

KEYNOTE ADDRESS

by

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Kick-off Rally - Teach-in on the Environment

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I am deeply honored to appear before what must surely be the world's largest seminar on ecology.

What a wonderful thing you have done! At a time when the whole country has begun to ask why, in the wealthiest, the most scientifically advanced nation in the history of man, the heavens reek, the waters below are foul, children die in infancy, and we and the world which is our home are threatened with nuclear annihilation--you have shown us how to take off our blindfolds, pull out our earplugs and shout 'We're not gonna take it!'

It is marvelously fitting--and to me deeply moving--that the nation's new fight for survival is being led--here in this great teach-in, in all the teach-ins to follow, and in the vast movement that will surely grow out of them--by the youth. For young people and future generations are the real victims of the impending ecological catastrophe. You are the first generation in the history of man to carry strontium-90 in your bones and DDT in your fat; your bodies will record in time the full effects of environmental destruction on mankind. It is you who face the frightful task of seeking humane knowledge in a world which has, with cunning perversity, transformed the power that knowledge generates into an instrument of catastrophe.

The sudden public concern with the environment has taken <sup>many</sup> most people by surprise. After all, garbage, foul air, putrid water and mindless noise are nothing new; the sights, smells and sounds of



pollution have become an accustomed burden of life. To be sure, the mess has worsened and spread in the last decade, but not at a rate to match the dramatic, nearly universal reaction to it that has hit the country in the last year.

By any measure the change has been sudden. For example, up to a few years ago the New York Times Index recorded an annual average of about 30-40 news items about water pollution; in the first 10 months of last year nearly 300 such items were published. Four years ago when Ronald Reagan ran for Governor of California he was widely quoted, in response to conservationist pleas: "If you have seen one redwood you have seen them all." In his current campaign for re-election he has chosen the quality of the environment as the central theme. When Richard Nixon campaigned for the presidency in 1968, he claimed that law and order was the chief domestic issue; yet, the issue which dominated his first State of the Union message earlier this year was the urgent need to restore our deteriorated environment.

That there is a new, intense, and growing demand for action against environmental pollution is very clear. What is not so clear is how this movement came about, and where it is going. This is a particularly crucial time to find out. For the environmental teach-ins which are being held on thousands of campuses are both the chief evidence of the origins of the movement and, in my opinion, the main force which will determine its future.

The multiple origins of environmental concern are evident in the roster of participants in your teach-in. In a way, the people you have brought together here illustrate what I like to think of as the first law of ecology: "Everything is connected to everything else."

The presence of such a distinguished array of public officials-- Governor Milliken, Senators Nelson and Hart and Ann Arbor's own Mayor, Congressman, State Senator and State Representative--is evidence that the issue is serious enough to merit close attention, and perhaps, too, that in the judgment of these elected officials, voter interest in the environment is high.

Among your teach-in speakers are a number of scientists with a professional interest in the environment: biologists, ecologists, engineers, sociologists, urban analysts, and public health experts. This reflects one of the earliest origins of the environmental movement: The work of those of us in the scientific community who, some years ago, began to detect in our own studies evidence that pollution is more than a nuisance, but rather a symptom of pervasive threats to the integrity of the environmental systems that support human society, and therefore a threat to the health, even the survival, of mankind. Two of the teach-in participants are Arthur Godfrey and Eddie Albert.

Both have for a long time been ardent conservationists concerned with



the preservation of natural areas; but in recent years they have been studying the work of environmental scientists. Both have become equally ardent anti-pollutionists. They exemplify the recent marriage between the nation's long-standing conservation movement and the scientists who see in pollution the gravest evidence of the destruction of the natural systems that support both whooping cranes and man.

Ralph Nader is to speak; there is a natural affinity between environmental concern and his attack on the technical failures of modern industries, for both reflect the inability of our technological society to meet the real needs of the human beings who live in it. You will also hear from Dr. Ansley Coale, one of the world's leading demographers. There is a feeling in some quarters (not including Dr. Coale) that the population problem and the pollution problem are closely connected. The entertainment for your teach-in is meaningful too--Gordon Lightfoot and members of the Chicago cast of "Hair"--symbolic of the deep feeling of the new generation's poets (e.g., Allen Ginsberg) and minstrels (e.g., Pete Seeger) for the affinity between man and an unpolluted nature.

Also among the teach-in participants are officers of the Detroit Edison Company, the Consolidated Edison Company of New York, the Ford Motor Company and the Dow Chemical Company. All of these industries bear a large responsibility for serious pollution problems

and their interest in public concern with the environment is a matter of direct corporate necessity. Each has already felt the effects of the early stages of the environmental movement. For example, Con Ed is acutely aware that its plan to build a nuclear reactor in Queens was blocked by local citizens, armed with information about nuclear hazards provided by a group of scientists devoted to public information about environmental problems--The Scientists' Institute for Public Information (Two of the teach-in participants, Dr. René Dubos and myself, are members of the Institute). The Detroit Edison Company had a similar problem with the Fermi reactor outside of Detroit about 5 years ago. They won the fight and built the reactor, only to have it fail in an accident which came close to causing a large-scale disaster. Their chief antagonist was the United Automobile Workers, headed by Walter Reuther--also a speaker at your teach-in. Mr. Reuther's union has since developed a broad interest in environmental quality and has established an educational program on the environment both within the union and in its members' communities. New UAW contract demands include the matter of environment quality. Indeed, everything is connected to everything else.

That the president of the Dow Chemical Company was invited to speak reveals another important element in the environmental movement.



Dow has been, of course, a prime target of the anti-war movement; its campus recruiting program has often triggered demonstrations by student activists, who cite the hold of the military-industrial complex on U.S. policy as a reason why our social system must be radically changed. And they have their representative on the roster of teach-in speakers--Murray Bookchin, an environmental analyst who takes a social-revolutionary approach to this and other social ills. Finally, the speech which will close your teach-in is to be given by Richard Hatcher, Mayor of a city--Gary, Indiana--with the specially intense environmental problems of a largely black community.

This teach-in epitomizes the remarkable convergence around the environmental issue of a number of earlier, separate concerns: conservation, the scientists' responsibility for the social consequences of science and technology, the consumer movement, the new generation's feeling for a more humane life-style, the businessman's worries over the impact of all of these on industrial profits, the problem of the ghetto and urban decay, the anti-war movement, student activism against the nation's social and economic system. Somehow, the issue of environmental quality touches all these separate facets of the crisis of American society.

Each of us whom you have brought here has something that he wants to say. But we have also come here to learn. The environmental crisis is so deep, so shattering to our old ideas and so difficult to solve, that none of us can find in our experience the sensitivity fully to appreciate it, or in our own learning the knowledge to understand it. The environment which is now so threatened is an incredibly complex, marvelously dynamic, wonderfully rich whole. No one alone has the wisdom to save it. Each of us must teach, each of us must learn. We all share our place in the world that we live in. To understand it, to save it from destruction, to survive ourselves, we must also share with each other our feelings for that world and our thoughts about its present sorry state.

That is why I am so glad to be here, among so many of you, and share with you some of my own feelings and thoughts about the great issue of survival--and I hope that you will share yours with me.



I have the feeling that the degradation of the environment in which we live has become a pervasive, intractable, discouraging problem. It clashes noisomely with the magnificent progress of the age, with the marvelous competence of our new machines, with the rising productivity of our factories and our farms, with the new inventions that have revolutionized communications and management.

I want to know why a society which is so enriched by the progress of technology has now become so impoverished in the quality of the life which that technology supports. What are the causes of this dismaying phenomenon? What lessons can be learned from the environmental crisis that might help us survive it?

I should like to propose a thesis which, I believe, may provide some useful insights into these problems. The thesis is this: Environmental pollution is not to be regarded as an unfortunate, but incidental, by-product of the growth of population, the intensification of production, or of technological progress. It is, rather, an intrinsic feature of the very technology which we have developed to enhance productivity. Our technology is enormously successful in producing material goods, but too often is disastrously incompatible with the natural environmental systems that support not only human life, but technology itself. Moreover, these technologies are now so massively embedded in our system of industrial

and agricultural production that any effort to make them conform to the demands of the environment will involve serious economic dislocations. If, as I believe, pollution is a sign of major incompatibilities between our system of productivity and the environmental system that supports it, then, if we are to survive we must successfully confront these economic obligations, however severe and challenging to our social concepts they may be.



The environment makes up a huge, enormously complex living machine--the ecosphere--and on the integrity and proper functioning of that machine depends every human activity, including technology. Without the photosynthetic activity of green plants there would be no oxygen for our smelters and furnaces, let alone to support human and animal life. Without the action of plants and animals in aquatic systems, we can have no pure water to supply agriculture, industry, and the cities. Without the biological processes that have gone on in the soil for thousands of years, we would have neither food crops, oil, nor coal. This machine is our biological capital, the basic apparatus on which our total productivity depends. If we destroy it, our most advanced technology will come to naught and any economic and political system which depends on it will founder. Yet, the major threat to the integrity of this biological capital is technology itself.

One example is the fact that much of our present water pollution problem is not due to inadequate utilization of the present technology of sewage disposal, but rather to the very success of that technology. Present sewage treatment procedures were designed to

relieve the burden of organic wastes on the self-purifying biological system of surface waters, by converting these wastes to supposedly innocuous inorganic products, such as nitrate and phosphate. This sewage-treatment system is quite successful in achieving its aim.

The system is failing, however, because its inorganic products are themselves reconverted to organic materials by the green plants that participate in the aquatic biological system, thereby frustrating the initial aim of the treatment process. This accounts for much of the mass of rotting algae which fouls the water and beaches of Lake Erie.

Another example is provided by modern agricultural technology, which is largely based on replacing the dwindling natural supply of plant nutrients in the soil by the massive use of inorganic fertilizers, especially nitrogen. These fertilizers do greatly increase the immediate crop yields; but at the same time, the impoverishment of soil organic matter, by altering the physical character of the soil (especially its porosity to oxygen), sharply reduces the efficiency with which the added fertilizer is taken up by the crop. As a result, unused nitrogen fertilizer drains out of the soil into rivers and lakes, where it joins with the nitrate imposed on the water by the effluent of sewage treatment plants--causing overgrowths of green plants and the resultant organic pollution. The drainage of nitrogen from fertilizer has already destroyed the self-purifying capability of nearly every river



in Illinois, and the same process is at work in many other parts of the Nation. In the Midwest and California fertilizer drainage has raised the nitrate level of drinking water supplies above the safe limit recommended by public health authorities.

A third example which is--surprisingly--closely related to the previous ones is the matter of air pollution due to automotive exhaust fumes. This problem originates with the production of nitrogen oxides by gasoline engines. Released to the air these oxides, upon absorption of sunlight, react with waste hydrocarbon fuel to produce the noxious constituents of smog. This problem is the direct outcome of the technological improvement of gasoline engines: the development of the modern high-compression engine. Such engines operate at higher temperatures than older ones; at these elevated temperatures the oxygen and nitrogen of the air taken into the engine tend to combine rapidly, with the resultant production of nitrogen oxides.

The present smog control technique--reduction of waste fuel emission--by diminishing the interaction of nitrogen oxides with hydrocarbon wastes, enhances the level of airborne nitrogen oxides. In the air nitrogen oxides are readily converted to nitrates, which are then brought down by rain and snow to the land and surface waters. There they add to the growing burden of nitrogen fertilizer, which, as shown in the previous examples, is an important aspect of water

pollution. What is surprising is the amount of nitrogen oxides that are generated by our automotive traffic: it amounts to more than one-third of the nitrogen contained in the fertilizer currently employed on U.S. farms. One calculation shows that farms in New Jersey receive about 25 pounds of nitrogen fertilizer per year (a significant amount in agricultural practice)--from the trucks and cars that travel the New Jersey highways. Another recent study shows that in the heavily populated Eastern section of the country, the nitrate content of local rainfall is proportional to the local rate of gasoline consumption. Thus, the emergence of a new technology--the modern gasoline engine--is itself responsible for most of the smog problem and for an appreciable part of the pollution of surface waters with nitrate.

As a final example of the intrinsic failure of a technology which bears a considerable responsibility for the present pollution of the environment, we may look at the current status of the insecticide problem. Recent reports from Asia, Africa, and Latin America show that, with awesome regularity, major outbreaks of insect pests have been induced by the use of modern contact-killing insecticides, because such insecticides kill the natural predator and parasitic insects which ordinarily keep the spread of insect pests under control. At the same time there is now increasing evidence that synthetic



insecticides are responsible for declining populations of birds and fish. Because of such hazards, and the still poorly understood danger to man, DDT is being withdrawn from most of its uses.

I have cited these examples in order to illustrate the point that major problems of environmental pollution arise, not out of some minor inadequacies in our new technologies--but because of the very success of these technologies in accomplishing their designed aims. A modern sewage treatment plant causes algal overgrowths and resultant pollution because it produces, as it is designed to do, so much plant nutrient in its effluent. Modern, highly concentrated, nitrogen fertilizers result in the drainage of nitrate pollutants into streams and lakes just because they succeed in the aim of raising the nutrient level of the soil. The modern high-compression gasoline engine contributes to smog and nitrate pollution because it successfully meets its design criterion--the development of a high level of power. Modern synthetic insecticides kill birds, fish, and useful insects just because they are successful in being absorbed by insects, and killing them, as they are intended to do.

We cannot escape from a profound truth of modern technology--for all of its goods, we pay some price in hidden costs. These costs

are a serious challenge to the social value of our new technology and the economic system which is based upon it. For the economic consequences of the hidden costs of environmental pollution due to modern technology are not trivial. It has been calculated that if the U.S. paper industry were required to meet present water-pollution standards, the industry would need to spend \$100 million for each of 10 years. The total profit in the paper industry is \$300 million per year, so that, as a minimum, the bill represented by the pollution caused by the paper industry, if paid, would reduce the industry's profit by one-third for 10 years. The total cost of bringing water pollution control up to present standards has been calculated at \$100 billion over the next 10-20 years. The total economic loss from air pollution has been estimated at \$11 billion annually. These sums loom large in the national budget. More important, in certain industries they may represent amounts which are so large relative to the profits as to constitute a serious threat to the industry's stability--if it were required to pay the full bill for the hidden costs of operation.



It seems to me that these examples reflect a faith, now common in our society, that a technological advance which results in an improvement in the yield of a particular desired product is an undiluted social good. In a sense, this faith is justified. The modern automobile, or the nuclear reactor, is indeed a technological triumph. In each is embodied the enormous insights of modern physics and chemistry, and the exquisite skills of metallurgy, electronics, and engineering. Our success is in the construction of these machines; our failure is in their operation. For, once the automobile is allowed out of the factory, and into the environment, it is transformed. It then reveals itself as an agent which has rendered urban air carcinogenic, burdened human bodies with nearly toxic levels of carbon

monoxide and lead, embedded pathogenic particles of asbestos in human lungs, and contributed significantly to the nitrate pollution of surface waters. Similarly, the design and construction of a nuclear reactor epitomizes all the skills of modern science and technology. However once it begins to operate, it threatens rivers and lakes with its heated waters and human bodies with radiation.

We have already paid a large price for such illusions. For the advantages of automotive transportation, we pay a price in smog-induced deterioration and disease; for the powerful effects of new insecticides, we pay a price in dwindling wildlife and unstable ecological systems; for nuclear power, we risk the biological hazards of radiation; by increasing agricultural production with feedlot operations and fertilizers, we worsen water pollution.

Because of our illusions we have become unwitting victims of environmental pollution. Most of the technological affronts to the environment were made, not out of greed, but ignorance. We produced the automobile that envelops our cities in smog--long before anyone understood its harmful effects on health. We synthesized and disseminated new insecticides--before anyone learned that they also kill birds and might be harmful to people. We produced synthetic detergents and put billions of pounds into our surface waters--before we realized that they would not be degraded in disposal systems and would pollute our



water supplies. For a number of years we spread radioactive fallout across the globe--before we learned that the resulting biological risks made it too dangerous to continue. We have unwittingly killed thousands of sheep in testing our chemical weapons and have triggered unanticipated earthquakes with our nuclear tests. We have, in sum, blindly assaulted the integrity of the environmental systems that support us, and unwittingly risked our very survival.

The environmental movement has become a kind of theater, and on its stage we can often see in dramatic clarity many of the deep-seated issues of the troubled world. One issue was brought up yesterday, where as a kind of curtain-raiser to your teach-in, there was held an "Environmental Scream-out: 'An open forum on intellectual pollution--the diversion from the ghetto and the war.'"

I can report, from my own experience, that there is a close link between the problem of war and the problem of the environment. My concern with the environment does not stem from my professional training; I was trained as a cellular biologist, not an ecologist. But I also learned that science is part of society and that every scientist owes it to himself, and to the society that supports him, to be concerned with the impact of science on social problems. And it was the problem of war that first introduced me to the environmental crisis. In the 1950's, when nuclear tests showered the world with fallout, and the Atomic Energy Commission showered the nation with assurances that radiation was "harmless," along with many other scientists, I studied the path that fallout takes in the environment from the bomb to man. And I was shocked to learn that nuclear radiation is never harmless, to the ecosystem or to man. That is when I began to appreciate the importance of the environment to man. It was the AEC that turned me into an ecologist. No, if we are devoted to the survival of the earth's ecosystem, and of man, we must be deeply concerned with the gravest threat to survival--modern war.

There are strong links between the environmental crisis and the evils of war in general, and the war in Vietnam in particular. One link can be seen in the economics of war and of pollution. That our industrial system is heavily sustained by the military diversion of human and natural resources



from human needs has been cogently demonstrated by numerous observers; the "industrial-military complex" was not a myth to Pres. Eisenhower, nor is it to the stockholders in the major American industries. What is less known, but can be equally well-documented, is that the profitability of most American industry and agriculture has been significantly related to the avoidance of a large cost of doing business--environmental deterioration. For example, the power industry, which is a major cause of urban air pollution, sells electricity to its consumers for a certain amount of money; but those same consumers pay an added cost for the environmental consequences of the power that they buy--in laundry bills caused by soot, and in doctor bills (and some part of their life expectancy) caused by sulfur dioxide and organic air pollutants from power plants. The dollar value alone of these "social costs" of air pollution that we now know--and many remain unknown--adds about 25% to the city-dwellers electricity bill.

Some economists assert that the economic system could readily adjust itself to this situation by undertaking the cost of preventing pollution and adding that cost to the real price of its products. Such a readjustment would affect the cost to the consumer, not only of power, but of all manufactured goods (nearly every factory pollutes the air and water), of transportation (cars, trucks and airplanes are major polluters of air), and of food ( U.S. agriculture, through its use of intensive fertilization and of feedlots for fattening cattle to high-priced grades, bears a major responsibility for water pollution; organic wastes from U.S. feedlots exceed those produced by the total U.S. urban population).

It may be that the economic system can get along without the crutch provided by the diversion of environmental costs to the people, and that it can get along without the crutch of military production. But thus far it hasn't, and one can at least suspect that in both cases the crutch has become a support which is essential to the system's stability.

Another close link between the problems of war and the environment is that both represent the inability of our system of technology to foresee its own inherently fatal environmental flaws. Like detergents, which much to their developer's surprise, failed to be accommodated by natural water systems and bloomed into unsightly mounds of foam on our rivers, or the unanticipated ecological backlash of DDT, the nation's war program can be viewed as a vast technological blunder. When, in the 1950's the Pentagon generals and their scientific advisers decided to hang the nation's defense on nuclear weapons, they did not know what the scientific community has since told them: that it will not work, that no nation will survive a nuclear war. Remember that in 1956, Eisenhower campaigned for continued nuclear tests in part because "by the most sober and responsible scientific judgment they do not imperil the health of man." Eight years later Johnson praised the nuclear test ban treaty because it "halted the steady, menacing increase of radioactive fallout." In the same way, the Pentagon replied, to an inquiry from scientists, that it would not use herbicides in Vietnam if it believed that these agents would have "long term ecological effects" on that tortured land. Now we know from scientific evidence that mangrove areas of Vietnam will not recover from herbicide attacks for at least 20 years.



Indeed because of herbicide attacks not only on forest areas, but on food crops, together with the massive assaults by more conventional weapons, the war in Vietnam represents, in my opinion, the first ecological warfare conducted by the U.S. since the attacks on American Indians. The technological failure of biological warfare as a suitable means of defense (for there is no way to test artificial infectious agents, much less use them, without incurring serious risks to ourselves) was recently acknowledged when the government ordered the abandonment of its entire biological warfare program.

If there is little reason to regard the environmental movement as a diversion from the anti-war movement, its relation to the racial issue is less clear. Some approaches to the environmental problem seem to run counter to the interests of the blacks. This was dramatized recently at San Jose State College, where a student environmental program was climaxed by the burial of a brand new car, as a symbol of environmental rebellion. The event was picketed by black students who believed that the \$2500 paid for the car could have been better spent in the ghetto.

The San Jose burial reflects a kind of personalized approach to the environmental crisis which is now fairly common among some student groups. They reason that pollution is caused by the excessive consumption of goods and resources by the U.S. population; a favorite statistic is that the U.S. contains about 6% of the world population, but consumes half of the planet's total goods and resources. Since the wastes generated by this intense consumption pollute our environment, the eco-activist is advised to "consume less" (to quote a recent publication, "Eco-tactics",) In the absence of the added statistic

that in the U.S. the per capita consumption by blacks is much less than that of the white population, such observations are not likely to arouse the enthusiasm of blacks.

Disaffiliation of blacks from the environmental movement would be particularly unfortunate, because in many ways blacks are the special victims of pollution. A white suburbanite can escape from the city's dirt, smog, carbon monoxide, lead, and noise when he goes home; the ghetto-dweller not only works in a polluted environment, he lives in it. And in the ghetto he confronts his own, added environmental problems: rats and other vermin, the danger of lead poisoning when children eat bits of ancient, peeling paint. And, through its history, the black community can be a powerful ally in the fight against the environmental crisis. The environmental crisis is a crisis of survival, for pollution signifies the eventual breakdown of the very environmental system on which we depend for our lives and our livelihood--the soil, water and air. To middle class Americans, survival is not a familiar issue. They have not yet learned how to face such a soul-shaking threat; witness our continued failure to appreciate that the existence of ready-armed nuclear weapons means that doomsday may be tomorrow. For blacks, the issue of survival is 200 years old. If they too have not yet mastered it, they have at least had a good deal of experience that may be enormously valuable to a society which, now as a whole, must face the threat of extinction. Blacks need the environmental movement, and the movement needs the blacks.



Confusion between certain aspects of the environmental movement and other social issues is also generated by the view that the environmental crisis is closely connected to the population crisis. In one sense this is true, for clearly the world population cannot continue to grow at its present rapid rate (largely in underdeveloped countries) without eventually outrunning the capacity of the planetary ecosystem to produce food sufficient to sustain it. But some environmentalists hold that in an advanced country like the U.S. "The pollution problem is a consequence of population". This view leads to the idea that the environmental crisis in the U.S., which clearly calls for drastic action, can be solved only if we take strong action to stop the growth of the U.S. population--that population is more important than pollution.

A good deal of this confusion can be cleared up by some facts. Nearly all of the stresses that have generated the environmental crisis in the U.S.--smog, detergents, insecticides, heavy use of fertilizers, radiation--began about 20-25 years ago. In that period there has been a sharp rise in the per capita production of pollutants. For example, total utilization of fertilizer has increased about 1400%, of electric power nearly 400%, of pesticides more than 500%. In that period the U.S. population increased only by 43%. This means that the major factor which has increased pollution in the U.S. since 1945 is not the number of people, but the intensified effects of ecologically-faulty technology on the environment.

So the environmental movement--and the teach-ins which signal its emergence as a major political force--has become a meeting place for the major issues which trouble American society. This is its strength, and this is the importance of its future course.

Demands for action dominate the environmental movement, and wide-ranging action programs are being organized. Some are direct, personal efforts to clear up the environment, such as community-wide campaigns to remove the junk from a stream bed. Some are politically-oriented demonstrations, such as the delivery of a mass of beer cans to the lawn of a can manufacturer's home. Petition campaigns directed at remedial legislation abound. For legislators have been busy trying to reflect in law the new desires of their electorates for a clean environment. There are strong indications that on most campuses, the teach-ins will merge into a continuing campaign of environmental action. If the ongoing movement reflects the strength and breadth of the teach-ins themselves, it may become a major, continuing feature of campus life.

There are those who regard the environmental movement as the latest phase in a series of ephemeral fads for political action, which like its predecessors--the civil rights movement, the anti-war movement, and student power--will, in their view, rise to an enthusiastic peak and fade away before the hard, intransigent realities of political life.



There is that danger, for there are no easy solutions to the fundamental problems of the environmental crisis. Some of the superficial symptoms can be attacked directly: creeks can be cleared of junk and beer cans collected. But no band of activists can return a river to an unpolluted state when the polluting agent is fertilizer draining from the surrounding farmland. For, if farmers were required, abruptly, to halt the intensive use of fertilizer, which is often the major economic input to the profitability of their operation, they would simply go out of business.

Once we look beyond its immediate accessible symptoms, the environmental crisis confronts us with very hard, inescapable choices. If we really want to cure the evil of water pollution, we shall need to make drastic revisions in present waste-treatment methods, for these over-fertilize algae in the water, which soon die, reimposing on rivers and lakes the very burden of organic waste which the treatment was supposed to remove. The natural ecological system which can accommodate organic waste is not in the water, but in the soil, and no lasting solution to the deterioration of both surface waters and the soil can be achieved until organic waste is returned to the soil. For the same reason, no scheme to handle garbage that fails to meet this fundamental requirement of nature can, in the long run, succeed. And since these and similar violations of the demands of the ecosystem have become embedded in our system of productivity, any effort to change them will encounter the massive economic, social and political forces that sustain that system.

There is, I believe, some disparity between President Nixon's statements about the nature of the environment crisis and the actual program that he offers to cure it. He speaks of paying our "debt to nature," but, in my opinion, his program cannot even pay the interest on that debt. To solve the water pollution problem, for example, he proposes "a \$10 billion clean water program to put modern municipal waste treatment plants in every place where they are needed to make our waters clean again." But these plants are themselves a cause of massive water-polluting algal overgrowths. The cost of the needed fundamental revision of municipal waste systems, together with the huge cost of restoring a natural balance in our agricultural system, will be vastly more than \$10 billion.

We cannot long defer a confrontation with the real debt that we owe to nature--the total reorganization of our system of productivity and its techniques to make them compatible with the ecosystem. By their own design, our major technologies--power production, transport, the metal and chemical industries, and agriculture--are a threat to the ecosystems which support these technologies themselves--and our lives.



Because we reckon the value of a technology by the value of its marketable products we have neglected their cost to society--potentially, extinction. President Nixon has spoken of the need for "the total mobilization of the nation's resources." But the resources needed to roll back pollution remain immobilized by the cost of the Vietnam war and the huge military budget, by the talent- and money-gulping space program, by the disastrous cuts in the federal budget for research support, by the reduction in funds for the cities and education. The environmental crisis, together with all of the other evils that blight the nation--racial inequality, hunger, poverty and war--cry out for a profound revision in our national priorities. None can be solved until that is accomplished.

Confronted by the depth of this multiple crisis, it is easy to respond with a morass of studies, reports and projections for distant action. But however essential, more than plans are needed. For the grinding oppression of environmental deterioration--the blighted streets and uncollected garbage, the rats and the cockroaches, the decaying beaches and foul rivers, the choking, polluted air--degrades the hope of our citizens in the future and their will to secure it. To unwind this spiral of despair, we must take immediate steps against the symptoms as well as the fundamental disorder. Community efforts to clean up rivers and beaches, to build parks, to insist on enforcement of anti-pollution ordinances and to improve them, can give tangible meaning to the spirit of environmental revival.

The environmental crisis is a grim challenge, yet the very depth of the crisis gives the nation a new opportunity to find its way out of the morass of curses that is the fabric of American society. In its depth, the environmental crisis reaches to the core of our basic economic and social institutions. And it is here that this crisis meets all the rest. All of our problems--in the environment, in the slums, and in our relations with the rest of the world--are urgent. None can be neglected; the fundamental changes which each demands must take all into account.

All of these problems seem to have a common root. Something is wrong in the way that this nation uses its human and natural resources. And I believe that it is always healthy to reexamine, to test, the basic mechanism that we have created to run our affairs. Those who are already convinced that our social system is in need of radical revision will welcome this opportunity to discuss the prospect. Those who are convinced that the system is sound in its fundamentals and can be adjusted to the new stresses should welcome this opportunity to demonstrate their conviction. Here, then, is good reason to bring the social revolutionary and the industrialist onto the same platform. Both need to face the same question: how should our society be organized to resolve the crisis of survival?



Each of us bears a grave responsibility in the environmental crisis. I was proud, and moved, recently to be termed "The Paul Revere of Ecology." To extend the metaphor a bit, what should we expect of Mr. Nixon if he hopes to become the nation's first eco-President, or, if you like, "The George Washington of Ecology?" Here are some of the ecologically urgent actions that are within his power to take, now:

1) He can announce to the nation that we are, now, in a fight for environmental survival and declare a state of national ecological emergency.

2) He can act to enable the scientific community to take the first steps toward environmental survival by releasing it from the paralyzing effects of the most severe cutbacks in research support in 25 years. Environmental research will be hopeless without a sound system of science in this country. And I know personally that the government is forcing severe budget cuts on even environmental research programs.

3) He can find the immediate means to devote federal resources to a simple, yet enormously meaningful, program: Let us declare that every piece of land not in actual use by its owners must be returned, until otherwise needed, to grass and trees; let us find the means to remove the abandoned buildings and junk piles from blighted city streets and restore them to nature's green.

4) He can, in the name of ecological sanity, halt the development of the SST--an environmental horror which, if it is ever flown in the nation's airplanes, will expose a fourth of the nation to noise equivalent to that which surrounds our airports.

5) He can avert the impending \$250 million appropriation for the construction of the Florida Barge Canal, a project which in the considered opinion of ecologists will do more harm to the welfare of the state than any possible commercial value that it might yield.

6) He can call a halt to the exploitation of oil deposits in Alaska, until the project devises--if it can--methods of drilling and transport that do not risk the future of the delicately balanced ecosystem of our--and Canadian--arctic territories. He can also hold in abeyance the further exploitation of offshore oil in California and elsewhere until the ecological risks are effectively mastered.

7) He can stop the war in Vietnam and halt the barbaric destruction of the ecological resources of that unfortunate land, not only by unprecedented destruction of its vegetation with weed killers, but the destruction of the land itself and of its people by the needless horror of war.

8) He can declare to the world what we in the scientific community have long known--that modern warfare, with its nuclear, chemical and biological weapons--is totally incompatible with the continued life of mankind and take steps toward the permanent dismantling of the war machine that holds the whole world in terror.

These immediate actions, and the long-term massive effort to roll back pollution at its roots, amount--of course--to a wholesale reorganization of our national priorities. But if we are staggered by the magnitude and gravity of these undertakings, let us remember that we have indeed "incurred a debt to nature," a debt which must be paid if we are to survive.



The environment crisis has brought us, I believe, to a great turning point in this nation's history. We have become a nation that wields the greatest power in the history of man: power in the form of food, industrial plants, vehicles, and the weapons of war. We have also become a nation beset by violence: on the battlefield, on the highways, and in personal encounters--but more fundamentally--in the destruction of the natural, harmonious fabric of the environmental system which supports us. It is this fundamental violence to the world in which we live which divides us, as we compete among ourselves for the earth's goods, unaware that each of us, in our own way, is thereby contributing to the destruction of the whole that supports us all.

We have long known that ours is a technological society, a society in which the knowledge generated by science is a chief source of wealth, of power. But what the environmental crisis tells us is that the future of our society now depends on new, profoundly fundamental judgments on how this knowledge, and the power that it endows, is to be used. If, as it should in our democracy, power is to be derived from the will of the people, then it is they who need to have the new knowledge--about strontium 90, DDT, herbicides, smog and all the other elements of the environmental crisis--that must be the source of the grave new judgments and sweeping programs that this nation must undertake. Here then is an urgent task that must follow the teach-ins. Let us take our knowledge about the environmental crisis to the people; let us help them learn what they need to know to decide, for themselves, the future course of our society, to find the road to survival. Let us organize a huge, national teach-out--and let us begin soon, this summer to take what we know to every community in the land.



The obligation which our technological society forces upon all of us, young and old, black and white, right and left, scientist and citizen alike, is to discover how humanity can survive the new power which science has given it. Every major advance in the technological competence of man has enforced new obligations on human society. The present age of technology is no exception to this rule of history. We already know the enormous benefits it can bestow, and we have begun to perceive its frightful threats. The crisis generated by this knowledge is upon us.

The environmental crisis is a grim challenge. It also is a great opportunity. From it we may yet learn that the proper use of science is not to conquer nature, but to live in it. We may yet learn that to save ourselves we must save the world that is our habitat. We may yet discover how to devote the wisdom of science and the power of technology to the welfare, the survival, of man.