
REVIEWED BY FRANK COLLINS

The subject of this book is best described as a highly tentative investigation into human ecology and the environmental crisis. It is timely and will be of wide interest. The book is essentially a report of a systems analysis of a model representing the strongly coupled interactions of variables such as world population, pollution, capital investment, natural resources, and "quality of life." The methodology is essentially a repetition of that which Forrester made use of in his earlier books Industrial Dynamics (1961) and Urban Dynamics (1969).

In spite of the rapid proliferation of the literature in the field of the human environment, Forrester is practically alone in attempting a full account of the complex interrelationships which surely exist among the relevant variables. In the opinion of the reviewer, this book makes a unique contribution which outweighs the several negative aspects which the book may have. Other writers on human ecology have tended to confine themselves to fairly simplistic extrapolations of existing trends of single variables. Consequently, the remedies they propose are likewise directed to the separated variables and they generally neglect the possible counterproductive effects of their remedies on the other system variables.

The human ecological system is enormously complicated and its feedbacks, both positive and negative, cannot be simply ignored. For example, increased capital investment, generally considered beneficial for the developing countries, will clearly increase pollution and also increase depletion of natural resources with counter-effects on the "quality of life." This is not to say that capital investment in the developing countries may not be a good thing; it suggests that the total system should be investigated before plunging ahead with superficially considered proposals which in the long run may prove to be detrimental. The Aswan High Dam on the Nile, for example, may turn out to be in this category because of dangerous increases of the endemic snail borne disease schistosomiasis in the newly irrigated areas.

The principal variables selected by Forrester for consideration were population, capital investment, natural resources, fraction of capital devoted to agriculture, and pollution. "Quality of life" is quantified but is considered as a subordinate rather than as a primary variable. A graphic representation of the model used is depicted in the text and it is impressively complex. Several groups of time dependent curves of the leading variables were generated from the model on the basis of numerical choices of "multipliers" which expressed the nonlinear influence of the various factors on a given variable. For example, in the case of the birth rate, these factors are food, material standard of living, and crowding.

The predicted behavior of the system under 36 arbitrarily chosen sets of conditions is illustrated by way of 36 graphs of the system variables versus time, in the period from the year 1900 to 2100 or to 2500. As an exercise in assessing the range of the possibilities for the future of mankind on the basis of some reasonably chosen even if somewhat crude assumptions, the work is enormously stimulating. The wide diversity of the results obtained with arbitrary variations of the numerical parameters should relieve Professor Forrester of the charge that he actually pretends to predict our future on the basis of an artificial model.

The work is valuable simply because it shows that a system, having a mechanically chosen set of relationships which are roughly analogous to some of those of world human ecology, behaves in a highly complicated manner which is highly sensitive to the values of the parameters. It would seem reasonable, that in extrapimating the conclusions from the model to the real world, the behavioral pattern of the real world would be supposed to be far more complicated than in the model and that its inner variables would interact in far more subtle and complex ways. It is a valid objection to Forrester's book that he does not emphasize strongly enough the limitations of his or any other conceivable model as the basis for an interpretation of the behavior of the real world.

There are a number of criticisms of Forrester's book which can be made even after accepting the thesis that the work has importance in considerations of future human ecology. The first of these is that in some respects his analysis is quite crude. His nonlinear "multipliers," which are crucial to the quantitative behavior of his system, depend on unsubstantiated relationships which he does not justify in any satisfactory way. No allusion is made to possible difficulties which might arise from the wide geographical disparities in the averaged variables that Forrester uses even though he does mention the special problems of the developing countries in the first chapter. Similarly, he does not take account of the age structure of his populations which is highly important in quantitative calculations of birth and death rates. Natural resources, exploration rates, and projected reserves and their relation to the level of the technology of mineral recovery are dealt with cavalierly as are the details of the other primary variables. This degree of simplification may have been necessary to reduce the work of analysis to manageable proportions but it does raise questions as to the quantitative significance of the results.

There are a number of variables which one might suppose are important to a systems analysis of world dynamics which are simply omitted from consideration. One of these is the average level of formal education. This variable is fairly easily quantifiable. It is of recognized importance with respect to fertility rates, exploration rate of natural resources, and capital investment.

Because of the foregoing, the quantitative results of Forrester must be taken as dubious representations of reality. On the other hand, Forrester's analysis, from the purely qualitative standpoint can make a positive contribution to our understanding of the nature of the tangle of complexities underlying the environmental crisis. This being the case, World Dynamics is worth reading and careful study by engineers and others interested in human ecology.

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Dynamics World was formed out of several conversations among a group of work colleagues who work with Microsoft Dynamics. It began with a question, who were the most recognisable people in the channel and why? That conversation became our Top 100 list, and it also highlighted the unique histories of the Dynamics products which recently inspired us to create the Timelines. Along the Dynamicsworld.com offers Martial arts supplies including Taekwondo uniforms, karate equipment, sparring gear, Martial Arts weapons, Apparels, Gloves, Training Gear, Nunchaku, at wholesale prices, almost major brands are available with dynamicsworld.com including Macho, Adidas, Nike, Dynamics, CPC, Pine Tree and more. World Dynamics took on modeling the complex interactions of the world economy, population and ecology, which was controversial (see also Donella Meadows and Limits to Growth). Publications.