Eleven Billion Thrive

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Our Context in Numbers

I love numbers. To me, they are poetry, and they help me understand the world around us. For instance, according to the median projections conducted by the United Nations, we may reach eleven billion people on this planet by 2100. Some of us may still be alive by then, it's not that far away. This can be assessed by understanding the key parameters that determine the number of people we might be on this planet in 2100. One of them is life expectancy: the longer we live, the higher the population gets; fertility rates are another one and it is expressed by how many kids we have per person, or per woman; and the third parameter is the parents' age at which the children are born. The younger the parents, the more overlap there will be between generations.

More than twenty years ago, I co-founded Global Footprint Network. On our website, we offer a scenario calculator where visitors can play with these dynamics and test their assumption.[1] These assumptions are then translated into how many people there would be. It's just math.

Using standard assumptions, the United Nations concludes we will be eleven billion people. Even if we don't reach such a high world population by 2100, planetary limits may become more noticeable since ecological overshoot—or the dynamics where our population is overusing the planet's life-support systems—is a cumulative impact. It is not about what happened the previous year; instead, the impact on the planet is driven by the accumulation of overuse of the biosphere.

Let me put this in context. You may have heard of Justin Bieber and all his scandals. To me, the most shocking thing about his life is this: between his birth in 1994 and 2025, of all the fossil fuel ever used in human history, we have burnt 57%. I was born in 1962, in my life, 88% of all the fossil fuels ever have been burnt.

[1] See https://www.footprintnetwork.org/resources/footprint-scenario-tool.

The Paris Agreement sets the intention to limit climate change to never exceed global average temperatures 2°C above the temperature we had before the Industrial Revolution, preferably not even exceeding 1.5°C. Looking at the physics of it: The Intergovernmental Panel on Climate Change (IPCC) states that with 450 parts per million CO_2 equivalent—that means all greenhouse gases combined—we have a 66% chance not to exceed 2°C. So, that's weaker than the goal of the Paris Agreement. Yet, the CO_2 equivalent in 2023 was 534 parts per million, and that's according to the National Oceanic and Atmospheric Administration (NOAA), a federal agency of the United States government.[2]

Parts per million refers to a concentration. It is a function, not of how much we added the previous year, but of how much we have added over time, leading to this concentration. And it is this concentration that produces the climate impact; and we keep adding to that concentration. Because of this cumulative effect, the type of future we do not want is coming towards us faster than many would expect.

More than Climate Change

However, climate change is just one big aspect of that future. In fact, the future has never been more predictable. Much of the future is predictable because we know people will want to eat and sleep, move about and be safe. And we also know there will be more climate change and resource constraints, in any imaginable scenario. We may choose to avoid a stark climate future, but this requires rapid reduction of fossil fuel use, on which nearly the entire human species has become so massively dependant. Or we may not react, continuing our dependence on fossil fuels, but then have far more climate change and eventually more resource constraints—just not in the short run. So, inevitably, there will be a combination of more climate change and resource constraints.

To better navigate this future and see our context with more clarity, it is helpful to focus our attention on the resource that is most significantly shaping and limiting human activities. This focus is not pessimistic, but empowering, as it gives us more clarity about what shapes our context. Understanding these contexts increases the likelihood that our longer-term decisions, such as investments or construction projects, produce the expected results.

Regeneration as the Limiting Resource

So, what is the resource that physically most limits our economies? The answer lies in regenerative resources—the amount of resources the planet's ecosystems can renew. These resources determine how much

[2] See https://gml.noaa.gov/aggi/aggi.html.

food, timber and fibres we can get. They also constrain our fossil fuel use, because the use of these fuels is not capped by how much is still underground but by how much of the emitted CO_2 the biosphere can absorb. Similarly, mining is not limited by subsoil resources, but by how much energy and ecosystems we are willing to give up for accessing and concentrating ores and minerals.

All economic activities compete for these regenerative resources, which makes regeneration into the underlying physical currency of our economies. We can therefore map our economies through the lens of all the regenerative resources they require. We call this their Ecological Footprint. Tracking the regenerative resources embodied in all economic activities is quite basic, something farmers have known since the neolithic revolution. They think of how much farm is needed to produce the amount of cereals or vegetables they want to grow. Or they estimate how many cows they can keep on a given pasture. The Ecological Footprint represents the biologically productive space needed to provide for everything a city, a country or an individual consume.

Since the Industrial Revolution, the carbon footprint is an ever more significant component of the Ecological Footprint—it represents the amount of regenerative capacity (or biocapacity, as we call it) to absorb the excessive CO_2 from fossil fuel burning. Over two hundred years ago, the carbon footprint was zero, and if we intend to follow the Paris Agreement, it should be zero again, possibly before 2050. However, as we move out of the carbon footprint, will we just push this demand into another domain—like crops for biofuels, or forests for fuel wood? Globally, the carbon footprint currently makes up 60% of humanity's entire Ecological Footprint. For industrial societies it is 70–80%.[3]

At Global Footprint Network, we express how much biocapacity is available on the planet in global hectares, which are average productive hectares. United Nations' statistics show that there are about 12.2 billion biological productive hectares on this planet—deserts and oceans are not highly productive, there is life there, but not concentrated enough to harvest it at scale. We are now also about 8.1 billion people. And so, the amount per person is about 1.5 global hectares (12.2 / 8.1 = 1.5). Then, we can compare that average against human demand for biocapacity. Using the United Nations' statistic, with about fifteen thousand data points per country and year, we can add up all human demands on biocapacity—the country's Ecological Footprint.[4]

[3] See https://data.footprintnetwork.org.

[4] Key results are available on the Footprint Data Platform at https://data.footprintnetwork.org.

What these Numbers Mean

Our accounts likely underestimate the extent of planetary overuse. This is because United Nations' data, with its production-based focus, tends to underreport environmental damage, which leads to an overestimation of biocapacity. Similarly, the data often fails to fully capture all consumption, resulting in an underestimation of the Ecological Footprint. In other words, the biocapacity deficits we report are probably even larger in reality. These accounts allow us to compare two key measures: the biocapacity available per person—currently about 1.5 global hectares—and the Ecological Footprint per person, which averages 2.6 global hectares globally.

You might wonder: How is it physically possible to use more ecological area than exists? It's similar to how we can spend more money than we earn. With nature, we rely on the flows generated by Earth's biocapacity. For instance, we can harvest more trees than forests can be regrown—this is equivalent to having a larger forest and using it at a sustainable rate. Or we can emit more CO_2 than ecosystems can absorb. In both cases, we're drawing down natural capital—the reserves nature has built up over time. As with finances, overspending leads to debt—except in this case, it's an ecological debt, and the consequences are material, measurable and long-lasting.

The ratio between regeneration and demand (2.6 global hectares of Footprint per person divided by 1.5 global hectares of biocapacity per person equals 1.7) means that it currently takes us the equivalent of 1.7 Earths to support humanity's Footprint. We can accordingly calculate the day of the year by which we will have used the entire annual biological budget of the Earth. In this case, 1 Earth divided by 1.7 Earths times 365 days gives us the number of days in that year that are covered by the planet's regeneration.

Yet, humanity may be better off not using the entire budget of the planet since it depends on health biodiversity. Any other wild species also need access to biocapacity to live. Ecologists suggest that to maintain 85% of the biodiversity present on this planet one hundred years ago, humanity can't use more than half of the planet's biocapacity. This would indicate that the current use of 1.7 Earths is more than three times larger than a more ideal use of not more than half an Earth. In other words, humanity lives on a material metabolism that is at least three times too large.

Do we truly know much about the future? Through these calculations it becomes clear that in any imaginable scenario there will be more climate change and resource constraints. Given past emissions, we're already pretty much locked into an at least 3°C heat increase. If humanity moves (largely) out of fossil fuels very quickly, we will feel resource constraints very soon; but if we don't, we will face far more climate change—which also will reduce biocapacity and make biological resources scarcer. The relative prominence of climate change and resource constraints is not yet set; but what is clear is that overshoot will end, either by design or disaster. Which one will we choose?

What's Going to Be Valuable?

Therefore, the transformational question is not how to integrate sustainability into decision-making or our professional practice. Rather, a more engaging and productive way would be to ask, 'What's going to be valuable in that future?' My first proposed assertion is that it will be those things that can work in that future—because whatever doesn't work well in that future will most likely lose value.

Then, I would even sharpen this assertion with the hypothesis that the most valuable things will be those that, as they expand, reduce global overshoot. In other words, this would include companies which, as they grow, lighten the pressure on the planet. Or inversely, if these companies did not exist, humanity's overshoot would be worse. These companies will not run into constraints and higher costs, and they will be more needed.

The global economy, on average, needs two square metres of biological productive space to produce one dollar value added every year. But there are big differences among economic actors. For instance, a recycling company in Germany that Global Footprint Network worked with. In our collaboration, we found that for every annual dollar of their value added, global overshoot goes down over thirty square metres. Fifteen times lower than overshoot increases on average per dollar value creation.

Which companies can, as they produce value, reduce global pressure on the planet? It seems counterintuitive at first. For example, a car factory: The more cars it produces, the more resources it needs. And it also will take more resources to use these cars. So, expanding a car factory inevitably increases global overshoot. On the other hand, a windmill company also takes resources to produce windmills, but if their windmills displace, for instance, coal-powered electric plants, this overcompensates for the resources it took to build the windmills and pressure on the planet goes down. If windmills just add more electricity to the grid without out-crowding carbon-intensive sources, the impact is not net-negative. It merely leads to less impactful electricity, but still higher global overshoot.

Examples

Is the mentioned recycling company in Germany that reduces global overshoot thirty-two global square metres for every annual dollar they generate expandable to the entire economy? Clearly not. It does take resources to produce output, but some can generate value by reducing inefficiencies and waste. Those have a huge value advantage because they can expand without being in resource competition with others.

In a different, older example, the sustainability director at a large retail mall developer in Australia, GTP, investigated what it takes to build and operate retail space. She concluded that it was 1,650 square metres of biologically productive area for each square metre of retail space. This sustainability director was brave enough to show the results to her CEO. Interestingly, the CEO did not fire her but realised the waste this represents and the opportunity to do much better than their competition. This analysis of Footprint per square metre of retail space became a key tool that helped them win billion-dollar-contracts and operate malls more resource-efficiently, and therefore more economically. It also made retail space operators look ecologically astute, rather than stingy. So, this demonstrated a tangible way of driving ecological and economic performance in parallel.

Let's move to the city scale. A few years back, we compared cities around the Mediterranean. Our research showed some cities' Footprints and also the host country's biocapacity all to scale—all in global hectares. Obviously, in reality, Egypt has more surface than Turkey, but many of Egypt's hectares are not productive and therefore represent very few global hectares. This makes the biocapacity of Egypt smaller than Turkey's. Or consider Athens, just one city in Greece. Its resource demand is 20% higher than the entire biocapacity of Greece. Such analysis is not a moral judgement. Rather, it points out enormous risk for such cities, whose resource dependence is baked into their infrastructure. It makes clear how significant resource security is, even for cities. And increasing their resource security is adding value to the city as it will be more resilient to navigate the predictable future.

For this reason, I never advocate for reducing Footprints. Rather, I offer to help entities, whether a company, a city or a country, to increase their resource security. It is nearly the same, but with the lens of offering benefits. The same logic can also be applied to buildings.

When analysing buildings, one needs to consider various dimensions. It starts with the embodied energy and resources in the construction of the building. Then there are the operational requirements. In Switzerland, highly energy-efficient buildings are now using about double the amount of embodied resources in the construction than in their first sixty years of use. Then, buildings can also induce resource use, both positively and negatively. For instance, by encouraging lower density neighbourhoods, they help increase resource use for everyone around them. Vice versa, they can also enable lower-resource ways of living, for instance, by encouraging walking and biking, rather than car dependence. For example, if we build a parking garage, we induce traffic. If we build a bicycle shed, we induce moving away from fossil fuels. So, what do we displace with our buildings?

Of course, the projects of up-and-coming architects will become inspirations and their buildings will have a lighthouse effect. This effect is not direct and is one of the hardest to measure. Nevertheless, if done well, these examples show others what's possible and set standards. While hard to quantify the inspirational effect, effective examples also make a significant impact on future buildings.

Tools for Decision-Making

Global Footprint Network builds its work on describing what is. Accounting is not speculation about the future, but documentation of the present condition and past trends. Our assessment of humanity's current demand for 1.7 Earths can then be broken down for individual nations, like the United Kingdom or Spain, or for cities, regions, households, et cetera. We can show, on a yearly basis, how much nature is used. Given data limitations, the numbers are not totally exact, but a robust indication. National averages can also be further broken down by subpopulations or consumption categories. This gives us a picture of where we are at, resource wise.

Then, this description can be compared with where we want to go, the normative part. The descriptive analytics then help to inform the resource budgeting. For example, if we decided that the goal for humanity would be using no more than half an Earth, a necessity to meaningfully protect biodiversity, we could then run a budgeting exercise accordingly. How much Footprint would be reasonable to allocate to the various activities that make up the total consumption pattern of a population? For example, food is harder to shrink because we need the calories; whereas buildings, like housing, can be far more malleable resource wise. They can become far more resource efficient. Resource requirements for mobility are highly malleable as well. If we use bicycles instead of jets, we can shrink that portion enormously. Such a budgeting approach would enable us to develop quite specific resource benchmarks for various activities or even building types.

As an illustration, let's look at buildings. We could start from the assumption of needing to provide twenty square metres of living space per person. For such living space, we may have allocated five-hundred global square metres of our per person biocapacity budget. Therefore, this would lead to twenty-five global square metres of Footprint per square metre of living space. This would be our building's resource budget, i.e., the benchmark. In comparison, there is the aforementioned mall requirement of 1,650 square metres of biocapacity per square metre of mall space. Of course, not every building would need the same per square metre. For instance, a bicycle shed needs much less per square metre, a hospital probably significantly more. So, the benchmark could be adjusted for various building types.

Transformative Information

Is this information useful? We all hope that better information changes the world. Yet, Upton Sinclair warned us, recognising already in the 1920s that 'it is difficult to get someone to understand something if their salary depends on them not understanding it'. Therefore, information is not enough to produce change, even if perfectly accurate. There are three core conditions that make information effective, and all three need to be met, in my experience: information has to be factual, relevant and empowering. If information is not empowering, people fight it even more if it is made more relevant and more factual, because it becomes even more of a threat. Therefore, if information is not empowering to the audience, it's better not to share it as it would only produce resistance. It is better to use your time to figure out how the information can be deployed so it becomes empowering. In other words, it's not only about having good information, but also about being able to make it into something the audience appreciates, so they can and will take it on.

Consider this way of presenting the overshoot dilemma: This predictable future of ever more climate change and resource constraints is coming towards us much faster than our physical infrastructures can adjust. As a result, we are already late in the race. It's not about the future. It is about current value propositions. Work with the people who recognise the predictable future as they will recognise that now is the best moment to invest in sustainable assets because these assets are currently underappreciated by the market. Help them take advantage of it. Envy is a much stronger motor of transformation than blame. Think ahead, plan ahead.

Power of Possibility

Once we better understand our context, the opportunities become obvious, too. For that, Global Footprint Network created a website called Power of Possibility, where we translate into graspable terms what the impact on overshoot would be if everybody embraced a certain action.[5] We initiated this work with Schneider Electric, a large global company focused on digitisation and decarbonisation. Together, we calculated if everybody in the world used their current, economically viable technology, Earth Overshoot Day would be postponed twenty-one days. Obviously, this is not all theirs to capture, but it does demonstrate the market potential.

[5] See www.overshootday.org/pop.

Building this 'Power of Possibility' opportunity space builds on our Earth Overshoot Day slogan '#MoveTheDate'. It goes even further as it makes obvious that moving the date is becoming a fundamental value proposition. Many opportunities can be found on the supply side: Strengthen the planet's biocapacity and heal the wounds in the environment. On the demand side, there are four fundamental categories of opportunities:

(i) How are cities organised? Cities mightily shape consumption patterns of their inhabitants. Urban design imposes how people move, where they sleep, how they shop, et cetera. It affects everything, from housing to transport.
(ii) How do we power cities? It makes a difference whether one uses solar power or coal.
(iii) How do we feed ourselves? Currently, 51% of the planet's biocapacity is occupied just to feed humanity.
(iv) How many are we? If we are twice as many, there is only half as much planet per person available, mathematicians have found. If reproductive rates currently common in Portugal, Italy, South Korea and Spain were the global norm, humanity may shrink all the way down to four billion people worldwide by 2100—a time when humanity should be able to operate without the currently omnipresent fossil fuels. Now the projections point towards eleven billion people. Changes in population size are slow but steady, and make a big difference over time.

Is Capitalism the Culprit?

Some claim that the underlying problem is capitalism. That may be too simple a view. To succeed with the predictable future of climate change and resource constraints, we need to put more focus on maintaining our assets and making them work for that future. This means we need to make sure our assets stay valuable. With assets, I mean capital, not just on paper but in the physical world. A physical expression for capital is capacity—the capacity to provide the things we want. In other words, we want to ensure society has the capacity to enable us all to eat, sleep, move about, play, et cetera. Safeguarding these capacities, safeguarding our capital, is therefore essential. Protecting our capital, or our assets, is very much like brushing our teeth. Most realise the importance of protecting our tooth capital. That's healthy. We are doing that because it serves us, not because of moral pressures. This is what I mean: Advancing the sustainability transition for your company, your city or your country is not just a noble cause in which we give ourselves up for the common good. Engaging with the sustainability transition is far more like brushing teeth to make sure your teeth stay healthy, today and tomorrow.