SOCIOLOGY-AGRICULTURE

The Double Crisis

What can be done about world population that threatens to outstrip food resources? First of two articles keynoting UNESCO "Food and People" discussion.

The world's food resources are being used very unevenly and very wastefully. The world can ill afford this, for its population is growing at a rate of more than 20,000,000 a year.

The United Nations Educational, Scientific and Cultural Organization has selected "Food and People" as a major discussion topic for this year, inviting schools, clubs, organizations, etc. to give attention to this world problem.

Upon UNESCO's invitation, Aldous Huxley, the British author, has written this challenging article which SCIENCE NEWS LETTER *presents to its readers in cooperation with UNESCO. Next week's issue will continue the discussion with a reply by Sir E. John Russell, the British agricultural scientist.*

By ALDOUS HUXLEY

➤ THE HUMAN RACE is passing through a time of crisis, and that crisis exists, so to speak, on two levels—an upper level of political and economic crisis and a lower-level crisis in population and world resources. That which is discussed at international conferences and in the newspapers is the upper-level crisis—the crisis whose immediate causes are the economic breakdown due to the War and the struggle for power between national groups possessing, or about to possess, the means of mass extermination. Of the low-level crisis, the crisis in population and world resources, hardly anything is heard in the press, on the radio or at the more important international conferences. And yet the low-level crisis is at least as serious as the crisis in the political and economic field. Moreover, the problems on the upper level cannot be solved without reference to the problems that are shaping up in the cosmic and biological basement. If it is ignored, the low-level crisis is bound to sharpen the crisis on the political and economic levels. At the same time, a concentration of attention and energy on power politics and power economics will make a solution of the low-level problems not merely difficult, but impossible. In what follows I propose to discuss certain aspects of the low-level crisis and to point out how the obscure happenings in the basement have affected and are likely to go on affecting the lives of private individuals, the policies of statesmen and the conduct of nations.

It has been fashionable for some time past to talk about "poverty in the midst of plenty". The phrase implies that the planet possesses abundant resources to feed, clothe, house and provide amenities for its existing population and for any immediately foreseeable increase in that population, and that the present miseries of the human race are due entirely to faulty methods of production and, above all, of distribution. Given currency reform, socialism, communism, unrestricted capitalism, distributism, or whatever the favorite remedy may be, humanity, like the prince and princess in the fairy stories, will be able to live happily ever after. Want and hunger will be transformed into abundance and the whole earth will become one vast Land of Cockayne.

Such are the miracles to be achieved by political and economic planning. But when we pass from these high-level considerations to a study of what is going on at the biological and ecological levels, our optimism is apt to seem a little premature, to say the least of it. Instead of poverty in the midst of plenty, we then find that there is poverty in the midst of poverty. World resources are inadequate to world population. At the present time, our planet supports a little less than 2,250,000,000 human beings, and the area of food-producing land is in the neighborhood of 4,000,000,000 acres. It has been calculated that two and a half acres of land are needed to provide a human being with a diet which nutritionists would regard as adequate. (This may be an extreme estimate but I shall take it as the basis of what I have to say.) Thus, even if all the available productive land were good—and much of it is of very poor quality—the existing population could not be assured of an adequate diet. Actually, in order to bring all the people in the world who are at a very low nutritional level up to even a modest level of adequacy within the next 25 years, the prewar food supply would have to be doubled. But this cannot be accomplished overnight. In the words of Dr. Thomas Parran, the former Surgeon-General of the U. S. Public Health Service, "the greatest possible increase in food production will not for decades be enough to meet the minimum adequate diet." And world population will continue to rise. It is rising at the rate of about 200,000,000 every 10 years.

Moreover, while population goes up, the fertility of the soil declines. "Modern man", writes Ward Shepard in his recently published book, FOOD OR FAMINE, "has perfected two devices, either of which is capable of annihilating civilization. One is atomic war, the other is world soil erosion. Of the two, soil erosion is the more insidiously destructive. War disrupts or destroys the social environment, which is the matrix of civilization. Soil erosion destroys the natural environment, which is its foundation." In other words, atomic warfare can destroy one particular civilization; soil erosion can put an end to the very possibility of any civilization. Favorable weather has prevailed in North America for the last 10 years and, in consequence, we hear much less of erosion than was heard during that succession of dry seasons which called the Dust Bowl into existence. Nevertheless, in spite of considerable improvement in agricultural practices, soil erosion still goes on and is likely, as soon as the continental weather takes another turn for the worse, to assume the same disastrous proportions as it did in the 'thirties. Already enormous areas have been partially or completely sterilized, and millions of acres more are destined to suffer the same fate. But within the next 25 years, the population of the United States will rise (if nothing untoward happens in the interval) by about 30,000,000. There will be more mouths to feed from a diminishing area of productive land.

What is happening in North America is happening also in other parts of the world. Erosion is rampant all over Africa, where a rapidly increasing native population clings tenaciously to its old habit of measuring social status in terms of cattle. There are more people, therefore more cows, therefore more over-grazing, therefore more soil erosion. In Asia, too, the same irreparable damage is being done to the very foundations of any possible civilization. Human poverty exists in the midst of a steadily increasing natural poverty.

Sound practices have combined with a climate that is without extremes to provide Western Europe with a tolerably stable agriculture. Its farmers produce good crops without, in the process, destroying the soil. But however good these crops may be, they are insufficient to provide the present population of Western Europe with even its minimum good requirements. In relation to the local food supply, Western Europe is over-populated. Since 1800, Western Europe has trebled its population. This increase was made possible by the exploitation of the empty and agriculturally virgin territories of the New World. Today, the New World has a large and rapidly increasing population of its own, and its soil, after more than a century of abuse, is losing its fertility. There is still a very large exportable surplus of food; but as numbers go up, and fertility goes down, there will be less and less to spare

for the hungry in other parts of the world. Moreover, the manufactured articles which Western Europe exchanged for food and raw materials have tended to become less acceptable in proportion as the nations of the New World have developed their own industries. Europe will find it more and more difficult to pay for supplies which, as the population pressure on the New World's eroded soil increases, are bound to diminish. And this will happen at a time when a newly-industrialized Asia will be in a position to compete for whatever surpluses of food the New World can still make available to the Old.

Food is a renewable commodity. If the soil is not abused, this year's harvest will be succeeded by next year's. But the vein of tin or copper which produced this year's output of ore will not be renewed in years to come. When the lode has been worked out, the miner must move on to another deposit of the mine. And if he can find no other deposits—well, that is just too bad. Industrialism is the systematic exploitation of wasting assets. The thing we call progress is, in many cases, simply acceleration in the rate of that exploitation. And such prosperity as we have known up to the present is the consequence of rapidly spending the planet's irreplaceable capital.

How long can the accelerating dissipation of capital go on? How soon will the wasting assets of the world be exhausted? All we know for certain is that the supplies of many hitherto essential commodities are limited and that, in many places, very rich and easily available deposits of those commodities have been, or are in process of being, worked out. Thus, in the United States, high-grade iron ore is running low; so are zinc, copper, lead; so is petroleum. And this is happening at a time when a rising population with steadily improving methods of production is calling for ever increasing quantities of consumer goods—in other words, is making ever heavier demands on the limited reserves of our planetary capital.

Further Complications

Up to this point, I have dealt with world population as a single undifferentiated whole. The problem thus posed is that of increasing pressure upon diminishing resources. But this basic problem of our time is deepened and complicated by the fact that rates of increase are not uniform throughout the world's population. Different birth rates as between the various peoples of the earth, and as between classes within a people, are rapidly engendering a host of new problems.

In Western Europe and North America, the over-all birth rate has sharply declined in the course of the last 50 or 60 years. Because of the lowered death rate and the relatively large numbers of persons within the reproductive age groups, this decline in the birth rate has not yet manifested itself in a net decline of population. But the onset of such a decline is close at hand. For example, by 1970 the population of France and Great Britain will have declined by about 4,000,000 apiece, and the number of persons over 65 will be approximately equal to the number of those under 15. Similar declines are due, at a slightly later date, in the other countries of Western Europe and in the New World (except South America). Meanwhile, in spite of much higher death rates, the population of Eastern Europe and of Asia is destined to go on increasing. By the end of the present century, Asia alone will have a population of about 2,000,000,000. And in 1970, when Western Europe will have some 9,000,000 fewer inhabitants than it possesses today, Russia will have gained upwards of 75,000,000.

Food and Politics

In the preceding paragraphs, I have indicated, in baldest outline, the nature of the lower-level crisis through which humanity is now passing—a crisis which, so far as we can see, will grow more acute with every year that passes. We have now to consider how these untoward events on the biological level have affected, and are likely in the future to affect, behavior on the levels of international and domestic politics, and how the more dangerous symptoms might be palliated during the long period required for removing the underlying causes.

An unfavorable relationship between population and natural resources creates a permanent menace to peace and a permanent menace to political and personal liberty. In our days, whether there is a threat to peace depends upon whether an overpopulated country possesses an industrial plant capable of producing armaments. There can be no aggression without the means to aggression. Lacking these means, the people of an overpopulated country are confronted with only two alternatives. They can either stop breeding, and so reduce the population. Or else, they can go on breeding until famine, disease, political unrest and civil war combine to raise the death rate to the point where a decreased population can reestablish a favorable relationship with natural resources. But some overpopulated countries are also industrialized; and for these, there is a third alternative: to enslave or exterminate their neighbors, and so acquire more land, food, raw materials and markets.

Remembering that "God is on the side of the big battalions", the military leaders of industrialized countries with high birth rates will feel confident of winning any war they care to wage against the countries with low birth rates. And remembering that David killed Goliath with a stone from his sling, the military leaders of the countries with low birth rates will come to believe that their only chance of survival consists in using, before it is too late, their technical superiority in atomic and biological weapons, in order to offset the effect of the big battalions. So long as it remains axiomatic that nations exist for the purpose of damaging or destroying one another, the unequal increase of world population is no less dangerous, politically speaking, than the over-all increase of population pressure on resources.

A World Population Policy?

The world's underlying population crisis can only be relieved through the adoption, by all nations, of a world policy, aiming at the stabilization of population at a figure at which the relationship between numbers and resources, numbers and the amenities of life, shall be most favorable. As things are at present, no political foresight is possible, since the rapid changes in the absolute and relative numbers of human beings create a constantly varying social, economic and political environment. A rational control of human destiny depends on the existence of a stable world population with low death rate. It doesn't make sense to talk about Human Dignity and the Four Freedoms in relation to some Far Eastern countries where, say, almost half of the inhabitants die before they are 10 years old; where two-thirds die before they are 30; and where, none the less, the total population rises by tens of millions every decade. The "giant misery of the world" cannot be mitigated by inspirational twaddle, but only by an intelligent attack upon the causes of that misery.

It is, of course, a great deal easier to talk about a world population policy than it is to get such a policy accepted by the various national governments; and it will be easier to get the policy accepted than to get it implemented. Moreover, even if it should, by some miracle, come to be accepted and implemented immediately, the beneficent results could not, in the nature of things, be apparent for several generations. Let us elaborate a little on this depressing theme.

So long as idolatrous nationalism remains the effective religion of mankind, and so long as it is taken for granted that war is right, proper and inevitable, no government of a country with a high birth rate will pledge itself to the reduction of that rate; and no government of a country with a low birth rate will forego in advance the privilege of trying to increase that rate with a view of increasing the size of its armed forces.

Assuming now, for the sake of argument, that, in spite of nationalism and militarism, a world population policy should be agreed upon, how easy would it be to get that policy implemented? The answer is that, in the countries where its immediate implementation would be most desirable, it would be exceedingly difficult, indeed almost impossible, to do so. For a variety of reasons, material and psychological, birth control is not practised by persons

whose standard of living falls below a certain level, and this level, for the great majority of Asiatics and even of Eastern Europeans, is unattainably high. To obtain any conscious or deliberate reduction of the high birth rates prevailing in the East would be a task requiring many years of education and technological advance.

Finally, even if a substantial cut in the present high birth rates of the world were to take place tomorrow, the number of persons in the reproductive age groups is at present so large that, despite the reduced birth rate, over-all population would continue to increase until at least the end of the present century. In the most favorable circumstances we can reasonably imagine, world population is bound to rise to at least 3,000,000,000 before it starts to decline. This means that, whatever happens, the next half century will be a time of the gravest political and economic danger. If a world population policy should be agreed upon and implemented in the near future, this danger may be expected to grow less acute after about the year 2000. If no such policy is adopted, the crisis is likely, unless something startlingly good or something startlingly bad should happen in the interval, to persist for many years thereafter. The adoption of a population policy is a goal at which we should certainly aim; but while we are waiting for it first to be agreed upon and then to take effect, we must do what we can to minimize the dangers to peace and liberty which are inseparable from overpopulation.

The problem requires simultaneous attack on several fronts—the ideological front, the organizational front and the scientific-technological front. On the ideological front, the formidable enemy to peace is nationalism; for it is in the context of nationalistic thinking that overpopulation becomes most dangerous. The depth and sincerity of religious belief are measured by the sacrifices which the believer is prepared to make for it. At the present time, there are probably a thousand men and women prepared to undergo martyrdom for the local national idol, to every one who would willingly die for his or her belief in God. Of all the motives for mass action, nationalism is, at present, by far the most potent.

The idea that war between nations is right, proper and inevitable, remains a kind of axiom and, as it were, a necessity of thought. The appalling experiences of the last 30 years have taught collective humanity precisely nothing. The nations of the world continue to think and feel and act in the same old ways—the ways that are positively guaranteed to lead to catastrophe. If social aggregates fail to learn by even the bitterest kind of experience, how is the indispensable lesson to be imparted?

The Contribution of Science

From the ideological and organizational approach to the problem of war, we pass to the scientific and technological. Workers in the fields of pure and applied science are in a position to make two important contributions to the cause of peace. They can refuse to take part in the current preparations for the mass extermination of civilians. And, supplementing negative by positive actions, they can work for the palliation of those consequences of overpopulation, which are among the basic causes of war. Of the first course of action, I need say no more than that the question of taking it or not taking it is for the individual to decide. Some scientific workers regard it as a matter of duty to place their knowledge at the service of the State; others regard it as a duty to refuse to participate in research whose avowed purpose is the discovery of improved methods of slaughter. It is a matter of conscience.

In regard to the morality of positive scientific action, there can be no difference of opinion; nor, I think, can there be serious disagreement about the basic objectives to be aimed at. The facts are only too obvious. We have, as a species, a rapidly rising population which cannot, under present conditions, be adequately fed. Over large areas of the earth, soil erosion is gnawing at the foundations of any possible civilization. Moreover, the dominant civilization of our time—Western industrialism—is based upon the ever more efficient exploitation of wasting assets. While waiting for a world population policy to take effect, we can and we should use the resources of applied science to increase the food supply, to check erosion, to conserve the rapidly disappearing basis of industrial prosperity and, at the same time, to see what can be done to shift our civilization on to a less precarious foundation.

The world's supply of food can be increased in the following ways: by improving existing methods of production, conservation and distribution; by opening up hitherto unexploited areas of land and sea; and by developing techniques for transforming easily available materials into nourishment, either directly for man or indirectly for his domesticated animals, insects and fungi.

The Food and Agriculture Organization of the United Nations exists for the purpose of considering, and making recommendations about these methods of increasing the world's food supply. The Organization possesses no authority, and one of its most ambitious schemes, the Orr Plan for a World Food Board empowered to buy and distribute surpluses, to stabilize prices and preserve an "ever-normal granary", has been rejected by a majority of the governments concerned. But there are other ways of getting results, the delegates to the FAO are extremely competent, and we can certainly count on them, in the years ahead, to do as good a job as the various national governments, to which they are responsible, will permit.

Consider, for example, the second method of increasing the food supply. When one looks at a map of the world, colored or shaded according to the density of population, one sees that large areas are almost uninhabited. They are uninhabited because, under present conditions, they are uninhabitable. In some places, the expenditure of more or less considerable quantities of human labor and capital might change the conditions and make the land productive. As world population rises and the demand for food yet further outstrips the supply, it will become increasingly worth while to spend time, work and money on tasks which, in present circumstances, are economically unjustifiable. And if atomic power can be harnessed without too much danger, and made available at a very cheap rate, many projects at present quite unjustifiable would become matters of practical policy. Meanwhile, it has been reported that the Russians have succeeded in thawing out the Siberian tundra and converting it into fields of rye and wheat. If this experiment should prove successful, much hitherto barren land in sub-arctic Asia and America might become productive.

Any increase in the world's total food supply is desirable. But it should always be remembered that, from a political point of view, the most desirable kind of increase is one which does not involve a natural monopoly by any one nation. The ideal to be aimed at is a method for increasing the food supply that shall be equally available to all nations, regardless of their size, population-density and geographical position. A step in this direction would be taken if new methods could be devised for getting a greater amount of food from the sea. At the present time, some of the seas in the immediate neighborhood of densely populated areas are perhaps being overfished, but there are large under-exploited areas. It has been found, too, that in landlocked bays and inlets the supply of fish can be increased by dropping suitable fertilizers into the water. The overgrazing and consequent erosion of pasture lands will soon compel us to turn more and more to the seas as our prime source of animal protein. The sooner we set about discovering the basic laws of marine stock-raising the better.

Some countries are far from the sea and some seas are by nature less productive than others. Even in salt water there is a natural monopoly. To break the politically dangerous monopolies in fertile territories and in access to the sea, chemists and biologists should be enlisted to collaborate on a series of Manhattan Projects, not of destruction, but of creation. Thus, the Germans are said to have used a method for

converting organic waste products, such as sawdust, into a sugar solution for the culture of edible yeasts. Such a technique, if suitably developed, might provide much-needed proteins for those millions who, at present, have to subsist on an unbalanced diet of cereals. And the goal of another of these projects would be the synthesis of chlorophyll, the substance which permits the growing plant to use the sun's energy to convert air and water into carbohydrates. Up to the present, the rulers of the world have been ready to lavish time, energy, money and brains upon the development of atomic and biological weapons; it might be a good thing to use the resources of applied science for the relief of the world's hunger and the removal of one of the principal causes of war.

Natural monopolies in raw materials are even more politically dangerous than natural monopolies in food. When located in the territory of a strong nation, deposits of minerals necessary to industry are a standing temptation to the abuse of military and economic power; when located in that of a weak nation, they are a standing temptation to aggression from abroad. Research should be deliberately organized for the purpose of discovering universally available substitutes for these relatively rare and most unevenly distributed minerals. If successful, such research would have two beneficial results; it would break the natural monopolies which are so politically dangerous; and it would help our industrial civilization to shift from its precarious basis in the exploitation of rapidly wasting assets to a more secure, a more nearly permanent foundation.

The Threat to World Peace

We now come to the problem of atomic energy. Though we would like to assume (and it would be a pretty large assumption) that henceforward atomic energy will be used exclusively to provide power for peacetime industry and agriculture, all the time the temptation to use the new source of energy for political purposes, in war or revolution, would beckon every ambitious adventurer, every fanatic and idealist. "Lead us not," we pray, "into temptation"—for the good reason that, whenever temptation is strong enough and persistent enough, we almost invariably succumb to it.

Industrial civilization is based upon the exploitation of wasting assets by means of man-power and the power generated by coal, oil, gas and falling water. If successfully harnessed, atomic energy will increase the available power to an enormous extent. From this two results may be anticipated, one unfavorable, the other favorable. To begin with, we may expect that increased power will lead to the more effective exploitation and consequently to the more rapid exhaustion of the more easily available supplies of such indispensable minerals as iron, tin, copper, zinc and the like. Atomic energy will permit us to enjoy the prosperity of the spendthrift who lives gloriously for a few years on inherited capital. If this were all that could be expected, the discovery of atomic energy would be wholly disastrous. But fortunately this is not the whole story. Given an indefinite amount of cheap power, it will become economically possible to exploit deposits whose low concentration of desirable minerals renders them, under present conditions, practically worthless. In other words, the harnessing of atomic power is likely to accelerate the dissipation of what may be called our high-grade capital; but it should postpone the final onset of bankruptcy by making available to industry the low-grade capital which it now costs us too much to spend. In combination with a reasonable population policy, a reasonable policy for the use of atomic energy might permit some better version of our industrial civilization to achieve stability and a certain permanence.

Applied science can be used in the fight for liberty, no less effectively than in the fight for peace. Let us assume, for example, that a means will be discovered for substantially increasing the supply of food. This would have the same kind of result as the discovery of a second New World. It would make life easier for the inhabitants of overcrowded countries and, by doing so, it would remove the necessity for some of the "centralized and peremptory social controls", which must always be imposed when the pressure of population upon resources become excessive.

Meanwhile, every day brings its quota of some 55,000 new human beings to a planet which, in the same period of time, has lost through erosion almost the same number of acres of productive land and goodness knows how many tons of irreplaceable minerals. Whatever may be happening to the superficial crisis, to the crisis on the political, or industrial or financial levels, that which underlies it persists and deepens. The current, almost explosive growth in world population began about two centuries ago and will continue, in all probability, for at least another 100 years. So far as we know, nothing quite like it has ever happened before. We are faced by a problem which has no earlier precedent. To discover and, having discovered, to apply the remedial measures is going to be exceedingly difficult. And the longer we delay, the greater the difficulty will be.

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ASTRONOMY

Total Eclipse of Moon

The first eclipse of the year will occur on the night of April 12. Saturn will be the only planet visible next month in the evening skies.

By JAMES STOKLEY

➤ THE most interesting astronomical event of April is a total eclipse of the moon, which occurs early in the night of Tuesday, April 12, and is visible throughout North America. This is the first eclipse of 1949 and one of two eclipses which occur in April, but the second will not be seen from this part of the world.

The second is a partial eclipse of the sun, which comes on April 28 and will be visible over practically all of Europe, northwestern Africa, Greenland, Iceland, Baffin Land, the North Atlantic Ocean and the Arctic regions, including the northernmost part of Siberia. Where it is at its maximum, only 60% of the solar diameter will be hidden by the moon. That is, the inner part of the lunar shadow, where the sun would be totally eclipsed, does not touch the earth at all.

The evening skies in April bring only one planet, Saturn, which stands high in the south very close to the star Regulus, in the constellation of Leo, the lion. Its position is shown on the accompanying maps, which depict the heavens as they appear about 10:00 p.m. at the beginning of the month and an hour earlier at the middle. Saturn is just twice as bright as Regulus, and shines with a steadier light. This is because of the fact that it is a planet, shining by reflected sunlight, rather than a star, as Regulus is, a distant sun emitting light itself.

In Leo is a smaller star-group called the sickle, with Regulus at the end of the handle. The blade of the sickle forms the lion's head, while Denebola, farther east and part of a little triangle of stars, is the animal's tail.

Next to Leo, to the left, is the rather long constellation of Virgo, the Virgin, in which we find the star called Spica. On the other side of the lion is Cancer, the crab, not a very conspicuous group though it is part of