goods are no longer wanted. The individual can, through slight effort, insure that metal objects are directed toward recycling rather than to a dump or the bottom of a lake. More and more carbonated beverages come in cans: if one objects, he can, with some extra effort, buy these same beverages in returnable bottles. This is the price for having seen a problem and having decided not to be a party to its continuance. It appears unlikely that lasting shifts in values leading to valid changes in resource policy can arise unless large blocks of citizens are sufficiently concerned to alter their own habits. It is like the white suburbanites whose "liberal" politics lead them to criticize inner-city blue-collar whites for not being enthusiastic about racial integration.

Of course there are many individual responses which, though appropriate, are impractical. Individual responsibility also compels social participation: simple dialogue with other people, participation in groups concerned with environment, and expressions of opinions to government leaders. Personal actions tend to reinforce one's commitment necessary for participation and leadership at higher levels. Rational changes in life style by affluent, influential people in the center of contemporary society, such as those represented by the alumni of Yale participating in this seminar, can have a major impact.

MAN AND HIS ENVIRONMENT

It bothers us to think how much more like moral practitioners than sociologist and ecologist we are sounding. Kenneth Boulding remarked in a lecture in the Yale School of Forestry last winter that today's ecologists are behaving more and more like preachers. Ecologists seek no such role; however in looking at the whole problem of environmental crises and, seeing that before solutions there must be changes in human values, he is trapped into talking about social responsibility.

A FREE ENTERPRISE ECONOMY WITH ENVIRONMENTAL RESPONSIBILITY

While focusing strongly on the individual, we do not imply that America's dilemma is solvable through the accumulated acts of individuals alone; coordinated action by government, private business, and other private institutions is essential. We examine two issues in terms of actions required of society and its institutions: the first of these is the impact and the growth of industry, and in the last section we look at population growth.

Can the American political systems adapt sufficiently to outlaw industry's pollution, to curb its continuous expansion, to compel it to recycle non-renewable resources, and to substantially reduce the turnover of manufactured goods by establishing higher standards of product quality? Would our economic system be able to function if it could not continuously strive for expanding markets and productions? Is a state of stability and restraint, with emphasis on quality rather than quantity, incompatible with the free enterprise machinery? Have we built such an excellent self-guiding machine that it is no longer manipulatable by the public whose interests it presumably serves? If the answers are affirmative, then America is riding a self-destruct system that will eventually degrade the entire state of human existence.

We do suspect that if the American public is now and continues to be firmly convinced that future affluence, moral strength, and international prestige ride with privately owned, privately directed, uninhibited and forever-growing industry, then there is no hope of the U.S. achieving a stable ecology. The implications of such a failure spell widespread social chaos and ecological disaster to all mankind. On the other hand, if enough influential and responsible citizens challenge the rationality of growth for its own sake and challenge industry's disregard for environmental protection and its depletion of the world's non-renewable resources, then change may be possible soon enough to prevent the catastrophe which some ecologists are now predicting. There are many indicators that America's socio-political system is sufficiently flexible

FREEDOM AND RESPONSIBILITY

to effect such change, given sufficient motivation by the citizenry and willingness on their part to alter personal life styles.

If indeed decisions and motivations within our economy are based, as we are carefully instructed, upon the demands of a free market, then presumably the system is not a planned one, and each entrepreneur, as he competes vigorously, is guided primarily by maximization of profits. It appears improbable that such a system could adapt, within itself, to the wise, long-term allocation of resources; neither could it be self-restrained in curbing environmental and public-health perturbations. Led by Milton Friedman, some American economists believe religiously that a free-market approach produces the most healthy economy, which in turn produces the greatest benefits to society in general. Friedman also implies that the private sector of American business today does operate essentially as a free-market economy.

Other economists, most prominent among whom is probably John Kenneth Galbraith, challenge the Friedman school, claiming the widely advertised notion that America's economy is primarily unplanned and subject to free-market conditions is more myth than fact. Galbraith (1967) argues that economic activities here are not extensively planned well in advance but that in successfully so doing, entrepreneurs create and shape their own markets rather than simply responding to them. Without claiming for ourselves any professional expertise on these matters, we recognize the direct relevance of such controversy to the environmental dilemma.

Galbraith's thesis claims that no longer does each private unit compete freely, and no longer is the primary goal of industrial leaders the year-to-year maximization of profits. He explains that the massiveness and technological complexity of today's industrial processes necessitates organization of productive units into giant corporations, which are capitalized far beyond the resources of anyone man or small group of men. The corporations are in effect semi-public institutions. Managing of corporations has become so complex that decision making is spread among many persons: they in turn are not as directly concerned with current profits as if ownership were in their hands or in the hands of their immediate superiors. Galbraith refers to these men, with their diverse skills, as the "Utechnostructure." A major portion of resource extraction, manufacturing, transportation, and utility services in the U.S. today is provided by a relatively few giant corporations. Their management is diffuse, and their ownership is even more diffuse. Competition within many industries is no longer such a critical and unknown variable; it does not as in the past necessitate day-to-day changes in operations. Long-term planning at all levels

MAN AND HIS ENVIRONMENT

within corporations and within industries is not only possible but is virtually essential to permit efficient functioning of the giant concentrations of capital and human resources.

The decrease in outright competition, the increase in long-term planning, and the manipulation of the market itself may appear as conspiracies against treasured traditions. These changes, however, probably result simply from a maturing of the economy and can be likened to the changes **ecologists** identify in the maturing of a biotic community. Under stable conditions, biotic communities slowly evolve increasing diversification of **specializations** and well-developed strategies for avoiding competition among the specialists. Production of population surpluses, which are somewhat akin to profits not reinvested, decreases; less of the energy goes into reproduction and more of it into building up biomass, which can be likened to capital assets. Non-renewable resources (nutrients) are used and recycled more efficiently. The evolved strategem of each species seems not so much to overwhelm the community by aggressive competition, but rather to assure itself never-ending participation in the game. So it is within the technostructure: personal goals motivating decision makers include more than financial gain; key personnel are motivated by security and prestigious identification with a big-game concern. In addition then to their normal responsibility of keeping profit margins favorable, these men work to enhance the size and the image of their company. Profits of course cannot lag, but after a reasonable dividend has been paid, there usually remains a large share to be ploughed back for the increase of size or diversity. In this growth process, the technostructure maintains considerable control over future events; hence the role of planning becomes critical, and the fate of these giant corporations does not rest on the whims of the market or upon totally unpredictable competition and cost factors.

If one accepts Galbraith's thesis, then he should reexamine the relationship between industry and environmental dilemmas. First, the oldest of the problems, air and **water** pollution, may well be solved with an ease which is directly proportional to the size of the corporation and to its freedom from competitive pressures. The biggest of firms are those most concerned with image and least influenced by the immediacy of a profit margin; public displeasure, when truly present, will be most effective in eliciting voluntary responses from these big firms. In contrast, the small marginal firms are unavoidably in for a disproportionate share of inconvenience. The latter, being less concerned with image and often operating with little or no margin to allow for increased cost, are the least likely to volunteer pollution control. They are then most subject to

FREEDOM AND RESPONSIBILITY

governmental sanctions, particularly when public pressure has already caused large corporations to voluntarily clean up their pollution.

It is imperative that air and water safeguard standards be established and be protected by law; this law *must* originate at the national level. Actually treaties and enforcement must be sought to protect international waters and the entire atmosphere. In any event, the impact upon many small businesses will be severe: however it is not rational to overlook pollution on the basis of a private business' survival any more than it is to overlook dishonest practices or tax evasion: in all three instances, one is saying the public should be cheated in order to insure the survival of a private entrepreneur who could otherwise not survive within the realm of society's standards. If the public opts to support the firm which otherwise cannot make it, such support should be apparent to all: a direct cash subsidy to eliminate pollution. By this approach, misuse of the interest should be minimized: subsidies should not serve to bolster firms which are otherwise in the throes of failure.

Far more difficult, but in the long run much more critical to humanity, is the challenge of curbing economic growth, preventing waste of non-renewable resources, and channeling the energies and imagination of Americans towards qualitative goals. Businessmen and many economic theorists who are supposedly capable of rational thinking, consider real growth, i.e. expansion of capital goods and production of consumer goods, as subject to no ultimate limitation. We judge this not only appalling from an intellectual standpoint but, due to the influence of this thinking at all levels of American society, dangerous beyond measure to our future. In the process of shaping their markets, corporate policy invests heavily in conditioning the public to accept as part of "better living" ever-increasing consumption and waste. In an insidious but naive manner, this pressure, applied in an atmosphere of affluence, has led to more than a wanton attitude toward consumption, resources, and waste; it has developed into an unspoken and unreasoned ethic of consumption and contempt for parsimony.

The continued growth of American industry, involving ever-increasing demands on this land's natural resources and the resources of the entire planet, with parallel increases in pollution and in misuse and despoilation of the land, pose grave questions about the future quality of life here. More and more America gambles with the living standards of its coming generations as it lavishly expands present standards. One need not be an expert capable of precise predictions on when shortages will occur or when the capacity of this nation's resources no longer supports a reasonable quality of life to predict

that such consequences are being brought even-closer under current rates of economic and population growth. If stability is to replace growth, and if resource cycling is to replace resource waste, and if total social planning is to replace partial planning for profit, then great changes in social values and habits are demanded.

We frankly doubt that corporations, as presently guided, can accommodate to this revolution. However, it appears that these semi-public institutions should be more adaptable to changes in accord with public interest than would small, individually owned concerns whose operations are dictated more directly by profits alone. There exist enough arguments against outright nationalization of all economic endeavors to justify our trying to find compromises which retain as much private incentive, ingenuity, and reward motive as is practical. Pragmatically, of course, there are such strong emotional reactions against socialism in this country that, despite the example of relative success of publicly owned industry in several democratic, industrialized nations, Americans for the time being cannot be expected to accept any major shift away from what they consider hallowed ideologies. Should compromises not succeed, however, the public's interest will demand ever-increasing restriction of the private sector to counteract threats to environment and resources.

To those who claim that attitudes among corporate leaders will not mesh with those of society's long-term environmental needs, we raise one question: what sorts of values are being carried into the corporate technostucture by the current crop of university graduates? Are radical changes in personal values and in traditional attitudes towards authority now demonstrated on campus going to be carried into the business community and eventually change business philosophy in America? The so-called student rebellion represents the action of more than a Bohemian fringe; participants are numerous, they are bright and ambitious and seeking power, and they include many children of current leaders in business. While we do not predict whether or not significant numbers of the so-called radicals will enter the technostucture, and if so whether or not they will accomplish major changes, we do believe these questions deserve careful study. Here lies an outstanding possibility for orderly change in an area which otherwise offers depressing prospects of continued irresponsibility towards the environmental future of man.

An ethic of stability and conservation in man's economic activities is essentially heretical to the philosophy of American business. The implications of this fact are best pointed out by one economist, Kenneth Boulding, who, while highly respected for his general competence, is apparently suspect by

FREEDOM AND RESPONSIBILITY

his colleagues for his notions about stable, self-sustaining economies. He speaks of the "economics of the coming spaceship earth" (1966), and describes economic development as passing through successional stages starting with a "cowboy economy" in which competition is rampant and resources are wasted, and great emphasis is placed upon growth. Then as resources diminish in relation to demand, if the economy is to remain viable, the cowboy phase is disposed in favor of a "spaceman economy." In this, non-renewable resources are recycled, waste is minimized, energy sources are stable, and quantitative pursuits are replaced by qualitative ones. (All this is possible, of course, only with a stable population.) Thus similarities between actual ecological conditions and desired economic systems again become apparent. Boulding labels the entire system within which economic activities transpire as the "ecosphere;" ecologists label the sum of life support systems, involving interactions and exchanges between living and non-living components of a biotic community, as an "ecosystem" and the earth's entire life-support arena as the "biosphere." One need not proceed much further to suggest that economics might be classed as a branch of ecology rather than as a "social science."

Boulding, in the same article, reviews his ideas about America's favorite economic symbol, the gross national product, and challenges the assumption that GNP is an index of economic well-being. He argues that GNP might better be used to measure consumer dissatisfaction, since it indicates how fast yesterday's goods and services become obsolete or junk and must be replaced. If economic activity supposedly serves to meet the individual and collective needs of society, then GNP is a poor indicator of how well these needs are being met: it is as if the prime criterion of performance of a manufacturing machine is its speed.

Perhaps most relevant to our pursuit here is Boulding's discussion of how society might be motivated to adopt the spaceman economy. Why should a community, which is not presently faced with deprivation, voluntarily shift its values and restrict its consumption in order to protect resources and environmental quality for generations yet born? While at first cynical glance we tend to judge such a shift unlikely because of human shortsightedness and self-concern, Boulding argues, ". . . the welfare of the individual depends on the extent to which he can identify himself with others, and that the most satisfactory individual identity is that which identifies not only with a community in space but also with a community extending over time from past into the future." He goes on to argue that posterity does have a voice in today's decisions, and that the society which, according to Polak (1960), ". . . loses

MAN AND HIS ENVIRONMENT

its identity with posterity and which loses its positive image of the future, loses also its capacity to deal with present problems, and soon falls apart." This brings us back again to the original questions of freedom and responsibility with regard to social cohesion.

If there exists sufficient social cohesion to maintain a viable society today, then we predict there is sufficient concern for the future to precipitate the necessary economic changes. It seems to us that the 1970's will tell the answer. There are many signs that social cohesion in the U.S. is coming apart at the seams. A principal reason we are told is strong revulsion by young people and by minorities against the self-complacent, materialistic, and nationalistic values held by America's established majority. Dissatisfaction also arises, as will be discussed below, from various by-products of continued population growth as well as from a deteriorating environment. So the critical question ahead is whether a national purpose, including the overhauling of its economic apparatus, will refocus social cohesion, or whether growing discontent will lead to further social disruption, which in turn lessens the probability of restructuring for preservation of the environment.

ETHICAL ASPECTS OF POPULATION GROWTH IN AMERICA

In this seminar as well as in many recent publications, implications of current world population levels and continuing human growth have been well expounded. The overall threat to humanity is observable now in various deteriorations of life quality; the trend can be extrapolated into frightening spectres of ever-more likely atomic war, famine, and erosion of the very institutions upon which man must depend to stop this crisis.

Again we restrict ourselves to viewing the situation only in the United States. One may validly question such narrowness of focus on a problem so universal in scope. Why not be first concerned with the vast areas of poverty where population growth rates are two and three times that of ours instead of in the U.S. where affluence appears to hold promise that many more can be comfortably supported. The appalling scene of exploding populations and undernourishment in large parts of Africa, Asia, and Latin America does indeed cry out for immediate action; our nation must be prepared to help. The extent to which we can help, however, is mainly limited to the amount of aid requested: beyond that, efforts to curb other nation's populations are held suspect as a sinister conspiracy to hold down opposition to America's resource exploitations and to its ideologies, and to protect the white race from being

FREEDOM AND RESPONSIBILITY

swamped. So, while suffering in spirit for those billions, America must look to its own problem, not just to safeguard its future, but also because herein lie solutions which eventually will be applicable to the economically underdeveloped regions. Ours, the most influential, the richest, and the most imitated of nations, stands responsible more than any other to set a world pattern. It is unlikely the world's economic and population problems will be solved before America resolves its own encounter with the environment. For example, this country's current concern and action about pollution should precipitate changes in attitude the world over.

The primary justification for focusing alone on American population growth, however, is in the impact this nation's growth has on the rest of the world. The U.S. bears a moral obligation to the rest of humanity to stabilize both numerically and economically right now, because comprising only 6 percent of the world's population, it is using 50% of the natural resources, and this percentage is rising even though we comprise progressively fewer of the world's people. Each increment of population growth in America, as well as economic growth, drains proportionately more and more resources from regions whose people today are economically unable to utilize them but who will someday realize the hypocrisy of this plunder. Americans wonder today why hate towards us is on the increase in economically underdeveloped regions: we are perhaps seeing just the beginnings of a trend, which, if continued, will have frightening consequences.

Population limitation, in the sociological sense, is the most sensitive and controversial area being dealt with now by scientists. Ecologists who address an array of environmental problems, always come back to population as the prime issue which, they predict, will decide the fate of our environment. Yet ecologists, as a professional group, are not well-equipped to deal with the social aspects of curbing growth. To speak of changing human birth rate is to challenge religions, cultural, political, and economic beliefs and traditions that run deep in the emotions of man.

If simply asked, however, what it takes in a demographic sense to stop growth, the ecologist can answer with great surity and ease. If he is to stay within the ethics of our culture, he has but one course to recommend: since growth is to be supplanted by non-growth, births and deaths must be made equal. And because he will not suggest increasing deaths to erase the current disparity of excess births, he must recommend reducing births.

In seeking guidelines for establishing stability, there are two demographic aspects from which to proceed, rate of change and actual numbers. It may well

MAN AND HIS ENVIRONMENT

be argued that a rational population policy cannot proceed until consensus on an optimum level is reached. In theory this is correct, but it appears slightly inappropriate at this juncture. In view of the unprecedented growth rate now extant, the search for optimum population size is almost too esoteric a pursuit to deserve our full and immediate attention. Since a consensus on the optimum derives from value judgments and complex facts, both of which are subject to change and further refinement, the level itself is subject to change. Meanwhile, we do have rough indications that, economically and socially speaking, there are already too many people in this country or soon will be, to permit continuance of the kind of life Americans want. Furthermore, rapid, unplanned growth *per se* tends to dissipate qualitative and intellectual progress. Thus a policy dedicated to stop growth is needed before society can weigh carefully the more complex question of what density will best serve our long-term welfare. If coming generations should decide the nation or the world needs more people, it will be easy enough to arrange for the increase; it will not be so easy, however, to arrange for decrease should they judge their ancestors overshot the optimum level. Of course, in working to sell stability, the notion of an optimum level must be held out as one of the great positive benefits.

Having decided to stop population growth through birth control, society has available a variety of guideline patterns through which policy is related to the individual. Equilibrium can be achieved immediately if the community accepts procreation by permit; for example, a yearly number of permits might be allotted according to the actual or predicted annual mortality. Such a system, however, is so fraught with inequalities and uncertainties for the individual couple, that it appears unacceptable to a traditionally unregimented society such as ours. There are even more arbitrary schemes which can and probably will be attempted by autocratic governments. On the other hand, if every man and woman knows from the outset that he or she is entitled to replace his own life with one new life, there need be no further imposition on privacy. The individual may produce his replacement whenever he chooses. Interfamily adjustments may be worked out to compensate for inability or preference not to have children on the part of some. While this system does not provide immediate stability nor stability at a level exactly predictable, it does clearly permit each individual to exercise his personal responsibility and privilege in a manner most compatible with our political philosophy. Demographers calculate that if today in the U.S., family size averaged 2.3 children, stability would eventually be achieved. A realistic guideline from this statistic is that two children are a couple's responsible maximum.

FREEDOM AND RESPONSIBILITY

That size of individual family should be other than sacredly private is not new. For military security, strength, and other nationalistic purposes, governments throughout history have urged, subsidized, and coerced couples into having more children than they might otherwise have chosen. An excellent example was Moscow's persuasive pressure on Russian mothers following World War II to have ten children. The Days (1964) point out that in Old Testament times high procreation was urged because of constant threats of warfare from neighboring tribes, and this probably accounts for incorporation of pro-natalism into Judaic religious belief which in turn influenced our own philosophic heritage. On the other hand, the Days point out that Aristotle was in favor of determining and maintaining an optimum population in order that political processes operate smoothly. In post-war Japan, public realization that exploding population would increase current poverty, which was resultant from inadequate resources and land, underlay history's most dramatic example of a voluntary cutting back, though not complete cessation of, population growth. Birth rates and population growth rate was reduced by 50% in 12 years. Perhaps the absence of strong religious taboos against contraception and abortion made birth control rapidly acceptable in Japan.

In America subtle but powerful pressures impinge on the bearing of children. The notion that *everyone* should marry, without undue delay, and soon thereafter produce children, preferably three to five, results from religious traditions (actively pursued now only by Roman Catholicism and certain Fundamentalist sects), from commercial pressures, and from the general tendency to conform with a cultural pattern. Also influential must be the presumption that population growth and prosperity are surely linked in this land of unlimited riches. Up to now family planning programs have been aimed only at individual problems where parents are producing more children than they are able to cope with, from the standpoint of current living standards. Contraception has been widely available to middle and upper-class couples; family size for most Americans has been largely by choice rather than by accident or ignorance. Only recently have citizens organized to plead for family limitation throughout all of society as a means to save everyone's environment and living standards.

Given then the need for action, the question soon arises whether voluntary efforts alone will suffice to stop growth or whether governmental intervention is inevitable. To us this question is not terribly relevant right now. If, in the U.S., a major segment of the influential public did not become convinced that stability was vitally necessary, it is improbable that any subsidization or coer-

cion to curb births could be legislated. If, however, a majority did agree that growth must stop, then birth rate would presumably already have begun to drop through voluntary action. A stigma would be borne by couples who subsequently opted for large families. At this point, if a minority continued to disregard community efforts towards stability, public frustration and offendedness might well lead to legislation on family limitation. We do not **predict** that a minority would necessarily stand in irresponsible opposition, but the kinds of rationale underlying governmental intervention of any sort need to be discussed in considering all eventualities. Were changes in public attitude not to arise soon enough or strongly enough to prevent this country's population from rising to a point where individual dignity became severely eroded, then the legal bases of personal freedom might surely be lost. With such a loss, arbitrary and autocratic institutions would likely replace present ones; then governing forces could choose the most direct **means** of population control without regard to personal sensitivities.

Before proceeding any further in discussions of population policy in America, certain ground rules must be reiterated, for the safeguarding of humanistic principles and the essence of the American heritage of political and legal equality. Any program intervening in the reproductive decisions of citizens at large must be totally egalitarian. The slightest element of differentiation based on race, political or religious belief, economic status, social class, or region of residence would render the system suspect of conspiratorial undertones. Birth control aimed at the "poor" may in some cases help both parents and children to find a better quality of life and a better chance in the world, but limiting population is a responsibility which falls equally on every citizen. In America, where middle and upper classes predominate, it is those who can "afford" large families who are currently contributing the greatest share of our growth. Thus it is appropriate that a new organization, Zero Population Growth, Inc., uses the catch phrase, "The population bomb is everybody's baby."

Next, it is imperative that the notion of an unwanted or unneeded *birth* be refuted. While there continue to be plenty of unwanted and excess conceptions, when a child does join the community he shares equally the rights and privileges of all men. In fact, in terms of the world's things, he has a greater share than we, because we have already used up a fair portion of ours. This dichotomy of values between conception and birth creates potential difficulties; but then it is no more difficult than putting many other aspects of democracy and equality to work.

We defer to the experts specific aspects of methods and personal motives

FREEDOM AND RESPONSIBILITY

in birth control, and recommend to you the book "Too Many Americans" by Lincoln and Alice Day (1964) for a comprehensive, authoritative, and humanistic discussion. Suffice it here that we examine the broad roles of freedom and responsibility in relation to achieving stability within a democratic community.

Education is obviously a key factor in prompting value change, and, in the case of attitudes towards birth control, we face the somewhat delicate problem of sex education for the pre-pubertal age levels. It would appear unquestionably that all aspects of man's reproductive biology need be made a more objective and unembarrassed topic of knowledge. Since one result of sexual participation is the addition of new members to society, it is hard to justify that the biology behind the event is too personal to handle in public schools. While great strides are being made in curricula of many districts, **vituperative** attacks upon sex education are currently frequent. If successful, these attacks serve not only to impede basic education and man's ability to understand himself, but also by hindering discussion of birth control impede his solution of the environmental dilemma. On the other hand, we take encouragement in the increasing openness of youngsters toward their sexuality. Recognizing that hedonism and promiscuity, primarily as they disrupt the environment of the developing child, are doubtless harmful to the fiber of society, we are not aware that the levels of biological understanding are related to the degree which sexual pursuits can cause social problems, unless there be a negative relationship.

In seeking the basis for a population ethic, we return to Boulding's use of Polak's notion that a society's cohesiveness is related to its ability to identify with others in space and through time. Continued increase of our numbers can be viewed not nearly as much an affront to our own generation as to our children's generation, and their children's, and so on. We who are presumptuous enough to bring even one new person onto the planet cannot, in good conscience, shirk the responsibilities of providing at least as good an environment for him as we ourselves have inherited. If then it becomes obvious that the world is now crowded, then we are shortchanging our progeny. This puts family planning in the context of strong ethical obligation to those not yet born. Persons who say, "let the next generation decide for itself," ignore the fact that only this generation can decide how crowded the next one will be.

Does precedent exist in American political ethics to support government action in family-size limitation? We examine this in terms of the most benign sort of intervention, but do not speculate on what forms might be proposed.

MAN AND HIS ENVIRONMENT

Consider our nation's broad concern with qualitative development of the young: great investments of time and wealth are made by private citizens to enhance moral, intellectual, artistic, and physical attributes of tomorrow's citizens. In fact, the qualitative development of children is judged so critical that it is legally usurped in part from parents: children are compelled to attend years of school and to undergo physical training and medical care. Society thus joins into an immense group effort, backed by law and financed by heavy taxation on all citizens, to develop the quality of its heirs. Whatever small minority in America disagrees with this rationale are completely overruled legally and socially. If society is so amenable to transgressing individual liberty and family privacy to develop qualitative standards in tomorrow's generation — presuming that standards would be unacceptably low without compulsory education, etc., then this rationale might reasonably be extended to birth control when it is shown that more people will lead directly to a poorer quality of life for the majority. With current population growth, technological progress, and increasing expectations for goods, services, and pleasant environment, each increment of numerical increase is producing an increment of qualitative decrease.

There are other precedents similarly relevant to family planning. Eventually society must admit that space and resources and the earth's productivity and pollutability are limited. When these entities are being used at capacity, relative to a given standard of living, further increases in those doing the using lead to less of each entity per man. If these facts are agreed upon and growth prevention policy is legislated, then the couple who deliberately contributes more persons to the next generation than their own replacement, may be justifiably charged with devaluing the share of these entities available to other members of that generation. Today, if a person pollutes a river, or damages an historical monument, or sets a forest fire on public land, he is subject to sanctions, although he has not caused harm or loss to any specific person or party. Likewise defaulting on income tax or otherwise "stealing" from the government does not cause loss to any one individual, but such offenders are prosecuted on the basis of having defaulted the entire citizenry — present and future. Precedent for legal action against tax default and destruction of public forests goes far back in history: only now are jurists coming to grips with legal protection of public rights against fouling of air and water. When further population increase is clearly recognized as a threat to the interests of present and future generations, and when an individual's responsibility for maintaining population stability can be legally defined, then ample precedent

FREEDOM AND RESPONSIBILITY

exists to protect by law, if necessary, the interests of the majority in preventing overpopulation.

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