THE POPULATION BOMB
(Revised)

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PROLOGUE

The battle to feed all of humanity is over. In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date nothing can prevent a substantial increase in the world death rate, although many lives could be saved through dramatic programs to "stretch" the carrying capacity of the earth by increasing food production and providing for more equitable distribution of whatever food is available. But these programs will only provide a stay of execution unless they are accompanied by determined and successful efforts at population control. Population control is the conscious regulation of the numbers of human beings to meet the needs not just of individual families, but of society as a whole.

Nothing could be more misleading to our children than our present affluent society. They will inherit a totally different world, a world in which the standards, politics, and economics of the past decade are dead. As the most influential nation in the world today, and its largest consumer, the United States cannot stand isolated. We are today involved in the events leading to famine and ecocatastrophe; tomorrow we may be destroyed by them.

Our position requires that we take immediate action at home and promote effective action worldwide. We

must have population control at home, hopefully through changes in our value system, but by compulsion if voluntary methods fail. Americans must also change their way of living so as to minimize their impact on the world's resources and environment. Programs which combine ecologically sound agricultural development and population control must be established and supported in underdeveloped countries. While this is being done, we must take action to reverse the deterioration of our environment before our planet is permanently ruined. It cannot be overemphasized, however, that no changes in behavior or technology can save us unless we can achieve control over the size of the human population. The birth rate must be brought into balance with the death rate or mankind will breed itself into oblivion. We can no longer afford merely to treat the symptoms of the cancer of population growth; the cancer itself must be cut out.

FOREWORD

Man can undo himself with no other force than his own brutality. It is a new brutality, coming swiftly at a time when, as Loren Eiseley says, "the need is for a gentler race. But the hand that hefted the axe against the ice, the tiger, and the bear now fondles the machine gun as lovingly."

The roots of the new brutality, it will become clear from *The Population Bomb,* are in the lack of population control. There is, we must hope and predict, a chance to exert control in time. We would like to predict that organizations which, like the Sierra Club, have been much too calm about the ultimate threat to mankind, will awaken themselves and others, and awaken them with an urgency that will be necessary to fulfillment of the prediction that mankind will survive.

It was only twelve years ago that we even suggested, in any Sierra Club publication, that uncontrolled population was a menace. We went far enough to write: "People are recognizing that we cannot forever continue to multiply and subdue the earth without losing our standard of life and the natural beauty that must be part of it. . . . These are the years of decision—the decision of men to stay the flood of man."

In the next two years we worried about the battle of man versus his own numbers and were concerned that growth itself was growing and were not joyful about

the imminence of California's outstripping New York.

It was Professor Raymond Cowles who shook us loose with a provocative address before a Sierra Club conference, "The Meaning of Wilderness to Science."

What in the late fifties had seemed heretical soon was not so. For the complaints that I had received about mentioning population problems in early speeches, there were more vociferous complaints if I forgot to mention the big problem. In just two or three years it became possible to question growth, to suggest that DNA was greater than GNP, to predict that man had enough genius to require that science and technology be put to good purpose. He could limit his numbers. He could limit his heretofore unslackened appetite for destroying wilderness. He could go back over the nine-tenths or so of the earth that had already felt his touch, sometimes a gentle touch but too often brutal, and do better where he had been. He could start with Manhattan, or Los Angeles.

Whatever resources the wilderness still held would not sustain him in his old habits of growing and reaching without limits. Wilderness could, however, provide answers for questions he had not yet learned how to ask. He could predict that the day of creation was not over, that there would be wiser men, and they would thank him for leaving the source of those answers. Wilderness would remain part of his geography of hope, as Wallace Stegner put it, and could, merely because wilderness endured on the planet, prevent man's world from becoming a cage.

The good predictions could be entertained—the notion of predicting a more and more desirable future, not just a more and more crowded one.

—DAVID BROWER

Chapter 1

THE PROBLEM

I have understood the population explosion intellectually for a long time. I came to understand it emotionally one stinking hot night in Delhi a few years ago. My wife and daughter and I were returning to our hotel in an ancient taxi. The seats were hopping with fleas. The only functional gear was third. As we crawled through the city, we entered a crowded slum area. The temperature was well over 100, and the air was a haze of dust and smoke. The streets seemed alive with people. People eating, people washing, people sleeping. People visiting, arguing, and screaming. People thrusting their hands through the taxi window, begging. People defecating and urinating. People clinging to buses. People herding animals. People, people, people, people. As we moved slowly through the mob, hand horn squawking, the dust, noise, heat, and cooking fires gave the scene a hellish aspect. Would we ever get to our hotel? All three of us were, frankly, frightened. It seemed that anything could happen—but, of course, nothing did. Old India hands will laugh at our reaction. We were just some overprivileged tourists, unaccustomed to the sights and sounds of India. Perhaps, but the problems of Delhi and Calcutta are our problems too. Ameri-

cans have helped to create them; we help to prevent their solution. We must all learn to identify with the plight of our less fortunate fellows on Spaceship Earth if we are to help both them and ourselves to survive.

Too Many People

Americans are beginning to realize that the underdeveloped countries of the world face an inevitable population-food crisis. Each year food production in these countries falls a bit further behind burgeoning population growth, and people go to bed a little bit hungrier. While there are temporary or local reversals of this trend, it now seems inevitable that it will continue to its logical conclusion: mass starvation. The rich may continue to get richer, but the more numerous poor are going to get poorer. Of these poor, a *minimum* of ten million people, most of them children, will starve to death during each year of the 1970s. But this is a mere handful compared to the numbers that will be starving before the end of the century. And it is now too late to take action to save many of those people.

However, most Americans are not aware that the U.S. and other developed countries also have a problem with overpopulation. Rather than suffering from food shortages, these countries show symptoms in the form of environmental deterioration and increased difficulty in obtaining resources to support their affluence.

In a book about population there is a temptation to stun the reader with an avalanche of statistics. I'll spare you most, but not all, of that. After all, no matter how you slice it, population is a numbers game. Perhaps the

best way to impress you with numbers is to tell you about the "doubling time"—the time necessary for the population to double in size.

It has been estimated that the human population of 8000 B.C. was about five million people, taking perhaps one million years to get there from two and a half million. The population did not reach 500 million until almost 10,000 years later—about 1650 A.D. This means it doubled roughly once every thousand years or so. It reached a billion people around 1850, doubling in some 200 years. It took only 80 years or so for the next doubling, as the population reached two billion around 1930. We have not completed the next doubling to four billion yet, but we now have well over three and a half billion people. The doubling time at present seems to be about 35 years.[1] Quite a reduction in doubling times: 1,000,000 years, 1,000 years, 200 years, 80 years, 35 years. Perhaps the meaning of a doubling time of around 35 years is best brought home by a theoretical exercise. Let's examine what might happen on the absurd assumption that the population continued to double every 35 years into the indefinite future.

If growth continued at that rate for about 900 years, there would be some 60,000,000,000,000,000 people on the face of the earth. Sixty million billion people. This is about 100 persons for each square yard of the Earth's surface, land and sea. A British physicist, J. H. Fremlin,[2] guessed that such a multitude might be housed in a continuous 2,000-story building covering our entire planet. The upper 1,000 stories would contain only the apparatus for running this gigantic warren. Ducts, pipes, wires, elevator shafts, etc., would occupy about half of the space in the bottom 1,000 stories. This would leave three or four yards of floor space for each person. I will leave to your imagination the physical details of existence in this ant heap, except to point out that all would not be black. Probably each person would be limited in

his travel. Perhaps he could take elevators through all 1,000 residential stories but could travel only within a circle of a few hundred yards' radius on any floor. This would permit, however, each person to choose his friends from among some ten million people! And, as Fremlin points out, entertainment on the worldwide TV should be excellent, for at any time "one could expect some ten million Shakespeares and rather more Beatles to be alive."

Could growth of the human population of the Earth continue beyond that point? Not according to Fremlin. We would have reached a "heat limit." People themselves, as well as their activities, convert other forms of energy into heat which must be dissipated. In order to permit this excess heat to radiate directly from the top of the "world building" directly into space, the atmosphere would have been pumped into flasks under the sea well before the limiting population size was reached. The precise limit would depend on the technology of the day. At a population size of one billion billion people, the temperature of the "world roof" would be kept around the melting point of iron to radiate away the human heat generated.

But, you say, surely Science (with a capital "S") will find a way for us to occupy the other planets of our solar system and eventually of other stars before we get all that crowded. Skip for a moment the virtual certainty that those planets are uninhabitable. Forget also the insurmountable logistic problems of moving billions of people off the Earth. Fremlin has made some interesting calculations on how much time we could buy by occupying the planets of the solar system. For instance, at any given time it would take only about 50 years to populate Venus, Mercury, Mars, the moon, and the moons of Jupiter and Saturn to the same population density as Earth.[3]

What if the fantastic problems of reaching and colo-

nizing the other planets of the solar system, such as Jupiter and Uranus, can be solved? It would take only about 200 years to fill them "Earth-full." So we could perhaps gain 250 years of time for population growth in the solar system after we had reached an absolute limit on Earth. What then? We can't ship our surplus to the stars. Professor Garrett Hardin[4] of the University of California at Santa Barbara has dealt effectively with this fantasy. Using extremely optimistic assumptions, he has calculated that Americans, by cutting their standard of living down to 18% of its present level, could in *one year* set aside enough capital to finance the exportation to the stars of *one day's* increase in the population of the world.

Interstellar transport for surplus people presents an amusing prospect. Since the ships would take generations to reach most stars, the only people who could be transported would be those willing to exercise strict birth control. Population explosions on space ships would be disastrous. Thus we would have to export our responsible people, leaving the irresponsible at home on Earth to breed.

Enough of fantasy. Hopefully, you are convinced that the population will have to stop growing sooner or later and that the extremely remote possibility of expanding into outer space offers no escape from the laws of population growth. If you still want to hope for the stars, just remember that, at the current growth rate, in a few thousand years everything in the visible universe would be converted into people, and the ball of people would be expanding with the speed of light![5] Unfortunately, even 900 years is much too far in the future for those of us concerned with the population explosion. As you will see, the next *nine* years will probably tell the story.

Of course, population growth is not occurring uniformly over the face of the Earth. Indeed, countries are divided rather neatly into two groups: those with

rapid growth rates, and those with relatively slow growth rates. The first group, making up about two-thirds of the world population, coincides closely with what are known as the "underdeveloped countries" (UDCs). The UDCs are not industrialized, tend to have inefficient agriculture, very small gross national products, high illiteracy rates and related problems. That's what UDCs are technically, but a short definition of underdeveloped is "hungry." Most Latin American, African, and Asian countries fall into this category. The second group consists of the "overdeveloped countries" (ODCs). ODCs are modern industrial nations, such as the United States, Canada, most European countries, Israel, the USSR, Japan, and Australia. They consume a disproportionate amount of the world's resources and are the major polluters. Most, but by no means all,[6] people in these countries are adequately nourished.

Doubling times in the UDCs range around 20 to 35 years. Examples of these times (from the 1970 figures released by the Population Reference Bureau) are: Kenya, 23 years; Nigeria, 27; Turkey, 26; Indonesia, 24; Philippines, 21; Brazil, 25; Costa Rica, 19; and El Salvador, 21. Think of what it means for the population of a country to double in 25 years. In order just to keep living standards at the present inadequate level, the food available for the people must be doubled. Every structure and road must be duplicated. The amount of power must be doubled. The capacity of the transport system must be doubled. The number of trained doctors, nurses, teachers, and administrators must be doubled. This would be a fantastically difficult job in the United States—a rich country with a fine agricultural system, immense industries, and access to abundant resources. Think of what it means to a country with none of these.

Remember also that in virtually all UDCs, people have gotten the word about the better life it is possible to have. They have seen colored pictures in magazines

of the miracles of Western technology. They have seen automobiles and airplanes. They have seen American and European movies. Many have seen refrigerators, tractors, and even TV sets. Almost all have heard transistor radios. They *know* that a better life is possible. They have what we like to call "rising expectations." If twice as many people are to be happy, the miracle of doubling what they now have will not be enough. It will only maintain today's standard of living. There will have to be a tripling or better. Needless to say, they are not going to be happy.

Doubling times for the populations of the ODCs tend to be in the 50-to-200-year range. Examples of 1970 doubling times are the United States, 70 years; Austria, 175; Denmark, 88; Norway, 78; United Kingdom, 140; Poland, 78; Russia, 70; Italy, 88; Spain, 70; and Japan, 63. These are industrialized countries that have undergone the so-called demographic transition—a transition from high to low growth rates. As industrialization progressed, children became less important to parents as extra hands to work on the farm and as support in old age. At the same time they became a financial drag —expensive to raise and educate. Presumably these were the reasons for a slowing of population growth after industrialization. They boil down to a simple fact —people just wanted to have fewer children.

It is important to emphasize, however, that the demographic transition does not result in zero population growth, but in a growth rate which in many of the most important ODCs results in populations doubling every seventy years or so. This means, for instance, that even if most UDCs were to undergo a demographic transition (of which there is no sign) the world would still be faced by catastrophic population growth. *No growth rate can be sustained in the long run.*

Saying that the ODCs have undergone a demographic transition thus does not mean that they have no population problems. First of all, most of them are already overpopulated. They are overpopulated by the simple criterion that they are not able to produce enough food to feed their populations. It is true that they have the money to buy food, but when food is no longer available for sale they will find the money rather indigestible. Similarly, ODCs are overpopulated because they do not themselves have the resources to support their affluent societies; they must coopt much more than their fair share of the world's wealth of minerals and energy. And they are overpopulated because they have exceeded the capacity of their environments to dispose of their wastes. Remember, overpopulation does not normally mean too many people for the area of a country, but too many people in relation to the necessities and amenities of life. *Overpopulation occurs when numbers threaten values.*

ODCs also share with the UDCs serious problems of population distribution. Their urban centers are getting more and more crowded relative to the countryside. This problem is not as severe in ODCs as it is in the UDCs (if current trends should continue, which they cannot, Calcutta would have 66 million inhabitants in the year 2000), but they are very serious and speedily worsening. In the United States, one of the more rapidly growing ODCs, we hear constantly of the headaches related to growing cities: not just garbage in our environment, but overcrowded highways, burgeoning slums, deteriorating school systems, rising tax and crime rates, riots, and other social disorders. Indeed, social and environmental problems not only increase with growing population and urbanization, they tend to increase at an even faster rate. Adding more people to an area increases the damage done by each individual. Doubling the population normally much more than doubles environmental deterioration.[7]

Demographically, the whole problem is quite simple. A population will continue to grow as long as the birth

rate exceeds the death rate—if immigration and emigration are not occurring. It is, of course, the balance between birth rate and death rate that is critical. The birth rate is the number of births per thousand people per year in the population. The death rate is the number of deaths per thousand people per year.[8] Subtracting the death rate from the birth rate, ignoring migration, gives the rate of increase. If the birth rate is 30 per thousand per year, and the death rate is 10 per thousand per year, then the rate of increase is 20 per thousand per year ($30 - 10 = 20$). Expressed as a percent (rate per hundred people), the rate of 20 per thousand becomes 2%. If the rate of increase is 2%, then the doubling time will be 35 years. Note that if you simply added 20 people per thousand per year to the population, it would take 50 years to add a second thousand people ($20 \times 50 = 1{,}000$). But the doubling time is actually much less because populations grow at compound interest rates. Just as interest dollars themselves earn interest, so people added to population produce more people. It's growing at compound interest that makes populations double so much more rapidly than seems possible. Look at the relationship between the annual percent increase (interest rate) and the doubling time of the population (time for your money to double):

Annual percent increase	*Doubling time*
1.0	70
2.0	35
3.0	24
4.0	17

Those are all the calculations—I promise. If you are interested in more details on how demographic figuring is done, you may enjoy reading Thompson and Lewis's excellent book, *Population Problems,*[9] or my book, *Population, Resources, Environment.*[10]

There are some professional optimists around who like to greet every sign of dropping birth rates with wild pronouncements about the end of the population explosion. They are a little like a person who, after a low temperature of five below zero on December 21, interprets a low of only three below zero on December 22 as a cheery sign of approaching spring. First of all, birth rates, along with all demographic statistics, show short-term fluctuations caused by many factors. For instance, the birth rate depends rather heavily on the number of women at reproductive age. In the United States the low birth rates of the late 1960's are being replaced by higher rates as more post World War II "baby boom" children move into their reproductive years. In Japan, 1966, the Year of the Fire Horse, was a year of very low birth rates. There is widespread belief that girls born in the Year of the Fire Horse make poor wives, and Japanese couples try to avoid giving birth in that year because they are afraid of having daughters.

But, I repeat, it is the relationship between birth rate and death rate that is most critical. Indonesia, Laos, and Haiti all had birth rates around 46 per thousand in 1966. Costa Rica's birth rate was 41 per thousand. Good for Costa Rica? Unfortunately, not very. Costa Rica's death rate was less than nine per thousand, while the other countries all had death rates above 20 per thousand. The population of Costa Rica in 1966 was doubling every 17 years, while the doubling times of Indonesia, Laos, and Haiti were all above 30 years. Ah, but, you say, it was good for Costa Rica—fewer people per thousand were dying each year. Fine for a few years perhaps, but what then? Some 50% of the people in Costa Rica are under 15 years old. As they get older, they will need more and more food in a world with less and less. In 1983 they will have twice as many mouths to feed as they had in 1966, if the 1966 trend continues. Where will the food come from? Today the death rate in Costa Rica

is low in part because they have a large number of physicians in proportion to their population. How do you suppose those physicians will keep the death rate down when there's not enough food to keep people alive?

One of the most ominous facts of the current situation is that over 40% of the population of the underveloped world is made up of people *under 15 years old*. As that mass of young people moves into its reproductive years during the next decade, we're going to see the greatest baby boom of all time. Those youngsters are the reason for all the ominous predictions for the year 2000. They are the gunpowder for the population explosion.

How did we get into this bind? It all happened a long time ago, and the story involves the process of natural selection, the development of culture, and man's swollen head. The essence of success in evolution is reproduction. Indeed, natural selection is simply defined as differential reproduction of genetic types. That is, if people with blue eyes have more children on the average than those with brown eyes, natural selection is occurring. More genes for blue eyes will be passed on to the next generation than will genes for brown eyes. Should this continue, the population will have progressively larger and larger proportions of blue-eyed people. This differential reproduction of genetic types is the driving force of evolution; it has been driving evolution for billions of years. Whatever types produced more offspring became the common types. Virtually all populations contain very many different genetic types (for reasons that need not concern us), and some are always outreproducing others. As I said, reproduction is the key to winning the evolutionary game. Any structure, physiological process, or pattern of behavior that leads to greater reproductive success will tend to be perpetuated. The entire process by which man developed involves thousands of millennia of our ancestors being

more successful breeders than their relatives. Facet number one of our bind—the urge to reproduce has been fixed in us by billions of years of evolution.

Of course through all those years of evolution, our ancestors were fighting a continual battle to keep the birth rate ahead of the death rate. That they were successful is attested to by our very existence, for, if the death rate had overtaken the birth rate for any substantial period of time, the evolutionary line leading to man would have gone extinct. Among our apelike ancestors, a few million years ago, it was very difficult for a mother to rear her children successfully. Most of the offspring died before they reached reproductive age. The death rate was near the birth rate. Then another factor entered the picture—cultural evolution was added to biological evolution.

Culture can be loosely defined as the body of nongenetic information which people pass from generation to generation. It is the accumulated knowledge that, in the old days, was passed on entirely by word of mouth, painting, and demonstration. Several thousand years ago the written word was added to the means of cultural transmission. Today culture is passed on in these ways, and also through television, computer tapes, motion pictures, records, blueprints, and other media. Culture is all the information man possesses except for that which is stored in the chemical language of his genes.

The large size of the human brain evolved in response to the development of cultural information. A big brain is an advantage when dealing with such information. Big-brained individuals were able to deal more successfully with the culture of their group. They were thus more successful reproductively than their smaller-brained relatives. They passed on their genes for big brains to their numerous offspring. They also added to the accumulating store of cultural information, increasing slightly the premium placed on brain size in the next

generation. A self-reinforcing selective trend developed —a trend toward increased brain size.[11]

But there was, quite literally, a rub. Babies had bigger and bigger heads. There were limits to how large a woman's pelvis could conveniently become. To make a long story short, the strategy of evolution was not to make a woman bell-shaped and relatively immobile, but to accept the problem of having babies who were helpless for a long period while their brains grew after birth.[12] How could the mother defend and care for her infant during its unusually long period of helplessness? She couldn't, unless Papa hung around. The girls are still working on that problem, but an essential step was to get rid of the short, well-defined breeding season characteristic of most mammals. The year-round sexuality of the human female, the long period of infant dependence on the female, the evolution of the family group, all are at the roots of our present problem. They are essential ingredients in the vast social phenomenon that we call sex. Sex is not simply an act leading to the production of offspring. It is a varied and complex cultural phenomenon penetrating into all aspects of our lives—one involving our self-esteem, our choice of friends, cars, and leaders. It is tightly interwoven with our mythologies and history. Sex in human beings is necessary for the production of young, but it also evolved to ensure their successful rearing. Facet number two of our bind—our urge to reproduce is hopelessly entwined with most of our other urges.

Of course, in the early days the whole system did not prevent a very high mortality among the young, as well as among the older members of the group. Hunting and food-gathering is a risky business. Cavemen had to throw very impressive cave bears out of their caves before people could move in. Witch doctors and shamans had a less than perfect record at treating wounds and curing disease. Life was short, if not sweet. Man's total population size doubtless increased slowly but steadily as human populations expanded out of the African cradle of our species.

Then about 10,000 years ago a major change occurred—the agricultural revolution. People began to give up hunting food and settled down to grow it. Suddenly some of the risk was removed from life. The chances of dying of starvation diminished greatly in some human groups. Other threats associated with the nomadic life were also reduced, perhaps balanced by new threats of disease and large-scale warfare associated with the development of cities. But the overall result was a more secure existence than before, and the human population grew more rapidly. Around 1800, when the standard of living in what are today the ODCs was dramatically increasing due to industrialization, population growth really began to accelerate. The development of medical science was the straw that broke the camel's back. While lowering death rates in the ODCs was due in part to other factors, there is no question that "instant death control," exported by the ODCs, has been responsible for the drastic lowering of death rates in the UDCs. Medical science, with its efficient public health programs, has been able to depress the death rate with astonishing rapidity and at the same time drastically increase the birth rate; healthier people have more babies.

The power of exported death control can best be seen by an examination of the classic case of Ceylon's assault on malaria after World War II. Between 1933 and 1942 the death rate due directly to malaria was *reported* as almost two per thousand. This rate, however, represented only a portion of the malaria deaths, as many were reported as being due to "pyrexia."[13] Indeed, in 1934–1935 a malaria epidemic may have been directly responsible for fully half of the deaths on the island. In addition, malaria, which infected a large portion of the population, made people susceptible to many other dis-

eases. It thus contributed to the death rate indirectly as well as directly.

The introduction of DDT in 1946 brought rapid control over the mosquitoes which carry malaria. As a result, the death rate on the island was halved in less than a decade. The death rate in Ceylon in 1945 was 22. It dropped 34% between 1946 and 1947 and moved down to ten in 1954. Since the sharp postwar drop it has continued to decline and now stands at eight. Although part of the drop is doubtless due to the killing of other insects which carry disease and to other public health measures, most of it can be accounted for by the control of malaria.

Victory over malaria, yellow fever, smallpox, cholera, and other infectious diseases has been responsible for similar plunges in death rate throughout most of the UDCs. In the decade 1940–1950 the death rate declined 46% in Puerto Rico, 43% in Formosa, and 23% in Jamaica. In a sample of 18 undeveloped areas the average decline in death rate between 1945 and 1950 was 24%.

It is, of course, socially very acceptable to reduce the death rate. Billions of years of evolution have given us all a powerful will to live. Intervening in the birth rate goes against our evolutionary values. During all those centuries of our evolutionary past, the individuals who had the most children passed on their genetic endowment in greater quantities than those who reproduced less. Their genes dominate our heredity today. All our biological urges are for more reproduction, and they are all too often reinforced by our culture. In brief, death control goes with the grain, birth control against it.

In summary, the world's population will continue to grow as long as the birth rate exceeds the death rate; it's as simple as that. When it stops growing or starts to shrink, it will mean that either the birth rate has gone down or the death rate has gone up or a combination of

the two. Basically, then, there are only two kinds of solutions to the population problem. One is a "birth rate solution," in which we find ways to lower the birth rate. The other is a "death rate solution," in which ways to raise the death rate—war, famine, pestilence—*find us.* The problem could have been avoided by *population control,* in which mankind consciously adjusted the birth rate so that a "death rate solution" did not have to occur.

Too Little Food

Why did I pick on the next nine years instead of the next 900 for finding a solution to the population crisis? One answer is that the world is rapidly running out of food. And famine, of course, could be one way to reach a death rate solution to the population problem. In fact, the battle to feed humanity is already lost, in the sense that we will not be able to prevent large-scale famines in the next decade or so. It is difficult to guess what the exact scale and consequences of the famines will be. But there *will be* famines. Let's look at the situation today.

At least half of the people of the world are now undernourished (have too little food) or malnourished (have serious imbalances in their diet). The number of deaths attributable to starvation is open to considerable debate. The reason is threefold. First, demographic statistics are often incomplete or unreliable. Second, starving people usually don't die of starvation. They often fall victim to some disease as they weaken. When good medical care is available, starvation can be a long, drawn-out process indeed. Third, and perhaps most important, starvation is undramatic. Deaths from starvation go unnoticed, even when they occur as close as Mississippi. Many Americans are under the delusion that an Asian can live happily "on a bowl of rice a day." Such a diet means slow starvation for an Asian, just as it would for

an American. A *New Republic* article[14] estimated that five million Indian children die each year of malnutrition. Dumont and Rosier in their book *The Hungry Future*[15] estimate that 10 to 20 million people will starve to death this year, mostly children. Senator George McGovern[16] has called hunger "the chief killer of man."

Through the first decade following World War II, food production per person in the UDCs kept up with population growth. Then, sometime around 1958, "the stork passed the plow."[17] Serious transfers of food began from the ODCs to the UDCs. As food got scarcer, economic laws of supply and demand began to take effect in the UDCs. Food prices began to rise. Marginal land began to be brought into production—as evidenced by reduced yields per acre. In short, all the signs of an approaching food crisis began to appear. Then in 1965–1966 came the first dramatic blow.

In 1965–1966 mankind suffered a shocking defeat in what is now popularly called the "war on hunger." In 1966, while the population of the world increased by some 70 million people, there was *no* compensatory increase in food production. According to the United Nations Food and Agriculture Organization (FAO), advances in food production made in developing nations between 1955 and 1965 were wiped out by agricultural disasters in 1965 and 1966. In 1966 each person on Earth had 2% less to eat, the reduction, of course, not being uniformly distributed. Only ten countries grew more food than they consumed: the United States, Canada, Australia, Argentina, France, New Zealand, Burma, Thailand, Rumania, and South Africa. The United States produced more than half of the surplus, with Canada and Australia contributing most of the balance. All other countries, including the giants of China, India, and Russia, imported more than they exported. In 1966 the United States shipped *one quarter* of its wheat crop, nine million tons, to India. In the process we helped

change the distribution of people in the country. Thousands migrated into port cities so as to be close to the centers of wheat distribution. We also, in the opinion of some, hindered India's own agricultural development. Perhaps we gave too many Indians the impression that we have an unlimited capacity to ship them food. Unhappily, we do not.

In 1967 we were extremely fortunate in having a fine growing year almost worldwide; harvests almost reached the per capita level of 1964. This partial recovery, due largely to good weather, shifted some agriculturists (especially in the U.S. Department of Agriculture) from pessimism to limited optimism about the world food situation. Some hopeful signs, especially in the form of new wheat and rice varieties (the Green Revolution), encouraged even more optimism. But even those most concerned with the Green Revolution say it can at the very best buy us only a decade or two in which to try to stop population growth. It's too soon to evaluate its true potential. But it clearly cannot be assigned the panacea role so devoutly wished for by many.

Even with the Green Revolution well established in some areas, there was again *no* increase in world food production during 1969 according to the FAO, while the population inexorably rose by 2%. Much of the lack of increase was due to deliberately lower production in ODCs, which in 1968 had produced great grain surpluses that they were unable to sell. These were economic surpluses, food that destitute, hungry people in other countries could not buy. The possibility that such "surpluses" can exist is in itself a commentary on the moral conscience and economic system of the world.

Large segments of the populations of many UDCs (and many people in some ODCs) simply do not receive enough to eat. If the world's food were equitably distributed (which it certainly isn't today),[18] there would be enough calories—just barely—for everyone. Some

optimists maintain that there is plenty of food and that food will not be a problem in the future. Usually, these people are only counting calories. Unfortunately, human beings need much more than calories to stay alive and healthy; they need protein, fats, vitamins, and minerals. Malnutrition—a lack of one or more of these essential elements in the diet—is even more widespread than a shortage of calories. The most common deficiency is in protein. Without enough high-quality protein (protein which is properly constituted to meet human nutritional requirements) in a mother's diet during pregnancy and in a child's diet during the first few years, the child may suffer permanent brain impairment and be mentally retarded. Permanent dwarfing, crippling, and blindness (as well as illness and death) can also result from various nutritional deficiencies.

So the food problem is not simply one of providing more food. The *quality* of food provided is also very important. Protein is the key to the world food problem —it is high-quality protein which is most expensive to obtain, both in economic terms and in terms of the ecological cost of getting it. The highest quality and highest concentrations of protein are found in meat, seafood, poultry, and animal products such as milk and eggs. Poor people must subsist mainly on plant foods—grains, fruits, and vegetables—thus their diets may have inadequate protein, both in amount and quality.

Some of the most depressing situations are found in Latin America. There, politicians have generally been far behind those of Asia in recognizing overpopulation as a major source of their problems. As noted earlier, doubling times in many Latin American countries are truly spectacular. And the poverty, hunger, and misery of the people are equally spectacular. The hideous conditions in the urban slums—*favelas* in Brazil, *barriadas* in Peru, *tugurios* in Colombia, *ranchos* in Venezuela—have received wide publicity in the press and popular

magazines in recent years. Yet most Americans either do not know or choose to ignore the true depths of the misery and despair in which so many of our southern neighbors spin out their lives. Dry figures unfortunately make little impression. It is hard to grasp the meaning of Peru's doubling time of 23 years. It is easy, however, to grasp the meaning of Peruvian Indian children chewing coca leaves. The leaves are the source of cocaine, which suppresses the children's hunger pains.

Turning to Colombia, we find an extremely poor country with a doubling time of 21 years. Death control did not reach Colombia until after World War II. Before it arrived, a woman could expect to have two or three children survive to reproductive age if she went through ten pregnancies. Now, in spite of malnutrition, medical technology keeps seven or eight alive. Each child adds to the impossible financial burden of the family and to the despair of the mother. According to Dr. Sumner M. Kalman,[19] the average mother goes through a progression of attempts to limit the size of her family. She starts with ineffective native forms of contraception and moves on to quack abortion, infanticide, frigidity, and all too often to suicide. That's the kind of misery that's concealed behind the dry statistic of a population doubling every 21 years. What do you suppose American families would do if, after the last child was born, the average family had to spend 80% of its income on food? That's the spot the Colombians are in.

Arthur Hopcraft has published a book, *Born to Hunger,*[20] which might be described as a "report from the front" of the war on hunger. His record of a 45,000-mile trip through Africa, Asia, and South America has much greater immediacy than any set of population-food production statistics. He visited a Dr. Lema, whose survey of the vicinity of Dar es Salaam, Tanzania, revealed 30% of the children under five to be malnourished. Sixty-five of those children were hospitalized with

severe kwashiorkor, a malnutrition disease "in which open sores spread over the flesh, particularly on the thighs and lower body, so that the child looks as if he had been badly burned." Fourteen of these children died. To the west of Dar es Salaam, in a less fertile region, the death rate of children under five is nearly 50%. Hopcraft quotes Dr. Shah of Ajarpura, India, to the effect that the infant mortality rate of 125 per 1,000 births in the area was due to gastroenteritis, respiratory diseases, and malnutrition. Ajarpura was considered a progressive village, although the majority of the people were malnourished.

From Colombia, Hopcraft reports 100 infant deaths *per day* from malnutrition, supporting the picture of desperation painted by Kalman. From Turkana, Kenya, he reports 6,000 people still living on handouts in famine camps established in 1961. Hopcraft reminds us again of what we must never forget as we contemplate our unprecedented problems—that in all the mess of expanding population, faltering food production, and environmental deterioration are enmeshed miserable, hungry, desperate human beings.

I wish I could tell you that in the face of this dilemma the United States is doing everything it possibly can to help the less fortunate people of our globe. Quite the contrary; in many ways we have been a major factor in pushing them into deeper misery. We have cooperated in a "rich man's club" of nations which has controlled the world trade situation to the great detriment of the UDCs. Along with the other ODCs, we have grabbed the lion's share of the world's protein—taking more from the protein-starved citizens of the UDCs than we return to them. What's worse, we feed a great deal of the protein we import to our pets (that protein is lost forever as human food) and to our farm animals (50% to 90% of that protein is lost to mankind).

Perhaps worst of all, in order to protect our overseas

commercial empire and to protect our access to the resources we "need" for our affluent society, the United States has supported an unhappy status quo throughout the "Third World." We have backed a series of dictators and oligarchs in numerous countries under a phoney banner of "anti-Communism." By open and covert action we have often prevented land reform and other socio-political changes which are needed before reasonable agricultural development can occur.[21] There is no question that changing this pattern of behavior will be essential to the survival of both UDCs and ODCs; the world can no longer afford to support and tolerate such inequities.

Soon food production in the UDCs will fall catastrophically behind population growth. Many of these countries now rely heavily on imports. As the crisis deepens, where will the imports come from? Not from Russia—she herself will probably need to import food. Not from Canada, Argentina, or Australia. They need money and will be busy selling to food-short countries, such as Russia, which can afford to buy. From the United States then?

They will get some, perhaps, but not anywhere near enough. Our vast agricultural surpluses are long gone. Indeed, if we were to suffer a large-scale crop failure, we would be in serious trouble. We have less than one year's supply of stored crops. Our agriculture is already highly efficient, so the prospects of massively increasing our production are dim. And the problems of food transport are vast. No knowledgeable person thinks that the United States can save the world from famine with food exports, although we might be of considerable help in temporary or local situations which may precede a general collapse.

All of this can be easily summarized. There is not enough food today. How much there will be tomorrow is open to debate. If the optimists are correct, today's level

of misery will be perpetuated for perhaps two decades into the future. If the pessimists are correct, massive famines will occur soon, possibly in the 1970s, certainly by the early 1980s. So far most of the evidence seems to be on the side of the pessimists, and we should plan on the assumption that they are correct. After all, some two billion people aren't being properly fed in 1971!