

Our Ecological Crisis

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In this issue seven authors discuss the increasing devastation of the American environment and the ways in which it came about. Our first author says "... the historical roots of our ecological crisis must be sought in the history of how our present attitudes toward nature and our fellow men came into existence."

Our Ecological Crisis

BY CARROLL QUIGLEY
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I: DEFINITIONS

“ENVIRONMENTAL POLLUTION” has many meanings, but essentially they all boil down to the movement of objects by human action from places or conditions where they are natural or unobjectionable to places or conditions where they are unnatural, objectionable, and injurious.

There are many degrees of environmental pollution ranging from the least objectionable to the most injurious. These degrees of pollution could be divided into four great classes.

Class I consists of movements of objects from places where they are unobjectionable to places where they are objectionable, without being injurious to safety or life. Topsoil is valuable in the garden, but it is objectionable on the dining room tablecloth. A can of beer inside the refrigerator is good, but an empty beer can on the White House lawn is an example of Class I pollution.

On the whole, Class I forms of pollution are objectionable from the point of view of taste or aesthetics and are not injurious to health or life. But many objects which are

out of their proper place—like roller skates left at the top of the cellar stairs or a razor left where a child can reach it—are potentially a threat to human safety and perhaps to human life and thus would fall into Class II, that is: objects out of their proper place and thus likely to be injurious to safety or to life.

The difficulty with Class II pollution is that some people would interpret the expression “injurious to safety or to life” to apply only to human life, while others would apply it to other forms of life as well. Thus the use of insecticides and weed killers on the lawn may not injure human beings and may not injure worms who ingest these poisons. The worms may be able to go on indefinitely making topsoil, even when they are full of DDT, but this condition may kill off all the robins who eat the worms. Some people would say that lack of robins is only an aesthetic loss and only a loss to those persons who happen to like seeing robins. But others argue that no one knows exactly how all the different forms of life fit together and are interdependent, including man, so that we have no way of being sure that the loss of

robins and many other forms of life from DDT, including sea birds and some hawks (such as ospreys), may ultimately be very injurious to human life. At this point we begin to reach the more complex and less known aspects of environmental pollution, the ecological aspects.

Ecology is concerned with the interrelationships between natural environment and living forms, a process in which one form is dependent upon the continued survival and operation of other forms, even when we are totally unaware of the relationships. For example, the ability of some grass-eating animals to digest cellulose in the fodder may depend on the actions of bacteria in their stomachs, which break up the vegetal materials. If man were dependent on these grass-eaters for food, as some nomadic tribesmen are and as some American steak eaters seem to be, then men would be dependent on the bacteria and could not live (or, at least, could not live as well) if environmental pollution killed off the bacteria in the stomachs of herbivores.

Class III pollution is concerned with the disruption of ecological relationships and the complex balanced interrelationships of living forms within the natural environment. These relationships appear as long chains in which one form of life depends on another which, in turn, depends on a third, which then depends on a fourth. Thus, for example, man may be dependent on beef which is dependent on grass and corn, which is, in turn, dependent on topsoil, which may be dependent on worms, which may be dependent on all kinds of things, including bacteria.

Such chains of life also have side links which join them together into a complex multidimensional network. In this network, each living form has an "ecological niche" in which it can survive. Such a niche is an area with rather narrowly defined conditions within which that particular form of life can survive. These conditions are created and maintained by all the surrounding natural conditions, both living and non-living. There is a close interrelationship of these

two: non-living conditions like temperature and rainfall not only influence the forms of life but are influenced by them, as both temperature and rainfall are influenced by the prevalent forms of vegetation. Any change of conditions anywhere may make life impossible for a living form somewhere else because of these pervasive ecological interrelationships. The disturbance of these relationships make up Class III.

If we look at living forms as a whole in all their interrelationships, we see that they form a pyramidal hierarchy with soil, bacteria, worms and other invertebrates on the lower levels; many species of vegetation on somewhat higher levels; somewhat fewer species of herbivorous vertebrates on an even higher level, and considerably smaller populations of carnivores near the top levels, with man, as the culmination of the evolutionary process, at the apex. In this pyramid of life we have not only a representation of the evolutionary sequence, with later forms of life at higher levels, but we also have a system of ecological dependence in which the higher levels are supported by the lower ones. The interrelations among the levels go in both directions with materials being processed upward to higher levels from lower ones at the same time that dead individuals or their waste products are being broken down to lower levels where they become available as materials for repetition of the building-up process. Thus materials are constantly flowing in both directions in the biologic pyramid of life, upward by aggradation of materials to higher forms of life and downward by degradation of materials to lower forms of life. The process of degradation through decay and disintegration, by the activities of bacteria, parasites, termites, worms and many kinds of "pests," is just as important as the process of building up. Men tend to resent the processes of decay and degradation and do all they can to prevent them by killing those living forms which are performing this essential task (the parasites, termites, worms and "pests" just mentioned) but also by changing materials which can be degraded by natural processes (such as wood and paper)

into materials which cannot be degraded, or can be degraded only very slowly (like plastics, detergents, rustless metals) by any natural processes.

This brings us to Class IV, the last (and final) kind of environmental pollution, in which human actions begin to interfere with the fundamental cyclical processes of nature on which all life depends. There are many of these cycles, of which the aggradation and degradation of materials within the pyramid of living forms is only one. Others include the hydrologic cycle, the heat cycle, the nitrogen cycle and many others.

At the present time, students of environmental pollution are becoming increasingly worried that, by interfering with these basic cyclical processes of nature, human actions may make life impossible not only for all, or most, men, but also for other higher forms of life. For example, the oxygen-carbon cycle is the process by which plants take in carbon dioxide, break it up, and release atmospheric oxygen which, in turn, is breathed in by animals who breathe out carbon dioxide. Much of our atmospheric oxygen comes from the activity of microscopic plant life in the oceans. If these oceanic microflora are killed off as we pollute the seas, the flow of oxygen from the oceans to the atmosphere might be reduced, leading to a reduction of the oxygen content and an increase of the carbon dioxide content of the atmosphere. Not only would this make it more difficult for higher animals, including man, to breathe but it might lead to dangerous distortions of the heat cycle and the hydrologic cycle.

The heat or thermal cycle is based on the contribution of heat made by the sun and other sources each day to our globe, especially to its atmosphere. As it is dissipated into space again, this heat is a major factor in our weather cycles. We have already seriously disturbed the thermal cycle by our destruction of vegetation and our burning of fossil fuels, which increase the carbon dioxide in the atmosphere and disturb the natural patterns of rainfall. If atmosphere heat were to increase only a few degrees, much of the snow and ice in continental and polar glaciers

might melt, raising world sea levels a few hundred feet, and flooding many of the world's major cities.

The hydrologic cycle is concerned with the process by which water is evaporated from the earth's surface (and especially from the ocean's surface), rises into the atmosphere, condenses into rain or snow (usually over land), and slowly makes its way back to sea level through snow-capped mountains, glaciers, ground waters, and surface streams. In some cases, it takes thousands of years for waters to complete a single cycle of this process. But over that period these waters are available for the living processes of many forms of life, both plants and animals. Man's interference with this process, both consciously but even more by his unconscious activities, has already gravely damaged this hydrologic cycle, speeding it up, eroding mountains and topsoil into the seas, creating man-made deserts, destroying wet lands (and much of the life which depends on them), driving ground waters to lower and often inaccessible levels, and filling all of these waters with death-dealing and life-destroying pollutants in the process.

In summary we might say that environmental pollution is an accelerating problem by which man violates the quality and ultimately even the possibility of human life. The four stages in which it may be divided are:

Class I in which the amenities and aesthetic qualities of life are violated.

Class II in which there is injury and death to individuals from environmental contamination.

Class III in which whole species are threatened with extinction from disturbances of ecological inter-relationships.

Class IV in which fundamental cycles in the biologic pyramid and its natural environment are distorted or destroyed to such a degree that life for whole series of living forms becomes impossible over wide areas and possibly over our globe as a whole.

It is worthy of note that these four classes, based on a study of our biologic system, are also chronological, in the sense that man's activities of this kind began with Class I while he was still a primitive creature, passed

on to Class II long ago, are now in Class III and are moving with constantly accelerating speed toward Class IV.

II: ROOTS OF THE CRISIS

The origins of our ecological crisis are usually sought in the history of technology. Any careful examination of the subject, however, reveals that advancing technology is not a cause of the crisis, or historically antecedent to it, but is rather a part of it. Accordingly, the roots of the crisis must be sought elsewhere and could be formulated by such questions as this: "Why does our technology take such ecologically disruptive or destructive directions?"

This question leads us to problems of two kinds. One of these concerns our outlook and value systems; these determine what we want and what we admire. The other concerns organizational questions, that is, the patterns of behavior in our society which form it into a functioning social system, together with our technology on one side (determining what we can do) and our outlook and value systems on the other side (determining what we will want to do). These three aspects of our society form a social system that is now ravaging our natural environment and has been doing so for several centuries with increasingly disastrous consequences.

From this point of view we must see our ecological crisis in terms of four interrelated aspects:

1. The natural environment viewed as an ecosystem, especially that part of it now known as the biosphere.
2. The technology and artifacts which man has turned into a buffer area between man as a natural living form and the natural environment where he finds the resources to satisfy his needs.
3. The organizational system consisting of patterns of behavior and arrangements among people and artifacts. In general, any system of technology is enclosed in an organizational system which directs and manages the technology.
4. The society's patterns of beliefs, values, and assumptions, which I shall call, in general, its "outlook." This is of the greatest importance because any people, as a consequence of its historical traditions, have an outlook which takes

the human *needs* common to all mankind and turns them into the human *desires* which are the objects sought by any particular society at any particular time in its history. Thus, all men need food, but Chinese want rice; Europeans may want bread; Americans desire steaks; Eskimos want raw sealmeat or whale blubber; and North Africans may want fried grasshoppers.

On the whole, we might regard these four systems as forming a chain of mutually dependent links in which the biosphere and natural environment is at one end with the artifactual system imbedded in it and operated by the organizational system in accord with the motivations and drives of our outlook. Thus *Outlook* acts on *Organizations* which handle *Technology* against the *Natural Environment*.

On the whole, there is increasing recognition today that the basic causes of our ecologic crisis and its historical roots lie in the first of these systems: our Outlook.

This means: (1) that both the causes and the remedies of our ecologic crisis must be sought in changes in outlook; and (2) that changes in our technology and even in our organizational arrangements are, at best, concerned with symptoms rather than with causes. Moreover, remedies sought in these symptomatic areas will probably be enforceable, or even manageable, only with very great expenditures of resources and energy under conditions of great social and political controversy. On the other hand, changes in outlook will, to a much greater degree, lead to changes in organizational arrangements and in the uses of technical knowledge which will be more spontaneous and relatively self-enforcing.

Really, all we are saying here is that the destroyers of our natural ecosystems are not so much the bulldozers or even the internal combustion engines but rather the way these tools are being used. From this point of view, the historical roots of our ecological crisis must be sought in the history of how our present attitudes toward nature and our fellow men came into existence. This is too large a subject to be handled in one brief article, but fortunately there is no need to tell the whole story or even the major part of it.

All we have to do is to establish the chief steps by which our outlook, in the West European and American tradition, became established in opposition to nature. For it is clear that it is not the "backward" peoples of the globe who are threatening to destroy the ecological basis of human life, but the most advanced groups of our own Western Civilization, especially the Americans (followed, in an imitative way, by the Soviet peoples). The peoples of the Third World are threatening the natural environment chiefly to the degree that they are trying to adopt Western (or, to a lesser degree, Soviet) ways of life, including technology, organizational patterns and outlook.

HUMAN ORIGINS

The process of alienation began with the origins of man, at least four million years ago, when our hominid ancestors began to become dependent for survival on learned behavioral patterns rather than on inherited patterns like other animals.

This development came long before man had tools or material artifacts, but his learned behavior patterns, including cooperative behavior, language beginnings, and lengthening infantilism, were artifacts, made by men and passed on by social inheritance rather than by biological inheritance. In time these learned patterns of action and relationships were supplemented by more elaborate or more obvious artifacts, such as developed language, tools and fire-making. In this way, over several million years, man obtained culture which became a buffer between his living body and the natural environment. In time, man came to believe that this buffer of artifacts, customs and learned relations with other humans was the source of all satisfaction of his human needs, rather than simply the instrument through which nature's satisfactions of his needs reached him. And as culture came to seem the source of satisfaction, nature seemed to become a danger and threat to such satisfactions.

This separation of man from nature by culture did not, however, alienate man from nature for millions of years because man con-

tinued to regard himself as part of nature, as a relatively weak being in a nature which contained innumerable other powers. Accordingly, for a long time, man saw his role in nature as relatively helpless; in a word, his attitude in the primitive period was based on humility, not on pride.

The invention of agriculture, in which man had to protect his crops and domestic animals (that is, his *unnatural* possessions) against natural pests and predators (an obligation symbolized by the establishment of fences and barriers around these economic assets), marked an even more drastic change in man's relationship toward his natural environment. But, once again, the increased tendency toward man's alienation from nature thus begun, about 8000 B.C., was curtailed for thousands of years by the persistence of earlier attitudes and beliefs, especially religious beliefs.

In fact, from the invention of agriculture about 8000 B.C. until the organizational and technological revolutions about A.D. 1780, changes and persistence in religious beliefs remained the key factor in this whole subject. To use old-fashioned religious words, man became capable of destroying his natural environment only when his personal attitude toward his environment shifted from humility to pride.

THE ARCHAIC PERIOD

Our present attitude toward agriculture as an activity in which we *force* nature to do what we want by attacking it with tools and chemicals is totally different from man's attitude toward agriculture in the Neolithic period (after 8000 B.C.) and in the Archaic period (say, in the earliest civilizations, from 4500 to 500 B.C.). In the Neolithic period, men generally worshipped the Earth as a Mother Goddess, one among many deities, who provided food, children, prosperity and personal security under the influence of petitions and magical actions, not by any power which could be applied by such a weakling as man.

In the Archaic stage, during which men constructed the first civilizations, men con-

tinued to regard agriculture as a magical and religious activity, rather than as a technological problem. Until the sixth century revolutions, men continued to see all human experience as occurring in a chaos of conflicting powers, not as a system of laws or rules. This chaos was viewed as a single macrosystem in which man, nature, spirits and gods were all mingled in a tangled nexus of conflicting powers.

THE SIXTH CENTURY REVOLUTION

In the thousand years from about 1500 B.C. down to about 500 B.C., this attitude was changed in some areas by a series of intellectual revolutions which we generally know as the "sixth century revolution," from their culmination in the period 600–500 B.C. These changes took place in China, India, and Persia, but we must restrict our consideration to the changes among the Hebrews and the Greeks.

Among the Hebrews during the thousand years after 1400 B.C., new ideas developed about the nature of deity. These ideas were confused, but we may divide them into two stages which we might call: (1) "Providential Monotheism" in the earlier period (say before 600 B.C.; and (2) "Transcendental Ethical Monotheism" (largely after 600 B.C.).

In the earlier stages of this revolutionary growth in men's ideas about the nature of deity, the Hebrews, perhaps inspired by the Egyptians, came to combine all, or almost all, the spiritual powers into a single Supreme Being who was not only the Creator of everything (out of nothing), but was omniscient and omnipotent. There was still, at this stage, no conception of laws or rules; accordingly, everything that happened was the consequence of God's actions. Providential Monotheism was, like the earlier theories of archaic deities, inextricably mixed up with the world of time and nature. Man, in his weakness, was totally dependent on another power and on nature as the variable instrument of that power. But the Hebrew idea of the Providential Creator considered man as the result of a special act of creation in which God had set man *outside* nature and had

given him power over living things (including the right to name them, an ancient symbol of power), and had ordered man to master nature and its creatures for his own use. Thus the orthodox Hebrew, by 600 B.C., could see man as outside nature and even opposed to nature, but was not likely to feel that he could do anything he wished to nature so long as a Providential God was running nature. Indeed, the danger of this was reduced by the growing Hebrew idea that the greatest human sin was pride.

This alienation of man from nature, in Hebrew thought, was symbolized by the story of man's ejection from the Garden of Eden, where he lived with God, into nature, where he had to struggle to earn his bread against the resistance of nature. This belief is an essential element in the causes of our ecological crisis today.

It was not enough, however, for man to feel alien from nature, and for him to come to regard nature as wilderness or "wild-ness," that is, potentially unfriendly and injurious. No major step toward environmental despoilation could be taken, no matter how alienated from nature man might feel, until man ceased to feel weak and began to regard himself as the master of nature. And, in 600 B.C., even the Hebrews could not feel that they were masters of nature until God got out of nature. This occurred after 600 B.C., when the Hebrew God ceased to be actually providential (while remaining potentially providential) and, instead, became transcendental.

By 500 B.C., the leading Hebrew religious teachers were becoming Transcendental Ethical Monotheists. This marked a revolution in human outlook far greater than that attributed to Copernicus 2000 years later. By "Transcendental" we mean that God is seen as outside of the world of nature and of space-time. By "Ethical" we mean that "God is Good," that is, God is seen as not merely all powerful and thus able to do anything; he is also imagined as good, with his power restricted by his goodness. This means that there are rules (at least ethical rules) and that God is under those rules.

In this sixth century revolution among the Hebrews, the seed was planted for much of modern science and modern technology, for, if God were outside nature and interfered with nature only rarely, man (who is also outside nature, since he is a spiritual being like God), could become the master of nature by learning its laws.

For a long time, this consequence did not follow, largely because most people continued to act as if God were merely providential and thus failed to grasp the significance of his being transcendental. This significance, in fact, appeared first among the Greeks, who had their own sixth century revolution in which they invented two-valued logic.

TWO-VALUED LOGIC

Until after 600 B.C., the archaic Greeks, like archaic peoples elsewhere, viewed human experience as a dynamic chaos of nature, spirits, men, gods, and mixed creatures such as demigods. This point of view survived, in one version, in the thought of Heraclitus, who wrote, "All is flux." But even Heraclitus was falling under the growing influence of two-valued logic and tried to analyse the chaos of human experience into the conflict of opposites.

By 350 B.C., this way of looking at human experience in terms of opposites had developed into the explicit logic of Aristotle, in which all things could be classified into categories by the rule of contradiction ("a thing cannot both *be* and *not-be* a quality in the same way at the same time"). Thus to the Greeks, unlike the archaic peoples, things were *either* "living" or "non-living"; *either* "divine" or "not divine"; *either* "in nature" or "not-in-nature."

Under this Greek influence, even those who knew nothing of Aristotle or of logic came to talk of human experience in two-valued terms. In fact, these less sophisticated persons slightly changed the situation by regarding experience in terms of polarized opposites: that is, not simply as "cold" and "not-cold," but as "cold" or "hot," as either "alive" or "dead," and ultimately as "life" versus "death," "material" versus "spiritual,"

"body" versus "soul," and, finally, as "man" versus "nature." Although human experience is not, in fact, experienced in such polarized opposites, this way of looking at human experience and of talking about it did become widely established wherever Greek cultural (or the similar Persian cultural) influence spread. Thus even today, in our society, where Greek culture, including two-valued logic, is explicitly ignored, we still have great difficulty in experiencing life and talking about our experiences except within this unconscious two-valued logical framework.

We are today, either imprisoned in this mistaken way of looking at the world or we are increasingly impelled to flee from rational thought to simple existential social and emotional experiences without rational thinking to escape the straitjacket which misapplied two-valued logic has put on our patterns of rational thought. This explains why we, having ceased to be spiritual and otherworldly in the nineteenth century, have come to regard a totally materialistic and this-worldly way of life as the only alternative. Indeed, for the past 1900 years most Western Christians, even illiterates, have had a tendency to look at the Christian faith through the eyes of Greek logic, because the Western cognitive system was based on two-valued logic. They did this even when most Christians *acted* like non-Christians or heathens in their emphasis, in action, on the heresies of secularism, materialism and this-worldly aspirations.

CHRISTIAN RELIGION VS. GREEK DUALISM

This complicated confusion in the Western outlook lies at the foundation of our present ecologic crisis. In effect, from about 100 A.D. on, there was an irreconcilable conflict between Christian religion and Greek dualistic philosophy. The former generally tried to settle religious questions by a solution which said, "Both," to insure consideration for both sides of human nature, the physical and the spiritual. But the dominant philosophy remained generally dualistic and Greek, while the dominant activities remained secularist and even pagan.

Only briefly, in the period 1150–1300, did Western culture develop a philosophy which was reconcilable with Christian revelation. In this medieval scholastic synthesis, everything from worm to God was seen in one continuous hierarchical pluralistic pyramid, in which nothing was evil in itself, but everything was good in varying degrees, from no-good-at-all at the bottom to the supreme and perfect goodness of God at the top. In this synthesis, evil ceased to be a positive entity and became simply a negative condition, the relative absence of good.

This brief revolution in thought in the High Middle Ages almost reversed the sixth century revolution by making the human body and nature “good” (even if of lesser good than soul or God), because both were made by a supremely good God; this had a tendency to make God appear less transcendental and more immanent, as he had been before 600 B.C. This philosophy emphasized man’s role as a part of nature, sustained by the lesser creatures beneath him, who were essential for his survival although not so important as he in cosmic terms; it also emphasized man’s individual freedom and personal responsibility toward all bodies, all nature and all creatures. Thus, Francis of Assisi, the “patron saint of ecologists,” called the wolf “Brother Wolf,” saw God’s presence in all nature, preached to the birds, and escaped being attacked as a heretic only by his early death.*

A subsequent triumph of conservative theology was achieved, along with the reemergence of the worship of Greek culture (including two-valued logic) in the period 1400–1600. This gave rise to religious, philosophic and ideological conflicts in which the hierarchical moderates were very largely crushed by the upholders of dualistic spiritual values on the right and the supporters of secular, materialist practices on the left.

These two extremes agreed in their basic dualism. Both saw God as outside the uni-

verse; saw man as outside and opposed to nature; agreed that nature was to be exploited, or even plundered, by man; and found no difficulty in simultaneous usage of spiritual verbiage and material brigandage.

SECULARIZATION OF FUTURE PREFERENCE

With this tacit intellectual agreement, after 1500, the West set out to plunder the world with the sword in one hand and the Cross in the other. Those who remained in Europe continued to provide the material equipment and the intellectual justification for those who sailed the seven seas to China, the Indies, the Levant, Africa and the Americas. One of the intellectual contributions of the seventeenth century was “the secularization of future preference,” an intellectual trait which is prepared to make almost any sacrifice of leisure, pleasure or consumption in the present time for the sake of some hypothetical benefit in the future. Such secular future preference became one of the chief bases of the world we have today, since the whole capitalistic economy was built on present sacrifice for future investment. And a large part of our inability to communicate across class lines or across the “generation gap” arises from different assumptions of time preferences: the middle classes assume future preference; their dissenting children reject this for greater emphasis on present preference; the lower classes generally agree with the children; while the few aristocrats in any society have assumptions of past preference. In the present context, the contemporary shift in our society as a whole toward living in the present with relatively little concern for the future is an additional obstacle to any successful handling of environmental pollution or of its most threatening aspect, the population explosion (since birth control is an extreme practice of future preference).

The Enlightenment of the eighteenth century, in some ways, marked a brief halt in the intellectual movement toward assumptions which encouraged environmental pollution, since it unconsciously reverted to some of the beliefs of the high medieval synthesis.

* I owe this idea on St. Francis (along with much else) to my old friend, Lynn White, “The Historical Roots of Our Ecologic Crisis,” *Science*, vol. 155 (March 10, 1967), 1203–1207; reprinted in G. De Bell, ed., *Environmental Handbook* (New York: Ballantine, 1970), pp. 12–26.

It believed that man and nature were intrinsically good, that many human cultural conventions were evil and destructive and could be changed by the use of human reason, and that man was part of nature. But, as the Enlightenment became increasingly materialistic and anti-religious, the benefits to the environment which might have arisen from its reversion to some medieval beliefs were lost.

THE RISE OF CAPITALISM

At this point, about 1780, European outlooks had reached a point where man's intellectual readiness to devastate nature without mercy was fully developed, but his ability to carry out such devastation was still severely limited. Limitations on his powers to act destructively were almost entirely removed in the two centuries after the enlightenment. Much of this destructiveness has been attributed to the advent of something called "capitalism," but this economic system had been lurking around Europe and the world a long time before 1780 without contributing substantially to environmental destruction.

From this point on, we must be very careful about our use of terms, because only a most careful definition of the various aspects of the historical process will enable us to identify those aspects responsible for our ecological crisis.

There is nothing new about capitalism today, except that more people live under this system than ever before. If we define capitalism as "an economic system motivated by the pursuit of profits within a price structure," historians will tell us that such a system is older than the Phoenicians and began to grow in our Western civilization as far back as the twelfth century. But it was only about 1780 that any substantial portion of the people of West Europe began to live under a capitalistic system. Until that time, even those persons who lived in the capitalistic economy continued to live in an earlier form of enterprise. But this I mean that their capitalistic economic activities did not take place in a "firm," but continued to take place in a village, a plantation, or in a craft shop.

This invention of the "firm" as the unit of capitalistic enterprise, followed by the invention of the modern "corporation" as a special kind of "firm," have been ignored in most history books, although both these innovations were as important as the industrial revolution which came along about the same time. The "firm" was an innovation in bookkeeping techniques, just as the "corporation" was a legal gimmick. Both were man-made and both are imaginary; yet together with the industrial revolution they have made it possible, even likely, that we have already passed the point of no return in environmental pollution.

THE "FIRM"

Establishment of the "firm" was a bookkeeping decision that in calculating profits by subtracting "costs" from "income," "economic costs" would be included but "social costs" would not be counted. Social costs referred to the inevitable cost of human life, the costs of having children, of socializing them and bringing them up, the costs of getting rid of wastes, both sanitary and rubbish, the costs of sickness, incapacity to work, death and burial, the costs of moving goods and people, and the costs of all the non-material aspects of life, including religion, sex, recreation and emotional upset.

All these factors, or most of them, were regularly included in the costs of economic production and consumption in the earlier forms of enterprise we have mentioned: village, plantation or craft shop. These factors continued to exist to a large extent, under capitalism; but they were not included in the cost calculations of the new "firm." When a child fell sick in the village, on the plantation, or in the craft shop, the enterprise did all it could to help. The same thing was true if a man was unable to work: his associates kept the enterprise going. In the craft shop, where this was more difficult, the workers in the shop, including relatives, apprentices, or employees (who lived in), were assisted by the guild, to which many shops were aligned. Orphans, widows, cripples and those too old to work were cared for by their continued

association with the shop and the guild. But in the firm the association was only between an atomized individual and the firm and was continued on a day-to-day basis, so that it ceased the day the individual did not come to work, whatever the cause.

What this meant in practice was that the inevitable social costs were taken off the books of the firm and were imposed on any available social unit. Naturally, the firm showed a "profit." And two other consequences were equally natural: the older forms of enterprise slowly passed from the scene because they could not compete with the firm when the cards were "stacked" in this way. And many social costs, even when they involved the most basic of human needs, were not met. The village would not have left human excrement piled up on its paths, but Sir Edwin Chadwick's reports to Parliament on the slums of London in the 1830's tell of tenement courtyards housing hundreds of persons in which human excrement was eight inches deep, simply because no social group assumed the responsibility for removing it, or even knew what to do with it.

THE INDUSTRIAL REVOLUTION

The destruction of social grouping and of personal or social responsibilities arising from the invention of the firm was made worse by the advent of the industrial revolution about the same time.

Here again, we must be careful about definitions. The industrial revolution has been confused with many developments including the rise of capitalism and the factory system. Correctly, it should refer to the application of energy from non-living sources to the productive process. That means energy which does not come from the actions of men or animals, but rather from such things as falling water or fossil fuels. The latter, originally delivered through the external combustion (or steam) engine, now comes largely from internal combustion engines. In any case, the key to the industrial revolution lies in the fact that it made it possible for men, with relatively unlimited sources of non-living energy (at least temporarily), to enter

upon an era of relatively unlimited quantities of production.

It also gave them the power to devastate and pollute nature to a degree which was also relatively unlimited. The early protests against this were based on aesthetic grounds and the violations of the ordinary amenities of life, rather than on the threats to human health and life; later these dangers were recognized.

But the adverse influence upon life and health of the early industrial revolution was soon counterbalanced by advances in science and technology, especially in medicine and eventually in sanitation, with the result that a fall in death rates much greater and more rapid than a somewhat similar fall in birth rates led to the population explosion. This has now become one of the greatest threats to the natural ecologic balance, especially in the less developed areas of the globe which have received the new techniques for saving lives much sooner than they have accepted either the techniques or outlook for any reduction in birth rates.

The combination of the capitalistic firm and the industrial revolution gave us the factory system, something which has received more than its share of blame from historians. But the factory system was only one example of a nineteenth century tendency toward division of labor and specialization, which was itself merely a localized manifestation of a much deeper intellectual attitude which could be called "analytical thinking."

"Analytical thinking" assumes that we can find out how anything functions and can, indeed, control its functioning, if we take it apart. This is a very Western way of looking at human experience. This movement toward isolation, analysis, quantification, division of labor, specialization and materialism gave Europe and the United States a point of view, by 1880, which we may call "positivism." In economic theory it assumes that if we take care of the parts, the whole will take care of itself.

The damage which the positivist outlook of the 1880's inflicted on economics also affected education. Just as the depression of

1930 showed the bankruptcy of accepted economic thought, so the whole educational system today is being forced by the ecologic crisis to turn from its existing specialized, analytical, materialistic, quantitative approach toward a more holistic, contextual and qualitative approach. It is worthy of note that the existing specialized university departments have very little to contribute to the dominant problems of today (such as war and peace, environmental pollution, economic backwardness, mental ill-health, urban violence and crime, ghetto poverty and youthful dissension) just because these problems fall *between* the specialized academic departments. These problems are problems today because they have been so long neglected, and they have been neglected because they did not readily fall within any specialized academic department but bridged over many subjects.

Since the triumph of the positivist outlook about 1880, Western civilization's rush toward the environmental crisis has accelerated. It took thousands of years for men's ideas to reach a point where men were ready to plunder and destroy nature; it required more than a century after 1780 for men to devise a technology able to do this; but it took only a century or less, after 1850, for men to obtain a social organization which compelled them to use that power in destructive ways as an everyday mode of living.

THE TWENTIETH CENTURY CRISIS

In the final stage of this sad story, the American contribution has been paramount. The reasons for this are very complex and are interwoven into the whole history of the United States. First of all, the people who came to America were different from the people who stayed in Europe. Those who came were more alienated, if not from nature at least from their social context. They were psychologically more restless. This combination of social alienation and psychological restlessness gave them greater psychological insecurity, a feeling which Americans have increasingly tried to assuage by the piling up of material possessions, by immersion of self

in ambiguous social groupings, and by symbolic distinctions of differential status (including academic degrees). All of these factors intensified an outlook which made the plundering of nature seem natural.

Moreover, these immigrants came from regions where there was a relative scarcity of the economic factors of production. Generally, the immigrants left places where labor was in over supply and cheap, while land and materials were in under supply and expensive. In such conditions, economic processes tended to be wasteful of labor but saving of land or materials. In America, the situation was the reverse. Labor was scarce and thus expensive, but the continent was plentiful in land and materials. Thus the American economic processes tended to be labor-saving but wasteful of land or materials.

An example of this may be seen in early American agriculture which sought productive efficiency in high output per man-hour of labor, while European agriculture sought productive efficiency in terms of high output per unit area of land. Thus, Americans turned to power production and excessive mechanization of all economic processes, with little concern for any resulting waste of materials or land. The land was plundered of its natural vegetation and its natural fertility leaving, as a heritage, the exhausted lands of the east and the eroded lands of the west.

In less than two centuries, the magnificent virgin forests were gone, along with many of their natural creatures, the natural waters had vanished or were polluted, and the mineral resources were approaching exhaustion. In their place were mountainous accumulations of waste of all kinds, all justified in the name of "labor-saving" techniques, regardless of the destruction of resources, the growing human inconveniences and the decline in efficiency and the real quality of life.

This last point is important for it describes what Americans have done with the corporation and how they can use falsified accounting techniques and mistaken taxation methods, not only to encourage this process, but to conceal from themselves what is really happening.

The corporation is a legal device by which a group of persons can be regarded as a fictitious person in law and can thus own property and sue and be sued in the courts. A corporation allows the savings of many persons to come under the control of a few persons; thus it is a device for capital accumulation. But, unlike real persons, corporations do not die. Their property is not periodically redistributed by natural death, but can continue to grow and be applied to the same ends, even when these ends have become undesirable. Moreover, the corporation has limited liability in law and even more in fact.

Moreover, the corporation, by its accumulation of wealth and power, can cease to be the instrument through which human needs are satisfied and can become an institution to which real persons are increasingly enslaved. Moreover, it can use its power to reformulate the tax laws and thus all the flows of income in the country so that almost limitless moneys can be made available for corporations and for hardware. If any obligations are forced on corporations to direct any small portion of their power and resources to cover social costs, to pay for human welfare, or to provide amenities, both the tax system and the corporation's own system of accounting can be exploited to see that these costs are forced onto the consumers or onto the government (which then can tax consumers).

The ultimate falsehood of our accounting is to be found in official and semiofficial statistics on the American "standard of living." All amenities, all personal enjoyment and leisure, all considerations of quality, of nature, and of satisfying personal social and emotional relationships are rigorously excluded from any statistics of the American "standard of living"; so are all negative factors such as increasing crime and violence, pollution, disorder, noise and neuroses. Instead, the figures on our "standard of living" detail, as they have for years, only quantitative and material values: how many automobiles (but nothing about atmospheric pollution, traffic jams, or the dead and maimed from motor accidents), how many telephones

(but nothing about whether the messages they carry are joyful or sorrowful), how many devices for transmitting or amplifying sound (but nothing on noise pollution), how many bulldozers and earth-movers we have (but nothing on the trees they uproot, the natural drainage areas they disrupt, or the rivers they fill with eroded topsoil).

Moreover, this whole system of false reporting on the condition of America is solidly sustained by the tax system since the upkeep and maintenance of the most destructive earth-mover is tax-deductible.

Leaving aside questions of outlook, the chief tools we must obtain in seeking remedies for our ecologic crisis are these: (1) a tax system and a fiscal policy which direct income-flows in the United States in constructive instead of in destructive directions, by taxing destructive acts and subsidizing constructive actions; (2) a revision of corporation law so that corporations cease to be the masters of our society and become, as they were intended to be, its servants; and (3) standard-of-living statistics (or a system of social accounts) which will give us a more accurate idea of where we are going, and how fast, by giving weight to all the real elements of human living (that is, the non-material, the qualitative, the social, and the ecological).

These three basic areas of reform so necessary for ecological reconstruction are most unlikely to be achieved, even to a modest degree, unless two other areas of misdirected energies and general corruption are also reformed: our political system and our educational system. The political system must become more responsive to the interests of human beings and of real human needs and less responsive to the interests of corporations and to hardware and other material accessories. The educational system must like-

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OUR ECOLOGICAL CRISIS

(Continued from page 12)

wise become more concerned with what is meaningful, relevant and holistic, and become less concerned with interest groups (including what teachers happen to know), physical plant and symbols of quantitative "educational achievement."

Both the political and economic systems can be reformed, but, like the three other areas of reform just mentioned, they are unlikely to move along the right path unless the general cognitive outlook of our society is changed—changed by a clear-sighted recognition of the true nature of man and his relationship to the universe of nature, and of the values and assumptions which will make it possible to satisfy his real animal needs, and to develop those social, emotional and intellectual needs which make him something more than an animal.

AIR POLLUTION

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its generating plants on schedule to meet the demand for electric power that doubles every ten years.

There are encouraging signs. The airline industry, for example, has agreed to a voluntary program of refitting the bulk of aircraft engines to cut down the amount of pollution. Aircraft only account for about one per cent of the total air pollution picture, but it is a highly visible one per cent. Besides, the industry is well aware that if it does not act on a voluntary basis, it will face a law forcing compliance. In fact, the industry may face legislation anyway. And industry in general is much more aware of environment today. There is hardly a major company today that is not considering pollution-control equipment for new plants—and for old.

**** Ed. note:** See also the article by Marshall Goldman, "Costs of Fighting Pollution," *Current History*, August, 1970.

COSTS OF ABATEMENT

A big question mark now is cost.** There are no reliable figures on what air pollution abatement means to the pocketbook of either industry or government. One reason is that there will be a growing trend to stop air pollution before it reaches the smokestack. This will mean changes in processes for industry so that what goes up the smokestack contains no pollutants. It also means a change in fuels for some industries. In some cities and states there are already regulations that limit the sulfur content of the fuel that can be burned. However, the available supply of low sulfur fuel is scarce, and the supply that is available is expensive.

H.E.W. did develop some cost figures, which were published in the spring of 1970. They show that between 1970 and 1975, federal, state and local governments are expected to spend \$1.7 billion for air pollution control. This figure includes \$638 million for research and development and \$1 billion for abatement and control of air pollution. The bulk of the money will be spent by the federal government.

CONFLICTING PRESSURES

But local and state governments will be faced with an increasing pressure to control pollution, and continued pressure from industry to go slow. As President Nixon said in his environmental message:

Increasingly, industry itself has been adopting ambitious pollution-control programs, and state and local authorities have been setting and enforcing stricter anti-pollution standards. But they have not gone far enough or fast enough, nor, to be realistic about it, will they be able to without the strongest possible federal backing. Without effective government standards, industrial firms that spend the necessary money for pollution control may find themselves at a serious economic disadvantage as against their less conscientious competitors. And without effective federal standards, states and communities that require such controls find themselves at a similar disadvantage in attracting industry, against more permissive rivals. Air is no respecter of political boundaries; a community that sets and enforces strict standards may still find it is polluted from sources in another community or another state.