

## ECOLOGICAL SYSTEMS VERSUS HUMAN SYSTEMS: WHICH SHOULD BE SUPREME?

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### ABSTRACT

A reasonable outcome of man's quest for knowledge of the earth's dynamic forces is to attempt to control the future development of our environment. This manuscript considers the managerial relationship between the ecological system and the human system. It specifically discusses the benefits and costs that is derived by the human system by being a part of a larger more complex unit. The proposal is made that man is not yet ready to take the helm of the planet earth and to guide its orderly and sequential development.

The laws of nature were written by man himself as he observed the continually repeated order, disposition, and essence of the natural universe. For centuries man has watched and catalogued, sorted and classified, in his desire to understand the patterns and habits of the world around him. Bit by bit his knowledge of natural law and his desire to subdue the earth into which he was born have elevated him to a position of administrator of the planet. The unique facility of the human mind, its great power to reason, its logic and its sensitivity, have given mankind ever increasing abilities of control and dominance. But natural law remains irresistible. It will not yield to man's ambitions, but rather, continues to frustrate man's efforts to achieve complete dominance.

High in the ranks of natural law is the law of ecology. It tells us that all natural organisms which interact with their environment must do so to the advantage of the whole. But the law of ecology, as all of natural law, is mindless and mechanistic, amoral and precise. There is no acting out of intellectual conclusions or of value judgments; no conscious separating of the good from the bad. Nature does not reason. Only man has taken the care to understand himself and his environment. Only man has had mind, the mental and moral capacity to consider, to weigh, to ponder the outcome of his inter-activity with his world.

Why should he not, then, be superior in all aspects to the laws of nature? Why should he not become capable of overruling even natural law to his own advantage?

Of course, apart from its steadfast resistance to changes in its basic laws, nature remains mute in the argument of the balance of powers. But even if natural law could be subdued under man's control, the question remains, is man ready to be the giver of supreme law to the planet earth?

Throughout the process of human history, man has directed himself to higher and more complex levels of organization. Although at first he traveled only in small bands in quest of wild plants and animals, by 8,000 B.C. some of these groups had settled to form villages. Then the villages united to form states and nation states. And more recently some of these nation states have begun to cooperate and function as a regional state. Clearly man is a capable organizer.

But a similar process has also occurred in the biological world. Unicellular organisms have come together to form multicellular organisms. These organisms have joined together to form species, that is, organisms that naturally interbreed and produce fertile offspring. We have begun to realize that different species in a habitat themselves interact to form communities. Each community, with all its "living" plants and animals, then is thought to function along with the "dead" matter in the environment as an ecosystem—the functional unit of ecology.

So there are actually two complex systems operating on the planet earth: the ecological system and the human system. The question is, if there is a choice, which should be supreme? Which should be the sub-unit of the other? In order to confront this question we must first understand why there are higher levels of organization, and what is lost, as well as gained, by organizing.

Higher levels of organization have not been without loss. One of the most obvious losses is the reduction of the independence of each individual unit within the large-scale organization. The units within the complex system cooperate to act as a large unit. Consequently each unit is regulated to bring about the well-being of the whole. Cells in an organism are a sub-unit of the organism, and, as such, they obey its physiological behavior. They do not function independently of each other [1]. On the human scale there are laws to obey. These laws too are made to coordinate and interrelate the people within the communities, states, and nations. All units within the system are subject to its laws and limitations.

The loss of independence at times becomes so great that the destruction of one vital part of the complex system may cause the devastation of every unit in the system. We know from observation of the animal world that if an organ such as the liver is destroyed, the entire organism will very likely follow suit. The complicated structure of a nation is such, too, that if a vital area suffers from economic decay or revolution, it is very likely that the rest of the nation will feel the burden or loss and possibly be weakened or destroyed as a result.

But the loss of independence is not the only flaw in the structure of higher

levels of organization. A second phenomenon, described as the second law of thermodynamics, also affects multi-unit systems. This natural law, a conclusion based on observation of the natural world, says that all systems tend to a state of higher probability. That is, if left to itself, any system tends toward a state of greatest disorder, and thus, of lower potential energy. The fundamental principle of the second law is part of our daily experience. Water flows spontaneously downhill. Heat flows from a hotter body to a colder body. An organism, when it dies, decomposes. None of these processes takes place spontaneously in the opposite fashion.

The law suggests that as we proceed from random units to organized units we are decreasing the stability of the system, even though at the same time we are increasing the potential energy of the system. An organism has a lower stability than the cells it is composed of, because the cells lose most of their freedom and become more ordered and less random. They are being organized in opposition to their natural state; that of higher probability, of greater disorder, of lower potential energy. Similarly, nations are inherently less stable than their component parts, because, in forming the systems of nations, we are increasing order and diminishing individual freedom. Since both an organism and a nation are less stable than their components, the energy requirements increase to maintain a higher organization level. Thus the second law of thermodynamics is combatted at the cost of higher energy demand.

Evidently there must be some benefit in organization, however, for otherwise there would be no organisms or nations. Cooperation of many units makes possible the division of labor. Duplication of the work of existing units is avoided and the organization is free to perform many functions simultaneously. For example, in a set of disorganized cells, every cell is exposed to the environment on all sides and must therefore expend energy and materials on all sides for defense against environmental factors. In an organism (a community of cells), the cells aggregate and specialize. Thus the inner cells need not cope with the outside environmental factors. Consequently they do not duplicate the work of existing cells in the outer layer of the organism, the epidermis. Or again, a single-cell organism must necessarily carry out all the survival functions of life. Very often two such functions cannot be performed simultaneously. However, by cooperating to form a complex system, the cells of an organism can perform many vital functions simultaneously.

Division of labor permits the activity of each individual unit to become more specialized, and thus more effective. The overall benefit is a great economy of energy and materials and magnificent operational efficiency. In terms of cost-benefit analysis, the benefits have been proportionally greater than the losses, and larger systems have evolved.

Complex levels of organization require a government which compels the constituent units to obey the laws of the system. If laws are not obeyed there is no organization. The concept requires some form of rules and regulations which

must be adhered to if the units are to act in cooperation as one complex system. These laws are evident in the human system as they are in the ecological system.

In human society there are always some rules and regulations which act to stabilize the community. There are normally collections of principles or maxims, written or unwritten, in accordance with which the society functions. The regulations also tend greatly to reduce the freedom of each individual unit. This limitation has normally been considered necessary if a complex system is to operate with order. For example, the Preamble to the United States Constitution tells us its purpose. They are, in part, "to form a more perfect union, establish justice, insure domestic tranquility, (and) provide for the common defense. . . ." In short, the purpose of the Constitution is to insure *stability*. After its Preamble, the Constitution proceeds to delegate power. "All legislative powers herein granted shall be vested in a Congress . . . This Constitution, and the laws of the United States . . . shall be the supreme law of the land." The intent, again, is to delegate power, hence priorities, in an orderly and sequential way, and thereby to maintain stability.

In the ecological world also, tranquility or stability is maintained. However, there are no rules and legislations. Here stability is maintained by the mechanistic laws of physics and chemistry which have been in effect since the universe began to function. A dynamic equilibrium exists in the world, the result of which is a balance of nature. Stability in the inhabited world is maintained throughout the interactions of the ecosystems. Each ecosystem is stabilized by the exchanges between its component units, and so forth. Unlike human laws, ecological laws are amoral and precise, extremely orderly and sequential. Therefore if a stress is introduced into an ecological system the system can buffer the stress only up to a threshold. Thereafter the system is triggered to a new dynamic equilibrium. For example, as carbon dioxide increases in our atmosphere due to human activities, some scientists suspect that the temperature will also increase due to a "greenhouse effect." Thus polar ice caps will melt, sea levels will rise, lowland areas will be flooded . . . until a new dynamic equilibrium is reached. In short, and without exception, events in nature occur by the interaction of elements in the biosphere regardless of whether what follows is good or bad.

The basis of the human system is quite different and distinct from the ecological, mechanistic system. The question which man may yet have to decide is which of these systems should be supreme on the planet earth.

Early man was a unit of only minor significance in the complex ecological system. However, the development of modern industrial technology, coupled with the tremendous increase in population, has made it possible for mankind to manipulate the planet. Man's dominance has grown to such an extent that many natural environmental factors are no longer as effective regulators and controllers as they once were. This change in environmental control is, of course, a product of vigorously applied technology. Even birth and death rates are no longer a direct reflection of the regulating elements of the ecosystems. In short,

man is reaping the benefits of the ecological organization of which he is a part of without incurring the loss that a complex organization demands of its constituents. We are caught in a dilemma. If we force ourselves to obey the ecological laws, our own species will continue to be regulated and molded by mechanistic, ecological elements. If we conclude that man should be supreme even over natural law, we could cause the ecological system to pursue a disastrous, mechanistic path, possibly beyond the control of even our greatest technology.

If human laws and human morality are made supreme, the order of our world may well be based on economics, sociology, and other concepts of human civilization. Or if ecological laws are supreme, the laws that regulate us will be based on ecological principles, thus making human laws a sub-unit of ecological laws. What criterion, for example, should we use to determine how many people should populate each nation on earth? If we accept human systems as our model, our criterion could be based on economics. The optimum population of a nation might depend on the per capita income. If a population increase causes a decrease in income, then the optimum desirable population would lie at the level of the maximum per capita income. On the other hand, if ecological considerations were the supreme law, then the optimum population would be based on the interaction of at least two factors: First we would be limited by the amount of solar energy, crops, and land on which food products could be produced. Second, we must anticipate and limit pollution effects. Since pollution is a destructive change in the ecosystem, we must be extremely careful not to perturb the ecosystem to such an extent that its natural feedback mechanisms cannot absorb or replace the components which our presence may add to it or remove from it.

The philosophy of the economic criterion makes the ecological criterion a sub-unit of economics. All evidence available, however, indicates that the human system is currently a unit of the ecological system. Consequently, if ecological stability is to be maintained on our planet, we cannot lightly usurp the power of the supreme law of the planet, *the ecological law*. This rule is established in the ecological world, and is borne out in the history of the human world. To destroy this supreme law is to proceed along a disastrous path. It is to establish a new and unwarranted precedent in natural history, as well as in human history.

Sir William Blackstone, the Eighteenth century English jurist, urged in his *Commentaries* that "precedents and rules must be followed, unless flatly absurd or unjust; for though their reason be not obvious at first view, yet we owe such a deference to former times as not to suppose that they acted wholly without consideration." Yet, too rigid adherence to precedent may lead to injustice in a particular case, and also may unduly restrict the proper development of a society [2]. Suppose that we do wish to establish human law as supreme: *Is humanity yet ready to take the helm of the planet earth, and to guide its orderly and sequential development?*

To answer this question, we might consider research that is being done

presently in space travel. Scientists are working on the development of self-regenerating ecosystems for the life-support of a man during travels to other planets or solar systems. In many aspects the survival of man in a spaceship is similar to the survival of man on the planet earth. Both situations require the four basic components of an ecosystem. The non-living matrix, the producer, the consumer, and the decomposers are all essential to stabilize and maintain the proper parameters of an environment. Therefore research and development in an artificial ecosystem, such as a spaceship, is of extreme importance in understanding our own natural ecosystem, the planet earth.

The completion of an entirely efficient ecosystem capable of maintaining man for a long interval is not yet in sight. Current research is showing that ecosystems are very complex and would require much more research and development before we can completely understand them. One of the longest-lasting ecosystems constructed by scientists was maintained under the control of Eley and Myers [3]. In their experiment they enclosed an algae-mouse system for the study of gas exchange between a plant and an animal. Unfortunately the system survived for only eighty-two days. Obviously more study is needed.

It seems that man cannot yet control even a simple gas exchange system. Nor does he have the technology for creating larger, more intricate systems. Since such knowledge is not yet available, it would be folly to let ourselves so blindly take the helm of such a complex ship as our entire planet. Before we attempt to usurp the power of the ecological system, let us make sure we can replace it with a stable human system based on knowledge, understanding, and wisdom. At present we have no such system.

The human system does have the essential components of morality and aesthetics. They lend flexibility and sensitivity to our system of existence. But they are value oriented; and values are always changing in human history. Yet the natural laws for survival have rarely changed. This planet has many units interacting to form a complex, stable ecological system. And the formation of so stable an ecological system, mechanistic and amoral as it is, has not been without cost to the individual units. But, as we have seen, the benefits are worth the cost. Stability in the complex ecological system has been maintained for countless years. Only man's vigorous application of industrial technology has recently presented a threat to this stability. If natural stability on the planet is still our concern, we should base our life philosophy not on man's limited knowledge and changing values, but on the precedents established in an ecological system and demonstrated even in the human system itself. The precedent is that *all* units within a complex system must obey the laws of that system. And so man must obey the natural law, the law of ecology. We haven't the audacity to imagine anything less dismal than the destruction of our world if natural law is not obeyed.

We conclude that the following order of priorities is established:

1. An orderly and sequential biosphere is the supreme law of the planet earth.
2. Orderly and sequential ecosystems will continue under the system of natural law.
3. Survival of each species in the world community will be assured.

Until humanity has the knowledge, understanding, foresight, and wisdom to guide the natural development and insure the environmental security of the planet earth, the ecological system must be accepted as supreme.

#### REFERENCES

1. P. B. Weisz, *The Science of Biology*. McGraw Hill, 1971.
2. H. F. Birnbaum, *Stare Decisis Vs. Judicial Activism: Nothing Succeeds Like Success*. *A.B.A.J.* 54:482, 1968.
3. J. H. Eley, Jr., and J. Myers, *Study of a Photosynthetic Gas Exchanger: A Quantitative Repetition of the Priestley Experiment*. *Texas J. Science* 16: 296-333, 1964.