

Exploring The Paradox of Increased Global Health and Degraded Global Environment—How Much Borrowed Time is Humanity

Living on?

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Abstract

Ample documentation of the global environmental degradation of air, land, and water paints a grim picture for the future of humanity. And yet, by all measures global human health and well-being have been improving significantly over the past several decades, including significant improvements in middle and low income countries as well. The causes and consequences of this apparent paradox have not received the attention that they deserve, largely because they are measured and studied by different fields of inquiry. A systems approach that focuses on the drivers behind this apparent paradox of environmental degradation and human health improvement must include a combination of social and technological developments that have improved resource use, distribution, and innovation. But in many cases, such as phosphate resources and flying insect populations, the resource bank is not inexhaustible or replaceable, and priority

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must be placed for research and action on those critical resources upon which planetary health relies. Particularly, providing greater support and access to the table for youth leaders may be one way to create space for this first true generation of “Anthroponauts” to lead with solutions to our resource problems and to help build balance back into the environment-health equation.

Key Points

We have overlooked the apparent paradox of increasing global health status and declining ecological and environmental quality

Resource banks, and their largely undervalued nature, hold the key to understanding the global health-environment balance

Much more work needs to focus on ripple effects from exploitation of non-renewable, and non-replaceable resources

Plain Language Summary

The Planetary Health Alliance meeting in Edinburgh in May 2018 revealed the puzzling paradox between generally improving global health in the face of generally degrading global environmental conditions. Inadequately explored, however, are the resource base assumptions that have so far allowed us to withdraw from global resource banks at rates far higher than natural deposits. It is critical to explore carefully the balance between deposit and withdrawal, and to prioritize research in areas where there seems no alternative resource option. Youth leaders might prove the spark for these efforts, as

they might be considered the first generation to live their entire lives on a profoundly altered planet. They are the so-called "Anthroponauts" steering planet Earth forward.

Introduction

The health and well-being of humanity has improved markedly over the past 50 years.

Longer life spans, lower infant and maternal mortality, lower birth rates, lower poverty rates, are among many positive global health developments (e.g., Roser, 2018; Ortiz-Ospina and Roser, 2018). Many of these improvements are not just for those in High Income Countries (HICs), but increasingly are reaching into Low Middle Income Countries and Low Income countries (Ortiz-Ospina and Roser, 2018). Despite terrible and unjust genocides, wars of aggression, deaths from preventable diseases, and famine from climate change that appear on our news feeds, humanity is doing better on an individual level than ever before. Despite climate change beginning to have clear impacts on cities, communities, and cultures, pharmaceuticals and other chemicals of unknown ecotoxicity appearing in water samples throughout the world, legacy contaminants such as lead and polychlorinated biphenyl (pcb) poisoning our soils, water, and air, and poor air quality hovering over our major cities and countryside (e.g., Filippelli and Taylor, 2018), by all measures we are getting healthier, more prosperous, and living longer.

Meanwhile, ample evidence exists that environmental degradation is escalating on several fronts, from poor air quality to water and soil pollution to climate-driven ecosystem degradation to human-driven decline in animal and plant species globally (Whitmee et al., 2015). One line of evidence linking this degradation to human health is the sharp increase in morbidity and mortality from non-communicable diseases, with 9

million people dying from pollution every year (Landrigan et al., 2017), which constitutes 15 times more deaths than from all wars and violence combined. And much of this pollution has a long lifespan in the environment, meaning that the even if some pollution revolution would occur tomorrow, the legacy contaminants will remain in our environment for tens to thousands of years.

Discussion

This paradox, substantial improvements in health across most populations in the face of declines in environmental quality in many regions, was highlighted at the annual Planetary Health Alliance meeting held in Edinburgh in May 2018 (<https://planetaryhealthannualmeeting.org/>) in Keynote presentations by Hannah Ritchie and Philip Landrigan. Not discussed in a theoretical framework, however, are the implications of this paradox—how is this disparity characterized and can it continue sustainably?

This mathematical solution to this apparent paradox might best be characterized by:

$$EF + N = GH, \quad (\text{eq. 1})$$

Where EF is Earth Functions, encompassing the health of the environment and balance of global ecosystems, GH is global human health and well-being which constitutes the physical, mental, and economic well-being of humans, and $N = (n+s+t)$, which signify the natural, social, and technological resources that support the human ecosystem.

In the current state, then, the equation looks something like this:

$$\downarrow EF + N = \uparrow GH, \quad (\text{eq. 2})$$

with environmental degradation reducing environmental and ecological capacity while global health increases. To be sure, improvements in global human health can be ascribed to a shot of actions that might be only tangentially related to environmental or ecosystem processes, including water filtration technologies, access to information in remote locations, widespread vaccination efforts. But nevertheless, the benefits of these actions have their own limits, and many of these “public health” interventions rely on resources embedded in N .

The obvious balance to equation 2 is N , the resources bank for the planet. This bank receives deposits through natural processes, but these deposits typically come at a slow, geological rate. Take for example fossil fuels, which have accumulated over tens of millions of years but the carbon from which has been extracted and emitted to the atmosphere and surface systems at rates thousands of times faster than the deposit formed. Or, perhaps more troubling, take systems for which there are no obvious replacements, such as phosphate rock resources. These accumulate in rare settings over geologic time, but as for fossil fuels, are being withdrawn for fertilizer production at rates far outpacing deposits. But unlike fossil fuels, there are no alternatives to phosphorus, which plants depend on for photosynthetic processes and upon which the global population depends for food (e.g., Filippelli, 2018). And as a final example, the global population of pollinators, critical to food stability, is in sharp decline, with an observed decrease in flying insect biomass of 75% over the last 27 years (Hallmann et al., 2017), the result of multiple chemical and ecosystem pressures.

Our N , the resource capabilities of the planet, is impacted not just by the sheer quantity of reserves that exist in the resource bank itself (i.e., amount of oil, acreage of arable land, etc.), but also by our social interaction with this resource. This includes resource use intensity and preservation, and technological capacities to maximize or indeed bypass this resource, such as GMOs and precision agriculture to increase per acre yields and alternative energy sources to fossil fuels. Furthermore, geopolitical and resource distribution can impact N availability both globally and locally. For example, the majority of known remaining phosphate rock reserves exists in only two countries, Morocco and Western Sahara (e.g., Filippelli, 2008), whose standing as transparent states which cleave to the rule of law is not solid and which in fact do not even have an agreed-upon border, thus raising the potential for political instability impacting the extraction and distribution of this resource.

So at what point will withdrawals exceed deposits, resulting in an N that goes into a negative balance? There seems no capacity to receive a loan on N , and for some resources, no viable or at least painlessly adopted alternatives. In many cases, technological or social innovations can make N transitions feasible. The development and commercialization of alternative energy technologies relying on renewable sources is beginning to change the energy production and distribution landscape, thus replacing one N , fossil fuels, with several others. Emerging research, programs and businesses that focus on resource use reduction and resource reuse are beginning to change the way that we can reduce the withdrawal rate of N from various systems.

A major concept of Planetary Health is that all systems, including ecosystems, humans, social systems, political systems, etc., are linked together. This would imply that we could in theory quantify the components of the global *N* in such a way as to target exactly what components of this resource bank are most vulnerable to stress and thus should be prioritized for interventions or innovations to ensure that recent improvements in global health do not stall, or worse, degrade. In a practical sense, however, ample evidence already exists that highlight those *Ns*. Food production capabilities, mineral resources, energy sources, water and water distribution, and ecosystem services are among those critical, and vulnerable, resources. And hanging over all of this are the threat multipliers of climate change, inequities in resource distribution and/or redistribution, and conflict and impacts on global food trade, to name but a few.

One of the important final sessions of the Planetary Health Alliance meeting focused on solutions, both local and global. One session that resonated was by members of the Scottish Children's Parliament, which highlighted the passion, commitment, and effectiveness of youth in inspiring change. And perhaps that is where the answer to the resource paradox lies—not in passing down global problems that will impact kids, but rather passing down the knowledge, tools, and pulpit to allow youth to lead. As evidenced by Pakistani Nobel Prize-winning Malala Yousafi and her activism on female education and more recently by the Dutch youth activist Boyan Slat crusading for developing solutions for plastic pollution in oceans, with the right access to tools and platforms, there is nothing that moves hearts and minds more than hearing “enough is enough” from the very generation of humanity that will be living on a planet fundamentally different than the one the we grew up on. I argue that these

“Anthroponauts” will be the first generation to grow up and die on a Spaceship Earth that is fundamentally different than before, and thus should have that leading voice, which seems to have eluded previous generations, in substantively addressing the global environment-health paradox. Hope is not a strategy, nor is despair an answer.

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