Humanity and the 21st Century's Resource Gauntlet: a Commentary on Ripple et al.'s Article "World Scientists' Warning to Humanity: a Second Notice"

Mohsen Kayal[1#], Ph.D. (mohsen.kayal@gmail.com)

Hannah Lewis[2#], M.Sc. (hannahkathrynlewis@gmail.com)

Jane Ballard[3#], M.Sc. (ballard.jane.m@gmail.com)

Ehsan Kayal[4#], Ph.D. (ehsan.kayal@gmail.com)

[1]UPVD-CNRS, Centre de Formation et de Recherche sur les Environnements Méditerranéens, UMR 5110, 52 avenue Paul Alduy, 66860 Perpignan, France

[2]Biodiversity for a Livable Climate, Cambridge, MA 02139, USA

[3]National Estuarine Research Reserve Association, Wells, ME, 04090, USA

[4]Station Biologique de Roscoff, FR 2424 CNRS UPMC, Place Georges Teissier, CS 90074, 29688 Roscoff Cedex, France

#All authors contributed equally to this work

The 21st century will undeniably represent a major turn in the development of human societies, as Earth's limiting resources can no longer support the current pace of material consumption (supplemental file S1). In this context, Ripple et al. (2017) identified thirteen critical shifts in our ways of life to reduce humanity's ecological footprint and achieve sustainable development. While we endorse the pertinence and urgency of this call, we direct attention to critical shortcomings in the proposed solutions, which limit their potential to promote sustainability. Indeed, several prescriptions in Ripple et al. address symptoms rather than root causes, or seem

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to result from a simplistic consideration of inherently complex processes. We emphasize the importance of accounting for historical patterns and underlying drivers of the global socio-economic system, especially in relation to wealth inequality, human demography, and food production, which need deeper consideration than presently given in the warning and subsequent follow-up articles. Without such considerations, this second warning to humanity can be interpreted as prescriptive suggestions from a narrow, western-biased vision of the global socio-ecosystem, rendering it all but ineffective.

Latent idolization of the western-type society

A major limitation in Ripple et al. relates to an apparent idolization of western societies, in which the western lifestyle is assumed to be the norm and end goal of societal evolution rather than a path among alternative trajectories. Since the industrial revolution, western societies have contributed greatly to improving human health and material comfort, particularly through increasingly dominating what was often considered an austere and threatening natural world (file S2). However, this accelerated development was fueled by intensive exploitation of natural resources and human labor at a planetary scale, leading to severe inequality within and between countries and the global socio-environmental crisis we are facing today (file S3). Yet, both warnings to humanity (UCS 1992, Ripple et al. 2017) neglect to link the level of comfort enjoyed in western societies today with already imposing "vast human misery" and "environmental destruction" as the authors warn about on a large portion of the world. Territorial occupations and slavery have diminished in recent history, but colonial exploitation has taken new forms. Neocolonialism is today a major force driving resource flow at the global scale, strongly influencing resource exploitation and the fate of populations in the developing world (file S3).

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As such, from a global perspective, the current western lifestyle is neither humanly ethical nor ecologically sustainable, and should not be considered a reference endpoint system.

Wealth inequality

While the warnings recognize an equitable distribution of wealth as an inherent component of a sustainable future (prescription *l* in Ripple et al.), the current state of inequality, a major obstacle to sustainability, is left unaddressed. Accounting for inequalities is key to defining sustainable policy, including for establishing well-managed reserves, remedying defaunation, and promoting dietary shifts (prescriptions *a*, *e* and *g*, files S4 and S5). Poor communities often depend more directly on natural resources and ecosystem services for food and livelihood, making them more vulnerable to environmental decline (file S4). Populations in developing countries are also more exposed to ravages of climate change, despite being least responsible for it (Gore 2015). Environmental decline has repeatedly led to societal crises and humanitarian catastrophes, which in turn exacerbate anthropogenic stress on ecosystems in a downward spiral of poverty and environmental degradation (FAO 2017, file S4). In contrast, wealthy communities are typically higher consumers of natural resources, while being less-directly reliant upon them (Gore 2015, www.overshootday.org). Ironically, many developing countries harbor precious resources critical to western lifestyles. However, multinational corporations, assisted by their host governments, compel countries to sell their resources at low prices through political instability and corruption. Examples include exploitation across Africa of minerals used in producing energy, electronics, and jewelry (file S3). The developing world has also become a dumping ground for waste produced by western societies (file S6). Therefore, to be effective, a planetary call for

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sustainability needs to address prevailing inequalities standing as major obstacles to universal sustainability.

Human demography

Another incomplete and, in our opinion, misconceived statement in the two calls relates to the debate on population control (prescriptions *h* and *m* in Ripple et al.). While the role of increasing human population as an amplifier of anthropogenic stress on the planet is obvious, it is highly reductionist to assume a common environmental cost for every human life and limit the debate to birth rates. Per capita resource consumption is significantly lower in low-income communities (Gore 2015, www.footprintnetwork.org), and shorter life expectancies are often compensated by higher birth rates in developing countries (file S2). It is also overly simplistic to attribute recent birth reductions in western societies only to increased access to education (prescription *h*). Rather, economic pressure considerably regulates birth rates in modern societies where the need for a second income, longer educational trainings, and higher costs of raising children constrain births beyond voluntary decisions (OECD 2017, file S2). Fertility rates have declined globally since 1960's, including in developing countries, and unhealthy modern lifestyles and environmental pollutants may increasingly regulate human demography (file S2). Rather than human abundance, excessive resource consumption and ecosystem-destructive practices are today's major issues impinging on the biosphere, and need to be prioritized.

Agriculture

While the need for feeding the world is repeatedly used as an argument for limiting population and growing ever-larger agro-industries, enough food is already produced to feed billions of

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additional people (FAO 2017). In reality, inequitable food distribution and waste need to be addressed to solve the world's food crisis (file S7). Ripple et al.'s prescriptions on reducing waste and encouraging dietary shifts are pertinent (prescriptions *f* and *g*). However, the food-industry produces ~30% of greenhouse gas emissions and dominates land usage at a planetary scale, causing biodiversity loss, desertification, pollution and fresh-water scarcity, and ironically both hunger and obesity (file S7, FAO 2017). Industrial farming also represents a socio-economic trap for many exploited low-income workers, reinforcing inequalities globally (Hurst et al. 2007). Despite continuously increasing fossil-fuel-based energy and chemical inputs to retain productivity, the current industrial model of agriculture remains vulnerable, cannot be counted on to feed humanity in the future, and is in need of a new guiding paradigm (file S7). Meanwhile, increasing evidence points to a suite of practices (cover crops, diverse crop rotations, no-till, adaptive livestock grazing) that build thick, biologically active soil that sequesters carbon, mitigates flood and drought conditions, and restores fertility and biodiversity, and infers pest resistance to croplands. In fact, ecologically-based farming and well-managed grazing can preserve ecosystem services and wildlife habitat (prescriptions *a* and *b*), while increasing yields, resilience to climate change and socio-economical development (file S7, FAO 2017).

Changing the governing system

Climate change, wealth inequality and biodiversity collapse are not inevitable conditions of human life, but logical outcomes of the socio-economic systems that produce them. Rethinking the processes underlying our global socio-ecosystem, such as the continuous transfer of resources from the poor to the rich, and of carbon from soil to atmosphere, is crucial to produce sustainable outcomes. The points raised in Ripple et al. are imperative, but by ignoring

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underlying drivers and inherent biases in the proposed solutions, the transformative change we all strive for will remain elusive. Beyond being designed for perpetual growth on a finite planet (Daly 2005), today's global economic system is the result of centuries of exploitation of people and nature at the service of a minority (file S3). Amplified by mechanization and globalization, the ubiquitous pursuit of profit has resulted in a desensitization to fundamental moral principles. This has lead to prioritizing ephemerals and quantity over durables and quality in production systems, dehumanizing the workforce, and harming people and nature. Perhaps the darkest incarnation of profit-seeking is the war industry, where perpetuating conflicts has become a highly lucrative enterprise (file S6). While the current global economy is advertised as the ideal system and "the end of history" (Fukuyama 1992), it is inherently anti-democratic and has captured political institutions beyond people's reach.

We strongly support Ripple et al.'s point that a major reconsideration of political drivers is needed to shift decision power from economic growth to sustainability. However, while institutional work towards socio-ecological sustainability has been underway for decades, positive contributions are repeatedly dwarfed by powerful organizations undermining this goal, notably governments and lobbyists that benefit from petro-chemical, weapon, and agro-industries and hamper socio-environmental legislation despite global calls for action. We therefore hold that, more than a need for scientific knowledge, political decisions require guidance from independent institutions that guarantee socio-environmental justice beyond the reach of private interests, and with long-term perspectives that expand the short-term agenda of elected officials. Given the dependency of modern societies on markets, steps towards sustainability include incentivizing positive practices by establishing taxes that sanction socio-environmental impacts

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to fund subsidies of ethical goods and services. This facilitates accounting for the true environmental and human costs in the provision of goods and services.

Sustainability can only be achieved through prioritizing global ethics, including universal equality and respect for all forms of life. In this process, humanity needs to emancipate itself from past mistakes by overcoming western ethos of individualism and consumerism, where developing countries feed the western world in resources, host their wars, and welcome their waste (files S3 and S6). Even the education system constitutes today a strong driver of inequality and political propaganda that prevents progress towards universal sustainability, including in western societies where schools still provide incomplete, unilateral and embellished accounts of historical event (file S8). Our socio-economic system is more than ripe for scrutiny along the lines of humanism and environmentalism. Sustainable solutions to Earth's socio-ecological crisis already exist, however humanity still needs to realize that pursuing the same practices that created these problems is not going to solve them. The big question is, how to change the way the system operates?

Author biographical

Mohsen Kayal (mohsen.kayal@gmail.com) is affiliated with the Centre de Formation et de Recherche sur les Environnements Méditerranéens of the University of Perpignan, France. Hannah Lewis is affiliated with Biodiversity for a Livable Climate in Cambridge, Massachusetts. Jane Ballard is affiliated with the National Estuarine Research Reserve Association in Wells, Maine. Ehsan Kayal is affiliated with the Station Biologique de Roscoff, France.

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