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THE ECOLOGICAL CRISIS - HOW SERIOUS?

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INTRODUCTION

The ecological crisis is very serious indeed. The world is still suffering through its worst economic crisis in 50 years due to depletion of our natural resources, exacerbated by economic and agricultural mismanagement. The basic problem is that the world's human population is outgrowing our capacity to feed it. In order to maintain an adequate level of food production (tragically inadequate in Africa and other parts of the tropical world) we are committing biological and agronomic deficit financing, living beyond our means, by converting or deteriorating our croplands, overgrazing our grasslands, stripping away our forests, overfishing our waters, neglecting our water tables, and depleting irreversibly our biological gene pool through extinction of numerous plant and animal species and critical races of economic plants. We are, in short, living off our agronomic and biological capital.

EXCESSIVE POPULATION GROWTH

When I was a college freshman, I found in Baker Library at Dartmouth a three-volume work, an "Essay on the Principle of Population" by Thomas Malthus, an English economist. I was fascinated by his thesis that the human population, if unchecked, will increase in a geometrical progression while the means of subsistence will increase only arithmetically. His arguments, though not rigorously subjected to statistical analysis, sounded most logical. I did not agree with his economic conclusions that the poor should not be encouraged by economic support,

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nor his belief that only misery and self-restraint, presumably celibacy, could check excessive growth. Like the Pope, he included contraception under the heading of "vice." We now know, of course, that it is education and affluence that tends to lower the birth rate not poverty, starvation, nor unrealistic demands for celibacy. Family planning, with general use of contraceptives, and sometimes even with sterilization or abortion, are imperative to save mankind from self-destruction.

Malthus would not be surprised today to learn that the world population, about 1 billion in his time, was 2.5 billion in 1950, had expanded to 4 billion by 1975, is pushing 5 billion now, and is projected to reach 6.3 billion by year 2000. It has also been projected to reach 11 billion in perhaps a century before it finally stabilizes. With the economic growth rate now at about 2% per year, those emergent nations with population growth rates more than 2% must face malnutrition and starvation of their people. The United Nations World Food Council estimates that presently 15 million to 20 million people die from hunger each year. In Africa, the Middle East, and tropical America 34 countries with a combined population of nearly 400 million are growing in population by 3% or more. At present growth rates the Indian subcontinent could reach 2.7 billion people, more than the entire world population in 1950, and Nigeria presently with 84 million could increase to 623 million, more than now live in all Africa. Seventy-nine million humans were added to the world in 1983. A 3% growth rate compounded for 100 years will result in a nineteenfold increase (1% will result in a threefold increase for the same time).

This excessive growth can be curtailed. Now 12 European nations have brought births and deaths into equilibrium. Japan, U.S.S.R., and the U.S. have growth rates of 0.7, 0.8, and 0.7% respectively. China by Draconian methods has reduced fertility from 34 to 20 births per 1000 persons and Japan from 34 to 18 in one decade. By use of the carrot and the stick China is now pushing the 1-child per family rule. Other nations have had considerable success. It was not helpful to the Third World when our administration recently withdrew its \$25 million support for family planning due to the administration's distaste for abortion. The right-to-lifers would seem to prefer starvation to abortion as a population control.

DEGRADATION OF OUR CROPLANDS

By A.D. 900 the lowland Mayan civilization is believed to have reached 5 million people, a density similar to that of agriculturally intensive societies today. Their area had been almost wholly deforested by A.D. 250. Apparently the loss of topsoil and decline in productivity of the croplands led within a few decades after 900 to the collapse of the Mayan civilization and drop in population to 1/10 of what it had

been. The great Fertile Crescent Mesopotamian civilization likewise collapsed due to agricultural mismanagement, there due to waterlogging and salinization of the irrigated soils. North Africa, the granary of Rome, through overpopulation, overplowing, overgrazing, and erosion with resulting desertification, now must import much of its grain.

We can learn from the destruction of these and other great civilization. Yet the pressure on world farmers to produce more is causing an increase in erosion with consequent decline in productivity. More than 100 nations now rely on North American grain. The Dust Bowl taught us in semiarid areas to rotate crops, use fallowing alternating with strip crops as windbreaks, and plant trees for shelter belts. These measures now are largely being scrapped. Another Dust Bowl can be expected when drought coincides with high winds. Sloping lands are being farmed without adequate terracing or contour plowing resulting in rapid loss of topsoil and frequent landslides with consequent severe flooding in lowlands and siltation behind dams. The rotation cycles in shifting cultivation areas (cut-slash-and burn) in the humid tropics have been cut from 20-25 years to as little as 5 years with great decline in productivity. It is estimated that the world is now losing 23 billion tons of soil from croplands in excess of new soil formation. The world's topsoil is being depleted at an estimated rate of 7% every decade. We are mining our soil. When the average of 7 inches of topsoil is removed, the infertile subsoil or exposed bedrock usually results in greatly lowered fertility and ultimate abandonment of the land. About 1/3 of U.S. and world cropland is losing topsoil at an excessive rate undermining long-term productivity. Also conversion of cropland to other uses as urban sprawl, village expansion, shopping centers, factories, reservoirs, strip mines, and highway construction each year claims several million acres of prime cropland. Not many years ago Los Angeles County was the leading agricultural county in the U.S. Today it is essentially housed or paved over.

Salt is destroying much of our irrigated land. Up to 65% of all irrigated land is expected to be destroyed by salt before A.D. 2000. Pakistan loses 250 acres to salt every day. One tenth of the irrigated 5 million acres in California's Central Valley are already seriously affected by salt (2 million tons of salt added to the valley each year). Excess water leaches the salts deeper into the soil, but the impermeable clay layer under much of the Valley causes the salty leachate to build up to waterlog the root zone in toxic brine unless drainage is provided. Unless the excess drainage water is allowed out of the valley through San Francisco Bay much of the cropland in the Valley is doomed. Kesterson Reservoir already has serious selenium problems with birth defects and high rates of fetal mortality among resident waterfowl. The Imperial Valley, at least, can dispose of its excess leachate into the manmade Salton Sea.

OVERGRAZING OF THE GRASSLANDS

One third of U.S. grasslands are in poor condition, 1/3 only in fair condition due to overgrazing by livestock and feral animals. Pacific offshore islands like Santa Catalina, San Clemente, Santa Cruz, and Guadalupe have been devastated by feral goats, sheep, and pigs. Inland our desert areas are similarly overgrazed by feral asses and horses. Authorities are not allowed to protect these lands and their indigenous plants and animals because of the pro-feral-animal zealots. Beef output doubled between 1950 and 1976; since then there has been little or no growth at all.

Desertification: 1/10 of the land surface of the world is desert or near-desert. Half is climatically unproductive but usable, and half is being converted to waste land by man and his livestock. The thinly vegetated desert fringes can sustain only nomads and their grazing animals. Plowing and overgrazing have turned these fringes into unproductive desert. One estimate is that the Sahara is moving southward for these reasons about 3 miles a year. It is estimated that in the past 50 years 250,000 square miles of land suitable for agriculture or intensive grazing have been forfeited to the Sahara along the southern edge. The Sahara is also being pulled north toward the Mediterranean by overpopulation (sixfold increase since 1900), intense overgrazing, extension of unsustainable grain farming, and firewood gathering. The desert is moving west into Senegal and east into the Sudan as well. Southern Africa, especially Botswana, and vast semiarid grasslands in Kenya and Tanzania are badly damaged by overgrazing. The Atacama Desert of Chile is advancing up to 3 km per year. the Thar Desert of northwestern India has been pulled outward about 1/2 mile per year for 50 years due to deforestation and overgrazing. Desertification is going on also in the Middle East, China, Australia, Mexico, Argentina, and Brazil. Los Angeles has desertified the Owens Valley by excessive water drawdown.

FELLING OF FORESTS

Forests are shrinking each year by 1%, or an area the size of Hungary (11.3 million hectares). According to Food and Agriculture Organization 40% of the world's tropical forests have been destroyed in the past 150 years. Most of the rest are expected to be gone by the end of this century. With the elimination of almost all tropical forests in the next 25 years, most natural communities will be totally destroyed, and Peter Raven, Director of the Missouri Botanical Garden, estimates that hundreds of millions can be expected to starve to death in the tropics in the next 3 decades. In 1950 about 1/4 of the earth's surface was covered by forest. By 1980 it was less than 1/5. The world uses forests for lumber, fuel, and manufacturing, paper, furniture, plywood,

fiberboard, and many other products. Forty percent of the world population uses wood as its primary fuel, as much as 1-2 tons of firewood per person annually. In those areas stripped of wood, as in much of tropical Asia and Africa, the local people must use cow, yak, or other dung for heating, fertilizer desperately needed for their fields. Eighty million new people need housing each year, and many existing wooden structures must be replaced. In Central America and Brazil the tropical forests are being felled to obtain grazing land to produce lean beef to export for hamburgers for America's fastfood outlets. In other Third World countries firewood collection causes most of the deforestation. In SE Asia it is commercial timber harvesting by multinational companies doing clear-felling. In some areas the native rain forests are even being felled to make room for plantations of exotic pines and eucalyptus.

Forests protect the watersheds and recharge the underground aquifers. With their felling there is rapid runoff which causes rapid soil erosion and often landslides. Downstream floods contribute to sedimentation of streams and reservoirs. Dams designed to last 100 years have their reservoirs filled with sediment in 25. Often the dam sites are unique and cannot be replaced elsewhere. Devastating floods in India, Pakistan, and Bangladesh are due to deforestation in Nepal and other highland areas. Destruction of the rice harvest in 1974 by such a flood starved 1/3 million people in Bangladesh.

Acid rain has become a serious problem in much of the northern hemisphere. Some 300 Adirondack lakes in New York and many lakes in Canada are now devoid of fish, and the forests in those areas are showing damage. One third of West German forests are damaged and one-half million hectares of Czech forests are dead or deteriorating. The present administration in the U.S. continues to study the problem but refuses to force the Midwestern and other power plants to scrub their acid smoke. We are making our forests pay a heavy price for our cheap electricity.

OVERFISHING OUR WATERS

The world's fish catch grew spectacularly between 1950 and 1970, more than tripling to 68 million tons, including the inland fresh water catch and fish-farming. Such fish supplied more meat for humans than did the world cattle herds. Since 1974 the fish catch appears to have leveled off at 50 million tons for food and some 21 million tons for fishmeal for pigs, chickens, and other livestock. Over fishing is the general rule. Catches of herring, for example, have declined about 40% and of halibut more than 90%. Biologists had warned Peru that the sustainable yield for the Peruvian anchovy fishery was 9.5 million tons. Peru chose to ignore the advice and permitted the catch to approach 13 million tons. The fishery promptly collapsed to 3 then 2 million tons, where it has remained into the eighties.

Pollution is another threat. Oil spills, discharge of toxic metals, and other pollutants are eroding seafood stocks. Chesapeake Bay, U.S.'s largest estuary and one of the world's richest has had catches fall off precipitously. Pollution has riddled the Black and Azov Seas turning them almost lifeless. The seas as a limitless resource was a sad myth.

DETERIORATION OF OUR WATERS

Waterlogging and pollution have already been mentioned. Eighty percent of Black African populations have no clean water available. Water in our Southwest is in great demand. Southern California has raped the Owens Valley and Mono Lake, among other areas. It has lowered the water line disastrously in Mono Lake and has turned the semiarid Owens Valley into a dry desert. Much agricultural land in Arizona has been withdrawn from cultivation because of water demands for Phoenix. Forty-four thousand hectares have been withdrawn from irrigation, but groundwater levels have dropped by 10-20 feet per year.

In the southern Great Plains of the U.S. the depletion of the great Ogallala aquifer is threatening irrigated agriculture. It unfortunately is essentially nonrechargeable, so irrigation there will be relatively short-lived. A return to dryland farming has already begun in several states. Wells in many areas of the U.S. must be abandoned because of pollution of the local water table from toxic dumps.

DEPAUPERIZATION OF THE BIOLOGICAL GENE POOL

Another non-renewable resource under serious attack is the biological gene pool. The rate of extinction of plants and animals has been greatly speeded up by the destruction and alteration of habitats. Some 100 species of vascular plants are considered to have become extinct in the U.S. since the arrival of the white man. About 1200 of some 20,000 current species in the U.S. are threatened, with about 750 of these species in danger of extinction. By A.D. 2000 possibly a million species of plants and animals will have disappeared from the earth permanently. This will indeed be a serious depletion of potentially useful genetic diversity. Most of these species are resident in the rapidly vanishing tropical forests. Many of them are still unknown to science and will never even have a scientific name. Many races of crop plants are also being replaced in many regions by a few strains of high-yielding patented plants.

The diversity of the world's gene pool must be preserved at all costs. We are now able to transfer genes across species barriers not only by hybridization but also by genetic engineering. One species' ability to resist attack by fungus, virus, or insect pests may eventually be transferable to another economically important but susceptible species. The recently described perennial wild corn, *Zea diploperennis*, is resistant to a number of viruses that attack cultivated annual corn. It is estimated that 95% of the wild varieties of wheat native to Greece have become extinct in the last 40 years. International seed banks have helped, but we must preserve habitats to maintain species diversity in natural ecosystems. At least 10% of the rich, diverse, and ecologically fragile tropical forests should be preserved in well-guarded natural reserves, carefully selected to represent climatic and altitudinal diversity in each of the continents and tropical countries. So far only 2% are being partly protected.

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