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Evolution and Climate Change Through the Lens of Power

This essay is based on, and partly extracted from, the book POWER: LIMITS AND PROSPECTS FOR HUMAN SURVIVAL.

During the last century, evolutionary biologists developed the idea that power (defined as the rate of energy transfer) is key to the survival and success of species. This notion was formalized as the *maximum power principle*, which biologist John DeLong has explained as follows:

> "biological systems organize to increase power whenever the system constraints allow. . . . With greater power, there is greater opportunity to allocate energy to reproduction and survival, and therefore an organism that captures and utilizes more energy than another organism in a population will have a fitness advantage."[1]

The 20th century seemed a propitious time for such an idea to arise, as one species—*ours*—was in the process of gaining unprecedented power by harnessing the energy of fossil fuels. Coal, oil, and natural gas constitute tens of millions of years' worth of stored ancient sunlight—energy that's vastly greater in quantity than any energy sources humans had harnessed previously.

Constraints on all sorts of human activities were suddenly lifted. Soon we were out-competing all other organisms and, in effect, taking over the world. During the last two centuries, human *per capita* energy usage grew eight-fold—while the number of "capitas" also doubled three times over. All this newly available energy found uses in agriculture, mining, manufacturing, transportation, and warfare. Today, just through mining, we displace far more of the planet's crust each year than do all of nature's processes (wind, rain, and earthquakes) combined. Human-made stuff now outweighs all of Earth's biomass. It's been the biggest power grab on this little planet of ours in tens or hundreds of millions of years. And here we are today, at the top of the evolutionary heap, wielding extraordinary levels of control over the Earth, over other creatures, and over one another. We even have a name for this new era of human super-empowerment: the *anthropocene*.[2]

But, as the side effects of human empowerment via fossil fuels have become more evident, the maximum power principle has turned into a seriously depressing idea to many ecologists. Climate change, species extinctions, resource depletion, and air and water pollution are all evidence of increasing human impact on the planet—and all are side effects of the human power grab. There are technical work-arounds for some of these problems (such as replacing dangerous industrial chemicals with ones that are less so). But, overall, real solutions would require cutting back on our power: reducing energy usage, reducing land use, reducing our

extraction of natural resources, and reducing our population.

However, if the maximum power principle is inviolable, then cutting back may not be possible: we would have to go against our innate evolutionary imperative. And that's what's depressing. We humans may not be capable of anticipating natural limits and pre-adapting to them; instead, we may be designed by evolution itself to overshoot natural limits and then crash-land, with almost inconceivable levels of destruction to the natural world and to humanity itself.

Sure enough, policy makers for decades have looked askance at suggestions from ecologists for downsizing the economy, or limiting energy usage and population growth. Indeed, the requirement for growth has been baked into the structure of modern societies. Today, employment levels, investment returns, company profits, and government tax revenues all depend on continual economic expansion. Big environmental organizations, which used to call on society to "reduce, reuse, and recycle," have largely given up on that message; instead, they now call for "green growth" through renewable energy, hoping this message will be more palatable.

Unfortunately, several key studies suggest that the prospects for decoupling economic growth from increased rates of energy usage, and for "green growth" in general, are not good.[3] We can exchange some of our polluting technologies and processes for more benign ones, but as long as population and total consumption levels continue to grow, we are locked into a paradigm that's utterly at odds with nature's limits and balances. Resources will deplete, wastes will accumulate, and other species will be crowded out of existence.

Still, the idea that we are slaves to the passion for power is debatable. In *Power: Limits and Prospects for Human Survival*, I argue that evolution has found ways of preventing species from attaining so much power that they overrun environmental limits; similarly, human societies have evolved ways of reining in bullies, sharing and conserving resources, and limiting inequality. I propose a new bio-social principle in evolution—the *optimum power principle*—to describe these pathways toward moderation (it's not an alternative to the maximum power principle, merely an informal addendum).

Examples of the optimum power principle at work in nature and human affairs are abundant, starting with a protein in living cells (m-TOR) that senses whether there are sufficient resources and space for expansion, and directs cells either to grow or to retain current size and engage in cleaning and repair activities. Homeostasis, which maintains a healthy power balance within individual cells and whole multi-celled organisms, is an example of what systems theorists call balancing (or self-limiting) feedback. Ecosystems are subject to balancing feedbacks that often take the form of predator-prey population dynamics. And many organisms (such as the American pika, *Ochotona princeps*, a small relative of the rabbit) have seemingly made the choice to specialize on rare foods or harsh environments, thereby limiting their own numbers while in return gaining relative population stability.

Humans also have a long history of pursuing optimum (rather than maximum) power. In hunter-gatherer communities, nearly everything was shared. Bullies were eliminated through ostracism or capital punishment, and there was little opportunity for the development of extreme inequality of any kind. Children were taught to be humble and self-effacing so as to maintain solidarity within the group. Anthropologist Richard Lee, who studied the !Kung people of southern Africa, noted that when a hunter brought back a prized animal to share with the band, he always talked about how skinny and worthless it was. If he failed to do so, others would complain about the meat and make fun of him. When Lee asked about this, he was told:

> "When a young man kills much meat, he comes to think of himself as a big man, and he thinks of the rest of us as his inferiors. We can't accept this. We refuse one who boasts, for someday his pride will make him kill somebody. So we always speak of his meat as worthless. In this way we cool his heart and make him gentle."[4]

Taboos against overhunting were traditional methods of self-restraint and ecological stewardship. One example: the Bayaka of the Congo placed markers on paths that led into parts of the forest where hunting had been unsuccessful, thus warning others to avoid these places, and giving game populations time to recover.[5] Such practices were widespread and varied. Tribal taboos regulating the harvest of vulnerable species took at least six forms, according to anthropologists Colding and Folke.[6] These included "segment taboos," which forbade individuals of a certain age, sex, or social class from harvesting a resource; "temporal taboos," which banned the use of a subsistence resource during certain days, weeks, or seasons; "method taboos," which restricted overly efficient harvesting techniques that might deplete the stock of a resource; "life-history taboos," that forbade the harvesting of a species during vulnerable periods of its life history such as spawning or nesting; "specific-species taboos," which protected a species at all times; and "habitat taboos," which forbade human exploitation of species within particular reefs or forests that served as biological reserves or sanctuaries. Given the evidence that ancient peoples, as they migrated into new territories, often hunted abundant prey species to the point of extinction, it seems probable that indigenous conservation practices were learned over a long time, through trial and error.[7] As Clark Monson points out in his thorough review of the subject, indigenous resource management is now being studied widely as a model for modern practice.[8]

In the modern world, laws and constitutions limit the dangerous accumulation of social power. Government programs aimed to reduce economic inequality have come to include transfer payments (welfare, financial aid, and Social Security) and social safety nets (unemployment benefits, government-run or subsidized healthcare systems, free education, rights to housing, legal aid, funds for pensioners and veterans, consumer protections, and subsidized services such as public transport). Some nations have more robust public spending programs than others: Europe and Central Asia currently spend the most, averaging 2.2 percent of GDP; the Middle East, North Africa, and South Asia spend the least, at about 1.0 percent. In the US, government redistributive programs have become the subject of much political controversy, with right-leaning politicians seeking to reduce or eliminate programs, and their left-leaning opponents proposing to expand existing programs or create new ones, such as "Medicare for all" or a guaranteed basic income.

Modern humans have also sought to restrain their collective power in order to keep society from crashing against ecological limits. The environmental movement began in the late 19th century with efforts to protect public lands from exploitation; it has since taken on a widening array of issues, including the protection of threatened species, the reduction or ending of various forms of pollution, and the curbing of growth in human population. Tactics borrowed from the 19th century slavery abolition movement and from Mahatma Gandhi's nonviolent anti-colonial campaign have led to a long series of victories, including (in the US) the establishment of the Environmental Protection Agency, and the passing of the Clean Air Act, Clean Water Act, and Endangered Species Act.

More recently, worsening news about climate change impacts has ignited a new phase of environmental activism epitomized by groups like 350.org; the Sunrise Movement, which lobbies elected officials for a Green New Deal; and Extinction Rebellion, a global movement with the stated aim of using nonviolent civil disobedience to compel government action to avoid tipping points in the climate system.[9]

However, if we have the innate capability of restraining excess power, then why haven't we already stopped converging environmental crises in their tracks? Of course, the political clout of the fossil fuel industry is partly to blame, but there are deeper reasons. Humanity is in a unique situation now, wherein (because of fossil fuels) we've become accustomed to smashing through historic limits on energy, food, population, and scale of social organization that kept previous societies within critical bounds. Our very success may be temporarily blinding us to the fact that limits nevertheless still exist, and are in fact looming. We have even refashioned our economies to require continual expansion: failure to grow results in political and social turmoil. Indeed, economic growth is proposed as the solution to nearly every environmental and social ill (only if we grow the economy, it is claimed, will we have enough money to build renewable energy infrastructure, save endangered species, and fight poverty). But can growth really solve problems that were caused or worsened by too much prior growth?

There can be no perfect, stable society. Imbalance and impermanence are baked into biological existence. But we are in a particularly explosive moment now. History shows that over-concentrations of physical, economic, military, and political power create vulnerability to societal collapse, and, in the past few decades, humanity has found ways to build and concentrate these kinds of power as never before. The strong likelihood is that we are headed toward what economists glibly call a "correction," though not just in stock market values but also in population and consumption levels. If we hope to minimize the shock and casualties, we will need to mobilize cooperation and behavior change, aiming to limit our human collective power, at a speed and scale that are unprecedented.

Fortunately (or unfortunately, depending on how you look at it), cultural evolution is now happening faster than ever. There's certainly no guarantee that it will work to our advantage: the internet and social media could easily create opportunities for extraordinary levels of cooperation, but along competing lines, thereby defeating any effort to build a unified coalition of humanity willing to check its power now so that it can sustain itself and the biosphere over a much longer period.

Nevertheless, the possibility now exists for rapid shifts in human understanding and behavior —and such shifts are essential if we are to create future societies that live happily within natural limits. For rhetorical purposes, it is difficult to altogether avoid an either/or framing of the choices and outcomes before us. But, of course, reality will be complicated. It is pointless to imagine a future in which power self-limitation is entirely absent from human society, because such a condition has never before existed. It is just as unrealistic to paint an imaginary picture of a world in which all human power excesses have been quickly, sufficiently, and amicably checked.

However, we can be fairly confident that, one way or another, human power *will be* reined in through *some combination* of collective moral struggle on one hand, and, on the other, social/ecological unraveling triggered by climate change, biodiversity loss, resource depletion, economic collapse, political polarization, famine, population decline, pandemic, social fragmentation, and war. The actual trajectory of future events will be determined by *how much* collective self-limitation humanity can muster—what quantity of carbon emissions we are able to forgo, how many weapons we dismantle, how successful we are at taxing the wealthy. Can campaigners forge durable alliances? Can they communicate effectively with the public and take strategic advantage of opportunities? Or will self-consuming capitalism win the day? In the best instance, we humans will learn collectively and rapidly to live equitably and peacefully within limits to a much greater degree than we do now; in the worst, society will uncontrollably descend the ladder of cultural evolution back to a condition that *can* be sustained with whatever resources are left.

In the aftermath of a societal unraveling, our surviving descendants—learning from hard experience—might eventually adopt cultural narratives similar to ones that indigenous peoples used in order to protect biodiversity and to keep human population within the carrying capacity of the environment. Ironically, these narratives might closely resemble those we would need to develop now if we are to minimize the unraveling.

Those narratives would likely encode a deep cultural skepticism of power in all its forms, and a profound reinforcement for habits of self-restraint and self-control. We cannot do away with power, nor should we; it is necessitated by the fact that we are organisms—and especially since we are big-bodied, linguistic, tool-making mammals. But if we wish to avoid outcomes that are awful to contemplate and far worse to experience, we can and must rein in the extreme powers that currently threaten our success and even our survival. If we're truly smart, we can do so in ways that are beautiful, and that make our descendants happy for a long time to come.

[1] John DeLong, "The Maximum Power Principle Predicts the Outcomes of Two-Species Competition Experiments." *Oikos* 117: 13291336, 2008
[2] https://www.nationalgeographic.org/encyclopedia/anthropocene/
[3] https://meta.eeb.org/2019/12/03/the-renewable-revolution-cannot-occur-with-limitless-growth-experts-warn/;
https://www.sciencedirect.com/science/article/abs/pii/S1462901120304342?dgcid=coauthor
[4] Lee, R. B. (1988). Reflections on primitive communism. In T. Ingold, D. Riches, & J. Woodburn (eds.), *Hunters and Gatherers Vol. 1,* Oxford: Berg, 1988, pp. 252-268.
[5] "Tribal Conservationists in the Congo Basin," *Survival,* n.d.
https://www.survivalinternational.org/articles/3473-conservationistscongobasin Accessed September 3, 2020.
[6] Colding, J. and C. Folke, "Social taboos: 'invisible' systems of local resource management and biological conservation." *Ecosystems* 4, 2001, pp. 85-104.
[7] See also: Jim Robbins, "Native Knowledge: What Ecologists Are Learning from Indigenous People. *Yale 360,* April 26, 2018. https://e360.yale.edu/features/native-knowledge-what-ecologists-are-learning-from-indigenous-people Accessed September 3, 2020.
[8] Clark Monson, "Indigenous Resource Taboos: A Practical Approach Towards the Conservation of Commercialized Species." Dissertation, University of Hawaii, August 2004.
https://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/11606/uhm_phd_4488_r.pdf?sequence=2 Accessed September 3, 2020.
[9] See Roger Hallam, *Common Sense for the 21st Century.* White River Junction, VT.: Chelsea Green. 2019.