

"BEYOND THE LIMITS Confronting Global Collapse; Envisioning a Sustainable Future"

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A Critique by C.R. Nixon

Introduction

Beyond The Limits, a 20 year sequel to *The Limits To Growth*, by the principal members of the original team of researchers, should be a **must** read for all who are concerned about the future of life on earth.

Beyond the Limits should receive particular attention from those who misread *Limits to Growth* by ignoring its conclusions, overlooking its caveats, or emphasizing only those aspects of *Limits to Growth* which were counter to 1972 conventional wisdom: unfettered economic growth, the infinite capability of the planet to provide all of the resources that would be required by an exploding human population and the acceptance of all of the wastes that would be generated by it.

The writers, after a further 20 years of observations, research, refinement of their model "World 3", and endless "runs" of the model have come to similar conclusions (quoted below) to those of 20 years ago. They have changed the order of the conclusions, strengthened them, and emphasized that achieving a sustainable future has become both more urgent and more difficult with the passage of time.

The Conclusions

1. Human use of many essential resources and generation of many kinds of pollutants have surpassed rates that are physically sustainable. Without significant reductions in material and energy flows, there will be in the coming decades an uncontrolled decline in per capita food output, energy use, and industrial production."
2. This decline is not inevitable. To avoid it two changes are necessary. The first is a comprehensive revision of politics and practices that perpetuate growth in material consumption and in population. The second is a rapid, drastic increase in the efficiency with which materials and energy are used."
3. A sustainable society is still technically and economically possible. It could be much more desirable than a society that tries to solve its problems by constant expansion. The transition to a sustainable society requires a careful balance between long-term and short-term goals and an emphasis on sufficiency, equity, and the quality of life rather than on quantity of output. It requires more

than productivity and more than technology, it also requires maturity, compassion and wisdom."

The leading conclusion is the first instance where this critique writer has seen an unequivocal, categorical statement, based on analysis rather than subjective appreciation, that some limits for sustainability have been exceeded. A similar statement appears in a book⁵, recently released by UNESCO. It causes one to wonder when there will be enough of a consensus that sustainability limits have been exceeded to give rise to vigorous corrective action, even though it may well be too late to avoid disaster in the "real" world.

The second conclusion indirectly pin-points three culprits: "practices that perpetuate the growth in material consumption and in population", along with the inefficient use of resources and energy. This conclusion, backed up by the analysis, clearly shows that if a sustainable future is to be achieved, these simply-stated but fundamental issues **must** be addressed and with the greatest urgency. Only frustration and a brief postponement of what would seem to be an inevitable apocalyptic collapse of the "real world" system will be achieved by dissipating efforts in directions other than achieving sustainability and by failing to address the growth of material consumption and population, and the inefficient and profligate consumption of resources and energy.

Critique of the third conclusion follows after reviewing the general content of *Beyond the Limits* and the presented results of the runs of the model "World 3".

The Contents

A substantial portion of the book is devoted to providing some fundamental facts and theory relating to *Beyond The Limits*. Several examples are given of where sustainable levels have been exceeded and how the situation could be redressed to become sustainable. Exponential growth receives heavy emphasis as the phenomenon that has caused the levels for sustainability to be exceeded.

It is noted that exponential growth of population and of industrial capital are natural results of the prevailing human

⁵ *Environmentally Sustainable Economic Development: Building on Brundtland*. Edited by Robert Goodland et al. UNESCO, 1991

values and behaviour. whereas depletion of resources, erosion of land, and pollution of all sorts are the induced exponential growths that arise from the exponential growth in population and industrial capital. Rudimentary theory of positive (destabilizing) and negative (stabilizing) feedback in dynamic systems is covered with examples from the world situation. Then attention is given to the different tracks that a dynamic system, such as the global ecosystem, might follow as it experiences induced changes in its operating parameters. These tracks could be: a sigmoid smooth transition from one operating state to the next; an overshoot followed by oscillations before settling to a new steady state; or, an overshoot and collapse as the system self-destructs. Perhaps by emphasizing these fundamentals the *Beyond the Limit* writers hope to educate the layperson and by so doing obviate so much of lack of understanding and the fallacy-based criticism of LTG that occurred 20 years ago.

The Scenarios

Proceeding from these fundamentals, *Beyond the Limits* then presents a series of runs of their "World 3" model with explanations for the performance observed. The starting run is with the continuation of present trends. Successive runs then introduce, one-by-one, new assumptions in the system parameters. Finally, after combining all of the earlier assumptions in the system parameters, there is a run that does produce a sustainable future. A few further runs are presented to show the effect that would have occurred had the changes been applied in 1975 rather than in 1995, had the changes been delayed until 2015, and if the assumed levels of industrial output were higher than those required to achieve sustainability.

The sequence of runs with the new assumptions accumulating for the first eight runs is as follows:

- **Scenario 1.** Continuation of present trends.
- **Scenario 2.** Then add the assumption that there would be double the forecast reserves of resources.
- **Scenario 3.** Add the assumption that pollution control technology would be introduced by 1995 that would reduce world pollution levels to those which existed in 1975.
- **Scenario 4.** Add the assumption that agricultural technology is introduced by 1995 which after a 20 year delay in becoming normal practice would increase food output by 2% per annum beyond that otherwise forecast.
- **Scenario 5.** Add the assumption that land erosion would be reduced by a factor of 3 by new technology starting in 1995.
- **Scenario 6.** Add the assumption that non-renewable resources would be used more efficiency by a factor of 3% per year.
- **Scenario 7.** Add the assumption that all of the technological changes in the foregoing assumptions would take effect with a five year, rather than a 20 year delay.
- **Scenario 8.** Start over with scenario 2 and add the assumption that by 1995 there would be a world wide decision to limit fertility to two children per female.
- **Scenario 9.** Then add the assumption that world industrial output would be constrained to a world wide average standard of living 50% higher than 1990, (only equivalent to an annual per capita income of \$350).
- **Scenario 10. Finally, combine all of the assumptions of scenarios 2 through 9 and the result is a run with overshoot, but without collapse, and with a sustainable future.**
- **Scenario 11.** As with scenario 10, but with the changes starting in 1975 rather than 1995.
- **Scenario 12.** As with scenario 10, but with the changes being delayed until 2015.
- **Scenario 13.** As with scenario 10, but with the levels of industrial output increased in an effort to produce a higher average world-wide standard of living.

All of the scenarios, except for #10, result in an overshoot and eventual collapse as the model of the world self-destructs.

The hope and the promise from *Beyond the Limits* is that, as stated in its third conclusion, it would be possible on an extremely urgent basis to institute essentially an entire new set of human values and characteristics of behaviour, and to implement major (but as yet completely unknown) technological developments, so that a sustainable future could be achieved.

Feasibility of Implementation

A perceptive reader may well conclude that there are several really disquieting considerations that offset such hope and promise this third conclusion offers.

The collection of changes that would be required in human values and behaviour to achieve the only stable scenario, #10, is absolutely mind boggling. For starters, achieving world wide the contraceptive practices required for the two child family, and constraining average world wide standard of living to that of \$350 annual per capita income certainly would be revolutionary. Also of revolutionary proportions would be the rejection of the prevailing system of material allocation by free market forces, or the rejection of vast quantities of jurisprudence based on precedence, or the development of synthetic materials along with the change in consumption habits so as to ensure that renewable resources are not depleted to the point of no return and that non-renewable resources are not exhausted before sustainable al-

ternatives to them are found. Each of the last three examples of the type of change that would be required by the sustainability scenario #10 are, given what we know of human behaviour, beyond the realm of serious contemplation.

If the required changes in human values and behaviour are not frightening enough, just add in the fact that the sustainable scenario #10 also relies on achieving tremendously ambitious or as yet unknown technological changes: in agricultural yields, in reducing land erosion, in pollution abatement, and in the efficient use of nonrenewable resources. Moreover, for these technological changes to achieve percentage annual improvements means that there would have to be a continuing string of increasingly more difficult and complex technological improvements with each passing year. This would require exponential growth of technology where the margins for improvement would be exponentially decreasing - a highly improbable, if not completely unrealistic proposition.

As a further test one's perception of reality, now consider that the changes in human values and behaviour and the improvements in technology must be introduced not even in an optimistic time frame of 20 years but in the unbelievably short period of five years, and that the decisions and programs to implement these behavioral and technological decisions must be made by 1995.

One has to conclude that the changes that would be required to achieve the sustainable scenario (#10) would constitute a revolution more profound and certainly much more rapid than either the agricultural or the industrial revolution. It stretches credibility. It is dreaming in technicolour.

Limitations

The writers of *Beyond the Limits* acknowledge that their "World 3" model is an extremely simplified and probably optimistic representation of the real world ecosystem. It cannot allow for "real world" adaptations that could well occur as humanity faces the increasing problems of exponential growth, exceeding of limits, and world wide instabilities of one type or another. That is, faced with extreme conditions humans may react in manners which have not been seen in human history and which today would seem absolutely unrealistic. Such unpredictable factors obviously cannot be included in the model. The model does not and cannot allow for unique events with long lasting effects, such as a violent volcano throwing up large quantities of dust and thus affecting global climate for a long period. Nor is the model able to take account of global ecosystem linkages that are as yet not well explained. Moreover, although such developments indeed are possible, they would seem like a weak and unreliable safety net for achieving sustainability, and should not be the basis for rational humans to proceed into the future. However, the model has replicated the performance of the past 20 years reasonably well, albeit on the optimistic side.

The experience that *Beyond the Limits* writers have had with the "World 3" model effectively tracking the behaviour of the "real world" suggests that its results should provide some useful indication of what we should expect in the future. Therefore, the results of the "World 3" model should not be dismissed without good reason. It is at least necessary to answer the questions "where does the model not represent the "real world?" and "where is the alternative model that does not suffer from the deficiencies attributed to "World 3".". Until such a model and its associated results are available, the results of the "World 3" model should be taken seriously as a background to policy decisions related to achieving a sustainable future.

A model that was disaggregated by world regions, or by particular types of elements, such as resources, pollution, and land use etc., the results might be different. The difference from the aggregated model "World 3" used in *Beyond the Limits* might be more noticeable on a regional basis. However, it should be remembered that the results of the Mesarovic-Pestel disaggregated Model in "Mankind At The Turning Point" still suggested that there would be difficulty in achieving sustainability. Moreover, the recommendations in that book, albeit generalizations, were not too different from those of *Beyond the Limits*. They concluded that it would take a profound alteration in the system of humanity in order to implement the type and scope of changes that appeared to be required. An update of the Mesarovic-Pestel model similar to that done in *Beyond the Limits* on the "World 3" model would be a most worthwhile undertaking.

Need for Other Models

The results of *Beyond The Limits* certainly suggest that there is a crying need for the development of more complete and representative models of the behaviour of the "real world". Trying to construct policies and programs to avoid exceeding sustainable limits and redressing those instances in which those limits have clearly been exceeded is like "flying by the seat of the pants". If global circulation models can be created which reasonably track global climate change, then surely there is even a greater demand that intellectual effort, money and resources be directed to the derivation of a model of the "real world" which would have a high degree of credibility - one that is acceptable in the community of those experts who are both competent as dynamic modellers, and who are also well versed and experienced in human behaviour and in the social and physical sciences as they relate to the dynamic performance of the "real world".

While there are several passages in *Beyond the Limits* that are particularly trenchant, the following two quotations reinforce the message that achieving a sustainable future is a doubtful proposition and, moreover, it can only be achieved if correct decisions are made without delay.

- p. 136 "All that "World 3" has told us so far is that the model system, and by implication the "real world" system, has a strong tendency to overshoot and collapse. In fact, in the thousands of model runs we have tried over the years, **overshoot and collapse has been by far the most frequent outcome.**" (*emphasis added*).
- p. 208 "According to our computer model, our mental models, our knowledge of the data, and our experience of the "real world", there is no time to waste in easing down below the limits and structuring the information system toward sustainability. Putting off the reduction of throughput and the transition to sustainability means diminishing the options of future generations at best, and precipitating a collapse at worst. There is no time to wait for unmistakable signals, recognizable by everyone everywhere, that force an end to growth. Given the delays in the system, by the time those signals appear, it will be too late to avoid collapse. There is no time to waste, and there also is no reason to waste time."

There are Few Solutions

Having demonstrated quite conclusively that revolutionary changes in human values and behaviour and in technological developments are required, and on a crash timetable, to achieve a sustainable future, the writers of *Beyond the Limits* then fail to come forth with any concrete suggestions as to how this revolution is to be brought about. Such recommendations as there are consist of envisioning the paradigm that would be appropriate for a sustainable future, bringing it about through networking, truth-telling, love and learning. There is no suggestion of policies or programs that would both reduce the basic natural exponential growth factors of population and industrial capital, and/or induce each and every human on this planet to change values and behaviour towards that required for sustainability.

This absence of concrete suggestions towards achieving sustainability is particularly disappointing to the writer of this critique who has attempted to produce just such an approach: *viz.* the concept of energy warrants which was restated recently in these pages. They would be used to reduce industrial through-put while at the same time doing so in a manner which would encourage slower population growth. That paper emphasized the need to involve our educational and religious institutions in advancing the philosophy of the human in a sustainable world ecosystem, and to revise the appropriate disciplines of humanities, physical and social science, engineering and resource allocation to those which would be appropriate for a sustainable future.

The noted conclusions to *Beyond the Limits*, as were those of *Limits to Growth* have the same general message as those in Harrison Brown's *The Challenge Of Man's Future* and the Brundtland report *Our Common Future* With each successive book, the prevailing condition of the planet is presented in more appalling terms, the urgency of the situation becomes more desperate, but each expresses hope for achieving a sustainable future providing more and more dramatic and rapid changes are made in human activities. How desperate must the situation become before the changes required in human values and behaviour, in technological developments, and in the rate at which these changes are required will be assessed, based on the historic record, as being beyond the capacity of human societies?

Parenthetically, go back and reread the two pieces by Rennie Whitehead in recent Newsletters which presented quotes from several successive books over the past 35 years lamenting the state of the world and how with each successive book the conditions have continued to deteriorate and the related exhortations for alleviating changes have become more strident and urgent.

As noted at the outset, *Beyond the Limits* should be read by all who are concerned about the future. It is not another diatribe about the terrible mess that we humans have made and are continuing to make of this planet. *Beyond the Limits* takes this situation as a foregone conclusion and as starting point showing that on many dimensions the limits to sustainability have already been exceeded. More importantly, *Beyond the Limits* explains why this situation has come about and then demonstrates conclusively that it is going to take an incredible set of conditions and timing for a sustainable future to be achieved. *Beyond the Limits* thus should serve all readers as a basis for serious thought about the future prospects for humanity on this planet.

It is suggested in this critique that the *Beyond the Limits* team has done a professional job of modelling, researching and observing. It is further suggested that it will not be feasible to create the conditions which its results indicate are required to achieve sustainability. If these views are accepted, then the only rationale for proceeding to try to correct the situation is that the "World 3" model, although good as far as it goes, does not adequately represent the behaviour of the "real world".

Read *Beyond The Limits*. Study the assumptions and the results. Formulate your own conclusions as to the suitability of the "World 3" model, the results of the model runs, the *Beyond the Limits* conclusions, as well as the credibility of the entire work and particularly the implications of the third conclusion. If your views differ from those in this critique, make the effort to provide for your fellow CACOR members with a different appreciation of the message of *Beyond The Limits* which hopefully will be more optimistic than that which has been presented here.