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Many people see cities as their protection from the vagaries of nature. However, urban man is highly dependent on nature; fertile land for agriculture, and water and energy to service his artificial environment. Furthermore, the material needs of a highly developed modern technology make enormous demands on the physical environment.

When one considers the general topic "Nature and Urban Man", one may think primarily of the relatively unmodified natural areas or modified natural areas in cities. I believe these are very important, but we should first look at the broader topic - and consider the overall dependence of urban man on nature in a worldwide context. We depend for our survival now and in the future on a biosphere which we, as humans, are threatening to overwhelm. We draw on natural resources for raw materials and energy, plant and animal crops for food, and in a multiplicity of ways on oceans, lakes, and rivers and land for services and amenities. The artificiality and man-made character of our immediate surroundings need not lead to a sense of struggle of man against nature. Our perceptions can be altered by our culture from 'man in confrontation with nature' to 'man in cooperation with nature', including the vital insight that man is himself part of the living natural world.

What are the world-wide problems in the man-nature interrelationship, and what special aspects are there in the urban man-nature interrelationship? These will be discussed under the headings of population growth, urbanization, pollution and lifestyle.

POPULATION

Human-induced environmental stresses and strains may be expressed in the form:

$$\text{Overall impact} = (\text{impact per person}) \times (\text{no. of people})$$

For this simple reason, the severity of many world and local problems is directly related to the population size. The impact per person is related to the lifestyle, or the way in which we conduct our affairs. There are present problems with the size and distribution of population, but the growth rate of human population is truly alarming.

Globally, human births now exceed deaths by a margin of 5 to 2. The net increase is now about 2% per year, leading to a population doubling time of 35 years. A continued constant doubling time would lead to an exponential population growth. But, the doubling time itself has decreased dramatically so that human population growth is now superexponential. This population explosion has been sustained by human efforts to increase the

capacity of the environment to feed and hold human bodies and by widespread death control (public health measures have greatly lengthened the average lifespan and the number of children reaching maturity). Eventually, environmental resistance will limit this process, if we do not control population growth voluntarily.

The possibility of abrupt irreversible reductions in the carrying capacity of the earth due to man-induced ecological stresses is also increasing. After certain environmental thresholds have been exceeded, irreversible changes may occur. Due to the long time-delays, or to slow reaction times of our social systems, our population is likely to continue to increase beyond earth's human carrying capacity. This population 'overshoot' may be followed by a sharp involuntary drop in population due to starvation, disease or war.

As the developed countries use the most non-renewable raw materials and contribute most to global pollution, their impact per person is greater (by a factor of 10 to 50) than that of less developed countries. Yet only one developed country, East Germany, has achieved zero population growth to date.

Clearly, world-wide population control is needed to reach a stable population at a level below that which would overwhelm the projected human carrying capacity of the earth. Countries should individually adopt a policy of population stabilization. Free family planning services (contraception, sterilization and abortion) are needed. Governments must motivate reductions in birth rate so that the *desired* number of children will be low enough to produce a stable population.

URBANIZATION

Urbanization may be viewed as a population distribution problem aggravated by population growth. As cities grow, they often consume some of the best agricultural land. Increasing pressures are being placed on cities that are already overloaded in terms of the demands made on social and medical services, housing, schools, transportation, recreational and cultural resources, employment opportunities, and so on. The concentration of business and industry results in unequal concentrations of wealth which compounds the economic disparities within the country and arouses financial aspirations that cannot be met by many.

Large numbers of people are crowding into areas they perceive as desirable from an employment, climatic, scenic or cultural standpoint. Worldwide agricultural 'efficiencies' are decreasing the number of farm workers required per hectare of arable land. The surplus people are moving to cities. (This process might be called 'huddling' growth). In addition, once more than one half of the population lives in cities, the same percentage annual growth of both a smaller farm population and of a larger urban population leads to a greater overall proportion of urban dwellers. (This might be called 'cuddling' growth). The combined effect of huddling and cuddling means that most of the net population increase in many countries will be in the cities. By the year 2000, around 60% of the world population of 6 to 6.5 billion will be concentrated in

cities (1), and in Canada 30% of our population of about 34 million will be centered in Toronto and Montreal. The population of these cities will more than double from a little over 2 million each to 5 million each (2).

The social and environmental strains produced by such urbanization are enormous, with services available falling ever farther behind those that are needed. Social upheavals seem inevitable as unsatisfied rising aspirations become more widespread.

Carrying capacity studies are urgently needed for major and minor urban areas to determine whether they have remaining growth potential which does not place them at risk. Urban growth may be accommodated in part if fast, cheap and comfortable public transportation is developed. Social, environmental and aesthetic criteria must weigh in decisions, and not merely economic ones.

Small farm technology needs support so rural young perceive a possible rural future for themselves. Governments must prepare to assist frustrated young people to participate in determining their own futures. Governments must also prepare to rebuild damaged political and social structures after the almost inevitable clashes and disruptions have occurred. We should prepare to interpret the coming tragedies and learn from them how better to respond to future stresses.

POLLUTION

"Environmental pollution is the unfavourable alteration of our surroundings, wholly or largely as a by-product of man's actions through direct or indirect effects of changes in energy patterns, radiation levels, chemical and physical constitution and abundance of organisms." (3)

Pollution has both direct and indirect effects on society. Direct effects include assaults on human health: mercury poisoning, and human respiratory damage by air pollution; damage to goods and services society provides for itself: sulphur oxides can damage materials and property; and effects on what we see as our quality of life, for example litter or increased noise levels in a city. Indirect effects interfere with the services provided by natural ecosystems for society, such as, the pollution of coastal waters with oil may reduce fish production. The direct effects are usually more obvious, but the indirect effects are more insidious.

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1. Ward, Barbara. Human Settlements: Crisis and Opportunity. Information Canada, Ottawa, 1974.
 2. MacNeill, J.W. Environmental Management. Information Canada, Ottawa, 1971.
 3. U.S. President's Science Advisory Committee. Restoring the Quality of our Environment. Washington, U.S. Government Printing Office, 1965.

Various pollution 'catastrophies' have been forecast periodically which could have long-lasting, perhaps irreversible effects on human health, the world's climate, or the world's carrying capacity for human and other life. But society now treats these poorly understood grave risks as no risks at all.

Whenever pollution problems appear, we will need independent assessments of the marginal economic, social and environmental benefits of various techniques of pollution control, compared to the marginal economic, social and environmental costs of continuing the pollution. Economists have claimed that the divergence between private and social costs is the fundamental cause of pollution of all types. The difficulty lies in the estimation of social costs.

Society should regard any pollution as basically undesirable and adopt the point of view that any pollution that is permitted to exist must be justified in some reasonable fashion. Today, we operate with the opposite policy - that any pollution is permitted to exist unless it is proved to be of great harm to man or his environment.

LIFESTYLE

By 1970, less than 25% of the earth's land surface remained as unconverted natural ecosystems; 10% was purely artificial ecosystems (cities, etc.) and 65% was converted natural ecosystems (commercially exploited forests, grasslands, etc.). In other words, more than 3/4 of the earth's land surface is managed for human ends (4). How soon will we envelop the last 25%?

There is the biological principle that diversity leads to stability in ecological systems. Reducing the number of species can lead to unstable fluctuations of the numbers of the remaining species. When we displace or extirpate other living organisms, we may systematically lessen our own chances of survival. Therefore, species preservation is a necessary part of rational use of the environment. Currently we are doing rather badly on this score. For example, by overfishing (of several whales and many fish), we are in the process of exterminating many species . . . 'the tragedy of the commons' is being played out in many areas.

The growth of human population and the extirpation or extermination of other species is destabilizing. Such a biological 'simplification' process reduces the ability of our ecosystem to bounce back when disturbed. As the process continues we risk ever greater fluctuations and catastrophes. The risk may be reduced only if we conduct our activities more nearly in harmony with natural processes. We must design with nature and not against nature.

We are probably now exceeding the sustained yield protein harvest from the oceans of about 60 - 100 million metric tons per year. After

4. Nicholson, Max. The Environmental Revolution, McGraw-Hill, New York, 1970.

overfishing for a period, the yield will be reduced thereafter. Such renewable resources should be rationally used at or below a sustained yield level.

Some non-renewable resources can be exhausted rapidly by current techniques. Our present 'economy of flow' takes resources from source to single use, to waste. Such resources could be extended by an 'economy of stock' where resources are taken into stock, used for one purpose, and then re-used for the original purpose (recycled), or subsequent purposes (sequential use). Vast changes in design would be needed from our present technological practices to increase such recycling or sequential use. The change from a waste society to a non-waste society implies a change from a growth and waste ethic to a 'conserver' ethic.

Resource depletion can only be arrested through controls - changing to a privilege what has 'till now been regarded as a right. These controls will eventually pay off in terms of assured continuity of resource availability and improved quality of life. The controlling agencies must hold renewable and non-renewable resources in trust for future generations. Their policy-making processes will need to include open public scrutiny and participation.

Durability and workmanship and serviceability of goods must be stressed with tax incentives and other inducements to permit later recycling of materials on a broad scale. And minimum disruption of natural processes should be a condition of development and industrial activities.

What matters is not just what happens but how it happens. The social, economic and environmental impact of what we do all depend strongly on the way we do things. Confrontation between man and nature is widespread but not inevitable.

In urban living and in urban design, we should adopt Ian McHarg's prescription, "Design With Nature". The prescription is also the title of his superb book which sets out this philosophy and illustrates techniques of solving seemingly impossible land-use conflicts. Not only can specific competing proposals be evaluated for comparative environmental and economic impact, but perhaps more important, the techniques themselves generate new proposals for alternate solutions. This type of analysis shows a simple way of fairly including natural and environmental factors usually lacking in standard benefit-cost analyses. The resulting concept of ecological design deserves the widest possible adoption if we are not merely to survive, but to live in harmony with nature and urban man.

In conclusion, I should like to illustrate two possible urban futures. Recently, I visited many large cities and saw a great variety of approaches to the problems we have been discussing above.

Sao Paulo, Brazil, has a population of 11 or 12 million now, and is aiming for 20 million by 1980 (5). Growth is fostered by downtown expressways and an incredible jumble of permissive zoning, with factories allowed

5. *Personal discussion with the Mayor of Sao Paulo.*

next to houses. There are few parks or open green spaces, and despite a phenomenal number of apartment buildings, there are *favelas* (slums) festering inside the city. Five million people living in Sao Paulo have no running water or sewage services. In human terms and in environmental terms, Sao Paulo is a potential disaster area.

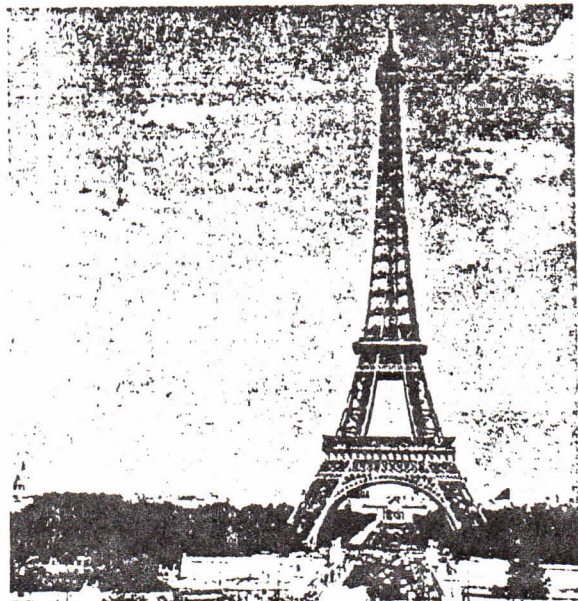
I offer the deliberately unfair comparison of Paris whose population is 9 million - which offers something more for the human spirit and more harmonious blend of human and natural design. Urban design in Paris has long included not only economic consideration but also social, aesthetic and natural values.

We can choose our future - which will it be - confrontation or cooperation ?

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*Sao Paulo, Brazil
freeways, factories, favelas*



*Paris, France
something more for the human spirit*