There are processes going on in the world that are not obvious to many of us, but they are of great importance, and sooner or later we shall have to decide which way we are going. Last week I spoke of the enveloping character of advanced technology and the choking side-effects of pollution. There’s another aspect of this subject which especially affects large bodies of fresh water such as the Great Lakes of North America, one at least of the Swiss lakes, even the new Lake Kariba in Africa, and, perhaps surprisingly, our own Loch Leven in Kinross-shire.

Lake Erie is now looked upon as the classic world example of the phenomenon of eutrophication — a sort of pathological overfeeding. Sewers and wastes went into the lake for years, which meant an excess of some plant nutrients, some animal poisons, and an upset in the natural oxygenation of the water. Fish life has gone, there has been a dense blooming of algae—microscopic water weeds—in the summer, and, of course, people do not bathe in this great lake any more. There has been a further dumping of phosphates into the lake since the use of detergents, and a vast quantity of nitrates coming from the use of nitrogenous fertilisers on agricultural land. Lake Erie is one of those ultimates which I’ve mentioned before, that we should concentrate on as examples of what can happen to places.

In Europe there’s Lake Geneva: there the oxygenation of the lower levels of the lake is failing through increasing deposition of pollutants. The lake perch are living in an increasingly shallow layer of water near the surface of the lake. They’re growing less numerous. Shall I one day attend a board meeting of the International Union for the Conservation of Nature at Morges on the northern shore of the lake and find I can no longer have a dish of lake perch?

My gastronomic disappointment would be as nothing to my sorrow that a rich lake was now dead. It probably won’t happen in my time but the process is well on the way.

Lake Baikal in Siberia is a very wonderful place, with unique ecological conditions round its shores. Industrialisation has begun and there are the first signs of eutrophication. The Russians are monitoring the situation carefully. We’ll see what the possession of absolute governmental power can do. Then there’s Lake Kariba in Africa—a new, multi-purpose artificial lake. Here eutrophication of the Lake Erie type isn’t taking place, but an excess of plant growth is appearing, and there will certainly be some ecological problems to solve in maintaining the multi-purpose of the lake.

Last of these examples of what can happen to fresh waters is the relatively small Loch Leven, in Scotland, with its great reputation for trout fishing. The lake is set in a fairly
rich farming area. The land is still well-farmed, but now the farmers are using a vastly increased quantity of mineral fertilisers, which means a greater run-off of water containing nitrates and phosphates. In 1948 I wondered about this change in the environmental conditions of the loch and hoped it was going to mean just more nutrients for the plankton, and ultimately bigger fish. But the process ran ahead too far: there was the initial phase for which one hoped, and then a fall. There came the algal bloom and a dense growth of bottom plants with less light for the insect populations, the, larval stages of which were important fish food. This fishery is of such importance that special care is now being taken about effluents, but the story shows how tender and sensitive are fresh waters to the treatment they get from humanity.

I should also mention that in Lake Michigan the Cohoe salmon was introduced years ago to fill an ecological niche which, strangely enough, had not been filled by nature. A valuable new fishery was created, but that has now gone. There is so much DDT in the water and in the food of this predatory salmon that the fish itself is now considered dangerous as human food.

**Rise of Carbon Dioxide**

There is also a much greater change to which we are contributing, this time in the planetary atmosphere. And our paradoxical friend and enemy, the internal combustion engine, is contributing all the time. I’m alluding to the rise in the level of carbon dioxide in the atmosphere, a rise which coincides with that of the consumption of fossil fuels—coal and oil. Of course, if there were double the amount of carbon dioxide in the air than there is, it wouldn’t interfere with our health in any way as far as we know. But in the biosphere as a whole, carbon dioxide is powerful stuff. There’s a carbon dioxide cycle which naturally keeps levels right. It’s a system of great age and stability which we are now taxing with the immense amounts of carbon dioxide which we’re adding from the fuel we burn. Vegetation is a great buffer: the forested wilderness removes a great deal of the carbon dioxide by the photosynthetic activity of the leaves, turns it into wood, and so sequesters it, giving out oxygen in exchange. It happens that a higher carbon dioxide content of the air creates a greenhouse effect, favouring tree growth, which locks up the carbon again until a lower level is restored. But unfortunately we’re cutting down the virgin wildnesses all the time and reducing tree cover in so many places.

The oceans also soak up carbon dioxide and lock up carbon in the deeps. But the increasing concentration of carbon dioxide in the air leads to a gradual warming of the oceans, so that they can hold less. The activities of industrial and technological man in our day are adding carbon dioxide and also injuring the capacity of the biosphere to redress the balance.

We are not yet at the end of this story. The warming oceans would alter considerably the distribution of the marine fauna. This has happened already in this century in the warming of the North Atlantic Ocean, and it has interfered with existing fisheries. Through time, fisheries adapt to new conditions, but there is another adaptation that would be much harder. The warming oceans and atmosphere would mean a recession of the polar ice caps. The Greenland ice is 9,000 feet thick, so if that were to melt, with an equivalent melting of the Antarctic ice, the level of the oceans would rise
considerably. Our ports would go under quite literally, and with them vast tracts of fertile soil. What happens then to the swarming human population? I suppose they move upwards and back—very slowly, but surely. And what then?

Some scientists are thinking about these phenomena, but not nearly enough data are being gathered, or monitoring done. How far, really, do we think for posterity? The carbon dioxide problem is as yet remote. I’ve often heard it said that posterity must look after itself. I can think of no more callous viewpoint. The sins of our forefathers, now descended unto the third and fourth generations, were largely the consequence of ignorance. We are ignorant no longer. Science enlarges our vision, and ecology is concerned with causes and consequences on a broad front. We should be delving ecologically into the future, but in general we are not doing so.

International Development

There is a subject nearer at hand but concerned with a shorter-term future: the field of international development. Agriculturists, engineers, marketeers and so on use their technical skills to devise schemes that will provide food, power, employment and industrialisation for what are called underdeveloped countries. Perhaps it would only he a cynic who would say the real problem is too many overdeveloped ones. Britain was early in this field and still pursues overseas development in a starry-eyed missionary spirit rather than a realistic one. I could list dozens of fiascos caused by blinkered thinking.

The Conservation Foundation which I serve recently helped to organise a study conference on the ecological aspects of international development. We were concerned with the integrity of the environment, which should be a primary responsibility of any advanced nation. Some of us could feel little but shame at what man was doing to his planet. Ignorance now is culpable, but we’re not ready to admit this. I’ve touched on world-wide pollution through the use of insecticides, and there are other aspects of the employment of these substances: ecological balance is upset almost immediately, with the likelihood of repercussions, and there is the most interesting scientific phenomenon of rapid genetic adaptation by insect pests to the insecticides being used. Indeed, the insects can almost beat the chemists who are developing new insecticides.

Cocoa was introduced as a new crop in Sabah, part of Malaysia, in 1956. By 1966, 6,000 acres of virgin stands of splendid forest had been felled and planted to cocoa. Bark-borers moved in as pioneer pests; getting rid of these by hand-picking was too costly, and by 1959 this was replaced by blanket sprays of DDT and Dieldrin. Several new leaf-eating pests began work that year, followed in 1961 by a plant-hopper which sucked the shoot tips. Then several species of bagworms appeared and the silken bags of these caterpillars gave them an excellent protection against insecticides. Finally, when the situation seemed near hopeless, it was decided to stop spraying. Recovery was rapid because the natural predatory insects re-colonised the area. The bagworms were controlled first by natural means, and the other pests either came down to tolerable proportions or were controlled by selective, carefully timed insecticidal attack, devised by ad hoc research. Mass control on the lines of blanket spraying is bad tactics. The strategy should be one of minimal use at critical moments.
Irrigation has been one of the great developments of this century, although it is one of the oldest of man’s achievements. Sumer and Egypt used their great rivers for seasonal inundation, but the modern methods involve continuous irrigation and the use of concrete channels from stabilised water sources. The disease of schistosomiasis has been endemic in Egypt, but its incidence has been moderate except in areas of perennial irrigation, such as the Delta. The disease is extremely debilitating and is caused by a tiny parasitic worm, the alternate host of which is a small water snail. Seasonal flooding doesn’t favour the snail to the extent that perennial irrigation does. As a result of irrigation, the disease has now spread the length of Africa to an alarming extent, and in perennially irrigated areas the fibre of the people is being sapped. There is almost 100 per cent infestation in the Delta, where sanitary measures are almost impossible to implement because of the high water-table and the seething population. In Upper Egypt the new Aswan High Dam development will certainly increase the intensity of infestation. Rhodesia is suffering appreciably. Intensity of infestation in human beings is also bringing about unexpected complications in bodily expressions of the disease.

And there is another problem. For each new area that comes under irrigation, some land from earlier schemes goes out of cultivation by salinisation and water logging—millions of acres, for example, in West Pakistan. Furthermore, it might be mentioned that the impoundment of water in the Aswan High Dam is having a serious effect on the Eastern Mediterranean sardine fishery. Once more a source of protein is being given up for more starch. The Mekong River in South-East Asia and the curious inland lake system have, through history, sustained a quite amazing fertility—of land which might be expected to deteriorate under the conditions of cultivation. But the overflow of the river in the monsoon deposits new silt on it each year. The lakes are replenished and their biological productivity is phenomenal: this undoubtedly made possible the Khmer civilisation of 1,000 years ago. Now a series of dams on the river is projected, which will certainly provide power but will retard the flow of water, and may well reduce the fertility of the lands formerly flooded naturally. Happily, a group of ecologists has got in there this year, but whether in time to modify these great measures of change we do not know. The underdeveloped nations may be very rude to us of the West, but they have a fervid belief in our technology. And were we to try to explain that we were not quite so sure of our cleverness, that we have made some deplorable mistakes, it would be interpreted as one more example of the West wanting to deny the benefits of technology to the rest of the world. We in the West are in a cleft stick and some of us know it.

Succession of Famines
There is indeed a growing unsureness in the world. Recently the Conservation Foundation arranged an almost impromptu discussion between 11 people to examine the possible common fields between medicine, ecology, psychology, anthropology, architecture and landscape-planning, and what is generally understood as conservation. We had a stimulating day and a half, but quite early in the proceedings members of several of the disciplines represented came round to the sense of impending tragedy which each of us felt. Basically, it was caused by the population problem: none of us could see that the world would escape the horrors of famine on a large scale. Indeed, there will probably be a succession of famines, but they will be no cure for the population problem. If ten million were to starve to death in India this
year, the population would still be greater at the end than it was at the beginning of the year. But it seemed to us that the catastrophe towards which we were heading would not happen as a result of any one cause, but as a culmination of several factors: famine, war, pestilence, pollution and so on. A breakdown in technology, such as the New York-New England blackout of November 1965, could be the precipitating factor in a society geared to the electronic control of so much of the machinery of living. There could well be a chain reaction around our paradox of a globe, this close-knit, shrinking world which exhibits ever greater unfriendliness between its constituent peoples. This, too, is a fact of social implosion.

The ecologist sees the decline of the great natural buffer of wilderness as an element in our danger. Natural wilderness is a factor for world stability, not some remote place inimical to the human being. It is strange that it has been so long a place of fear to many men, and so something to hate and destroy. Wilderness is not remote or indifferent, but an active agent in maintaining a habitable world, though the cooperation is unconscious. But we ourselves are conscious of what we are doing and capable of forecasting the consequences. Pragmatic man, typified by too many of our politicians and of those considered to have their feet firmly on the ground, has his head in some world of illusion of his own making. What is the use, he asks, of all that forest if it cannot be brought to the service of man? The answer is that it is already in the service of man if he is willing to accept fellowship with the world of nature. The forest is generous: it can spare him some trees for his timber, and all the time the silent forest is busy, giving us our oxygen, taking away the surplus carbon dioxide, helping to remove the pollutants. The hedgerow trees of England were never more valuable than today—nor were the hedgerows—yet a misguided government department can give 50 per cent grants for clearing what is called scrub. Even visually the trees are beautiful and stress-relieving, but in their silence they do much more. Their only voice is the wind; they have no vote and are defenceless. The practical man (whom Disraeli said was he who could be depended upon to repeat the mistakes of his ancestors) can remove what is the nation’s heritage and nature’s tool to allow the easier passage of some mechanical Moloch.

Once more, the press of people, Mr Robert McNamara recently delivered a lecture at an American university. It was terse in quality, the most direct statement yet by any statesman of his kind. He is committed to development, but not to development that is despoliation, and not to development designed to catch up with population increase. He said quite plainly that the birth rate must be lowered, because the food per head of the world’s population is already less than it was 30 years ago. He points to the parsimony of the governments of developed countries: ‘Hundreds of millions for death control. Scarcely 1 per cent for fertility control.’ He adds that the threat of unmanageable population pressures is very much like the threat of nuclear war, and that the threat of violence is very much intertwined with the threat of undue population growth. Mr McNamara added one hard truth: ‘No reduction in birth rates has yet been achieved anywhere in the underdeveloped areas which can significantly affect overall world population totals.’ He professes himself still to be an optimist and rightly argues against the belief that development must of necessity mean more population. He thinks it evident in the poverty-stricken countries that lack of development means continuance of the high birth rate and, I might add, of habitat destruction.
I suppose I am not an optimist, nor are my friends at the Conservation Foundation about whom I was telling you. We are not alone in our pessimism. Lord Snow has also given a lecture to an American college and called it ‘The State of Siege’. He admits that he and some of his fellows have felt an uneasiness deepening, that we ‘are huddling together in our own little groups for comfort’s sake’. He feels the threat of population to be out of control and the thought of large-scale famine appals his civilised mind. Where Mr McNamara is optimistic is in thinking that the genetical break-through in producing new strains of wheat and rice will boost yields by half a ton per acre throughout Asia. Only 200 acres of these new strains were planted in 1965, but 34 million acres was the estimate for 1969 though much of the wheat- and rice-producing areas haven’t yet changed. Lord Snow has also heard about this breakthrough. It gives him a glimmer of hope— if we in the West will help ourselves, and if the poor countries reduce or stop their population increase. Mr McNamara must take the stand he does, because as Lord Snow says—as one more free than Mr McNamara—we have to act as if the solution envisaged by both of them is more likely to occur than it is.

I am always troubled by any necessity for expressing a faith which at bottom I do not feel. I am guilty of this private lying to myself over conservation of wild life in Africa. What I imagine to be the closely similar guarded optimism and reserved pessimism of Mr McNamara and Lord Snow seem to me to take insufficient notice of the time factor, and because they are not ecologists, they ignore the destruction of the life-giving wilderness. The trouble is upon us, and the several changes of custom and attitude are not going to take place soon enough. My friends in the discussion I described, and I, were all except one of the opinion that the real trouble would be upon us this century, probably as a social implosion triggered off by one of the factors to which I have alluded. Student unrest, Black Power, and violence by spectators of sport, are all implosive signs of over-large numbers.

As Mr. McNamara, Lord Snow and our-selves were talking, a Soviet Academician, Andrei Sakharov, published a paper of strikingly similar sentiments. He is a pessimist but believes that extrication from our plight is possible if we move quickly enough, if the rich and poor nations of the world join in the endeavour. If we got to work and dropped the nonsense, Sakharov sees this as being possible by the end of the century. But have we got as long as this to achieve the unity of action that McNamara, Snow, Sakharov and a few more of us see as the prime necessity? I cannot answer this question yes or no. We who think this way are human, and a unique blend of optimism and pessimism which probably has evolutionary value. Also, we are fallible, but reason and intuition make us state the situation as we see it in hard terms. That group which discussed the future knew that we were among the fortunate, living in a still beautiful world. Is it a love of beauty that leads us to be moved by our denial of it to so many of our fellow men?