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PERSPECTIVE

In pursuit of sustainability: The root cause of human population growth

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Abstract

Human population growth has been identified as the primary cause of ecologically destructive phenomena. The evidence clearly shows that global human population growth proceeds as a function of the increasing food supply. Understanding and appreciating this reality is posited as a first step in successfully addressing human population growth.

Keywords: agriculture; carrying capacity; ecology; extinction; growth.

Scientists universally acknowledge environmental problems, including pollution, species extinction and climate change (Vitousek et al., 1997). In 1993, Meffe et al. reminded the scientific community that 'most environmental problems are attributable to the effects of an exploding human population'. However, the scientific community has avoided addressing human population growth, regarding it as a non-issue, a social or political concern, or a topic that is 'too hot to handle' (Allendorf and Allendorf, 2012; Bailey, 2004; Meffe et al., 1993; Mora, 2014; Pearce, 1984; Weiss, 2016).

The human species relies on the rest of the biological community for support. The most salient example of this support is human food, which consists of other

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species. An increase in human food species necessarily precipitates a decrease in the biomass of non-food species. Turning a forest into a cornfield reduces the number of trees, as well as the number of other creatures living in that space, in favour of corn. Creating vast amounts of human food necessitates a substantial decrease in the biomass of other (non-food) species, inevitably leading to species extinction (Marshall, 2016; McKee, 2004; Quinn, 2010).

The notion that human population dynamics is an ecological and behavioural process seems to be taboo in and of itself (Bailey, 2004; Meffe et al., 1993; Stebbing, 2011). There are additional ways in which humans view themselves as being immune from scientific laws (Skinner 1990). For example, although the perspective that humans evolved via the same process by which all other species evolved is well established and accepted among scientists, evolution continues to be contested by lay people, politicians and educators (Scott,1997).

Regarding non-human species, it is well accepted that there are specific and clear ecological laws that govern the population dynamics of all species, from microorganisms to the largest plants and animals. Carrying capacity determines population growth and decline. The environmental variables that determine carrying capacity consist of food, water, space, air, predation and disease. For plants, carrying capacity includes sunlight and soil nutrients. Regarding the entire non-human biological community, it has been demonstrated, and is universally accepted, that the population of every species increases to the level of its food supply (Pimentel,1966).

Quinn (2010) and others (Hopfenberg and Pimentel, 2001; Hopfenberg, 2003) have made explicit the reality that the ecological laws that govern the population dynamics of all other species also govern the population dynamics of humans. The human condition seems to be different because humans have done things to alter some carrying capacity variables. As the industrial era saw major increases in agricultural production, food production increases began with the agricultural revolution 10,000 years ago. A second spike began around 1500, mainly in Britain but this had global impact. By 1850, the industrial revolution intensified agricultural production. By this time, food had become a major economic commodity. The decrease in child mortality bolstered population growth and is a vital aspect of the demographic transition model (Hopfenberg, 2014). Although the population has grown more precipitously as a result of decreased child mortality, it can never grow beyond the level of food availability as that would be a violation of the first law of thermodynamics which states that neither matter nor energy can be created or destroyed.

One difficulty of scientifically demonstrating that human population dynamics are governed by the same laws that govern the population dynamics of all other species is that there is no human *experimental* evidence. It is important to remember that scientists have arrived at many findings regarding humans through non-human animal experimentation combined with human correlational and cohort studies. For example, it is common knowledge that smoking causes cancer. But there have been no human *experiments* that demonstrate this conclusion as it would require the unethical random assignment of people to smoking and non-smoking (placebo) groups. Also, relying only on correlational studies, one could *erroneously* argue that a propensity to contract cancer heightens an inclination to smoke. However, scientists have clearly shown the direction of cause and effect regarding smoking leading to cancer using cell and non-human animal experiments (Denissenko et al., 1996; Sasco et al., 2004).

Similarly, there is overwhelming evidence that an increase in food availability, a carrying capacity variable, is correlated with an increase in human population. The popular interpretation of this information is that the human population grows simply because that's what the human population does and then food production is increased to keep pace with this inevitable growth (Gilland, 2002). This perspective is apparent in statements such as: 'Global *demand* for food could easily double over the period 1990-2030, with two-and-a half-to threefold increases in the poorest countries.' (Daily, et al., 1998). However, non-human experimental research provides powerful evidence that the primary cause of population growth is the increase in food availability (Hopfenberg and Pimentel, 2001; Pimentel, 1966; Strecker and Emlen Jr., 1953).

Human food availability has been dramatically manipulated in favour of increases for the past 10,000 years. These agricultural increases are directly responsible for the increase in the human population and the decrease of non-food species which compete with humans for food, as well as for the space used to grow human food (Hopfenberg, 2014; Marshall, 2016; Meffe et al., 1993). The endeavour to continually increase food production, ostensibly to benefit mankind, is the ultimate cause of the nearly exponential growth of the human population, the extinction of species and the destruction of vital ecosystems.

Not only is it accepted that ‘we must continue to increase food production to feed the growing population’, we also hold to the perspective that increasing agricultural production must be pursued to solve the scourge of starvation and malnutrition (Global Food Security Act, 2016; Hopfenberg, 2019). Yet as Rosset et al. (2000) pointed out, ‘if the history of the Green Revolution has taught us one thing, it is that increased food production goes hand in hand with greater hunger’. Also, non-human experiments have demonstrated that, with a daily food supply that is elevated and constant, the population ‘grew rapidly to the limit set by the daily food allotment, then stopped abruptly and gradually declined’. This was due to *diminished reproductive activity* even though ‘no loss in weight or viability occurred’ for the subjects (Strecker and Emlen Jr., 1953).

To address and ameliorate environmental deterioration, it is essential that we address human population growth as it is the driver of all other environmental problems (Bradshaw et al., 2021). The one carrying capacity variable that has been dramatically manipulated for the past 10,000 years of human history is food availability. This increase in food availability acts as an ecological magnet, drawing population numbers up to it (Hopfenberg, 2003; Rodrigo and Zulkarnaen, 2022). We all understand that a precipitous decrease in food availability would cause a catastrophic decrease in human population. Yet many have difficulty appreciating that the precipitous increase in food availability has caused the catastrophic increase in human population numbers and has, paradoxically, increased the number of starving and malnourished people (Global Food Security Act, 2016; Hopfenberg, 2019). Only by appreciating and understanding this reality will we be able to formulate ways of attending to our population problem and ensuring human sustainability and wellbeing.

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