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population

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STANDING ROOM ONLY--2000 A.D.

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When one jumps into a pool of cool water, he is usually in for a shock. If, however, he enters it slowly and by degrees, it may cause him no difficulty at all. So it is with many things about us. If they happen suddenly we are shocked; if by degrees we may take them as a matter of course.

Today I should like to discuss some things that are sneaking up on us insidiously, and which we take for granted whether they are for good or bad. The first has to do with numbers of people and their wants and needs; the second has to do with the fulfilment of these necessities, and finally I should like to talk about an interest which is caught in the middle--our interest in fish and wildlife.

But before we get into these considerations, let us generalize for the moment.

A long while ago an English preacher by the name of T. R. Malthus stated that human populations tend to be controlled by the food supply. There are those who believe that the old theorist was wrong, but in our western civilization we have not as yet tried out his idea.

We are constantly thrilled and chilled by the great advances made in the physical sciences in the past few decades. The theoretical energy contained in the atom has been brought out of the ivory halls, and the ivory crania of a few philosophers. This theory turned out to be intensely practical, and it was unveiled to the world most dramatically. It was analogous to jumping into an icy lake.

But quietly, without fan fare, and forming scarcely a ripple in the stream of consciousness of the most of us, another scientific miracle has occurred. We

have temporarily kicked Malthus down into the cellar. We have developed food-producing methods which are the real phenomenons of the age, for we can live without our own brand of atom fission but we cannot live without food. We have done a stupendous, a gigantic thing which is without precedent. We have, in the United States and elsewhere, increased our populations and at the same time increased our standard of living. And this, I repeat, has caused scarcely a murmur among the populace; we have taken it as naturally as we take breaths of air

Possibly because this achievement sneaked in the back door unobserved, we find that there are those who feel that it was a natural thing, that it can go on indefinitely, and that there will be no problems in the future; that we can support an almost unlimited number of people on the earth. And this has given rise to two groups with opposite points of view, the Dangerous Optimists and the Fearful Pessimists: those who cry Hallelujah, and those who cry doom.

It is interesting to note that a generalization can be made concerning these two groups. The optimists seem to be generally the production scientists, the applied scientists, and the trusting laymen. The pessimists seem to be generally the more basic scientists, often basic biologists.

In this connection we must not pass without a comment on the place of science in human affairs. The general public, seeing only end results of scientific activity, tends to feel that science has no limits, that there are no problems which it cannot solve. We must remember that too much faith can be put into our powers. We must remember that there is somewhere a limit to our abilities and our production. We must have the humility to remember that we cannot solve all human ills.

People. First let us talk about people. As a race we have been on the earth for from a half-million to two million years. For hundreds of thousands of these years people skulked around in odd places, grabbing when the opportunity afforded itself and being grabbed when at a disadvantage. The important thing is that they did arrive, and that they held their own and moved about here and there, not diminishing in numbers and not increasing rapidly.

Through all of the history of the human race but the immediate past, growth in numbers must have been slow. In an issue of Science of about two years ago, Woodbury says, "The world population is estimated to have doubled from 100 million to 200 million in the first 1000 years A. D., more than doubled from 500 million to 1200 million in the 200 years from 1650 to 1850, and again doubled from 1200 million to 2400 million in the century from 1650 to 1850, and again doubled from 1200 million to 2400 million in the century from 1850 to 1950". If we come to relatively modern times we have some fair census figures.

World Populations					
Year	Millions	Annual Increase	Year	Millions	Annual Increase
1650	470		1950	2,400	16.0
1800	870	2.7	2000	3,600	24.0
1900	1,600	7.3			

Ralph W. Phillips, in a recent issue of The Scientific Monthly dramatizes this increase by visualizing a dining table at which two linear feet are given to each person. To seat all people at once would require a table extending around the earth 20 times, with a small auxiliary table only 4,232 miles long. In addition it would be necessary to employ a crew of workmen who would be making tables at the rate of 17.8 miles a day. By 1960, says Mr. Phillips, we would need 21 tables extending around the earth, plus a long auxiliary one 18,500 miles in length.

Now let's see how Paul Sears looks at this question. In his article titled, The Inexorable Problem of Space, in a recent issue of Science, he says that at the present rate of increase in about 22 generations, if we allow a spot 2x3 feet per person, there will be standing room only. This would, in 22 generations, put 4,646,400 people on a section of land, about as many people as were living in Massachusetts in 1950. Sears admits that he has allowed plenty of space per person, but believes that each should have enough so that he could reach into his pocket for the rent money.

Now to get closer home. The soil scientist, Firman Bear, says that under pristine conditions there were about 2,400 acres for each American Indian. At the time of Benjamin Franklin's birth there were still about 1,900 acres for each person in the United States. By 1800 this had reduced to a per capita allotment of 400 acres, and by 1900 to 25 acres. In 1955 there were 12 acres per person, and, if there are 300 million people in the year 2000, this will be cut to 6. Now, if you consider that only about 1 acre in 5 is tillable, this leaves as of today about 2.5 acres for each of us.

Let us see what has happened in the United States since 1800:

United States Population					
Year	Millions	Annual Increase	Year	Millions	Annual Increase
1800	5.3		1950	150.7	1.5
1850	23.2	0.36	1957	173.0	2.8
1900	76.0	1.06			

When we consider these figures we see all of the symptoms of a species of animal which is in irruption, which has got out of control, and which shows no signs of slowing down. In natural populations we consider this to be a danger sign, a forerunner of a depression in numbers, a break from a peak. If these figures are plotted we get a curve which is not a normal growth curve, but a startling upsurge in numbers. Certainly it cannot be considered to be evidence of a normal, healthy, ongoing population.

Food. Earlier we made some strong statements about our growing food production. This growth is entirely due to scientific advancement. The numbers of Americans employed in agriculture have constantly decreased as food production has skyrocketed. In 1850 a farmer fed 5 people, in 1925 he fed 9, in 1950 he fed 15, and in 1955 he fed 20. At the same time the acreage under control of each farmer has increased. Greater efficiency, modern methods, have brought this about. We are no longer an agrarian culture. Farming might be said to be the

field manufacturing of foodstuffs nowadays.

How did this come about?

Many scientific advancements contributed to the phenomenon. Hybrid crops produce much more on an acre than did the old open pollinated varieties. One hundred bushels of corn to the acre is now commonplace in the corn belt. New crops and new varieties of old crops have been put to use. More commercial fertilizer is now being used than ever before. Pest control has become a major science. Weed killers eliminate costly farming operations and cut down competition. New fungicides increase yields. Plant breeders have produced many varieties which are resistant to diseases and insects; sugar beets which do not get curly top, wheat resistant to hessian flies and wheat stem sawflies, wheat varieties which can withstand the deadly stem rust, apples resistant to scab disease, all of these things are in use or are being perfected. New insecticides so numerous and effective that they startle us are in use today. And well they might. Without them there would be no potatoes harvested. Our own studies of abandoned peach and apple orchards show that without the use of insecticides and fungicides we would harvest only about .2% of the crop. By modern standards untreated fruit crops will yield only one in 500 marketable fruits. Dr. G. C. Decker, on the basis of data from the United States Department of Agriculture, estimates that since the advent of DDT and its congeners, the yield of potatoes has risen 160%, onions 140%, sweet corn 160%, tobacco 125%, beet seed 180%, and alfalfa seed 160% (in the State of Washington alfalfa seed increased 420%).

Marketing has made tremendous advances. Take refrigeration and its contribution to keeping foods available throughout the season even though they may be produced seasonally. Grading has forced the production of quality products. Distribution systems have been developed to a high degree. Stored products can be protected from pests which cause deterioration.

All of these things have added to our use of food products made available through modern agriculture.

Furthermore, we are not generally using all of the tools which Science has made available to us. The fertilizer industry calculates that if we used proven methods of fertilizing crops, methods tried but not in use, we could keep the present production of corn, cotton, wheat, and hay, and retire 42 millions of acres. Osborn has said, "...official estimates indicate that the application of... (new)... techniques have, during the last 13 years, resulted in a gain the equivalent of production from 64,000,000 acres of land." In Illinois the corn yields for the past ten years have averaged 60% greater than before modern technology took hold.

Nor have we reached the end of this agricultural advance. Many advances are yet to be put into general use and many more are yet to be discovered.

This combination of scientific advance has put us in the anomolous and illogical position of producing foods in such quantities that we can neither eat

nor sell them.

The Dilemma. What, then, are we faced with in the future? We are in the midst of a tremendous race, a race between people and their food supply. Populations are growing apace. The rate of increase in the United States is greater than the rate in India. Food production, where modern science has had time and the opportunity to work on it, has grown almost beyond belief.

But man must never overtake his ability to feed himself. And here scientists, and especially biologists, and among them especially biologists interested in population dynamics, have feelings of uneasiness. To carry the belief of the optimists to an ultimate and absurd conclusion, there is no limit to what people can do in feeding themselves! There is a limit. And that is where the biologist gets concerned. Theoretically the ability of any successful organism to reproduce itself is infinite. The ability to produce food does have limits, though. It is the finite factor. On purely theoretical bases people will overcome their ability to think themselves into a square meal.

The June, 1958, number of the Kiwanis Magazine carries a thought-provoking article by Rear Admiral H. G. Rickover. Among many sobering comments we find the following:

"Ominous, too, is the fact that while world food production increased nine percent in the six years from 1945-51, world population increased by 12 percent. Not only is world population increasing faster than world food production, but increases in food production tend to occur in the already well-fed, high energy countries rather than in the undernourished low-energy countries where food is most lacking."

Let us look at some of the finite factors in food production.

The production of food is dependent on the surface of the earth. Directly or indirectly, we get our nourishment from that surface upon which the sun shines. But we must be more specific. There are approximately 196,836,000 square miles of surface, according to Phillips. Of this, only 55,786,000 square miles are land, the remaining are water. Only 28.3% of the earth's surface is land. Twenty percent of this area is in permafrost. More than 20% is too rough or too high for permanent human habitation. Another 20% is too arid for cultivation. That leaves us with less than 40% to play around with in producing food.

Of the land available, we are losing area from production. Despite the greatest widespread interest in soil conservation ever known, we are still losing topsoil through careless handling. Further, we submit to what I call land usurpation. This is a rather new thing as an effective agent in reducing the food production potential, for until the last half-century we have been adding more acres than we have been subtracting. According to Ordway, farm, forest, and grazing land in the United States was reduced by 16,000,000 acres from 1935 to 1945. This went into the building of cities, industrial development, roads, highways and the like. Kennard points to the Miami Valley in Ohio. Twenty-five years ago it was a rich, productive farming area. Now particularly from

Springfield to Cincinnati this is an industrial area. There are those that believe that a strip from Milwaukee to Peoria will, before long, be completely usurped for residence and industry. When this happens St. Louis will grow north up the Illinois and join the push south.

From 1942 to 1956 on a nation-wide basis, 20,000,000 acres have been withdrawn from food production. This is 5% of the total cultivated acres in the United States.

The Department of Agriculture estimates, according to Representative Arends, that each year we are losing 1,250,000 acres of good farmland. From 1942 to 1957 Ohio, Indiana, Georgia, Florida, and Texas each lost about a million acres. Connecticut has lost one-third of its cultivatable land, and it is estimated that another ten years at the present rate of usurpation will see the last of that state's good, commercial, producing farmland.

Champaign and Danville, Illinois, are about 35 miles apart. A new super-highway is being built between the two cities, which will usurp about 3000 acres, or approximately 4 2/3 sections!

The optimists say that we can irrigate new lands. Testimony given by the United States Department of Agriculture before Congress in 1952, according to Osborn, indicates that the food and export needs of the country by 1975 will require 113,000,000 more acres than are now being farmed, and this is 70,000,000 more acres than are planned on by the government in all of its land development and reclamation projects.

The tropics have always held an attraction to the optimists. All we have to do is to clear the Amazon basin and start to produce food and transplant people there. So far this has not worked. In a stimulating new book on the tropics by three Frenchmen, de la Rue, Bourliere, and Harroy, there are some sobering comments: "The legend of the inexhaustible fertility of the soil in the hot countries has taken a long time to kill," they say. "Too many fantastic accounts have given rise to a strongly held opinion that the surfaces cleared of the great tropical forests are of an unheard-of richness. . . . It has now been convincingly shown that, generally speaking, the soils of the tropics have nothing like the fertility of those of temperate regions, that their yield under cultivation is in general less, and that they are also very easily destroyed."

And so it goes through the most of the proposals of the optimists.

Let us quote some pertinent comment from a couple of the thinkers of the day.

In a speech given by Dr. Milton Eisenhower, we find the following, "If we had at this moment a feasible 25-year plan to bring the diet of people everywhere up to about 2600 calories per person per day (a meager diet by your standards and mine)--if we had such a plan, I say, it would involve increasing world food production by 110 percent, taking into account the estimated increase in population. And I say in all earnestness that it is an open question whether food production

for all our science, can be increased by that much. . ."

The University of Chicago's physiologist, A. J. Carlson, discusses the effect of modern medicine on the human race, and states that we are increasing the race faster than we are increasing food production. He concludes as follows: "What is the answer to this serious situation? Shall it be less of modern biology and medicine? more starvation? more violence and war? or more intelligence? there is fairly good evidence that we must practically double the present world food production even to feed adequately the present world population. So far as can be judged, this cannot be done."

Well that is that.

The dilemma in which the conservationist finds himself now is apparent. What can he do with people, and what can he do with food? He is not only watching, he is participating in the greatest race in history--the race between the farmer and the obstetrician!

And what will be the effect of this race on wildlife?

The first point I should make is that there is an inverse relationship between numbers of people and individual freedom. As the population increases we will find that our individual spheres of freedom will become more restricted. Now we aren't going to like this, but it is coming. We see it now. Today KEEP OUT and NO TRESPASSING signs appear where there were none yesterday. The inalienable right of the individual to fish and hunt will become less inalienable as time goes on. More and more we are going to be controlled by human organization, which is another way of saying Government. This is inevitable, and essential if there is to be a well-ordered society in a more dense population. I think that this can be predicted with complete assurance that it will happen. Further, game animals will be more and more regimented as far as our use of them in sport is concerned.

The second point I would make is that, while the discussion of food and people may have seemed somewhat academic to you, it certainly is not in one part. If we assume that food will balance with appetites for a long time in the future, the matter of space in relation to wildlife will not. If more space is needed for living it will be taken. If more space is needed and can be used for food production it, too, will be taken. When the chips are down, our defenses will have to be up, or we will lose wildlife habitat right and left.

These are sobering contemplations. As populations grow, and land surface is more and more usurped, and possibly long before human hunger is here, wildlife will have to be protected much more assiduously than is now the case.

To look at the most discouraging aspects of the situation, dams unheard of now will be built. Natural waters will be diverted and manipulated with regard for nothing but immediate human use. Public lands, now held inviolate, and for the use of all, will be opened for private or semi-private use. The collapse of

the west coast sardine fishery may well be the first dramatic instance where exploitation of an appreciable marine food item destroyed it. Wildlife will be destroyed by direct exploitation or indirectly by usurpation of habitat.

I have purposely painted a depressing potential future. I am not sure that it will happen, but I know that it can happen. It will not do much good to run into the woods, fields and waters, shouting, "Run for your lives; the dam is broken." Where is wildlife to run?

And that brings me to my third point. There is no one of us here who has not been concerned by the growing uses made of pesticides. About most of their uses I find myself not particularly concerned, however. If we wish to hasten the crossing of the supply and demand curves for food we will stop the usage of pesticides. If we wish to decay the quality of food we will outlaw pesticidal use.

As in almost every human endeavor, the use of these chemicals is the use of a two-edged sword. It can cut both ways; it can do good or evil. I do not go along with the general alarmists. What many of them do not know is that, as far as human health goes, we are now living under the most rigid protective laws which have ever been passed. Human health now is pretty well protected.

Further, safeguards have been built into labels which will cause the minimum of adverse effect to other forms of life than humans. Agricultural cropland has been treated for many years with little apparent change in the vertebrate populations. Insecticides are poisons; were they not they would be useless as insecticides, and we must expect some losses at some times. But as yet there are no data which show a cause and effect relationship in the diminution of any species through its range or permanently.

We must beware of the people who cry "wolf". Last year I received a copy of a letter written by a lady who stated that after the spraying of one Illinois town THERE WAS NOT A BIRD LEFT. Immediately I sent our ornithologist up to investigate. He found that sixteen common town species were present, and in numbers very little different from those in close-by unsprayed communities. There are too many wdfcriers.

In spite of what I have said, I am not at all sure that it is desirable to spread a non-selective insecticide over large acreages for the control of a pest, that is, in our present state of knowledge, and if this insecticide will decimate or eliminate valuable animals. It may well be that in the long run this will not be injurious, but our present knowledge of population structures and dynamics is enough to give us some concern.

I believe that we should be critical of the use of pesticides, but I believe just as firmly that we should be selectively critical. Where obvious errors have occurred we should not be quiet. But an over-all, blanketing, damnation of the use of pesticides can do us all much harm. Many of the entomologists involved in the problem are not only good but broad general biologists, and have a real awareness of the dangers involved in pesticidal use.

We must be intelligent in our criticism and not let our speculations run

away with us. And we must fortify ourselves with good, factual data before we get into a fight.

When we think of the future of wildlife in all of this competition, we cannot get away from zoning for land use. We must think of areas where people will live, areas where they will grow food, and areas which will be devoted to the production or protection of wildlife. We may not like this. It is an expression of the loss of freedom brought on by population density. Perhaps we who have interests in fish and wildlife are a little ahead of the game in this area, for what but zoning has been the setting aside of refuges, parks, and similar areas? More of these will have to be established. How many of you recall the time when you could go north into the lake country and have access almost anywhere? What is it like now? Cabins and private holdings are rapidly eating up the remaining shorelines. Time is slipping away from us. We should now be in the midst of a great land acquisition program; now while surpluses are still a part of the food picture, now while there is still an abundance of questionable and submarginal land, and now before human populations and "needs" have usurped everything. Now is the time to invest in recreational and protective lands for those added millions of the future to use.

In this discussion of zoning properly belong some remarks concerning commercial paid shooting or fishing areas. It appears to me that these activities have a real place in the development of outdoor sports for a growing population. But we should not consider that they are the ultimate goal or the final solution to a problem. At best they should be additions to a hunting and fishing program. There are esthetic factors to be considered. If the demand is stimulated for this type of sport to the exclusion of wild hunting or fishing, it is just one step for some ingenious person to develop some glorified pinball machine where we shoot at silhouettes or shadows, and bring back game from the operator's deep freeze as a prize for good marksmanship.

Further, while game is produced in the wild and is huntable, each item bagged is a savings to the state of the cost of producing that item, and this can mount up to fairly sizeable figures.

I do not imply that shooting or angling for game stocked before the sportsman is wrong; I do hold that it must not be considered as a complete substitute for the wild hunt.

Finally, in this matter of land use, we must ask ourselves if we know how to handle game in areas of heavy human habitation or use. Do we know all of the answers? It is obvious that we don't. It is obvious that we are ill equipped with facts to face what is ahead. It is equally obvious that we are not doing much right now to obtain these facts. Are we going to muddle along until we are in the midst of unique problems in need of immediate solution?

This business of finding facts which will help us must be more intensively pursued. The old style of research is not enough. The new research man must be a man with vision and imagination far beyond that usually demonstrated now. Such basic fields as genetics, physiology, and even psychology and sociology of

wild things must be investigated. And to do this will require good brains, and good brains must be bought. We can't get good research done at the pay of a maintenance foreman, and that is what some of us are doing!

Charles E. Wilson, when he was head of General Electric, summarized future research very well when he said, "It may seem to be a paradox that, at a time when science has so far progressed that its findings and its further directions are almost incomprehensible to ordinary men, it finds itself actually tied more tightly to ordinary men than ever before--first, because it has succeeded in almost scaring them to death with nuclear fission, and second, because the cost of research has gone right through the roof and must be paid for in large part out of the ordinary man's pants pockets.

"Modern research has become enormously expensive. It must be supported by tremendous sums of money supplied by laymen, through direct or indirect taxation, even though those same laymen can in the very nature of things have little to say as to how that money is spent. . . .

"As taxpayers and ordinary men, I don't think that any of us are quarreling with this state of affairs. I merely submit it to you--to those of you who are practicing scientists--as a sort of climatic condition which, like artificial rainfall, is new in this half of our century and therefore worthy of your consideration."

The responsibility on all of us here today is a grave one. We have a chance to meet a most unique problem if we have the fortitude to do it. And if we have the imagination.

We should think about this: If there is a meeting similar to the present one in the year 2000 A. D., how will those future officials evaluate us who are here today? Will they say that we are a bunch of muddlers, seeding the easy way for the moment, following rather than leading public opinion in this important field? Or will they point to us as far-seeing men of action, who really helped them in facing the most unusual situation which ever faced our North American culture?

A newspaper reporter once listened to an erudite discourse on a fossil animal which had such a well developed ganglion at the base of the spine that it resembled a second brain. The reporter's production of the evening consisted of a single 12-line poem which I quote:

'Tis plain to see from these remains	No problem bothered him a bit,
This creature had two sets of brains;	He made both head and tail of it,
One in his head, the usual place,	If aught escaped the forward mind
The other at the spinal base.	'Twas captured by the one behind,
Thus he could reason <u>a priori</u> ,	And when in error he was caught
As well as <u>a posteriori</u> .	He had a saving afterthought.

We may not have a chance for a saving afterthought, and the only satisfaction that I receive out of this whole discourse is that the majority of us here may be dead before the going gets really rough. So much more we owe to those who follow us.