

GLOBAL POPULATION EQUILIBRIUM: A MODEL FOR THE TWENTY-FIRST CENTURY

by Michael Cavanaugh

Abstract. In his prophetic book *Amythia*, Loyal Rue calls for the construction of bold new myths. Responding to his call in light of scientific arguments for global population equilibrium, this article proposes a model that may function as a surrogate form of myth, one that can motivate our age and future ages. Fortunately, the model is not only powerful but achievable, because policy makers have finally begun to realize how thoroughly the human population impacts on other world dynamics. The problem is reviewed, the relevance of scientific and theological studies bearing on it is shown, and the new model is described. Above all, an effort is made to show how global equilibrium can support Rue's twin requirements for the myth he commissions: namely, a foundation in plausible descriptions of reality, and a compelling normative status.

Keywords: amythia; carrying capacity; global equilibrium; global modeling; models; myth; policy; population; Loyal Rue; worldview.

Systems analysis is a discipline not often encountered in *Zygon*, though the editors have noted its relevance to our science and religion dialogue (Hefner 1994). One aspect of its work especially demonstrates that relevance, namely, global modeling.¹ After noting the interplay between myth and model, I will present a history of modeling, and then I will employ Loyal Rue's work to supply a theological foundation for the conclusions of certain modelers. I will argue that *global equilibrium* is not only good biology, but that it also can support Rue's requirements for myth, with the potential for consolidating contemporary culture by ushering in a new covenant mode of piety.

OF MYTHS AND MODELS

In *Amythia* ("the lack of myth"), Rue decries the fragmentation of Western civilization and traces our malaise to the loss of mythic cohesiveness

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and to widely differing worldviews. He defines *myth* as a “comprehensive symbolic model of the social/physical environment” which can “organize the evaluation of experience and the selection of appropriate action patterns.” This is an excellent definition of myth, but it leaves several questions unanswered. What is the relation of a myth to a worldview? Is a worldview a master myth, as Rue implies? Are there submyths, or only stories, sayings, legends, legal codes, and other mechanisms that somehow serve the master myth (Rue 1989, 45, 89, 51)? Are metaphors part of myths, or is a *root metaphor* itself a myth? Are myths dependent on language, created by language, or is language itself a mythic structure? Must a myth be simple, or is it infinitely complex?

The first contribution systems analysts make to philosophy and theology is to clarify these categories. They speak almost exclusively in terms of *models*, and thus affirm Rue’s basic definition. They simplify subsidiary questions by pointing to three kinds of models, namely, mental, verbal, and mathematical models (Meadows, Richardson, and Bruckmann 1982, xix–xxi, 7–8). All three models can describe the same reality, though each model has particular characteristics. For example, mental models incorporate more subtlety, mathematical models are usually more precise, and verbal models are often most useful. Each model has numerous submodels.

Seen this way, a worldview is clearly a large-scale mental model. It can be reduced to a verbal model, though that verbal model can never be as subtle as the underlying mental—and largely subconscious—model. A myth is one species of the verbal model, which serves to define a culture, because large numbers of people adhere to the same basic model and many of its submodels. This too is consistent with Rue’s conception; he says that myths must represent shared visions and that a culture *is* its myths (Rue 1989, 31).

I shall not delve more deeply into the myth-model relation (see Ramsey 1964; Barbour 1974), but that relation provides a dynamic interface between systems analysis and Loyal Rue’s work; therefore I shall expand the comparison further in a moment, after summarizing the work of global modelers.

A BRIEF HISTORY OF GLOBAL MODELING

Complex systems analysis has its roots in industrial engineering, so it is no surprise to find its story beginning at Massachusetts Institute of Technology. Jay Forrester headed a systems group there, which had already expanded beyond its technological boundaries by the early 1960s. The group started analyzing complex *social* problems after Forrester got into a conversation with the mayor of Boston, and soon systems analysis was employed to analyze complex problems at both local and regional

levels. It turned to global analysis when it was asked to do the work that led to the 1972 classic *The Limits to Growth* (Meadows et al.), which is still an influential model though often criticized; indeed, some of the authors have recently defended and updated the earlier work in a book entitled *Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future* (Meadows, Meadows, and Randers 1993).

In the fifteen years after the original model, six others appeared. They differ in various ways; for example, one targets practical United Nations questions, one emphasizes scientific methodology, and one elevates decision making over mere prediction. Yet all of them take the same basic approach: assimilating data from various geographical regions and sectors of society (agriculture, etc.), massaging the data with powerful computers and programs, and drawing conclusions based on the data. All the groups participate in the International Institute for Applied Systems Analysis (IIASA). So far IIASA has sponsored six global modeling conferences, each focusing on a particular model in order to clarify and improve its methods and conclusions. The conference proceedings are published, but in most cases a less technical book explains the model in lay terms, and the most recent has excellent summaries of the earlier ones (Meadows, Richardson, and Bruckmann 1982, 33–96).

In addition to these general models, several others address specific problems or make projections for specific countries. Of special note is the Complex Systems Research Center at the University of New Hampshire (Gever et al. 1986). Its focus is primarily one commodity, oil, and one country, the United States, but its conclusions are far-reaching and anything but nationalistic.

Although these models disagree in some respects, they present a consistent and sobering picture. For example, there is no consensus on how large a population the earth can sustain, but all agree that population cannot grow forever on a finite planet. They also agree that business as usual will not lead to a desirable future or even to meeting basic human needs. Most of them (especially the New Hampshire and MIT groups) believe we face drastic and pervasive changes unless we make policy decisions to avoid the collision course we are on. If unavoids, that collision is almost certain to produce widespread starvation, disease, and war. Even developed countries will be subject to serious economic disruption.

In a moment I will discuss some recent developments in modeling science. But first we must pause and listen to Loyl Rue's theological ideas, which provide a deep resonating drumbeat for the above conclusions. Indeed, the scientists and the theologian agree on many specific points, which allows us to harmonize their disciplines into a persuasive new worldview.

LOYAL RUE'S THEOLOGICAL PROJECT AS ECHOED IN GLOBAL MODELING

In describing our culture's malaise, Rue avoids harking back to an imaginary golden age. Instead he traces a history of cycles featuring long periods of stable social life, punctuated by amythic periods when society wallows in indecisiveness while struggling to find an acceptable new worldview. He traces specific paradigm shifts in Judeo-Christian culture; these paradigms are *modes of piety* connected only by loose social structures and by the powerful idea of covenant. One is reminded of the family ax, which has had two heads and six handles, yet is somehow the same ax; it is the ongoing *relationship and usage* that give continuity, and not a rigid adherence to a changeless myth.

Interestingly, Rue's diagnosis is widely affirmed by otherwise divergent groups. Fundamentalists and liberals, Democrats and Republicans, academics and laypersons, scientists and humanities scholars, all bemoan our lack of unity and the fragmentation of religious and civil life. The liberal vision includes much more diversity than the conservative vision does, but liberal theologians such as Rue² are clearly in agreement with conservative citizens in the desire for a basic unity. It even seems fair to say this is one place where C. P. Snow's "two cultures" (1965) stand on the same soil; almost everyone yearns for more safety and integrity than we seem to have, and almost everyone agrees that we need enough basic agreement about our moral and philosophical underpinnings to avoid the worst consequences of disagreement.³

Rue's cure will not be as widely accepted as his diagnosis is, but *Zygon* readers will see it as worthwhile because it affirms both science and religion. Rue calls for a new myth characterized by the twin requirements of (1) a plausible cosmology and (2) a persuasive morality based on that cosmology. Specifically, he suggests evolution as the *root metaphor* out of which any proposed myth would have to emerge. Above all, Rue interprets both biology and theology as mandating *community*, the one because community is inherent in our nature and the other because community is critical to mythic cohesiveness.

We are now in a position to point out at least four major points of agreement between Rue and the global modeling scientists:

1. Rue's emphasis on amythia's transitional confusion echoes the modelers, who agree that "over the next three decades the world socioeconomic system will be in a period of transition to some state that will be, not only quantitatively but also qualitatively, different from the present" (Meadows, Richardson, and Bruckmann 1982, 15–16; quotes below from same pages). Although the breakup of the former Soviet Union partially fulfilled this prophesy, the modelers anticipate even more dramatic changes.

2. His insistence that worldviews contribute powerfully to constructing a just society dovetails the modelers' conclusion that ". . . needs are not being met now because of social and political structures, *values, norms, and world views* . . ." (emphasis mine).

3. His belief that we need a plausible cosmology is matched by the modelers, who all agree that "Many plans, programmes, and agreements, particularly complex international ones, are based upon assumptions about the world that are either mutually inconsistent or inconsistent with physical reality."

4. His belief that community is better than competition is almost precisely restated by the modelers, who say "Cooperative approaches to achieving individual or national goals often turn out to be more beneficial in the long run to all parties than competitive approaches."

These points of agreement serve as the cornerstones of a new vision of the world's future, which is consistent with both Loyal Rue's call for a new myth and with the projections made by global models. Let me now present that vision.

THE NEW VISION: GLOBAL POPULATION EQUILIBRIUM

Although the most recent IIASA conference report listed twelve significant agreements among the modelers, I acknowledge that some of them would disagree with the proposal below.⁴ Nonetheless, the more persuasive models and those that look into the middle of the twenty-first century agree on a very basic point, and that is the need for stabilizing the size of the human population. The MIT and New Hampshire groups are quite explicit: unless we stabilize our population, the world will face serious problems before the year 2050. The graphs from the New Hampshire study are particularly strong: even if we discover major new energy sources and greatly enhance food yields, those breakthroughs will only buy time, and not much of that, unless we do something about the population.

The MIT group presented population equilibrium as a galvanizing goal for humanity in 1971, and its *theological* basis began to take shape about the same time as part of ecotheology.⁵ Loyal Rue was not the first such theologian, but his formulation fills in the details of the equilibrium concept, so that it becomes not only a compelling biological model but a major myth for natural theology, yielding the following progression of ideas:

1. Biology is central to any plausible worldview. Humans evolved in the context of earth's environment, and it is thus impossible to construct a sound theology without incorporating biological concepts. This is of

course consistent with the conclusions of many theologians (including Peacocke 1986; Hefner 1993; Kaufman 1993; see also Cavanaugh 1995).

2. Humans evolved as a social species that survives by cooperation. There may be innate prejudices in favor of kin, but we also evolved rationality, which expands our cooperative urges through economic, religious, and other cultural institutions. The details are being explored by sociobiology, which several philosophers and anthropologists view as crucial for explaining the culture-biology interplay (see Ruse 1985; Irons 1991).

3. Until recently one could depend on local models and myths, but reality has changed, and modern models of human cooperation must depict the whole world as a unit, with biological and cultural *diversity* built into the model as critical components of the unit's vitality.⁶

4. Equilibrium will eventually come whether we want it or not, through either biological disaster or rational planning. Rational planning is better, and "policy changes made soon are likely to have more impact with less effort than the same set of changes made later" (Meadows, Richardson, and Bruckmann 1982, 15).

5. The ancient concept of *covenant* serves as an excellent foundation for the global equilibrium model of human cooperation. Covenant always rested on each age's science (as Rue documents), and in our age science undergirds the need for global community. Thus, a new covenant of equilibrium would conjoin cosmology with morality, just as Rue requires.

Global equilibrium has advantages not mentioned above, which further support Rue's analysis. For one thing, it can be grasped at many levels, from the simple to the complex. Peasant farmers easily grasp the concept of carrying capacity once it is taught to them, and carrying capacity is the central concept of global equilibrium (Randers and Meadows 1973). At the other end of the scale, subtle theoreticians and economic analysts can see the same model from an infinitely more complex perspective. In between, policy makers can use global equilibrium as a guiding goal of statesmanship. Indeed, one of the global models operates specifically to help world leaders make informed decisions.

This mention of world leaders gets us into practical questions. Global equilibrium sounds good, but is it feasible?

POLICY ISSUES

The problems facing our generation go beyond scare stories. Granted, they make excellent fodder for charitable solicitations,⁷ and talk show

hosts make a living laughing at contradictory models. But sober civil servants and statesmen take those models seriously, searching desperately for ways to avoid disaster. It is clear to them that something must be done; the question is what?

I mentioned that one global model is associated with the United Nations. That is the Leontief model headed by the Nobel laureate who invented input-output analysis, and it is still being used today. Another model (the World Integrated Model) is tailored to demonstrate likely outcomes from alternative policy proposals, and world leaders are using the model to make decisions about such policies as tariffs and foreign aid. It is true that President Ronald Reagan terminated IIASA support, but President George Bush reinstated it, and the U.S. Congress has confirmed its status as a crucial resource in making informed policy decisions (Pry 1990).

As modeling moves away from general models toward more particularized ones, its skills are increasingly employed to answer specific economic, population, and environmental questions. The nationalistic implications are obvious, and although the current U.S. administration is relatively sensitive to population and environmental issues, one cannot help but acknowledge that it is local *economic* issues that are most important to policy makers at a hardheaded practical level. Therefore a new development within mainstream economics is of special note.

Over the last several years classic Keynesian economics has intersected the ideas of Leon Walras to produce the doctrine of General Equilibrium Theory (GET) (Sebastiani 1992). Though often used to construct local or regional strategies, GET models also are routinely applied to the global economy.⁸ Interestingly, the emerging consensus is just what one would expect from the modelers above, and just what one would hope from reading Rue's theological analysis. It is that "a rising tide lifts all boats" (Phelps 1994). In other words, it is becoming clear that any country (and specifically the United States) is better off by cooperating than by competing, at least insofar as competition means cutthroat competition. This is even more true when long-range perspectives are considered, as they must be in any sophisticated economics. Thus, even apart from moral arguments for cooperation, countries ought to cooperate in furtherance of their own selfish interests—the practical *is* almost completely overlaps the moral *ought*. If there is any boundary at all between the *is* and the *ought* in this situation, it is further obscured by Rue's analysis (1989, 46) of the relation between morals and myths.

General Equilibrium Theory is not yet gospel among mainstream economists, but it is quickly becoming so. Cambridge University is one perennial leader in economic theory, and it has bet the farm on equilibrium theory. Indeed, the crescendo of its recent publications shows

clearly that GET is firmly in place (Shoven and Whalley 1992; Bicchieri 1993; François and Shields 1994), and first-rate economists clearly realize the need for broadening economic analysis to include social dynamics (Morishima 1992, 202–3). That means global equilibrium will increasingly come to articulate the views not only of general modelers and forward-thinking theologians; it also will speak for businesspersons and partisan politicians, social scientists and engineers, laypersons and academicians.⁹ Even the most unsophisticated citizens of Third World countries have begun to realize the personal and social importance of keeping their own reproductive tendencies in check, and they already *want* to do it, given accurate information and clear alternatives (Bongaarts 1994; Piel 1994).

THE ROLE OF RELIGION

The original modelers understood religion's relation to population dynamics. Although they did not work out a complete theology, Forrester wrote a paper in 1972 entitled "Churches at the Transition between Growth and World Equilibrium."¹⁰ But in the years since then, there has not been much reason to believe churches would take up the cause of equilibrium. Indeed, fundamentalism has gained new energy during that time and has joined itself with conservative commentators who are against environmental conservation, against diversity, against population control, and against world cooperation.

That is why Rue ends *Amythia* with a ringing call for science-literate laypersons to get back into church. Since such people have always led the way to adopting new worldviews, they could help mainstream churches accept and preach the new vision as a prophetic model of our future. Forrester argued that churches stand in a good position to urge society toward *long-range* values, and Rue's insistence on the biological foundation of those values is underscored by such works as George Pugh's classic *The Biological Origin of Human Values* (1977). Those values must be expressed in both governmental and religious institutions, and the modelers add a keen awareness of the need for a worldwide perspective.

This synthesis of theology with modeling science has the potential to influence religion in another way: by stimulating a reinterpretation of classical doctrines. Thus, sin must be seen as a failure to respect communal needs, stewardship must be taken as a global command to protect diversity, Jesus' broad notion of *neighbor* must be constantly reiterated. The traditions of other cultures must be reinterpreted in similar ways, to render the underlying model both accessible and palatable to everyone, to the end that the motivating myth will be a shared one. Above all, we must all be able to reaffirm our roots and yet nourish them with the new

conception of global equilibrium in order to grow toward a more complete community than we have ever reached before.

CONCLUSIONS AND CAUTIONS

Global Population Equilibrium is an idea whose time has come. It is sound biology, and it can powerfully motivate our communal urges as expressed in theology and governmental policy. Workers of every discipline—artists, ministers, philosophers and theologians, politicians, businesspersons, health professionals, teachers, farmers, mothers, and the man or woman on the street—can all tap into it as a model, as a guide for action, as a harbinger of a new world order with the potential for shared prosperity and meaning. This is not to say, of course, that global equilibrium is a panacea. Humans have other problems besides those caused by population pressures, and although a stable population would greatly alleviate the pressures that lead to war, to environmental degradation, and to economic injustice, it can only provide the physical foundation for achieving human values. Legal, moral, and other cultural encouragements and admonitions will continue to be necessary even after global equilibrium is achieved.

Nor is Loyal Rue's conception perfect. Indeed, he adds certain unnecessary and gratuitous conclusions that must be modified in order to avoid cracks in the theological foundation his work provides. I will list two such modifications in closing.

Rue suggests the necessity of a one-world federation (1994), but that argument is belied by the work of GET theorists (one of whom calls his construct "competitive" equilibrium: Ellickson 1993), and it also is contrary to basic biological theory. We evolved with a *tension* between selfishness and cooperation, and that tension must be reflected in our institutions and theology. While Rue avoids the fallacy of equating adaptivity with selfishness, he runs the danger of going to the opposite extreme by trying to fit humans into a straitjacket of cooperation. We should instead use our evolved brains to coordinate and balance competitive and cooperative urges in light of actual situations. The next century may well see a return to nationalism (as one veteran modeler predicts; Hughes 1994), and if it does, global equilibrium will be even more important, requiring independent nations to address worldwide problems through cooperative agreements (Thurow 1996).

Second, whereas *Amythia* seemed committed to the search for objectivity (at p. 106, for example), Rue's latest book, *By the Grace of Guile* (1994), more readily accepts the notion that meaning is what we make it. The two views can be harmonized, I think, by employing the traditional doctrine of *humility*. I have elsewhere reviewed the need for a humble objectivity (1994), and there is certainly no room for dogmatism in the

present discussion—nobody is sure just how large a population the earth can support, and nobody can foresee the nature or scope of the changes we face. Listening to one another will be required, but more important, we must be listening to reality—to our understanding of human nature and to the interplay of that nature with available resources. The challenge is not to create an artificial meaning but to find the natural meaning that already resides in our natures in the context of our home on earth. That is the message of *Amythia*, and I do not believe Rue means to change it in the newer book.

Incidentally, global modelers are among the most humble of scientists. This is exemplified by the title of the Meadows, Richardson, and Bruckmann book *Groping in the Dark*, by its opening parable (which requires modelers to search where hard issues lie), and by its fervent acknowledgment of Thomas Kuhn's insights (Meadows, Richardson, and Bruckmann 1982, xii, xiii, 22; see also Kuhn 1962).

Finally, humility requires a self-imposed criticism of the model proposed above. One must always be cautious of single solutions to complex problems (as we are warned, for example, in Huss-Ashmore and Katz 1989), and we must not interpret *global population equilibrium* too narrowly. Specifically, it must not take the place of broader issues such as biological and cultural diversity; indeed, it must be interpreted within their context. Yet models get power from a narrow focus, and the single strategy of stabilizing human population would also enhance diversity, by relieving our unrelenting assault upon it.

Even as modified by these corrections and cautions, the work of complex systems scientists is powerfully supported and extended by Loyal Rue's work, to establish *global equilibrium* as a new model that is scientifically sound and theologically compelling. Economics and government are joining science and theology to flesh out the theoretical and practical details of that model, so that it will increasingly become a necessary and even optimistic goal for the twenty-first century.

NOTES

1. Complex systems analysis also explores other areas that are relevant to the science-religion dialogue, such as the nature of thought, the process of negotiating social space, and the use of conventions. See Dyke 1988.

2. See also Eaves and Gross 1992, 264–67; Gilkey 1989; Midgely 1983, 528–32.

3. Some deconstructionists might not agree, but even they seem to say such unity is desirable insofar as we can persuade one another to cooperate. See Feyerabend 1988, 260–61; Rorty 1991, 175–96.

4. *Philosophical* objections also have been registered. For example, see Walter 1981.

5. Early writers that come to mind are White (1967), Passmore (1974), and Gustafson (1983).

6. For a fascinating history of socioeconomic dynamics, see Johnson and Earle 1987. For an analysis of our economic future in the same vein, see Thurow 1996.

7. It is remarkable how many nonprofit organizations are working to get the message out, including ZPG (Zero Population Growth), NPG (Negative Population Growth), Population Communications International, and Planned Parenthood. Their fund-raising materials still

include a fair share of gloom and doom, but my sense is that they have lately taken a more optimistic turn.

8. At a technical level these new models incorporate such enhancements as fuzzy logic, the equilibrium of uncertainty, and artificial adaptive agents, using CRAY supercomputers and Connection Machines (massively parallel supercomputers). See especially Costanza et al. 1993 and Billot 1992.

9. Among the disciplines not mentioned in the text which contribute to our understanding of equilibrium dynamics are those that incorporate game theory. See Axelrod 1984 and Friedman 1994.

10. Forrester published this paper not only in Meadows and Meadows 1973 but also in *Zygon*, so my opening sentence does not mean the journal is a stranger to complex systems analysis.

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