

The Weight of the World

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Version 1.4 (posted on 20 September 2022)

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The mass of the entire earth is estimated to be 5.9736×10^{24} kg. That's approximately 6,000,000,000,000,000,000,000 kilograms (6 followed by 24 zeros). Another way to say the same amount would be 6 sextillion tons. Compared to the weight of a person, that's a lot. Compared to the mass of the Sun or Jupiter, though, not so much.

My interest is not with the weight of Gaia, however. I'm more interested with the biomass of living creatures existing at her surface — on land — or near the surface — in the oceans. I'm concerned as well with the anthropogenic mass, which is all the inorganic stuff we humans extract from the earth, then recombine or synthesize into other forms to make literally everything we manufacture and build. Think concrete for buildings, aggregates (gravel and sand) for road construction, and plastics for packaging and products.

Let's talk about biomass first. Organic life on earth is carbon-based, and therefore relatively dense. Myriad forms of life make up the earth's biomass. *Plants* comprise the bulk of all organic life on this planet (82.4%), with *trees* leading the way in terms of sheer weight. Leaves come and go annually for many plants, but tree trunks and limbs are heavy, inert, and relatively enduring. *Bacteria* comes in second at 12.8%, with *Fungi* in third place among the plant kingdom at 2.2%. *Single-cell microbes* account for 1.5%, with *protozoans and algae* at 0.7%, and *viruses* at a mere 0.04%.

There may be as many as 400,000 different species of flowering land plants currently living on the earth, with another 600,000 fungi species. Marine life is estimated at 2.2 million species, but that's a guess, since the deep oceans are still largely unexplored. The big winner in terms of species diversity is microbes, which might conceivably include trillions of separate species, since they arise and mutate so quickly.

Compared to plants, animals can't hold a candle in terms of mass. Although there are 7 million animal species, all of them together comprise only 0.4% of the total biomass. That's about 2 billion metric tons. Many species, but small populations, and not much overall mass. Human domestication of animals has

radically altered the ecosphere, however. Livestock — cattle, pigs, sheep, and chicken — now amount to 4% of total animal biomass, outweighing wild birds and mammals by a staggering 10-to-1. This dramatic reduction in the natural wild and diminishment of life within it occurred quite suddenly over just the past 150 years, and entirely because of human encroachment. Seems that we want the entire biosphere for ourselves. It's painfully obvious that we don't think of ourselves as shepherds of the earth, but instead consider ourselves its owners.

How much of earth's organic life is human? Even with 7.7 billion of us currently breathing on the planet, the human percentage of the earth's total biomass is still tiny — a mere 0.01% by weight. That's 1/10,000th of the living biomass.

How ironic that a species accounting for just a mere sliver of the pie among the total weight of organic life on earth would be so dominant and devastating, not only to itself, but to every other life form, and even to the planet itself. Or maybe it's not ironic at all.

Some people believe that the outcome of the two-billion-year "experiment" of life on earth was always going to be artificial intelligence that would eventually supplant organic life, and that humans, rather than being the crown of creation, were simply the vehicle driven to make this happen. In that seemingly science-fiction-like but oh-so-draconian scenario, humanity's odd combination of creativity and destructiveness are necessary to pave the way for A.I. All the earlier species of life upon whose shoulders humans stand took us 99 yards down the field, leaving it up to humans to punch home the ball for the touchdown from the one-yard line. (Oh jeez, a football metaphor. How fitting.)

I'm not sure what I think of that perspective about artificial intelligence and our own destruction being the whole point of the exercise, but we're almost there on both counts. We've already passed all the necessary tipping points for doing in ourselves and much of the rest of organic life on earth, and sentient A.I. is apparently right around the corner. The only practical question is: *Will humanity get far enough down the road toward development of sentient A.I. to allow it to take over before we kick the bucket?*

I am, of course, a card-carrying Luddite, so, for me, all this Brave New World shit is distinctly not pleasing. In my view, we humans have willfully refused to acknowledge two of the most important factors in life, which are natural limitations and collective responsibilities. To me, infinite growth on a finite planet is delusional and a recipe for disaster. More is not always better than less, and sometimes it's much worse. But what do I know? Whether or not I understand anything correctly, my vote carries almost no weight. Apparently I have mass, but no influence.

OK, let's move on to the second theme of this commentary — the non-organic anthropogenic mass, which means everything humans produce as our footprint on the planet grows ever heavier, and with such astonishing rapidity.

Below is a table with the major categories of human "stuff" (in terms of mass), and the amounts of it we've produced over the past century and a quarter. I find this very revealing about what modern civilization has wrought and who we've become.

In the animal kingdom, humans and ants are two species that stand out as spectacularly successful. Both species are inveterate builders, both are extremely aggressive, and both create rigidly class-based societies with a top-down pecking order. For the overwhelming majority of members in both species, life is very harsh, with only a tiny percentage — the privileged, elite royalty within each species — permitted to enjoy the fruits of all the others' labor.

But I digress. On to the table:

Human-Made Mass	Description	1900 (mass/Gt)	1940 (mass/Gt)	1980 (mass/Gt)	2020 (mass/Gt)
Concrete	Used for building and infrastructure, including cement, gravel and sand	2	10	86	549
Aggregates	Gravel and sand, mainly used as bedding for roads and buildings	17	30	135	386
Bricks	Mostly composed of clay and used for constructions	11	16	28	92
Asphalt	Bitumen, gravel and sand, used mainly for road construction/pavement	0	1	22	65
Metals	Mostly iron/steel, aluminum and copper	1	3	13	39
Other	Solid wood products, paper/paperboard, container and flat glass and plastic	4	6	11	23

Concrete is the second most used substance in the world, after water. Image: Visual Capitalist

source: <https://www.weforum.org/agenda/2021/12/weight-accumulation-human-made-mass-earth/>

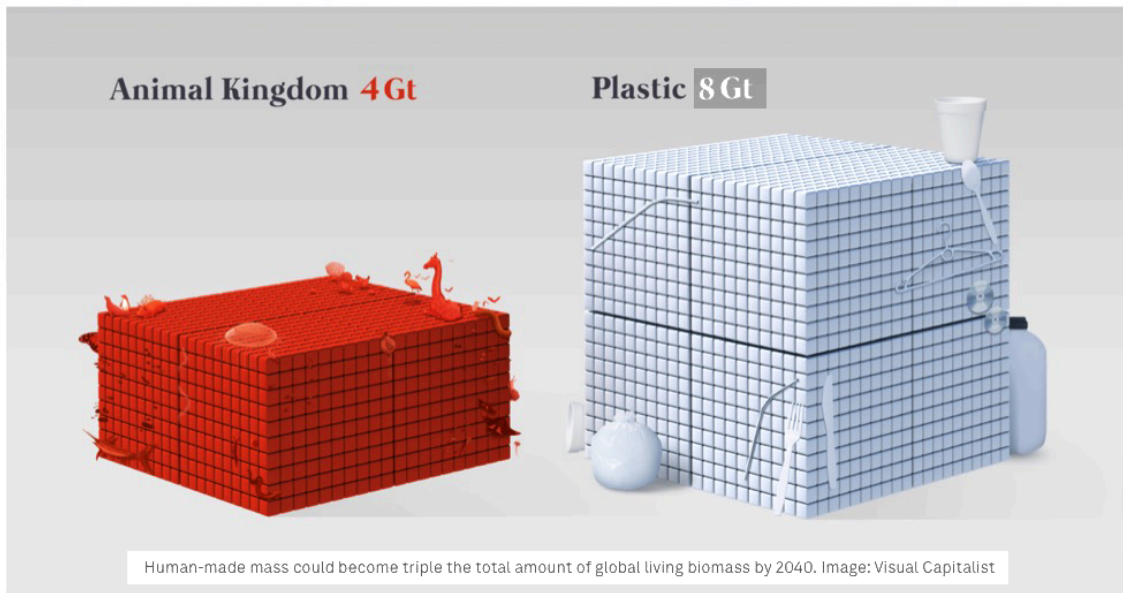
In 1900, the amount of concrete humans made was *2 gigatons* (one gigaton, abbreviated as *Gt*, equals 30 billion metric tons). In 2020, humanity produced *549 Gt* of concrete, an increase of *27,500%* in a mere 30 years.

During the same pandemic year of 2020, the total output mass of anthropogenic production exceeded for the first time ever the sum total global biomass of *all living creatures* on the earth. Humans made *1154 Gt* of stuff, while the entirety of organic life amounted to *1120 Gt*. I don't have figures for the air and water pollution nor the habitat destruction that accompanied our production of all that

stuff, but I fear that it was substantial. We had three decades to decrease the amount of carbon we spew into the atmosphere. Instead, we *increased* it (from 315 parts per million to 415 ppm), giving the term “suicidal” new meaning.

Then there’s *plastic*. Living organisms die, and their mass and constituent elements are quickly reabsorbed into the biosphere. We are all food for worms and bacteria. On this earth, everything eats everything else in an elegant and efficient system. Not so with plastic. Plastic “dies,” usually after a single use, then it’s tossed out, but it doesn’t degrade or go away. Instead, it lingers for centuries. And don’t even get me started about the radioactive waste from nuclear fission, with its 50,000-year half-life.

Annually, plastics already comprise *twice* the biomass of the entire animal kingdom on earth. By 2040 (if we get there), it’s expected to be *triple*. Below is a graphic showing where things stand presently:



source: <https://www.weforum.org/agenda/2021/12/weight-accumulation-human-made-mass-earth/>

OK, enough haranguing my readers with information. The upshot is that *none* of this is surprising to me, and may not be to anyone else my age or younger who’s been paying attention to the dramatic changes in the world that have occurred over our lifetimes. One doesn’t need to be a climate scientist to see the Big Picture. For many decades, I’ve been painfully aware of the handwriting on the wall. I regard the hard facts offered up in this piece as sad evidence of the many nails we’ve been so busily hammering into the lid of humanity’s coffin.

When I was young, I hoped that humans might come to our senses, and that civilization would change course, at least a little, but enough to save us from our own worst impulses. What's different for me now than earlier in my life is that I've come to regard everything that's transpired — what we've actually done, as opposed to what we give lip service to doing — as inevitable and unavoidable.

Could we really have turned away from the suicidal/ecocidal course we've been on and chosen a different path? Theoretically, maybe. But practically? No. The past two centuries have carried an irresistible, super-charged momentum as civilization morphed into the gigantic juggernaut that is like nothing so much as a runaway train. The discovery of fossil fuels were a one-time bonanza that virtually guaranteed our descent into hubris. Some of us didn't like what we saw happening and tried to jump off the train while it was gaining speed, with varying degrees of success on an individual level. Nothing that any of us did, though, slowed down or stopped the train. All our efforts — so many of which were well-intentioned but utterly naïve — have been in vain.

Now we're left with trying to figure out, predict, anticipate, and prepare for how bad the wreck will be when the train finally jumps the tracks and all the passenger cars behind the deranged locomotive jackknife in an accordion collapse, splintering into tinder and tangled heaps of twisted, smoldering metal. The vast majority of us have no certainty about the first three concerns — *what's going to happen? when? and how bad will it be?* On top of that, most of us don't have any real means to prepare, since — one way or another — we're still on the train, hanging on for dear life.

I wish this weren't so, but the reality of our situation becomes clearer each day. Some of us don't want to talk at all about where we are collectively and what's coming. Others (I include myself here) can barely talk about anything else. I'm sympathetic to both sides and sometimes long to be, if not in denial about what's happening, at least a little more quiet about it, but that's not my style.