

## Human Population Growth and The Fallacy of the Agricultural Maximum

If one seeks to estimate a maximum human population for the earth, the first-impulse factor that comes to mind is food. In the analyses that were made during the 1960s and 1970s, for example, multiple such estimates were made based on suppositions concerning maximum possible supplies of food.

While such analyses have an obvious and intuitive importance, they also:

- (a) Can lead us to seriously-incorrect *overestimates* of earth's carrying capacity, and
- (b) They also tend to leave us with a decades-old set of population perspectives that distract us from *other* imminent, dangerous, and unfolding aspects of our dilemma.

Thus, in this excerpt we address what might be called  
"THE FALLACY OF THE AGRICULTURAL MAXIMUM"

Similarly, in an earlier excerpt in this series we critique a related misperception that we call "The Open-space Delusion."

The late Roger Revelle achieved much distinction in his life and his career, but one part of his legacy may undermine his other contributions. Writing several decades ago, for example, Dr. Revelle once estimated earth's carrying capacity to be forty-four billion – a number that he derived primarily by imagining that food supplies (as opposed to industrial wastes or environmental damage) constitute mankind's principle limiting factor (Revelle, 1976; 1974).

Given our impacts today, it is hard to imagine a carrying capacity of forty-four billion. Revelle's catastrophic overestimate reflects assorted omissions and unstated and flawed assumptions. To envision our planet with forty-four billion people, we can multiply the impacts of our recent 6.5 billion (*only half of whom are industrialized*) by a factor of seven.

If tropical deforestation is taking place today (when only half of us are industrialized) what will be left if we multiply our numbers seven times? Imagine multiplying our production of greenhouse gases, acid rain, automobile exhausts, particulates, nuclear wastes, and power plant emissions seven times.

Multiply the number of shopping malls, suburbs, favelas, condominiums, asphalt parking lots, and landfills seven times. Multiply the drawdown of our aquifers by seven, along with the traffic on our highways and the crowding in our national parks.

Multiply the number of chain saws, logging companies, strip mines, fishing fleets, bulldozers, hydroelectric dams, terrorists, and chemical pollutants by seven.

*It seems increasingly likely that ENVIRONMENTAL DAMAGE and industrial and societal WASTES represent humanity's key limiting factors.*

How on earth was an imagined carrying capacity of forty-four billion ever derived? It was derived utilizing optimistic calculations involving agriculture and food supplies, with NO ALLOWANCE for the wastes and damage generated by each of our billions, or for planetary limits to accommodating those wastes, and with no consideration of the destructive impacts inflicted by each of our added billions when armed with the machinery, pollution, technologies, luxuries, and weapons of modern society.

In the two Revelle papers referenced above, the reader is offered a detailed appraisal of hunger, agriculture, arable lands, growing seasons, fertilizers, soils, agricultural capabilities and trends, and potential food supplies (all of which are clearly, obviously, and intuitively important). The papers' weaknesses, however, arise from a reliance upon an unstated and unexamined assumption that agriculture and food are the supreme (or even the only) factors that govern mankind's limits. *It is a fallacy, however, to suppose that, by simply calculating an agricultural maximum, that we have somehow correctly identified earth's carrying capacity for our species.*

Unfortunately, this same unstated supposition is routinely implicit in analyses rendered by dozens of economists and agronomists. Today, however, we see that other estimates must be made. For example, what are the **WASTE MAXIMA** and **DAMAGE MAXIMA** that can be inflicted upon an environment (or a planet) without catastrophic repercussions?

Most economic apologists, for example, take care of their cars and homes, which are, after all, replaceable.

*Why then are they so cavalier when it comes to the only planetary life-support machinery in the known universe?*

And is it safe to proceed to the very limits of those maxima, or is it wiser to chart a course for civilization *that stays far below such maxima and does not test them?*

Here is the major question arising from Roger Revelle's estimates:

*What if his estimates are wrong?*

Nowhere in his papers does he contemplate or address this possibility. What are the **consequences**, for instance, if his estimates of forty-four billion are *far too high* (they are) and the number that emerges is somewhat LESS THAN TWO BILLION (as multiple lines of evidence seem to suggest)?

What price will be paid by endangered species, earth's natural systems, climatic machinery, civilization, and humanity itself, if the Revelle estimate and its modern counterparts are not borne out? And what if food supplies and agricultural considerations are NOT the factors that act upon us first? What if our industrial and societal wastes, or environmental degradation, or technological overspecializations affect us first? The point we wish to make is this:

If one makes estimates of earth's carrying capacity,  
*one's estimates had better not be too high.*

## OTHER ESTIMATES

Wechskaop makes its own assessment of earth's carrying capacity for an industrialized humanity in its chapter entitled "the Big Question" and we recap that assessment here.

(1) We estimate with the intent that all of earth's people enjoy, at a minimum, a Western European standard of living, with no less-developed countries, and that all enjoy the health care, education, jobs, and amenities that such a standard implies;

(2) We estimate with the intent that a representative system of wilderness and wildlife reserves occupy at least 25-50% of earth's land and waters, that they remain essentially undisturbed by mankind, that their functioning remains entirely intact, that they are thoroughly self-sustaining and self-perpetuating; and,

(3) Our pollution and wastes do not accumulate and our activities do not degrade the environment, climate, atmosphere, waters, cycling, or functioning of earth's natural systems.

WECSKAOP thus suggests, assuming the reasonable standards cited above, together with the observations below, that earth's carrying capacity for an industrialized humanity is somewhat less than two billion.

### Why?

(1) Because our current six plus billion *is obviously inflicting damage*; overexploiting forests, fish stocks, freshwater, and aquifers; and is clearly introducing accumulating tons of poisons, radioactive wastes, CO<sub>2</sub>, and other pollutants each year

SO THAT SIX BILLION IS CLEARLY TOO MANY.

(2) The great bulk of today's pollution, overexploitation, and damage is being produced and driven by the fifty percent of humanity that is industrialized, as we remove earth's forests, strip-mine its seas, and drawdown its aquifers to satisfy our needs, consumption, and demands. Since this half of humanity numbers approximately THREE BILLION whose commerce, industries, and societies account for the bulk of today's pollution and damage,

*this suggests that THREE BILLION is also too many.*

3) Accordingly, a global population somewhat under two billion (similar to world levels in 1920) ought to be able to meet the standards enunciated earlier: (1) A Western European standard of living for all; (2) Self-sustaining, self-perpetuating, and functioning reserves of a representative 40-50% of earth's wilderness, habitats, and ecosystems; and, (3) A minimal accumulation of wastes and little or no inflicted environmental damage.

In 1991, when world population was approximately 5.3 billion, botanist Peter Raven remarked that there "is no evidence that the world can sustain its present population, much less a larger one" (Raven, 1991).

In his book HOW MANY PEOPLE CAN EARTH SUPPORT? (1995), Joel Cohen assembles for us more than two dozen past estimates of planetary carrying capacity. In instance after instance, the estimates address *food and agricultural considerations* – again, apparently under the assumption (usually unstated) that food and agriculture are the central – or even the sole – limiting factors affecting human population levels.

In virtually every instance, the estimates show essentially NO CONTEMPLATION of the environmental **damage** and **wastes** generated by each of our additional billions. These oversights and errors are not due in any way to Dr. Cohen, to whom we are indebted, but to the omissions and flawed assumptions of the writers whose work he has surveyed.

A more recent example shows that phrasing can also be problematic. For instance:

“If humans utilized as food all of the energy captured by plant photosynthesis on land and sea, some forty trillion watts, the planet could support seventeen billion people....but would surely have become a hellish place to exist.”

Here, then, we see "the fallacy of the agricultural maximum" at work again.

Notice that the statement, like so many others in the literature, appears to suppose that, given a calculated maximum of amount of food, the planet's natural systems might support that number of people, albeit in a hellish set of conditions.

How is that supposition justified? Why should we imagine that *any* of earth's biological and environmental machinery could continue to function in the presence of such numbers?

Permafrost is melting now; climate change is occurring now; ocean anoxia is spreading now; deforestation is taking place now; tropical rainforests are being eradicated now; fishing stocks are collapsing now; greenhouse gas emissions are increasing now; all of the tigers in India's two top "tiger-reserves" have already been wiped out now; Africa's elephants are disappearing to poachers now; we have increasing tons of nuclear wastes now; ocean acidification and endocrine disrupters are impacting marine systems already - and the list goes on.

The sentence fragment that "...the planet could support seventeen billion people..." (which, in light of the impacts of today's 6.8 billion would appear to be at the very least, questionable, unsubstantiated, and, probably calamitously incorrect ) invites journalists, policymakers, and non-scientists to *imagine* that food is the only or central governing factor

*when, in reality, our present levels of **wastes**  
and **damage** are already proving unsustainable.*

Thus, the cited statement *is an egregious mistake* because it invites complacency and inaction at a time when we are *already* smashing through thresholds and tipping points

in a cascade toward disaster  
that is already underway.

If we consciously or subconsciously adopt such mistaken or deficient assumptions, however,

*then we are distracted from or neglect  
OTHER important and dangerous possibilities*

(For example that ongoing and unending **damage** to, destruction, reduction, fragmentation, elimination, degradation, and eradication of vast percentages of earth's biota and natural systems

*might so disrupt climatic, biotic,  
and environmental functioning*

that assorted global systems that we depend upon undergo collapse.)

Notice further that the statement fails to contemplate the earth's capacity to absorb, cleanse, recycle, or otherwise accommodate the unique, unprecedented, and overwhelming avalanche of industrial and societal **wastes** that we generate.

#### ESTIMATES MUST NOT BE TOO HIGH

As we close, then, let us recall several key points:

First, despite declining fertility in much of the developed world, on a worldwide basis we are *still adding* 600,000 *extra* persons to our planet every three days, and we are *still adding* ONE BILLION extra persons to our planet every twelve to fifteen years.

Secondly, Wecskaop's actual chapters show that population projections commonly underestimate the actual population sizes that eventually emerge.

As Bongaarts and Bulatao (2000) put it, "...based on the record of previous projections, a greater risk exists of a large understatement of future world growth than of a large overstatement." Given the added billions currently projected between now and mid-century, if our latest projections also turn out to be underestimates, the results may well be calamitous.

Thirdly, current projections, like many in the past, may be placing too little emphasis on the possibility that current advances in medicine, life-extension, and genomics may suddenly and unexpectedly **lower mortality** rates enough to cancel out benefits expected to arise from falling fertility.

This is because we are commonly able to implement medical advances almost instantaneously, while changes in fertility rates, because of social customs and traditions, may lag behind for an entire generation or more.

Fourthly, we have seen that dangerous carrying capacity overestimates can result if we rely on sets of unwarranted assumptions that underlie THE FALLACY OF THE AGRICULTURAL MAXIMUM.

And lastly, we have suggested that if one makes estimates of earth's carrying capacity, one's estimates had better not be too high.

*A continuation of today's demographic tidal wave may constitute  
the greatest single risk that our species has ever undertaken.*

Excerpted from  
What Every Citizen Should Know About Our Planet  
Used with permission

Copyright 2009. Randolph Femmer.  
All rights reserved.

Librarians: The book version of Weeskaop is available from  
M. Arman Publishing, Fax: 386-951-1101

Expanded implications of this excerpt are also  
addressed in additional PDFs in this collection:

- Razor-Thin Films - Earth's Atmosphere and Seas
- Numerics, Demographics, and a Billion Homework Questions
- Conservation planning - Why Brazil's 10% is Not Enough
- Eight Assumptions that Invite Calamity
- Climate - No Other Animals Do This
- Critique of Beyond Six Billion
- Delayed feedbacks, Limits, and Overshoot
- Thresholds, Tipping points, and Unintended consequences
- Problematic Aspects of Geoengineering
- Carrying Capacity and Limiting Factors
- Humanity's Demographic Journey
- Ecosystem services and Ecological release
- J-curves and Exponential progressions
- One-hundred key Biospheric understandings

### **Sources and Cited References**

(pending)

Anson, 2009. What Every Citizen Should Know About Our Planet. M. Arman Publishing.  
Anson, 1996. Marine Biology and Ocean Science. Balaena Books.  
Bongaarts and Bulatao, 2000.  
Cohen, 1995.  
Raven, 1991  
Revelle, 1974; 1976