

# The Olduvai Theory

## *Toward Re-Equalizing the World Standard of Living*

BY RICHARD DUNCAN

### ABSTRACT

This study is based on (1) historic population and energy data from 1965 to 2008 and (2) backup studies by several scientists. The Olduvai Theory is explained by disaggregating the World into the U.S., the Organisation for Economic Co-Operation and Development (OECD) nations, and the non-OECD nations standards of living (SL). The U.S. SL peaked in 1973 (Figure 1). The World SL rapidly increased from 2000 to 2007 (Figure 2). This increase was caused by just a few non-OECD nations (Figure 3). The OECD SL peaked in 2005 (Figure 4). The Olduvai Theory shows each SL curve trending toward the same average SL value that the World had in 1930 (Figure 5).

### Introduction

The Olduvai Theory is defined by the rise and fall of the World standard of living. The main population data are from OECD (2008) and the main energy data are from *British Petroleum Statistical Review of World Energy* (2008). The Olduvai Theory is quantified by dividing World population (P) into World energy consumption (E):  $SL = E/P$ .<sup>1</sup>

In June 2008 I was pressed to explain the *rapid rise* in the world standard of living from 2000 to 2007. The cause turned out to be the rapid rise of the standard of living in just a few of the 165 non-OECD “underdeveloped” nations, namely China, India and Brazil. In contrast the standard of living of the thirty OECD “developed” nations peaked in 2005 and has since declined.

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Population and energy data from 1965 to 2007, OECD data for 2008 and early 2009, and OECD projections to 2010 are the basis for a scenario toward re-equalizing the world standard of living from 2008 to 2030.

The following backup studies are referenced, quoted, and discussed below:

1. M. King Hubbert presented an Olduvai-like hypothesis to the American Association for the Advancement of Science (AAAS) Centennial Conference in 1948 and published it in *Science* in 1949.
2. Jay W. Forrester in 1971/1973 used feedback modeling to show the likelihood of overshoot and collapse of the World ‘STEP’ system.
3. Walter Youngquist (advance copy of *GeoDestinies*, 2009) describes the grave problems resulting from U.S. and World population growth coupled to the depletion of earth resources.

### Three Geo/STEP Scientists

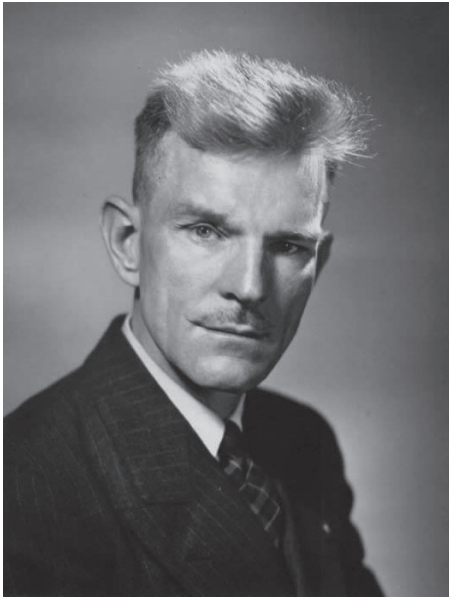
This section highlights how a geophysicist, a systems scientist, and a petroleum geologist view the past and project the future of industrial civilization.

M. King Hubbert (1903-1989), geophysicist and Professor Emeritus, Columbia University, gave an invited presentation to the Centennial Conference of the (AAAS) in 1948 titled “Energy from Fossil Fuels.” In it he sketched and discussed an Olduvai-like scenario. His presentation, excerpted below, was published in *Science*, 1949.

### Human Affairs in Time Perspective

The present state of human affairs can best be appreciated in the light of a time perspective, minus and plus, of some tens of

thousands of years from the present.... On such a time scale the phenomena we have discussed are represented by abrupt, nearly vertical rises from zero or near zero to maximum values. The consumption of energy from fossil fuels is thus seen to be but a “pip,” rising sharply from zero to a maximum, and almost as sharply declining, and thus representing but a moment in the total human history.



M. King Hubbert

Likewise, the consumption of energy per capita..., after having risen very gradually from 2,000 to possibly 10,000 kilogram calories per day, is seen to increase suddenly to a maximum value of several times the highest previous value. Again it is physically possible to maintain a high value... on a stable basis for an indefinite period of time from current energy sources, particularly direct and indirect solar radiation. It is also possible, however, that through cultural degeneration this curve may decline... to the subsistence level of our agrarian ancestors.<sup>2</sup>

Viewed on such a time scale..., the curve of human population would be flat and only slightly above zero for all preceding human history, and then it too would be seen to rise

abruptly and almost vertically to a maximum value of several billion. Thereafter, depending largely upon what energy supplies are available, it might stabilize at a maximum value...or more probably to a lower and more nearly optimum value.... However, should cultural degeneration occur so that the available energy resources should not be utilized, the human population would undoubtedly be reduced to a number appropriate to an agrarian existence....

These sharp breaks in all the foregoing curves can be ascribed quite definitely, directly or indirectly, to the tapping of the large supplies of energy stored up in the fossil fuels. The release of this energy is a unidirectional and irreversible process. It can only happen once, and the historical events associated with this release are necessarily without precedent, and are intrinsically incapable of repetition.

It is clear, therefore, that our present position on the nearly vertical front slopes of these curves is a precarious one, and that the events which we are witnessing and experiencing, far from being “normal,” are among the most abnormal and anomalous in the history of the World. Yet we cannot turn back; neither can we consolidate our gains and remain where we are. In fact, we have no choice but to proceed into a future, which we may be assured will differ markedly from anything we have experienced thus far.

—M. King Hubbert,  
*Science*, 1949, pp. 103-109



Jay W. Forrester, electrical engineer, computer scientist and Professor Emeritus, Sloan School of Management, MIT, has a remarkable record of innovations and applications in both hardware and software. This essay focuses on his groundbreaking book, *World Dynamics* (1971/1973), wherein he uses feedback control theory to model the World STEP system.

## The World Situation

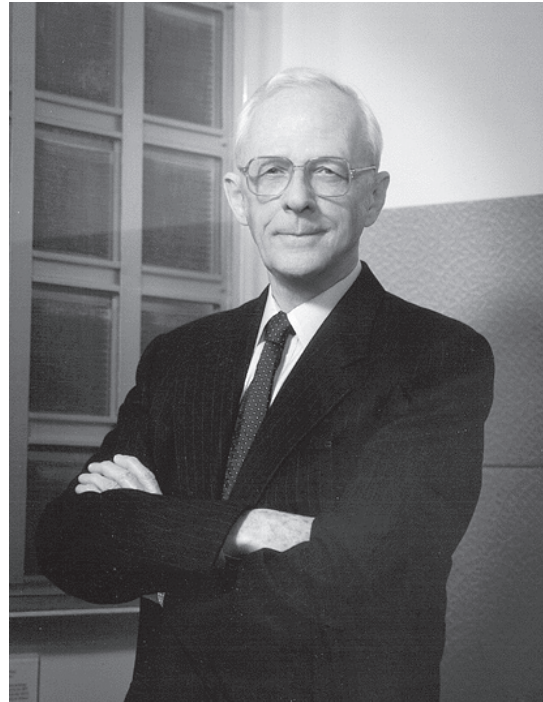
Many global attitudes and programs seem to be based on accepting future growth in population as preordained and as the basis for action. But, if we make provision for rising population, population responds by rising. What is to stop the exponential growth? This book describes the circular processes of our social systems in which there is no uni-directional cause and effect. Instead, a ring of actions and consequences close back on themselves. One can say, incompletely, that population will grow and that cities, space, and food must be provided. But one can likewise say, also incompletely, that the provision of cities, space, and food will cause population to grow. Population generates the pressures to support growth of population. But supporting the growth leads to more population. Growth will stop only in the face of enough pressure to suppress the internal dynamic forces of expansion.

Many programs—for example the development of more productive grains and agricultural methods—are spoken of as “buying time” until population control becomes effective. But the process of buying time reduces the pressures that force population control.

Any proposed program for the future must deal with both the quality of life and the factors affecting population. “Raising the quality of life,” means releasing stress, reducing crowding, reducing pollution, alleviating hunger, and treating ill health. But these pressures are exactly the sources of concern and actions that will control total population to keep it within the bounds of the fixed world within which we live. If the pressures are relaxed, so is the concern about how we impinge on the environment. Population will then rise further until the pressures reappear with an intensity that can no longer be relieved. Trying to raise quality of life

without intentionally creating compensating pressure to prevent a rise in population density will be self-defeating. Efforts to improve quality of life will fail until effective means have been implemented for limiting both population and industrialization.

Without effective legal and psychological control, population grows until stresses rise far enough, which is to say that the quality of life falls far enough, to stop further increase.



Jay W. Forrester

Everything we do to reduce those pressures causes the population to rise farther and faster and hastens the day when expediences will no longer suffice. People are in the position of a wild animal running from its pursuers. We still have some space, natural resources, and agricultural land left. We can avoid the question of rising population as long as we can flee into this bountiful reservoir that nature provided. But the reservoir is limited. Exponential growth cannot continue. The wild animal flees until he is cornered, until he has no more space. Then he turns to fight, but he no longer has room to maneuver. He is less able to forestall disaster

than if he had fought in the open while there was still room to yield and to dodge. The world is running away from its long-term threats by trying to relieve social pressures as they arise. But, if we persist in treating only the symptoms and not the causes, the result will be to increase the magnitude of the ultimate threat and reduce our capability to respond when we no longer have more space and resources to invade.

What does this mean? Instead of automatically attempting to cope with population growth, national and international efforts to relieve the pressures of excess growth must be reexamined. Many such humanitarian impulses seem to be making matters worse in the long run. Rising pressures are necessary to hasten the day when population is stabilized. Pressures can be increased by reducing food production, reducing health services, and reducing industrialization. Such reductions seem to have only slight effect on quality of life in the long run. The principal effect will be in squeezing down and stopping the runaway growth....

The long-term future of the earth must be faced soon as a guide for present action. Goals of nations and societies must be altered to become compatible with that future, otherwise man remains out of balance with his environment. Man can do vast damage first, but eventually he will yield to the mounting forces of the environment. Can the traditions of civilization be altered to become compatible with global equilibrium?

—Jay W. Forrester,  
*World Dynamics, 1973, pp. 123-125*



Geologist Walter Youngquist draws from his experience in living and working abroad. His travels include some 70 countries to observe the vital relationship of population to available earth resources. He is particularly concerned about continuing population growth against declining both nonrenewable and renewable resource bases—

fertile soil and fresh water being examples of the latter.

### **Selections from the Introduction, advance copy of *GeoDestinies***

We are relative latecomers on the scene, and the Earth existed for several billion years very well without us. But [from] our arrival and our development of culture to the technological age in which we now live, in a very brief time we have had an impact on the earth beyond what any other organism has ever had. We therefore live in a unique, and what is likely to be a very brief time in human history. Some of us have been very fortunate to live in these times near or at the top of the pyramid of technological and medical advances. But we are at the same time living at a great turning point in Earth and human history.

It is apparent that current political, economic, and social efforts are to keep things as they are—not to change. People in developed countries do not like changes in their lifestyles...if they believe they are good now. But changes come and are unavoidable....

As much as the future changed during [a period] less than my lifetime, the future of most of those reading this book will surely be equally or more changed from what [it] is [in] the present. Successfully adjusting to a different future from what has been enjoyed [for] at least some the past few hundred years is the challenge lying now directly ahead....

In earlier centuries, with many fewer people, these Earth resources were exploited only very slowly and in minor amounts. But within the past few hundred years, with the arrival of the Industrial Revolution,...the rate and volume of resource exploitation [have] greatly increased. It was the use of these resources that has been the base for the rise of our present civilization, allowing some segments of society to achieve...a



standard of living never before imagined.

Accompanying this rise in standard of living has been a huge increase in population, from an estimated 610 million in 1700 to the current approximately 6.7 billion. This has been a truly astounding event made possible chiefly by three factors: great medical advances including sanitation, the widespread use of high energy density fossil fuels, and the use of these fossil fuels to greatly enhance agricultural production.

[It] is the huge rise in population and related increased Earth resource consumption... that is probably the salient fact of these truly remarkable recent few centuries.

But these materials...can be extracted and used only once.... Can we continue to maintain the present high standard of living for some of us, by using truly renewable Earth resources...instead of an inheritance from the past?

Much of the discussion in the following chapters is related to stress on Earth mineral and energy resources, and stress on the environment from population growth. Equally and perhaps more important...are social stresses resulting in part from depletion of resources, such as water supplies and fertile soils...and resulting food shortages causing riots. Also population is growing... faster than are jobs.... Until recently, the outlet for stress from a growing population was migration...but this outlet no longer exists....

Even the United States, the United Kingdom, and European countries may show stress in several ways, including generally rising unemployment, and antagonism toward immigrant labor....

One fact is abundantly clear: we have already exceeded the permanent carrying capacity of the Earth, and the number one problem is to reduce population in an orderly fashion to fit into the new renewable resources paradigm....

[Nearly] all governmental leaders worldwide are committed to keeping and expanding the present agendas of resource consumption...with the rallying cry of “sustainable economic growth.” The underlying basic problem of population growth is rarely addressed—absent from most political agendas as being “politically incorrect.”

[Growth] based upon continuing to exploit the finite resources of the Earth is not possible. Yet this is the current basis of the world’s developing and developed economies.... We need to be...self-sufficient, dependent on resources from local economies,...for this has to be a part of any sustainable future....

History is informative and gives us a perspective on how we came to where we are today. But it is the future in which you will live and the future is “not what it used to be.” But it is now arriving...bringing with it more than 190,000 people each day to live on depleting resources....

It is the purpose of this volume to provide a perspective on the past, but more importantly provide a possible and hopefully a fairly realistic view of what the future may hold...., [namely] that on this finite earth high consuming societies are eventually going to be relegated to being an [artificial] of history....

Our modern, developed societies tend to be removed, by their present degree of affluence, from the environment as the basis for our existence. Food comes from the supermarket, clean water comes from the faucet. But the closer people live to the margin of existence, the more they realize the vital importance of fertile soil, and safe drinking water....

How we try to navigate the choppy waters to the future, will determine to a large extent when and in what condition we will arrive to the new land of sustainable renewable

earth resources.... The continued almost inevitable growth of population...against the depletion of earth resources combine to form the main challenge before us....

Those who will be living at the end of this century will see much of this land of the future come into view, but even there and then as now, earth resources will continue to be the base for human existence and will inevitably exert final control over the destinies of nations and individuals. We are made of Earth materials, and its biological products, and on these we survive. To continue to negatively impact our environment is a form of suicide. "Mother Earth" is not an abstract concept but very much a reality, for from Earth we came, on it we depend for our existence....

—Walter Youngquist, *advance copy of GeoDestinies, 2009*

**The American Example**

*Obvious Responses Will Not Suffice*

The dynamic characteristics of complex social systems frequently mislead people.... [Urban policies for example] are being followed on the presumption that they will alleviate the difficulties.... In fact, a downward spiral develops in which the presumed solution makes the difficulty worse and thereby causes re-doubling of the presumed solution so that matters become still worse.

The same downward spiral frequently develops in national government and at the level of world affairs. Judgment and debate lead to programs that appear to be sound. Commitment increases to the apparent solutions. If the presumed solutions actually make matters worse, the process by which this happens is not evident. So, when the troubles increase, the efforts are intensified that are actually worsening the problems.

—Jay W. Forrester, 1973, pp. 93-94

Figure 1 (below) shows the U.S. standard of living (SL) during 42 years. Evidence in Figure 1 shows that the standard of living in the United States grew dramatically from 1965 to its all-time peak in 1973. Then, after an erratic 21 years, it went into an accelerated decline from 2000 to 2007. Moreover, recent data show that the decline accelerated in 2008 and into 2009. Details follow.

*Growth–Peak–Decline:* From 1965 to 1973 the U.S. standard of living surged and reached its all-time peak in 1973. This was followed by a dip-and-rebound from 1973 to 1979. Then from 1979 to 1983 came a precipitous plunge wherein the U.S. standard of living fell by 14.5 percent (8.92 boe/c) in 4 years. A rough recovery came from 1983 to a high in 2000. Then from 2000 to 2007 the U.S. standard of living declined by 4.1 percent (2.46 boe/c) in 7 years.

*Historical correlations:* The U.S. SL grew swiftly during low energy prices from 1965 to 1973. Then in 1973-74—correlated with an Arab-Israeli

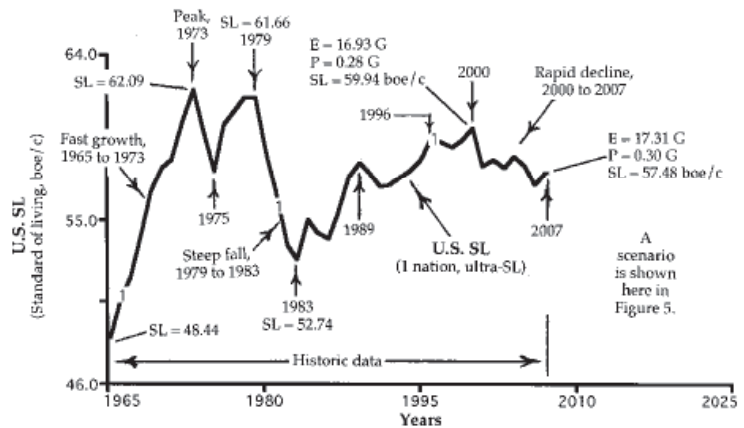


Figure 1. Archetype America: The U.S. Standard of Living

war—several OPEC nations banded together and refused to export oil to the U.S. Next in 1979 came the fall of the Shah of Iran—reputedly a “puppet” of the U.S—accompanied by a steep rise in the price of oil and a plunge in the U.S. standard of living from 1979 to 1983. This was followed by an erratic struggle wherein the U.S. standard of living reached a brief high in 2000. Then, beginning with the Dot.com bust, came the ominous decline from 2000 to 2007.

*U.S. population vs. energy:* The U.S. population grew from 211,909,000 in 1973 to 301,104,000 in 2007—an increase of 42.1 percent or 89,231,000 people in 34 years. At the same time U.S. energy consumption lagged at 31.6 percent. The net result was that the U.S. standard of living fell by 7.4 percent from 1973 to 2007.<sup>3</sup>



The United States annually takes in more immigrants than do all other nations combined. Somalians now live in Minnesota. Sudanese live in Kentucky. Medicaid is received by 14.8 percent of households headed by Americans, and 24.2 percent by households headed by immigrants. Many compassionate Americans feel that it is our duty to take in more and more immigrants. However, at the current rate of approximately 2.5 million a year, this accounts for only 3 percent of the 80 million people added to world population annually. The United States cannot continue to act as a safety valve for even a small portion of world population growth. Very near the U.S., Haiti has 9-million people living in an area smaller than Malheur County, Oregon. Haiti is on international food welfare. We ship food to Haiti, which simply results in more Haitians to whom to ship food next year. More than 27 countries now exhibit this same circumstance. Population is a homegrown problem, and it must be recognized and solved at home, without exporting it. As Garrett Hardin noted, “There is nothing more dangerous than a shallow-thinking compassionate person.”

—Youngquist, advance copy of *GeoDestinies*, 2009, Ch. 20

**The Olduvai Theory: Background**

The fifth revolution will come when we have spent the stores of coal and oil that have been accumulating in the earth during hundreds of millions of years...it is obvious that there will be a very great difference in ways of life...a man has to alter his way of life considerably, when, after living for years on his capital, he suddenly finds he has to earn any money he wants to spend.... This change may justly be called a revolution, but it differs from all the preceding ones in that there is no likelihood of its leading to increases of population, but even perhaps to the reverse.

—Charles Galton Darwin, 1953, p. 52



Charles Galton Darwin

The similarities and differences in the shape of the Olduvai/World curve in Figure 2 (below) are compared to the shape of the U.S. curve (Figure 1, previous) as an aid to understanding both.

Note well Figure 2 vis-à-vis Figure 1: (1) Both the world standard of living and the U.S. standard of living grew strongly from 1965 to 1973: 27.8

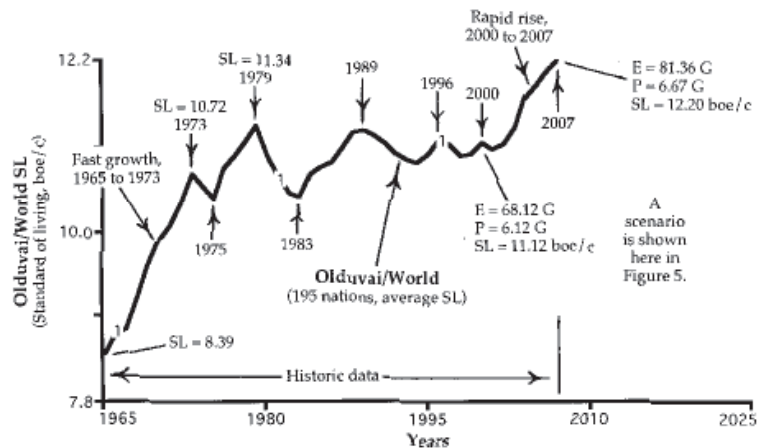


Figure 2. Olduvai/World Average Standard of Living



percent for the World standard of living and 28.2 percent for the U.S. standard of living. (2) Compare the ups and downs in each curve from 1979 to 2000 wherein there was a *net decline* in each curve: 1.9 percent decline in Figure 2 and 2.8 percent decline in Figure 1. (3) In contrast, the two curves differ markedly from 2000 to 2007: the World SL *increased* by a strong 9.7 percent while the U.S. SL *decreased* by 4.1 percent.

The strong correlation between the Olduvai/World standard of living and the U.S. standard of living from 1965 to 2000 is evidence that the same events must have influenced both curves during these 35 years. So we ask, “What likely caused the noted difference between the two curves from 2000 to 2007?” This question is discussed and answered in the next two sections.<sup>4</sup>



There is coming this century, in places, already here, an inevitable collision between resources available on a finite Earth and rising population demands from both growth and hopes for a more affluent existence.

—Youngquist, *advance copy of GeoDestinies, 2009, Ch. 33*

In 1972 the presidential appointed Rockefeller Commission was to examine the future well being of the United States. At that time the U. S. population was approximately 207 million, and the Commission reported they could see no advantage in having more people. But in 2009 the U. S. had 307 million and still growing.

Albert Bartlett [professor emeritus of physics, University of Colorado] has stated: “Can you think of any problem, on any scale from microscopic to global, whose long-term solution is, in any demonstrable way, aided, assisted, or advanced by having larger populations at the local level, the state level, the national level, or globally?”

Looking inevitably toward a renewable resource-based future, present population has already exceeded the carrying capacity of

the Earth, but by 2050 another 2.5 billion are projected to be here. The worldwide number one problem is population, for, as is the motto of one environmental group, “Whatever your cause is, it is lost without population control.”

—Youngquist, *advance copy of GeoDestinies, 2009, Ch. 20*

## OECD SL and Non-OECD SL

### *OECD Composite Leading Indicators Reach New Low*

The OECD composite leading indicators (CLIs) for January 2009 continue to point to a weakening outlook for all the major seven economies, with the OECD total falling again to a new low and little clear indication of stabilizing soon. The outlook has also continued to deteriorate in the major non-OECD member economies.... The CLI for the OECD area in January... was 9.1 points lower than in January 2008. The CLI for the United States in January... was 10.8 points lower than a year ago.... The CLI for China in January 2009... was 14.8 points lower than a year ago. The CLI



Albert Bartlett

for India in January... was 9.6 points lower than in January 2008. The CLI for Russia... was 19.4 points lower than a year ago. In January 2009 the CLI for Brazil... was 10.1 points lower than a year ago. OECD (2009b)



By most accounts there are 195 nations (countries) in the World. The OECD comprises the 30 “developed” nations and the non-OECD comprises the 165 “underdeveloped” nations. For example, the United States, United Kingdom, Germany, and Japan are OECD nations. In contrast China, India, Russia, Brazil, and Ethiopia are non-OECD nations. The Olduvai/World curve comprises both the OECD nations and the non-OECD nations.

Figure 3 depicts the Olduvai/World data disaggregated into one curve for the OECD nations and a second curve for the non-OECD nations.

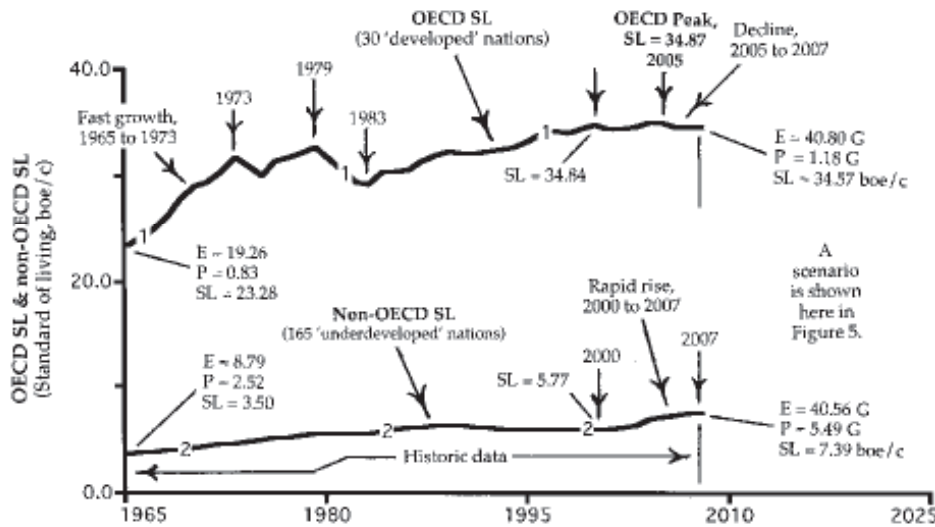


Figure 3. OECD SL and non-OECD SL Compared

The OECD document (2009b, above) and Figure 3, taken together; reveal several significant facts to explain the recent upshot of the Olduvai/World curve (Figure 2, previous): (1) The OECD SL curve from 2000 to 2007 *decreased* by 0.8 percent (0.27 boe/c). (2) The non-OECD SL curve *increased* by 28.1 percent (1.62 boe/c). Thus the rapid rise in the Olduvai/World curve from 2000 to 2007 was entirely caused by growth in the non-OECD SL and none of it caused by the OECD SL. (3) The OECD SL reached an all-time maximum in 2005. (4) Then from 2005 to 2007 it decreased by 0.8 percent (0.30 boe/c). (5) Further, the entire OECD SL fell by 9.1 CLI points during 2008.



**“Growth” — A Reaffirmed Global Objective**

[In] response to the global economic melt-

down, the G-20 was formed consisting of the leaders of the 20 biggest, richest, and emerging economies. A summary statement of their objectives was released and printed in full in...November 16, 2008. One of the clearly stated objectives was to “restore global growth,” to enhance “economic growth,” and foster “sustainable growth.” In total, the term “growth” in various contexts appears nine times.

An additional objective is “to stimulate domestic demand...” In all uses of the term “growth” the G-20 group meant it ultimately in terms of material things. It is clear the fact that “sustainable growth” is an oxymoron...Continued growth in use of both nonrenewable and renewable natural resources is the problem, not the solution....”

We are already exploiting the Earth’s vital resources at an unsustainable rate. Demand is exceeding resource supplies to the extent that even now more than half the world is in poverty. Standard of living... is most easily measured by per capita consumption of energy. In the United States this peak was in 1973, and now going down quite rapidly. Whatever gains may have been accomplished by the laudable efforts of efficiency and conservation...have been more than cancelled by increase in population, suggested also by the fact that the U.S. is the only industrialized nation with a significant growth in population, now about three million per year... Nationally, 80 percent is due to immigration, in California, nearly 100 percent, where by 2030 20 million more people are ex-

pected to arrive adding to the 38 million there now.

—Youngquist, advance copy of *GeoDestinies*, 2009, Ch. 33

**Focus on OECD Standard of Living**

*GDP to plummet 4.3 percent across OECD countries in 2009 as unemployment climbs sharply*

Economic activity is expected to plummet by an average 4.3 percent in the OECD area in 2009, while by the end of 2010 unemployment rates in many countries will reach double figures.... Amid the deepest and most widespread recession for more than 50 years, international trade is forecast to fall by more than 13 percent in 2009 and World economic activity to shrink by 2.7 percent.... In the United States, activity will fall sharply in the near term, but the country could begin to pull out of the recession in early 2010, assuming the effectiveness of the strong stimulus packages and more stable financial and housing markets.... In the large emerging economies activity is slowing as access to international credit dries up, commodity prices fall, and export demand weakens.... The Interim Outlook adds that the risks of an even gloomier scenario outweigh the possibility of a quicker recovery.... OECD (2009a)

Figure 4 focuses on OECD data from 1992 to 2007. Four key facts emerge: (1) The OECD standard of living grew by a remarkable 8.6 percent (2.77 boe/c) from 1992 to its all-time maximum in 2005. (2) Then it declined by 0.8 percent (0.30 boe/c) from 2005 to 2007. (3) Economic activity in the OECD area is expected to plummet by an average 4.3 percent in 2009. (4) The U.S. is the largest economy in the OECD, passed its peak standard of living in 1973, and its standard of living has since declined. These facts mean that the OECD maximum in 2005 will, I assume, be the all-time OECD standard of living peak.



Increasingly, from across the globe, nightly television brings to our living rooms photos of malnourished people; particularly touching are the starving children. Advanced countries can provide the means and the knowledge for a given country to adjust its population to its sustainable food resource base, but implementation of that action becomes an individual responsibility, and collectively a national responsibility. Thus far this most fundamental of all humanity's problems is consistently ignored by all—or nearly all—public officials everywhere. It has never, to my knowledge, become part of any political platform or a politician's agenda seeking office or one seeking to remain in office. All of the above also relates to the United States.

The number one, most important factor in all of this is current size of population and above all, continued population growth. But this overriding consideration is never recognized. The word "population" does not appear anywhere in the G-20 statement. If this document represents the forward "thinking" of the world leaders of the biggest and richest economies, we are in very deep trouble."

—Youngquist, advance copy of *GeoDestinies*, 2009, Ch. 20

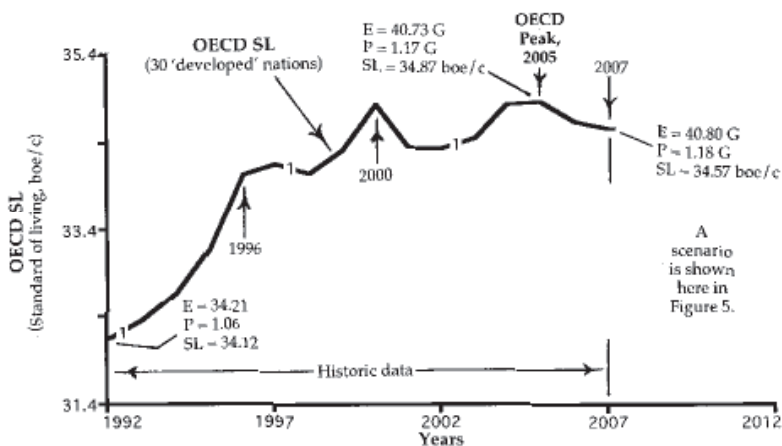


Figure 4. The OECD SL: Peak Revealed

**Toward Re-Equalizing the World Standard of Living**

The real issues, I believe, rest on the impossibility of a long-term favorable future for the human species if different parts of the Earth remain in grossly different stages of development. On a long-term basis it simply is not possible to contemplate a life of prosperity and luxury in a few favorable cases on the Earth existing permanently alongside poverty and starvation everywhere else. Sooner or later, standards of living work themselves to a pretty constant level, like water finding its own level.

—Sir Fred Hoyle, 1964, pp. 54-55

Figure 5 depicts four curves, one for each SL category we’ve discussed.

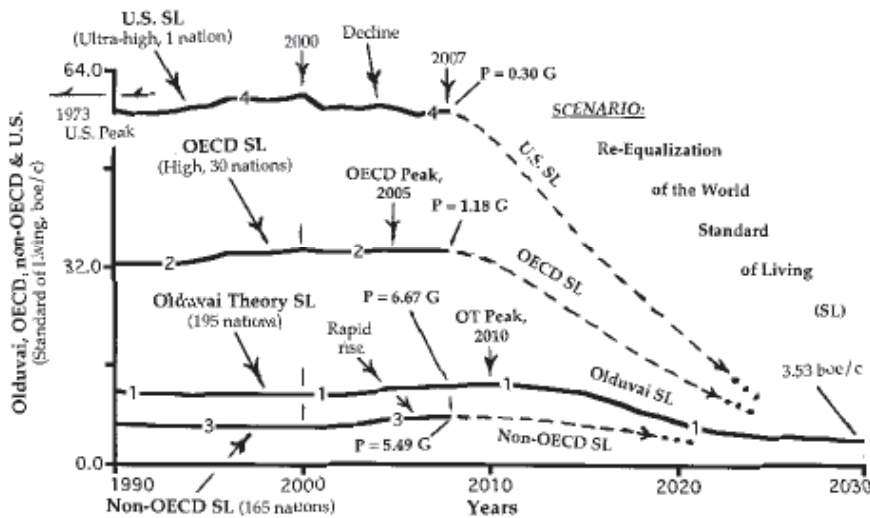


Figure 5. Toward Re-Equalizing the World SL

The vertical scale of Figure 5 goes from 0.0 boe/c to 64.0 boe/c to accommodate all of the SL curves previously shown. Historic data appear from 1990 to 2007 and—along with other data and many references—provide the basis for the Olduvai scenario shown from 2008 to 2030.<sup>5</sup>

In Figure 5 the U.S. curve (#4) in 2007 represents 4.5 percent (0.301 billion) of World population and has an SL of 57.5 boe/c. In contrast, the non-OECD curve (#3) in 2007 represents 82.3

percent of World population and has an SL of 7.4 boe/c. This difference cannot last for long. The following scenario projects how “Mother Nature” will resolve this problem.<sup>6</sup>

*The Olduvai Scenario:* The U.S. SL plunges (curve 4); the OECD SL dives (curve 2); the non-OECD SL levels off and then sinks (curve 3); the Olduvai SL (curve 1) peaks in 2010<sup>7</sup> and then declines to a scant 3.53 boe/c in 2030. That SL for the World in 2030 will equal the same SL the World had in 1930—thus giving Industrial Civilization a “pip” of 100 years. In other words: The falling World SL will eventually limit both World population growth and industrialization.



Population now has grown beyond the former abundance of relatively inexpensive basic resources. As costs of the necessities of life rise, strains are appearing across the world. Even in what has been called “the richest nation” the United States the fabric of everyday life is coming under stress. With the addition each year of three million people, the stress can only increase. One can begin to feel a growing uneasiness about the future, both here and abroad. There is good cause for unease, with world population increasing at the rate of more than 80 million a year continuing the assault on the life-sustaining environment.

—Youngquist, *advance copy of GeoDestinies*, 2009, Ch. 20

The irreconcilable current trends of a growing population and declining supporting resources seem not yet to be recognized at any levels of political leadership. However, these two facts will collide head-on this century. At best, this will result in a halt

to population growth. At worst it could be chaos. The ability of the Industrial Revolution and related technologies to find and exploit the Earth's resources at an unsustainable rate for a fortunate relatively few societies, by its very success carries within it the seeds of its own destruction. We inevitably face a future of less. However, bringing this message to the developed and developing world's citizens is not being done. Discussion of this topic and population growth unfortunately remains politically incorrect. Economists and political leaders nearly everywhere continue to endorse the illusion that more people consuming more resources ("buy more"—"increase demand") is the road to permanent prosperity, whereas now the exact opposite is true.

—Youngquist, advance copy of  
*GeoDestinies*, 2009, Ch. 20

### Summary and Conclusions

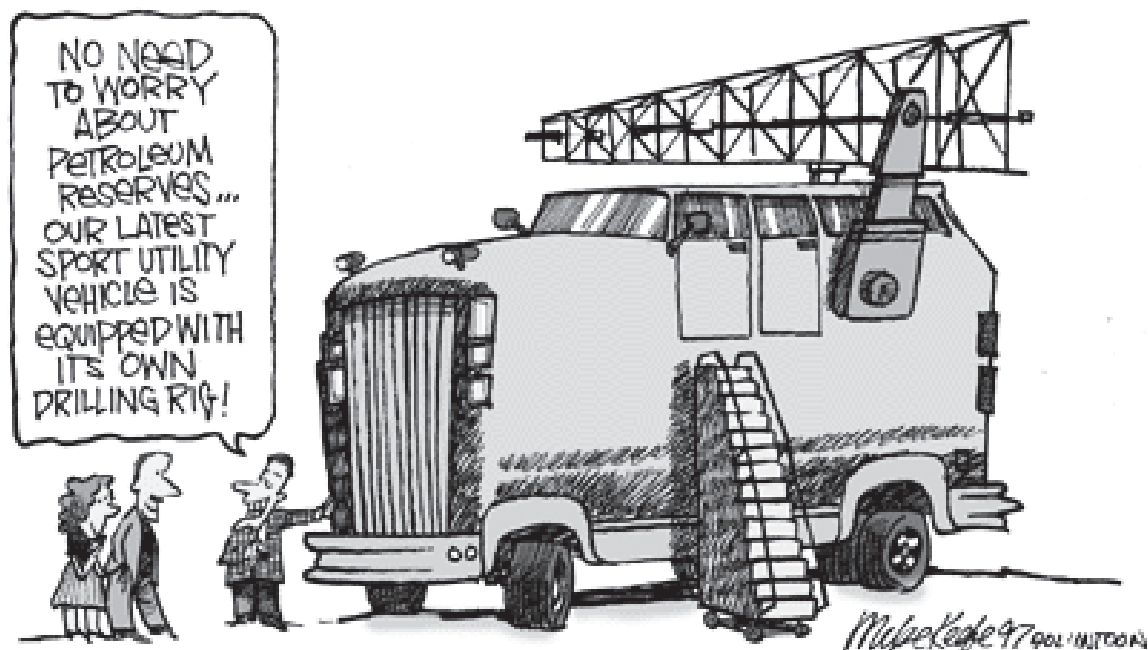
The average U.S. standard of living (SL, Fig. 1) peaked in 1973; from 1973 to 2007 it decreased by 7.4 percent; the U.S. composite leading indicator (CLI) in January 2009 was 10.8 points lower than in January 2008. Conclusion 1: The U.S. standard

of living will continue falling long into the future.

The Olduvai/World standard of living (Fig. 2) reached a temporary high in 1979; from 1979 to 2000 it *decreased* by 1.9 percent; however from 2000 to 2007 it *increased* by 9.7 percent; the increase was entirely caused by increases in a few non-OECD nations. Conclusion 2: The World standard of living itself will soon begin to decline.

The OECD standard of living (Figs. 3 and 4) reached its peak in 2005; from 2005 to 2007 it decreased by 0.8 percent; its "CLI was 9.1 points lower in January 2009 than in January 2008; economic activity is expected to plummet by an average 4.3 percent in the OECD area in 2009 and by the end of 2010 unemployment rates in many OECD countries will reach double figures." Conclusion 3: The OECD SL will continue to fall.

The non-OECD standard of living (Fig. 3) increased by 28.0 percent from 2000 to 2007, and this caused the rapid rise in the Olduvai/World standard of living during those years (Fig. 2). However, "In the large emerging economies activity is slowing as access to international credit dries up, commodity prices fall and export demand weakens." Further, the CLIs for China, India and Brazil all fell sharply in 2008. Conclusion 4: The non-OECD standard of living has already begun to fall.





The Olduvai Scenario (Fig. 5): The U.S. standard of living falls by 90 percent from 2008 to 2030. The OECD standard of living falls by 86 percent. The non-OECD falls by 60 percent. The OECD standard of living melds with the non-OECD SL in 2030, putting the World standard of living at 3.53 boe/c in 2030. Conclusion 5: The World standard of living reaches the same value in 2030 that it had in 1930, giving Industrial Civilization a duration of 100 years.

*Projections regarding the United States:* (1) We will refuse to solve our own problems so Mother Nature will “solve” them for us. (2) Sooner or later industrial decline will cause population decline and, tit-for-tat feedback, population decline will cause industrial decline. (3) The U.S. population distribution in 2100 will look more like the rural geography of 1900 than like the urban geography of today. (4) Trying to stimulate—or even maintain—the present level of domestic demand of nonrenewable and renewable Earth resources will fail. (5) Multiculturalism will cause chaos during the transition to localism. ■

### Acknowledgments

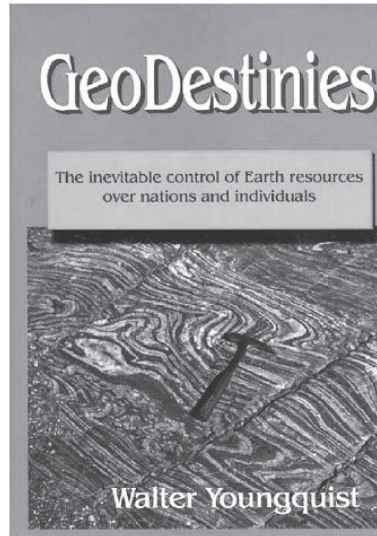
Dr. Walter Youngquist and Dr. Colin J. Campbell have shared their keen insights over many years. John Gibbons, publisher of <http://www.thinkorswim.ie/> motivated this study just as the world economy imploded. Dr. Euan Mearns has demonstrated an astute and useful way to analyze oil forecasts.

### Definitions

1. G means billion; 2. boe refers to the average energy content of a barrel of oil; 3. E means energy consumption in G boe; 4. P means population in G; 5. Standard of Living (SL) is the ratio of E and P:  $SL = E/P$ ; 6. Geo/STEP refers to complex Geo/social-technical-economic-political system; 7. Scenario means, “An outline for any proposed or planned series of events, real or imagined.”

### Endnotes

1. This is Ackerman’s Law, discussed in Duncan, 2005-2006, pp. 2-3.
2. M. King Hubbert in 1949 projected that the duration of Industrial Civilization would be more than 1,000 years, some ten times that of the Olduvai Theory.
3. “Re-equalization of living standards: It will be a long slow process but I think the trend will be there this century. You might note also that immigration tends to do the same thing—people migrate out of resource scarce poor countries to countries with more resources—the migrants use more resources and this cuts down total available for all. The USA is a good example. People use energy—more people use more energy, and if there is not enough to go around at low cost, everybody sees a cut in living standards. So migration is a factor in equalization of living standards. *I don’t think our standard of living gets any higher with more and more Mexicans coming into this country—that is it in a nutshell!*” (Walter Youngquist, letter, 8/28/08)
4. The noted Olduvai cartoon can be viewed online at Duncan, 1996.
5. “The expanding economy of the First Half of the Age of Oil led to increasing globalization based on growing world trade and financial hegemony by powerful countries. But the Second Half will likely see reversion to localism as different communities come to terms with the changed circumstances and find new sustainable patterns of life to match the resources available to them.” (Colin J. Campbell, 2009, p. 4)
6. “Forcible imposition of population control would be seen by most people as a sufficiently unfavorable change in the social environment that they might prefer that the forces take the tangible forms of lowered material standard of living and reduced food supply.” (Jay W. Forrester, 1973, p. 122)
7. Latest data at this writing suggest that the OT Peak actually occurred in 2008, but it was then too late to change Figure 5 and the associated text.



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