

The New Flat Earth Society

Albert A. Bartlett

This is a slightly revised version of an article that was published in the September 1996 issue of The Physics Teacher, Vol. 34, No. 6, Pgs. 342-343. This journal is published by the American Association of Physics Teachers, College Park, MD.

INTRODUCTION: THE PROBLEM

There was a time, long ago, when people thought that the Earth was flat, but now for several centuries people have believed that the Earth is round . . . like a sphere. But there are problems with a spherical earth, and a now a new paradigm is emerging which seems to be a return to the wisdom of the ancients.

A sphere is bounded and hence is finite, which implies that there are limits, and in particular, there are limits to growth of things that consume the Earth and that live on it. Today, many people believe that the resources of the Earth and of the human intellect are so enormous that population growth can continue and that there is no danger that we will ever run out of anything. For instance, after a United Nations report predicted shortages of natural resources that would follow because of continued population growth, Jack Kemp, who was then Secretary of Housing and Urban Development in the Cabinet of President George Bush, is reported to have said, "Nonsense, people are not a drain on the resources of the planet." (2)

These people believe that perpetual growth is desirable, consequently it must be possible, and so it can't possibly be a problem. At the same time there are still a few remaining "spherical earth" people who go around talking about "limits" and in particular about the limits that are implied by the term "carrying capacity." But limits are awkward, because limits conflict with the concept of perpetual growth, so there is a growing move to do away with the concept of limits. A friend recently returned from an international conference in Germany and he reports that whenever he brought up the subject of limits, the angry rebuttal was, "We're tired of hearing of limits to growth! We're going to grow the limits!" Another friend sent me a clipping (3) in which an eminent national economist closes an opinion piece by saying:

A 3% to 3.5% growth rate is not only an achievable national objective: it is an economic and social necessity. A spherical earth is finite. The pro-growth people say that perpetual growth on this earth is possible. If the pro-growth people are correct, what kind of an earth are we living on?

THE SOLUTION

A spherical earth is finite and hence is forever unappealing to the devotees of perpetual growth. In contrast, a flat earth can accommodate growth forever, because a flat earth can be infinite in the two horizontal dimensions and also in the vertical downward direction. The infinite horizontal dimensions forever remove any fear of crowding as population grows, and the infinite downward dimension assures humans of an unlimited supply of all of the mineral raw materials that will be needed by a human population that continues to grow forever. The flat earth removes all the need for worry about limits.

So, let us think of the "We're going to grow the limits!" people as the "New Flat Earth Society."

EXAMPLE

The economist Julian Simon is famous for his belief that there are no limits to growth. (4) In a recent article he wrote (5)

Technology exists now to produce in virtually inexhaustible quantities just about all the products made by

nature - foodstuffs, oil, even pearls and diamonds . . .

We have in our hands now - actually in our libraries - the technology to feed, clothe and supply energy to an ever-growing population for the next 7 billion years . . .

Even if no new knowledge were ever gained . . . we would be able to go on increasing our population forever . . . (6)

Two friends wrote me to call my attention to this article, and one of them said in his letter that Simon had been contacted and that Simon said that the "7 billion years" was an error and it should have been "7 million years." (7)

We should note two things. First, there is a big difference between "million" and "billion." In the U.S. a "billion" is a thousand million. Second, even 7 million years is a long period of time. One of these friends asked me: if the world population in 1995 is 5.7 billion people (5.7×10^9), what would its size be (P7) if it grew steadily at 1% per year for 7 million years ? (8)

ARITHMETIC

Although arithmetic is falling out of fashion, let's do some calculations so that we can understand how the old fashioned "spherical earth" scientists would treat the problem.

We will do this calculation assuming the length of time is exactly 7 million years and the growth rate is exactly 1% per year. For the case of an annual growth rate of 1% , the value of k is 0.010 . . . per year. It is easy enough to set up the equation for P7 , which is the world population after 7 million years of 1% annual growth:

$$\begin{aligned} 1) P7 &= (5.7 \times 10^9) \exp(0.01 \times 7 \times 10^6) \\ &= (5.7 \times 10^9) \exp(7 \times 10^4) \end{aligned}$$

Here is where we separate out those who understand algebra from those who only know how to do key strokes on a calculator. When you do the keystrokes to evaluate $\exp(7 \times 10^4)$ many calculators will flash the message "ERROR" because these calculators are not able to handle numbers larger than $9.99 \dots \times 10^{99}$. (9) One must have some understanding of algebra to work around this limitation.

What we want to find is the value of B in Eq.2.

$$2) \exp(7 \times 10^4) = 10B$$

If we take the natural logarithm of both sides we have

$$7 \times 10^4 = B \ln(10)$$

$$B = 7 \times 10^4 / 2.303 \dots$$

$$3) B = 30400.6137 \dots$$

(Remember that we assumed the input numbers were exact.) Equation 1 now becomes

$$P7 = 5.7 \times 10^9 \times 1030400.6137 \dots$$

$$4) = 5.7 \times 1030409.6137 \dots$$

If one wants to express this as an integer power of ten, we can note that $100.6137 = 4.11$, so that

$$P7 = 5.7 \times 4.11 \times 1030409$$

$$5) P7 = 2.3 \times 1030410$$

This is a fairly large number!

If we had used Simon's original number of 7 billion years, we would have had $B = 3.04 \times 10^7$.

It is hard to imagine the meaning of a number as large as the one given in Eq.5. To try to understand the meaning of this large number, let us compare it with an estimate the number of atoms in the known universe. If we assume the known universe is a sphere whose radius is 20 billion light years, the volume of the sphere is about 3×10^{85} cubic centimeters. If the average density of the universe is one atom per cubic centimeter, then the number of atoms estimated to be in the known universe is about 3×10^{85} . The number given in Eq.5 is something like 30 kilo-orders of magnitude larger than the number of atoms estimated to be in the known universe!

Note that in making this calculation we are assuming that the universe, like the Earth, is spherical, which could hardly be correct if the Earth is flat and is of infinite lateral extent.

A related question comes to mind: if world population growth continues at a rate of 1% per year, ($k = 0.01$ per year) how long would it take for the population to grow until the number of people was equal to this estimate of the number of atoms in the known universe? This calls for us to find t in the following equation.

$$6) 3 \times 10^{85} = 5.7 \times 10^9 \exp(0.01 t)$$

$$5.26 \times 10^{75} = \exp(0.01 t)$$

$$174 = .01 t$$

$$t = 17 \text{ thousand years}$$

This indicates that the population of the Earth, growing at 1% per year, would grow to a number equal to the number of atoms estimated to be in the known universe, in a period of time something like the period since a recent ice age. We could also ask, what growth rate would be required for the world population to grow from 5.7×10^9 to 3×10^{85} in 7 million years? We must find the value of k in this equation

$$7) 3 \times 10^{85} = 5.7 \times 10^9 \exp(7 \times 10^6 k)$$

Solving this, we find $k = 2.5 \times 10^{-5}$ per year. This is 2.5×10^{-3} percent per year. In the first year this growth rate would produce an increase of world population of about 1.42×10^5 people. Contrast this with the present increase of about 9×10^7 per year.

These numbers make it clear to us old fashioned "spherical earth people" that the world population cannot continue to grow for long at anything like its present rate. There are signs that the population growth rate is already slowing in some parts of Europe and Asia.

Calculations similar to these remind us that the major effect of steady growth in the rates of consumption of non-renewable resources is to shorten dramatically the life-expectancy of the resources. (10)

Julian Simon has claimed that the human mind is "the ultimate resource." As was noted in the review of his 1981 book, this is true "only if it [the human mind] is used." (11)

CONCLUSION

If the "we can grow forever" people are right, then they will expect us, as scientists, to modify our science in ways that will permit perpetual growth. We will be called on to abandon the "spherical earth" concept and figure out the science of the flat earth. We can see some of the problems we will have to solve. We will be called on to explain the balance of forces that make it possible for astronauts to circle endlessly in orbit above a flat earth, and to explain why astronauts appear to be weightless. We will have to figure out why we have time zones; where do the sun, moon and stars go when they set in the west of an infinite flat earth, and during the night, how do they get back to their starting point in the east. We will have to figure out the nature of the gravitational lensing that makes an infinite flat earth appear from space to be a small circular flat disk. These and a host of other problems will face us as the "infinite earth" people gain more and more acceptance, power and authority. We need to identify these people as members of "The New Flat Earth Society" because a flat earth is the only earth that has the potential to allow the human population to grow forever.

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 - (2) High Country News, (Paonia, Colorado), January 27, 1992, P. 4
 - (3) Felix G. Rohatyn, TIME, May 20, 1996, P. 46
 - (4) J.L. Simon, The Ultimate Resource, Princeton University Press, Princeton, NJ, 1981
 - (5) Cato Policy Report, "The State of Humanity: Steadily Improving", Vol. 17, No. 5, September / October 1995, P. 131, Cato Institute, Washington, D.C.
 - (6) The Cato Institute report identifies the author: "Julian L. Simon is a professor of business and management at the University of Maryland and an adjunct scholar at the Cato Institute. This essay [from which these quotations are taken] is based on the introduction to his latest book, The State of Humanity, just published by the Cato Institute and Blackwell Publishers."
- The Cato Institute is a think tank in Washington, D.C. that advises government leaders on policy questions.
- At the annual meeting in February of 1995, Julian Simon was elected a Fellow of the American Association for the Advancement of Science.
- (7) I am indebted to Mark Nowak of Population, Environment, Balance, in Washington, D.C. and Dr. John Tanton, Petosky, MI, for calling this article to my attention.
 - (8) The growth rate of world population in the early 1990s was around 1.7% per year.
 - (9) In doing these calculations, I was surprised to find that my new Hewlett- Packard Model 20S hand-held calculator will handle powers of ten up to 500.
 - (10) A.A. Bartlett, American Journal of Physics, Vol. 46, September 1978, Pgs. 876-888.
 - (11) A.A. Bartlett, American Journal of Physics, Vol. 53, March 1985, Pgs. 282-285