*A Worldwide Problem*


# Maintaining a Supportive Physical Environment for Man*

**PAULINE GRATZ ****

ECOLOGISTS today seek to communicate a message that can hardly be more critical or significant for education. It is that we are destroying the natural environment that is necessary for any kind of human life in our continuous search for what we call "a better way of life."

There is no doubt that man has made giant strides since his first appearance on earth. Many of these steps are laudable and have contributed to the "better life," but in other aspects we have made some monstrous mistakes in the direction of destroying the land upon which our food supply depends, spoiling the air we must breathe and the water we must drink, and in other ways upsetting the biological, geological, and chemical cycles upon which our very being depends.

Most ecologists will agree that they see no significant indication that we have much determination toward improving our practices. It is these practices which have implications for educating young people toward a realization of the crucial need for maintaining an environment supportive of life.

## Environmental Pollution

Environmental pollution is only one of several outcomes of our practices that should be seriously considered. The level of oxygen in the atmosphere today is slightly over 20 percent, a level similar to the atmosphere 400 million years ago. This is probably due to the efficiency of the combined efforts of green plants and organisms including animals which use oxygen. Green plants provide oxygen to the atmosphere at approximately the same rate as organisms use the oxygen available in the atmosphere.

This fortunate state of circumstances is primarily due to the presence of marine microorganisms suspended near the surface of the ocean's water, producing 70 percent or more of the earth's oxygen. Consequently, even though there is an interruption of the oxygen-carbon dioxide cycle known as photosynthesis during darkness and partially during winter seasons, man has been fortunate in that the circulation patterns in the atmosphere move the air about the earth in such a way that he has not had to be concerned that he would run out of oxygen to breathe.

Just as the oxygen is primarily produced by marine microorganisms in the sea, the carbon dioxide in the atmosphere is created in large measure by the process of combus-

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** *Pauline Gratz, Professor of Science, Duke University Medical Center, Durham, North Carolina*

tion. The carbon dioxide in the atmosphere before our appearance on earth was probably due to the spontaneous combustion that occurred in the forests covering the earth. Later we burned forests for warmth, food production, and protection.

As time progressed, we went on to find other uses for combustion and to find new combustible materials such as coal, oil, and natural gas which provided heat and power. It was the exploitation of these fossil fuels which made it feasible for more people to exist on earth than had ever been possible before. Use of these fuels brought with it, however, our serious problem of environmental pollution.

The oceans take carbon dioxide from the atmosphere, producing limestone. Ecologists warn, however, that carbon dioxide is now being added to the atmosphere far too rapidly for the oceans to absorb completely. A ton of petroleum hydrocarbon when burned produces about 1 1/3 tons of water and about twice this amount of carbon dioxide. With the increased use of fossil fuels by industrial facilities, automobiles, jet airplanes, and so forth, the amount of carbon dioxide spewed into the atmosphere is increasing tremendously. Concomitantly, vast tracts of land are being removed from the cycle of photosynthesis. In the United States alone, a million acres of green plants are paved under each year. The loss of these plants is reducing the rate at which oxygen enters the atmosphere. In addition, we do not even know to what extent photosynthesis is being inhibited through pollution of ocean and fresh waters.

This is why many scientists believe that the carbon-oxygen balance may be in danger. Should a point be reached at which the rate of combustion exceeds the rate of photosynthesis, the atmosphere will begin to run out of oxygen. If this occurs gradually, the effect would be approximately the same as moving to high altitudes, such as in the Andes mountains. Some ecologists believe this oxygen shortage might help to alleviate the population crisis by raising death rates. Others believe that atmospheric depletion of oxygen might occur suddenly, not gradually.

## The Great Paradox

So many of the problems besetting man in supporting his environment can be summed up thus far by the simple phrase, "We don't know." Does this mean, however, that we should do nothing? The magnitude of this crisis is visible but goes unrecognized by large majorities of people. Its gravity is felt but barely understood. People refuse to recognize or understand what is in plain sight, pretending it is not there, hoping it will go away and leave us alone. And precisely because individuals refuse to comprehend what they behold, the stress is starting to impinge upon our daily lives ever more frequently, ever more insistently. In the absence of treatment, the dimensions of the malignancy swell and multiply.

The paradox of the times lies in the fact that we are fully capable of rooting out the underlying causes of pollution. The human, technological, and financial resources are at hand. We do possess the knowledge and skill to use these resources. Yet we waver, hesitate, equivocate. We lack the will to act.

It is quite possible to cut down on some of the carbon dioxide pollution by installing a control system in automobiles. Yet many individuals doubt whether this is truly a practical solution to the pollution problem without inordinate costs to the automobile user. If this opinion is to be followed to its logical conclusion, then, as one scientist has suggested, there is no solution to the problem except to allow pollution to rise to such a level that one-half of the car operators succumb to the effects of their free use of the highways. Then, with the number of automobiles reduced to pre-smog level, air pollution will once again become insignificant until, of course, the car operators reproduce and the population increases again. Quite frankly, this is madness.

## Nitrogen Cycle

Another important aspect of the environment is the nitrogen cycle. Nitrogen is necessary for the building of protein. It is released into the atmosphere, along with

ammonia, as a gas when plants and animals decay. Live plants use both substances to build their proteins, but they cannot use the nitrogen in gaseous form. Certain bacteria and algae in the soil and roots of some plants use the nitrogen and ammonia gas to produce nitrates, which the plants use in turn to build their proteins. Animals then build their proteins from the constituents of plant proteins.

As was indicated in the discussion of oxygen, the rate of use and return of nitrogen has reached a balance so that the percentage of nitrogen in the atmosphere remains constant. It is not difficult to envision what might occur if any one of the numerous steps in the nitrogen cycle were to be disturbed. The atmospheric nitrogen might disappear. It might be replaced by ammonia which, if unused in the atmosphere, would become poisonous. Or plants could no longer make proteins because bacteria would no longer be available to use the gas in the atmosphere. In any case, disturbance of the nitrogen balance might mean disaster for the earth.

Has our interference with natural processes begun to have a serious effect on the nitrogen cycle? Again, we do not know. The point is, however, that we should know before we continue to do more interfering. The Federal Food and Drug Administration has indicated that we are dumping vast quantities of pollutants into the oceans. These include pesticides, radioisotopes, detergents, and other biologically active materials. No more than a fraction of these substances have been tested for toxicity to the marine microorganisms that produce most of the earth's oxygen, or to the bacterial life involved in the nitrogen cycle.

We have developed ingenious products and devices to bring about short-range benefits. We are constantly devising grandiose schemes to achieve immediate ends. Our influence on our earth is now so dominant that we must begin to consider what our products and schemes will do to the biogeochemical cycles instead of trusting to luck that none of our machinations will upset the balance of life.

## Role of Education

What shall we do as educators? Shall we produce more advertising executives who assert that billboards are "the art gallery of the public"? Or more industry spokesmen who say that "the ability of a river to absorb sewage is one of our great natural resources and should be utilized to the utmost"? Or more oilmen who show surprise and wonder at the outcry over the death of a "few hundred birds"?

There is much that educators can do individually and collectively. Probably the most important step is to educate with regard to the urgency of the problem. We must take every opportunity offered to speak about what man is doing to his environment. Every course should include at least one session on the subject. It is the educators who must take leadership. Now is the time to stop talking to ourselves and start talking to our students and to the rest of the population. Only an informed public will demand action. □