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# Economy, society and environment in the 21st century: three pillars or trilemma of sustainability?

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Over the past 70 years, human progress founded on economic growth has been expressive in practically all areas. Nevertheless, doubts concerning the continuity and extension of these advances are mounting. Economic growth has been bankrolled by the unsustainable use of non-renewable resources, by the destruction of biological diversity and by the emission of greenhouse gases that have triggered global environmental crises while also increasing the gaps between rich and poor. Serious ecological, economic and social problems in the context of deepening globalization pressure us to rethink development in the light of nature's own limits. This paper examines the interactions between the main conditioning economic, social and political factors of the present crisis. It also observes that current dilemmas modify the meaning and the direction of traditional debates on the role of demographic dynamics in this equation. "Sustainable development", though much desired, has become an oxymoron. Given the increasing difficulties in conciliating economic growth, social well-being and environmental sustainability, the Three Pillars of the Rio + 20 Conference have morphed into a trilemma.

Keywords: Sustainable development. Environmental degradation. Demographic dynamics.

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## Introduction

Human progress has been rather slow throughout history, but it quickened at an exponential rate over the last seven decades due to the acceleration of anthropic activities in the post-war period. Triggered by the capitalist economy's frenetic chase for profits, by cheap fossil fuels and by technological development, the rapid expansion of goods and services has recently generated a significant improvement in the quality of life for billions of people. Reductions in poverty and misery, as well as improvements in levels of health, education and well-being due to economic growth have been manifest and dramatic.

Nevertheless, there are clear signals that this bonanza period could fade rather quickly. Economic growth has been grounded on the unsustainable use of non-renewable resources as well on the reduction of biodiversity. This has led to the concentration of carbon dioxide in the atmosphere and to many other environmental ills as well as to increasing gaps between rich and poor. With the spread of economic globalization, social and environmental crises have deepened while the trajectory of the world economy shows signs of exhaustion in the hegemonic model itself.

Overt disinformation and misrepresentation efforts helps to retard our understanding of the nature and gravity of the environmental problems facing Planet Earth in the 21st century. The failure to generate a shared vision regarding the determinants and contours of the environmental crisis favors the emergence of spurious solutions and produces an ambience of political inaction that contrasts sharply with the dimensions and gravity of the environmental crisis.

Science has categorically determined that several global ecological frontiers are being exceeded and that this produces the possibility of abrupt and uncontrollable transformations in the planetary sphere, unless major urgent changes are made in the trajectory of our civilization. The current historical moment, marked by profound ecological, economic and social crises, demands that we reflect on this situation in light of the limitations imposed by nature itself.

This paper presents a structural analysis of the environmental crisis that examines the origins of the problem and investigates the interactions between its main economic, social, demographic and political facets. It proposes to underline some of the key limitations to "sustainable development". Unfortunately, this term has become an oxymoron; the development that we know is now anything but sustainable. The vaunted three pillars of sustainability – economic, social and environmental – that were highlighted at the Rio + 20 Conference have become a trilemma.[1] Conciliating economic growth, social well-being and environmental sustainability has become increasingly problematic. Indeed, the gap between these three poles is increasing.

[1] 'Trilemma' refers to a proposition composed of three contradictory mottos, or which includes a difficult choice between three conflicting alternatives.

How have we arrived at this predicament and how can we escape it? The interactions between causal factors that have brought humanity and our Planet to this condition are complex and the debate mingles scientific findings derived from several disciplines with ideological stances that rotate along both the conservative/liberal and optimistic/pessimistic alignments.

Demographic dynamics figure importantly in the aggravation and resolution of the trilemma, but in a different manner than that in which it is traditionally presented. Even the most recent debates between neomalthusians and anti-neomalthusians, or between cornucopians and pessimists have become anachronistic in light of the gravity of the current trilemma. The issue is not simply the number of people but the multiple crises that our paradigm of civilization has created and their origins as well as their consequences for different social groups and classes.

## The major clashes on population, development and environment over time

The academic world of the social sciences is multifaceted and polychromatic. It would be imprudent to adopt any binary perspective and to construct a black and white photo of the evolution of any field of study. Nevertheless, it may be useful to have a quick look at some main debates that have, directly or indirectly, taken a stand on the role of population dynamics in our socioeconomic and environmental history and that have marked a certain polarization between optimists and pessimists in the humanities over different historical moments. Although the environmental dimension was never completely absent in these debates, its importance has increased notably in recent years.

### *The 19th century: Malthus, Marx and Mill*

The initial writings of Thomas Robert Malthus (1766-1834) aimed to counter the progressive ideas of Enlightment authors such as the Marquis of Condorcet (1743-1794) and William Godwin (1756-1836). Malthus opposed industrial capitalism and defended the interests of landowners, nobles and clergy. He had no intention of defending the environment or the preservation of nature. According to his model, population growth tended to grow geometrically in response to a positive correlation between fertility and income. Consequently, reductions in poverty would result in a 'population explosion' since they would cause people to marry earlier, have more children who would be more likely to survive and live longer due to the reduction of infant mortality and the increase in life expectancy. Given his opposition to family planning and abortion, he held that population control would occur through both an increase in the age at marriage (a 'preventive' check) and through increased mortality rates (a 'positive' check).

Karl Marx (1818-1883) stands out among the many detractors of mathusianism, particularly through his criticism of Malthus' stance on poverty and the maintenance of subsistence wages in order to control population growth. He showed that the value of

wages depends on the productivity of work and the repartition of its fruits: paid work is transformed into wages while free work, or added value, is transformed into different forms of profit. The value of the "subsistence wage" depends basically on the degree of the exploration of workers.

Although Marx never formulated a consistent theoretical framework concerning population dynamics as such, he attempted to demonstrate that "excess" populations were not the product of natural laws as Malthus had suggested, but the result of capitalist dynamics that produced a "relative overpopulation" having two main functions: regulating the supply and demand of workers and ensuring the availability of human stock for capital expansion. For him, social and demographic problems would be settled by a social revolution that would guarantee workers enjoyment of the fruits of their work.

In review, it can be seen that Malthus was wrong on the relation between fertility and income while Marx simply ignored the demographic transition (which had been largely anticipated theoretically by Condorcet and Goodwin). Neither Malthus nor Marx showed any concern with environmental issues, biocapacity or biodiversity. Malthus focused on resource scarcity and nature's limits in providing the means of subsistence for a population, not from the standpoint of ecological concerns, but to justify the need for the continuation of subsistence wages and the inevitability of poverty. Marx believed that with communism, the progress of productive forces and the end of social conflict, people would attain a state of complete freedom. Undoubtedly, Marxism consented to the "domestication" of nature, and never questioned the domination and exploration of natural life nor "animal slavery" and all the ethical questions related to the rights of species.

During this same historical period, one of the precursors in examining the relation between population, development and environment was John Stuart Mill (1806-1873), who published "The Principles of Political Economy" in 1848. He anticipated the current debate, writing in Chapter VI of Book IV that the unlimited growth of Gross Domestic Product (GDP) and of population would, in the long run, be historically impossible and thus that the "stationary state" would have to prevail in the world, sooner or later. He observed that, in the same way that the Planet has limits, economic and demographic growth were also inherently limited. Mill was thus an innovator in in defending nature and foreseeing, in an affirmative manner, the end of economic growth as well as the limits to economic competition.

*A century later: the fear of a population explosion and revisionism*

Starting in the 1950s, the perception that a global demographic explosion was likely to occur given high levels of growth in poor countries generated a sudden interest in population issues among scientists and politicians. Several demographers provided legitimacy for bilateral and multilateral efforts to control fertility in poorer countries. However, after the mid-60s, biologists and ecologists basically took over the neomalthusian cause. The eventual opposition of many economists to this stance generated many heated discussions.

Paul R. Ehrlich (born in 1932) published "The Population Bomb" in 1968, at a time when the fertility transition was already advanced in developed countries, but still at very early stages in most countries of the so-called "Third World". As an ecologist, Erhlich provided an apocalyptical view of population issues based on his knowledge of the limits to natural ecosystems. He believed that any species that multiplied itself excessively would be destined to misery and possible extinction.

He proposed both malthusian (population control through increases in mortality rates) and neo-malthusian (population control through reduction of fertility rates) approaches. The goal of human society would be to equate fertility and mortality rates in order to achieve zero population growth. He recommended that measures aimed at reverting environmental deterioration should be adopted simultaneously. He agreed to the use of compulsory measures in case the voluntary methods failed to reduce fertility. Several other well-known natural scientists defended similar ideas, including Norman Myers (who also debated at length with Julian Simon) (MYERS; SIMON, 1994), Lester Brown and John Holdren, while others such as biologist Barry Commoner were bitter adversaries.

This sectarian debate from the 1960s extended into the World Population Conference held in Bucharest in 1974. At this Conference, organized by the UN, developed countries, led by the United States, advocated voluntary neo-malthusianism as a means of reducing poverty. Meanwhile, the poor and less-developed countries, led by China and India, defended policies that supported development rather than population control. The neo-malthusian standpoint was overcome by the slogan "development is the best contraceptive".

However, even before the next World Population Conference could be held (Mexico, 1984), a major turnaround in international stances towards reproductive issues took place. On the one hand, China, which had fought against the ideas defended by Paul Erhlich in Bucharest, adopted a rigid and coercive "one child policy" in 1979, the most draconian neomalthusian policy in history. On the other, reflecting the neoliberal baton of the Ronald Reagan government, the United States abandoned the defense of population control and defended the law of supply and demand, *inter alia*, for reproductive issues (ALVES, 2002; ALVES; CORRÊA, 2003).

In the context of this debate, it is interesting to observe that the United States' prestigious National Academy of Sciences commissioned two studies by demographer/economists that constitute watersheds in the analysis of the relations between population, development and environment. The first of these, published in 1971, offered an essentially equidistant posture in relation to the impacts of population growth, but was interpreted by the media as being more neo-malthusian. The second study, published in 1986, was described as "revisionist" and clearly defended the idea that development and the markets were perfectly capable of resolving population issues. This study was long considered by optimists as the last word on the subject and the positions suggested by this book have since predominated among the majority of demographer/economists.

Julian Simon (1932-1998), an economist and one of the neoliberal ideologues of the Reagan government, gained prominence in population circles during this period. At the peak of the debate, Simon adopted a diametrically opposed stance to Erhlich, supporting a radical pro-natalist policy and discarding any and all environmental restrictions. Simon is a typical example of what analysts define as a market fundamentalist. He was one of the founders of the "free market environment" movement and a forerunner of climate change negationists.

Simon defended the idea that there are no environmental limits to economic development and that scarcity problems are inexistent. For him, each new baby is a capital good bound to create merchandise and bring greater wealth to families and to society. He opposed Ehrlich's catastrophist views, believed that the supply of fossil fuels was infinite and criticized the authors of the ecological economics school. He was an "environmental skeptic" of the first order and argued that human activities were not responsible for global environmental problems such as the destruction of the ozone layer and the acidification of oceans. He defended the idea that unlimited human ingenuity together with the price system would be able to overcome all of the world's environmental problems.

At the height of this debate, Erhlich and Simon laid a wager in 1980 on the future price of certain commodities to test their theoretical conceptions. Simon bet that prices would be lower over a ten year period and Erhlich bet on growing scarcity and rising prices. The pessimist lost his bet since the price of minerals (as well as of oil and food) declined in the 1980s due to a prolonged international crisis. Nevertheless, the bet proved little since the price of commodities has fluctuated significantly in the post-1990 period. Technological development and mineral discoveries have undoubtedly alleviated the pressure on some of nature's scarce resources but the more relevant question is whether and how long this can continue given the Jevons' Paradox (cf. discussion in next section) and increases in global consumption.

*The debate in the 21st century – Lam versus Becker and the environmental crises*

American demographer/economist David Lam published a paper in 2011 that criticized the pessimism of Malthus and Ehrlich and endorsed the idea that the extraordinary progress observed over the previous 50 years demonstrated the capacity of humankind to deal with future challenges. Lam's optimism in relation to demographic dynamics is based on the fact that the "population bomb" has been de-activated and that the demographic transition will bring about zero growth before the end of this century. He also notes that changes in the age structure favor the onset of a "demographic dividend" that constitutes a positive force in increasing education and reducing poverty.

Lam also defuses concerns with three potential challenges caused by rapid demographic growth: hunger, depletion of non-renewable resources and poverty. He shows that hunger has diminished greatly due to the Green Revolution. He notes that the main non-renewable resources cost approximately the same today as they did 50 years ago, despite an increase

of some 4 billion people. He also observes the impressive decline in world poverty, citing both economic factors (market responses, innovation and globalization) and demographic factors (urbanization, fertility decline and investment in children) to explain the reduction in the rate of population growth.

Less radical than Simon, Lam recognizes two negative trends – global warming and unsustainable consumption levels. He notes that increasing incomes in China and India, the world's two largest and formerly poor countries have indeed contributed to higher prices of commodities and to environmental challenges. Nevertheless, in Pollyanna style, Lam (2011, p. 1258) comments: "But I do want to emphasize how amazing it is that in 2011 we are worried about the problems resulting from such rapid increases in consumption in India and China." The author also admits that there is cause for concern given that the world will add on another 2 billion people between 2011 and 2050, but considers himself an optimist given humanity's proven record in facing such challenges.

Lam's work can be seen as an important counterpoint to the simplistic messages emanating from the traditional "population establishment" as well as from the more recent "Northern Perspective",[2] both of which have tended to focus on population growth as a primary source of humanities' problems. Nevertheless, his optimism concerning the market's capacity to overcome all issues, including environmental ones, is questionable. His thesis has been criticized, perhaps most visibly in the demographic community, by Stan Becker, who focuses on the environmental limitations of "development" and of market-based economic growth. Essentially, Becker criticizes Lam for his anthropocentrism, for his limited views on the utilization of the Earth's non-renewable resources and for his failure to generally consider the devastating effects of anthropic activities on the Earth's ecosystems.

Becker points out that the per capita increase in production shown by Lam was grounded on the massive use of non-renewable resources. He notes that food prices are bound to increase over the 21st century due to: a) the massive use of fertilizers that are typically composed of fossil fuels and non-renewable resources; b) the fact that the enormous use of irrigation is rapidly depleting the capacity of rivers and subterranean aquifers.

Becker also cites a number of well-known negative impacts of human activity that are ignored by Lam such as deforestation, over-fishing, nitrogen pollution of streams, estuaries and oceans, the removal of mountain-tops for mining coal and other minerals and so forth. He shows that, although homo sapiens has indeed had considerable success, as described by Lam, the rest of the "world" has suffered setbacks during the Anthropocene, a period in which our species has altered the Earth's dynamics on a global scale. In sum, Becker asserts that Lam has failed to do justice to the great and imminent ecological problems that are resulting from the human progress that he so admires.

This debate extended into the XXVII Conference of the IUSSP – International Union for the Scientific Study of Population – held in 2013 where a plenary session was organized

[2] Cf. Hummel et al. (2009).

to debate the following assertion: "For developing countries, economic development needs to be a higher priority than environmental protection and conservation of natural resources." David Lam and Alex Chika Ezeh spoke for the affirmative while Stan Becker and Eliya Msiyaphazi Zulu took the opposite stance. After the debate, the participants were invited to vote for one or the other position. The result was a draw.

In short, the demographic community was evenly divided between a developmental and an environmental perspective. Two years later, the accumulation of additional scientific evidence concerning the environmental threats provoked by human action already makes this debate appear as anachronistic. An editorial in July, 2015 by Marcia McNutty, Chief Editor of Science, one of the two most prestigious scientific journals in the United States, summarizes the situation in a surprisingly aggressive tone: "we face a slowly escalating but long-enduring global threat to food supplies, health, ecosystem services, and the general viability of the planet to support a population of more than 7 billion people... The time for debate has ended. Action is urgently needed" (McNUTTY, 2015, p. 7).

Given the critical importance of this matter, it is imperative that we review the evidence in greater depth. The next segments of this paper address a series of issues affecting each component of the three pillars of sustainability proposed by the Rio + 20 Conference, in order to foster additional reflections on the contours of the optimist/pessimist debate. Taken as a whole, these elements would advise a much more cautious attitude towards the supposed capacity of market structures and human ingenuity to effectively solve the social, economic and environmental problems of our era.

## Impressive socioeconomic advances and their fragile underpinnings

The optimists have every reason to highlight humankind's enormous advances over the last 50-70 years. However, when viewed in the light of the exacerbation of major social and environmental problems, such advances can be compared to the reaction of the character who falls from the 20th floor of a building and comments – while whizzing by the 5th floor window - "so far, so good". In effect, the definitive answer to the cornucopian view is emerging both from the scientific literature and from nature itself. The major misgivings that surge in relation to human progress are of two types:

- Can humankind continue on this same path to 'progress' indefinitely?
- Can this progress be extended to the entire world population?

These two questions warrant a much more careful analysis since they will define nothing less than the future of humanity in coming decades. The answer to these questions will be defined by the present and future trajectory of what was characterized as the three pillars of sustainable development in the Rio + 20 Conference, namely – the economic, ecological and social spheres of global society. The limitations to progress in each of these pillars, analyzed in the next segments of this paper, constitute what we are identifying as the trilemma of sustainability in the 21st century.

*The foundations and the limitations of economic progress*

Peak and decadence of the global ecoomy

History reveals that before the Industrial and Energy Revolutions, which occurred in the latter stages of the 18th century, economic and demographic growth had been slow. However, between 1900 and 2000, global GNP was multiplied by 18.6, population by 3.9 and per capita income by 4.9. The fastest growth was registered during the post-war and pre-oil crisis period, that is, between 1950 and 1973 (MADDISON, 2008).

This exceptional period will certainly never be repeated. Indeed, the enormous economic growth of the 20th century was made possible by an exceptional array of favorable factors during a specific historical moment. These can be summarized in ten items: availability of fossil fuels at very low costs; availability of vast natural resources that had previously remained largely untouched (land, water, forests, biodiversity, etc.); large increases in population coupled with rising life expectancy and longer working lives; rapid concentration of population in urban areas, facilitating economies of scale that stimulated both increases in productivity as well as the extension of education, health, social and political participation and other social benefits; more favorable age structure with more "producer" sectors (ages 15-64) than "consumers"; improvements in level of education and in human capital; increases in the stock of fixed capital; technical progress; increases in productivity of the factors of production; and favorable environmental conditions, including relative climate stability.

Unfortunately, several of these determinants and conditioners have reached their limit at the current time and this could well lead to the breakdown of the model of production and consumption that has underwritten economic growth over the last two centuries. Getting used to this will not be easy. On the one hand, the economic growth objective is dominant worldwide, especially since the fall of the Berlin Wall. It has a logic and internal consistency that stimulates societies and all their respective economic actors – State, entrepreneurs and workers – as well as international development agencies to dedicate themselves to promoting growth because it has been the basis for material welfare during this bonanza period. On the other, as discussed below, this model requires constant increases in production which are, in turn, guaranteed by the culture of consumption, whose values are so deeply rooted that they defy eradication.

Despite this framework and the mechanisms that guarantee the prevalence and persistence of this model, objective conditions are putting a check on economic growth. Ever since Larry Summers, the former Secretary of the Treasury, spoke to the International Monetary Fund (IMF) in November of 2013 about "secular stagnation", the term has been used to describe an expected long period of low economic growth (BALDWIN; TEULINGS, 2014). The poor performance of the developed countries is contaminating emerging economies. The World Bank (2015) talks of "structural sluggishness" of the developing countries who are facing a particularly difficult transition wherein loan costs are high

and the price for oil and other commodities is low. According to the IMF (2015), emerging market corporate debt increased from US$ 4 to US$18 trillion between 2004 and 2014. The emerging market corporate debt-to-GDP ratio had grown by 26 percentage points in the same period. The IMF goes on to say that "These developments make emerging market economies more vulnerable to a rise in interest rates, dollar appreciation, and an increase in global risk aversion." (IMF, 2015, p. 86).

As explained in the next segment, the exhaustion of growth's ecological underpinnings constitutes one of the principal limitations to the persistence of its current mode. A series of factors - such as the reduction of the economically active Population, population ageing and increased dependency ratios in the developed countries, the end of the demographic dividend, the long-term increases in the cost of energy and food, growing environmental problems and the growing debt crises – will make it difficult to maintain investment capacity and technical progress.

Terrible crises, such as that recently experienced by Greece, may proliferate. Crises are recurrent in the history of capitalism and the classical economists had already surmised that it would be impossible to maintain growth indefinitely. Everything points to a deceleration of growth in the 21st century. The world will have to rethink its model of civilization based on consumption and constant increases in production.

## Technological development and its paradoxes

Faith in the miracle of the markets that Simon, Lam and other optimists profess is based, in large part, on their belief in technological development and human ingenuity. Cornucopian thinkers today continue to insist that technology and human inventiveness will be able to overcome nature's limits and that development can maintain economic growth rates for a longer period.[3] The example of the Green Revolution and its success in producing significant increases in production are commonly cited in this context. Such arguments obviously neglect the fact that the Green Revolution contributed to the depletion of land, aquifers, rivers, lakes and oceans, as well as biodiversity.

In a more general sense, all technological advances have limitations and conditioning factors. Thus,

- Enormous advances were made over the course of the 20th and 21st centuries in the utilization of resources and in the energetic efficiency of economic growth. However, much of this progress was utilized to increase production and consumption instead of reducing environmental impacts.
- The Jevons Paradox teaches us that each new technological advance, upon elevating the efficiency of a natural resource, intensifies its total use instead of reducing it (POLIMENI, et al, 2008). An example of this comes from the automobile industry wherein combustion motors of 21st century cars are much more efficient in the use of energy

[3] Cf. Matt Ridley (2010) for a more radical version of this line of thought.

and materials than the models of the 1970s. Nevertheless, the global consumption of gasoline has continued to increase and the increased efficiency of motors has not reduced the demand for materials, but it has made it possible for American cars to be ever larger and heavier (SMIL, 2014).

Peak oil and the carbon bubble

Since the Industrial Revolution, rapid economic growth has depended directly on the plentiful supply of cheap extrasomatic energy. The world economy has functioned on the basis of growing volumes of fossil fuel. However, the Peak Oil theory, as suggested by American geographer M. King Hubbert (1956), suggests that the production of hydrocarbons follows a normal curve (the Gauss Curve). Current evidence indicates that we will shortly reach the peak foreseen by Hubbert.

- The Earth's cheap oil has already been extracted and the cost of the exploration of new reserves is progressively greater. Conventional production of crude oil reached a peak around 75 million barrels in 2008. Some 60% of the world's supply comes from countries whose production is declining. In Saudi Arabia, 90% of oil comes from 50 year-old wells and, given the increasing domestic demand, the end of that country's oil exports is already in sight. Production levels from shale gas and tar sands is being seriously questioned from a financial and environmental standpoint and, in any case, would in no way keep up with the demand.
- The oil industry has invested heavily in fossil fuel reserves, but given the increasing costs of extraction and of its probable impacts on the environment, these may never end up being used. According to the British institute called Carbon Tracker (2013), the excessive appreciation by world markets of the carbon, gas and petroleum reserves held by oil companies could generate a "carbon bubble". Companies in this sector own assets valued in billions, but if this entire investment were to be used in the extraction of petroleum gas and carbon, the resulting $CO_2$ emissions would provoke an acceleration of global warming and a serious environmental crisis. However, if international agreements are effective in curbing GEE emissions (as expected from COP-21), then a financial crisis will occur as a result of the "carbon bubble".[4]

*The environmental weakness of "progress"*

As a result of the great acceleration of world social and economic progress since 1950, the quantity of goods and services available to the globe's inhabitants has grown enormously over a short time. But this enormous human success has been founded on the use of non-renewable natural resources (IGBP, 2015). The combination of grave environmental alerts

[4] For instance, Shell's belated withdrawal from the Arctic region, which is typical of the abandonment of fossil fuel investments by global capital, has already cost shareholders US$7 billion and is expected to cost an additional $4 billion. (http://www.environmentalleader.com/2015/09/29/shell-ends-arctic-drilling-operations/).

obliges us to urgently rethink the argument that human ingenuity, market mechanisms and technological development will be able to overcome whatever crisis arises.

## The planetary boundaries and the threat of ecological chaos

The imbalance between human activities and the environment has increased persistently as shown by the Global Footprint Network (2014). The ecological footprint helps to evaluate the impact that human beings exert on the biosphere. It measures the area of productive land and water ecosystems required to supply the resources that a population consumes and assimilate the wastes that it generates. Until the mid 1970s, humankind still lived within the renewable limits of the Planet. Since then, the ecological footprint of the world population has been growing continuously, as both the number of people and income per capita increased. WWF's Living Planet Report 2014 found that in 2010, the global ecological footprint was 18.1 billion global hectares (gha) or 2.6 gha per capita. Earth's total biocapacity was 12 billion gha, or 1.7 gha per capita. Since there were only 12 billion global hectares available, humankind was already using the resources of one and a half planets.

The consequences of this rapid journey toward unsustainability can already be perceived in the infringement of planetary boundaries. A study published in 2009 by the Stockholm Resilience Center at the University of Stockholm traced an initial sketch of planetary boundaries and defined the safe operational space for humanity on the basis of intrinsic biosphere processes that regulate the stability of the Earth System. The study identified nine central dimensions for the maintenance of the conditions for a decent life for human societies and for the environment. It indicated that planetary limits had been transgressed in three dimensions and that all the others were being threatened to a greater or lesser extent (ROCKSTRÖM et al., 2009).

A recent update of this study (STEFFEN et al., 2015) warned of an intensification in the violation of planetary borders. This new study, based on a large number of peer-reviewed scientific studies, aimed to solidify the methodology of the previous analysis. It generally confirms the original set of planetary boundaries but provides an updated analysis and a quantification of the situation in several of them. It maintains the same processes as the 2009 study but improves the methodology and the analysis of the planetary boundaries with a focus on biophysics based on scientific advances over the previous five years. Several of the boundaries are now presented in two levels in order to reflect scale and regional heterogeneity. According to the authors, the methodology of the Planetary Boundaries does not propose to dictate how human societies should develop but to help civil society and decision-makers in the definition of a safe operational space for humanity and for life on Earth.

The nine planetary boundaries listed in this more recent study are described as: climate change; biosphere integrity (loss of biodiversity and extinction of species); stratospheric ozone depletion; ocean acidification; biogeochemical flows (phosphorus and nitrogen cycles); landsystem change (such as deforestation); freshwater use; atmospheric aerosol loading

(such as organic pollutants, radioactive materials, nanomaterials and micro-plastics); and novel entities (defined as new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects).

These nine processes affect the mechanisms that regulate and maintain the stability and resilience of the Earth system. Interactions between land, oceans and the atmosphere control the conditions under which our societies depend for their survival. Transgression of a boundary increases the risks for all human activities and could generate a much less hospitable state for the planet, frustrating efforts to reduce poverty and leading to the deterioration of human well-being in many parts of the world, including in the rich countries.

The main novelty in this second study is the discovery that *four* of the planetary boundaries have already been breached: climate change, biodiversity integrity; landuse change, and; biogeochemical flows (phosphorus and nitrogen cycles). Two of these – climate change and biodiversity integrity – constitute what the scientists call "core" planetary boundaries due to their fundamental importance for the Earth system. Aggravating the violation of these core frontiers would be catastrophic and could lead to the collapse of the civilization we know. In other words, there are basic tipping points that cannot be surpassed.

The risks of ecological chaos if we continue to exceed planetary limits were dramatized in another study published in 2012 by 12 scientists from the University of California. The scientists alerted us to the fact that we are on the brink of a "state shift", that is, an abrupt critical transition that could suddenly alter known conditions, producing unanticipated biotic effects (BARNOSKY et al., 2012). Hence, the analysis of planetary boundaries confirm previous theoretical studies, such as those of Beck (1995) and Giddens (2002) in the sense that capitalist modernization, while overcoming some previous conflicts, escalates those between society and nature, creating global risks of catastrophic magnitude.

In this light, contrary to the cornucopian perception, the prevailing economic system is taking us towards an unsustainable future and succeeding generations will find it much harder to survive with a good quality of life. History shows us that civilizations follow a cycle of ascension, but when they are unable to accept new values or to change their trajectory, they tend to collapse. However, we have no historical record of any civilization that has ever deliberately risked suffering such vast devastation as ours! The next segment presents a brief analysis of the two threats that, according to current science, are particularly menacing for our current civilization – climate change and the integrity of biodiversity.

## Climate change

Climate change is the most obvious threat and it has received the most attention from the general public as well as from scientists and politicians. The inherent volatility of the weather and its everyday significance favors widespread puzzlement and scepticism – particularly among the negationists, but also from laymen – concerning the origins and the real dimensions of ongoing changes. In contrast, the scientific evidence is ever more conclusive. The documents of the Intergovernmental Panel on Climate Change – IPCC 2013

– produced by the most competent scientists on the planet, sent out a severe warning about the realities of global warming.

Despite the efforts of negationists, the enormous majority of scientists who study these questions is totally convinced that climate change is occurring and that it is related to our paradigm of development. That is, in this "Anthropocene" era, the diffusion and application of "the growth imperative" is primarily responsible for the present crisis.

The particulars of climate change and its probable consequences are well-known and confirmed by the literature and need not be repeated here. Suffice it to quote a recent typical report prepared by Mario Molina, recipient of the Nobel Prize for Chemistry in 1995, who recently led a committee of the American Association for the Advancement of Science. The resulting paper -"What we know: the reality, risks, and response to climate change", published in 2014, warns that the effects of greenhouse gases that we produce in the atmosphere can be horrific: "The evidence is overwhelming: Levels of greenhouse gases in the atmosphere are rising. Temperatures are going up. Springs are arriving earlier. Ice sheets are melting. Sea level is rising. The patterns of rainfall and drought are changing. Heatwaves are getting worse, as is extreme precipitation. The oceans are acidifying" (AAAS, 2014, p. 2).

The National Oceanic and Atmospheric Administration (NOAA) of the United States, provides updated information on the gravity of the climate situation. It recently announced that the month of June 2015 was the warmest since systematic data on the temperature of the Planet have been gathered. The six first months of 2015 also marked the hottest semester on record since 1880.

## Biodiversity loss and the biological holocaust

Despite not having received nearly as much attention as climate change, the reduction of flora and fauna – or, the loss of biodiversity – is another major ecological threat that could potentially have comparably significant impacts. Humankind occupies an ever-increasing extent of planetary space and this has resulted in the harmful invasion of all other forms of ecosystemic life on Earth. In and of itself, this increases global risks. The extent of human impact on biodiversity loss is increasingly evident and the Life Planet Index, which measures trends among millions of vertebrate populations, decreased by 52% between 1970 and 2000. In other words, the quantity of mammals, birds, reptiles, amphibians and fish on the Planet is, on average, only half of what it was 40 years ago (WWF, 2014).

In July of 2014, the journal "Science" published a series of studies showing alarming rates of crime against other living creatures. The responsibility of humankind to risks of the disappearance of species is 1000 times greater than natural processes. The journal confirms that human beings are causing, over a brief period of time, the sixth massive extinction on the planet. The causes are multiple – landuse, changes in soil cover, deforestation, disappearance of pollinators, soil erosion, changes in the quality of water and other related factors. Ultimately, the effects are systemic and result from increasing discrimination against non-human species and the generalization of the crime of ecocide.

Various proposals have been put forth to mitigate the damage caused by the human presence on the Planet and to avoid the collapse of biodiversity. Harvard biologist Edward Osborne, who classifies the situation as a "biological holocaust", suggests a conservation plan called "half Earth" in which half of the planet would be reserved for wildlife and for the extension of forest cover to sequester carbon and mitigate the effects of global warming (HISS, 2014). Elizabeth Kolbert (2014), in her book *The sixth extinction*, also calls attention to the dangers caused by the reduction of biodiversity, not only for ethical reasons, but also because ecological losses endanger those natural mechanisms which guarantee the equilibrium of ecosystems, the regulation of the climate, the purification of air, the protection of soil fertility, the control of pests and the healthy renovation of hydrographic basins.

*The unsustainability of unequal development: globalization, ecology and population*

Social unsustainability is a critical component of global sustainability. Although economic growth has contributed to improving life conditions for billions of people, its fruits have been distributed unequally. The mechanism that produced this growth is best characterized as throughput growth stimulated by consumerism. Globalization has massified this process and rapidly extended it to all continents. However, the rhythm of depletion of natural resources which sustains this growth, together with the aggravation of environmental risks, inevitably limit the benefits of "development" that a growing world population can expect to gain (CAVALCANTI, 2012).

According to the McKinsey consulting firm, the number of global consumers[5] already surpasses 2.5 billion people and will rise to 4 billion by 2025. Thus, the consumer population now constitutes approximately 36% of the total population and that proportion will grow to 49% by 2025. Such estimates are based on a very broad definition of "consumer" (persons who have an income of 10 dollars or more per day). A more recent study by the Pew Research Center (KOCHHAR, 2015), utilizing the same criteria for defining "middle class" (i.e. income of 10 dollars a day), found that only 29% of the world population could be classified in this category. The study concludes that the rapid expansion of the middle class is more promise than reality.

Be that as it may, the point is that, despite the optimism of global business concerns, there is still an enormous number of people who will NOT be participating in the world middle class. By 2025, when according to most scientific predictions, the crisis produced by this model of growth will already be showing clear signs of stress, more than half of the world's population will still not have made it into the world's consumer class.

It is exactly at this intersection between increased consumption and the environmental limits to a growth model based on constant increases in consumption and increasing global inequality that the social and political importance of demographic issues needs to be understood today.

[5] "Consumers" are defined as adults having an income of at least US$10 dollars a day (MCKINSEY, 2012).

## Progress through increased consumption

The economic growth we know requires constant increases in production and consumption, either through the incorporation of new consumers or by boosting consumption among present consumers. Consumption is the engine that moves economic growth and the reduction of poverty. Interest in consumption has a long history. Humanity has always been enticed by positional goods, that is, by those goods that others envy because they do not possess them.[6] As Veblen (1899) demonstrated towards the end of the 19th century, capitalism discovered early that there was profit to be made by stimulating "conspicuous consumption". Keynes went further in the 1930s when he stressed the need to stimulate an "effective demand" as a means of emerging from economic stagnation (MARTINE; TORRES; FREIRE DE MELLO, 2012).

In the post-war period, the accentuation of consumption was adopted in the United States as an explicit strategy to mobilize the military/industrial complex that would otherwise have been scrapped in the post-conflict period. Increasingly effective mechanisms were devised to incite the population to consume more goods and services, a good proportion of which were superfluous. Not by accident, the networks of mass communications such as radio and TV were extended and improved, along with the increase in practices such as "planned obsolescence" of consumer goods, stimulation of constant renewal of products and processes generated through technological development and increasing physical access to channels of consumption through the spread of supermarkets and shopping malls. Later, the process of economic globalization initiated towards the end of the 1980s, together with the Fall of the Berlin Wall and the prevalence of capitalist forms of production, even in "communist" countries, provided an enormous impetus to consumerism (MARTINE; TORRES; FREIRE DE MELLO, 2012).

The constant rise of consumption at the individual, national and global levels is being ensured with increasing efficacy by an proficient constellation of actors and institutions who remind us daily that we need to buy and consume more stuff. The culture of consumption has consecrated itself as the most efficient engine of capitalism in its efforts to promote economic growth, which has, in turn, become synonymous with "development". This culture entails a collection of values, beliefs and behavior patterns that are considered by society as appropriate. The omnipresent shopping malls have become the temples in which this culture and its gods are worshipped. The culture defines the contours and the objectives of happiness as well as the determinants of social status of individuals and social groups that are blessed with the ability to participate in this civilization. Consumerism ultimately induces people to search for contentment and social acceptability via the purchase of goods and services. Little does it matter that the studies of different social disciplines show that consumption does not guarantee happiness (GIANNETTI, 2002; WORLDWATCH, 2010).

[6] Giannetti (2012) quotes Petronio, a Roman satirical poet who, 2000 years ago proclaimed: "I'm only interested in goods that are capable of provoking envy in the masses". He also notes that Adam Smith described positional opulence in "The Wealth of Nations" (1776).

The culture of consumption can be considered as the most significant human force in recent decades, surpassing religions, ideologies, ethnicity or political parties. Since it functions so well at the individual level, the motivation to consume exercises a strong capacity to mobilize society at the aggregate level. The constant quest for happiness through consumption, though ethereal, feeds persistent increases in production which, in turn, foster economic growth. Given its efficiency in stimulating economic growth as well as poverty reduction, this model is aggressively promoted, not only by the market and business concerns, but also by national governments and international development agencies. Fomenting consumption has become, in this context, the essence of the development paradigm.

Unfortunately, this arrangement, whereby the promotion of consumption patterns that support constant increases in production give form, content and vigor to economic growth, also generates the two major threats to humankind in the 21st century: ecological chaos (as seen in previous segments) and deep global inequality. These two threats are intimately related and, as seen in the next segment of this paper, are directly conditioned by demographic dynamics.

## Increasing inequality and the population dilemma

Despite the vast literature on both the benefits of economic growth, population dynamics and the expansion of environmental threats, three critical aspects of this issue have not been sufficiently highlighted:

- the great majority of the world's population still does not participate in the global society of consumption;
- this majority has contributed very little to global ecological problems;
- this same majority is likely to suffer the worst consequences of global climate change caused by the greenhouse gases generated by "development".

The confluence of these three situations configures the profile of inequality that castigates the world at this historical moment and, at the same time, gives new dimensions to the demographic question. Resolving income inequality is an imperative and an essential condition in the promotion of social justice. But inequality is also a problem for economic growth itself: Increasing inequality means not only that an enormous segment of the world's population subsists in poverty, but also that riches are increasing in a limited portion of humankind.

A 2014 report on global wealth by The Crédit Suisse (2014) – a global bank obviously beyond suspicion of leftist or socialist leanings – leaves little doubt as to the degree of inequality between the prosperity of adults in the world. Global wealth was estimated as US$263 trillion in 2014. At the base of the pyramid, some 3.28 billion people, equivalent to about two-thirds of the world's adults, detained only 2.9% of global wealth in 2014. In the group immediately above that (wealth between $10,000 and $100,000), 21.5% of adults

held 11.8% of global wealth. The category comprised by adults having wealth between $100,000 and $1,000,000 included 7.9% of all adults and 41.3% of global wealth. The richest group contained 35 million adults (0.8% of the total) having 44% of global wealth.

In short, the two groups at the top of the pyramid comprised 8.7% of the total number of adults and possessed 85.3% of global wealth in 2014. At the base of the pyramid, 4.3 billion people, making up 92.3% of the world's adult population, held only 15.3% of global wealth. The worse part is that multiple sources indicate that this concentration is rising. Within this context, the vision of a strong global middle class is a pipe dream (KOCHHAR, 2015).

The injustices of this social architecture notwithstanding, the number of consumers and the value of wealth has increased over recent decades, creating more pressure on natural resources. The worsening of the environmental crisis today reflects, in part, the incorporation of numerous contingents of consumers, especially rich ones, many of which come from countries that were, until recently, considered as "underdeveloped".

In the context of increasing international concern with environmental problems in China and other emerging countries, it is easy to forget that the global environmental crisis was created by consumer patterns in a minority of the world's population – that from the developed countries together with the elites from other countries. Even before the recent economic expansion of the emerging countries, a small proportion of humanity had already disturbed the global ecological equilibrium. In the Babylonian setting of the many large conferences focused on the environmental crisis, the poor countries obviously demand the same right to consume – and thus to pollute – as much as the initiators of the crisis. Developed countries, in turn, refuse to alter their economic trajectory so as to allow the others a certain leeway to grow; on the contrary, they constantly point to the dangers of development in emerging countries.

Should the "underdeveloped" countries be denied the right to escape poverty and to also become consumers? Despite the enormous economic progress of recent times, almost two-thirds of the world's population still do not participate in globalized consumption and one quarter are definitely poor. Industrialized countries systematically procrastinate in relation to any environmental agreement that represents a threat to their current way of life. Retarding the socioeconomic progress of poorer population groups while consumption and degradation are stabilized or even increased in the rich countries signifies an expansion of the already-large gap between the two blocs.

How can the level and rhythm of humanity's consumption be controlled without diminishing the social progress of the enormous mass of people who are not yet consumers and who, on the whole, still suffer from basic needs? Improving the situation of the poor is an imperative, but the generalization of the production and consumption patterns of the rich to a significant proportion of the still-poor would require the natural resources of several planets. That is, in the absence of a dramatic turnaround in our conception of development, and of the culture of consumption that sustains it, the incorporation of significant numbers of new consumers – thereby fulfilling the aspirations of economists,

corporations, governments and development agencies – would evidently mean the hastening of the ecological crisis.

Are there enough resources and technology to guarantee minimal welfare for the entire world population now and into the future? Possibly so, but this would demand radical changes in the development paradigm and a drastic reduction of consumption. Unfortunately, despite the fact that human demand already surpasses the regenerative capacity of the planet by 50%, and that it has transgressed some critical planetary boundaries, no country or population contingent is keen to alter its trajectory towards ever-greater consumption. Proof of this is the international failure to implement effective environmental measures. A study carried out by UNEP and the Stockholm Environmental Institute on 90 environmental agreements signed by governments over the past few decades showed that only four of these had made any progress: removing lead from gasoline, improving access to good drinking water, promoting research on the marine environment and avoiding further damage to the ozone layer (UNEP, 2012).

In brief, conciliating the demands for consumption of a growing population – in a capitalist system centered on making greater profits by selling more merchandise that use up more natural resources in a finite planet wherein the energy flow is entropic – seems like an impossible task. What solutions can be offered to this vital dilemma of humankind in the 21st century? Several alternatives are being intensely discussed but, in practice, only 'painless' solutions are being seriously considered, that is, solutions that do not require profound alterations in a development paradigm that is founded on increased consumption and which has, so far at least, been efficacious in increasing wealth and reducing poverty – albeit, at the cost of the environment.

In this context, the first recommendation that tends to be evoked in relation to environmental problems is the need to reduce population size and its rate of growth through the intensification of family planning programs. The issue is very important and complex, but needs to be better understood.

First of all, there are different levels of environmental impacts from population dynamics. On the most general level, practically any environmental challenge is made more difficult by population growth. As succinctly expressed by Vaclav Smil (1993, p. 207) "I find it impossible to believe that greater crowding will make for a higher quality of life". Yet, the nature and extent of the population challenge to sustainability is neither uniform nor linear. It is ultimately determined by the manner in which production and consumption is organized in a given society, at a given moment in time, and by the relative size of the different social groups that engage in particular patterns of consumption within that society.

The rise in global emissions resulting from economic growth are due to increased wealth and not to increased population. The countries that originally created the ecological crisis were low-fertility countries, while high fertility countries are poor and contribute little to major environmental problems. As noted earlier, only one-third of the world's population actually consumes in the global market and contributes to major emissions. Therefore,

one unit of population – a person – is not equivalent to one unit of consumption. In this light, population control continues to be an ineffective solution by itself since the problem does not spring from the increase in global population but from the growth of consumers in today's globalized economy.

Secondly, family planning programs are not a quick fix since they do not guarantee rapid fertility decline nor population reduction. The evidence shows that fertility tends to decline only after some form of development sets in. As analysed by Demeny (1992, 1994), the mechanisms which nudge lower vital rates are prompted by transformations in the socio-economic system which set the framework for individual actions; fertility declines when many individuals in a given society find it to their advantage to have less children. Hence, the reduction of fertility in a country or population group is generally linked to improvements in living conditions and to urbanization. Providing people with the means to control their offspring is important to the welfare, health and liberation of women, but it does not necessarily reduce fertility drastically if people do not perceive prospects for improved living conditions. Moreover, much of today's population growth is inertial, that is, it results as much from the size of reproductive cohorts produced by fertility patterns in the previous generation as from current fertility rates. Hence, there is no quick reduction in total population size in sight.

Thirdly, fertility decline does not guarantee a decrease in consumption. The very reduction of family size itself favors increased per capita consumption, annulling in some form the gains from a reduced size of the total population. In sum, the same factors that reduce fertility also increase consumption. Consequently, without a change in the dominant consumption-based development pattern, fertility decline – a process which is well underway in most of the developing world – will have, *per se*, very little environmental impact **in the short run**.

Fourthly, and despite the thrust of the above arguments, the role of population in environmental issues acquires much greater urgency when viewed within a time perspective. Depending on development outcomes, current population growth rates can have a critical impact on the number of consumers in the future. The poor and high fertility countries of today can obviously increase their consumption levels drastically to the extent that they are successful in adopting the hegemonic economic model. This observation is critical, as dramatically illustrated by the trajectory of China in recent decades. Future increases in the number of consumers in such countries will be determined by the rates of population growth in current generations. Thus, the sensible approach would be to promote fertility reduction sooner rather than later, in case a more rational path to 'development' and the reduction of poverty is effectively adopted. Paradoxically, this reduction of fertility rates is unlikely to occur without access to urbanization and some type of development.

Fifth, a moderate but constant increase in population is seen by developmentalists to be an effective stimulus for throughput growth based on constantly increasing levels of production and consumption. From an environmental standpoint, this is a disastrous

assessment since additional people will also have the right to consume. The dilemma is that we already have, worldwide, a much greater number of people (consumers and potential consumers) that can be supported at middle-class consumption levels by the Earth's resources. As Abramovay observes, in commenting how Vaclav Smil paraphrased the Jevons Paradox:

> For Smil, it is impossible to generalize the consumption patterns that typify today's affluence to the whole of the human species without irreversibly compromising the supply of ecosystemic services on which we all depend. The problem is not technical progress, whose rhythm is extraordinary and which clearly reduces the quantity of materials and energy for the manufacture of goods. The problem is that, globally, this reduction is only relative. (ABRAMOVAY, 2014).

Thus, the overriding issue is that, in this end-of-century development scenario, our ecosphere's resources are being most seriously threatened by the manner in which industrial civilization's model of throughput growth is being adopted on a growing scale. Population dynamics are unquestionably important in this scenario. However, they fundamentally affect the dimension and gravity of environmental problems through patterns of development and social organization. Even if we had only three billion people in the world, we would still need to deal more effectively with the issue of unsustainable development.

One important aspect that has been insufficiently considered in this matter of the relation between demographic dynamics and the environmental crisis is the fact that – at the aggregate level – all future population growth will occur in urban areas. This trend has various contrasting implications. First of all, urbanization is, in itself, the most dynamic factor in the etiology of fertility reduction (MARTINE; ALVES; CAVENAGHI, 2013). In cities, people are more motivated to reduce their family size and have greater access to those factors that are known to promote lower fertility, such as education, participation in the labor force, access to services, information, gender equity, etc. Secondly, the urban population is, on average, wealthier and, consequently, consumes more. Thirdly, the success of future mitigation and adaptation efforts in the face of climate change will depend very much on what happens in cities. In this sense, the trend toward the greater adoption of anti-urban policies in many developing countries is cause for concern. Without a proactive stance towards inevitable urban growth, slums and social disorganization will multiply in today's urbanizing world, as will the negative social and environmental effects of economic expansion.

In light of the above, without major changes in the definition and practice of "development" and of the consumption patterns it promotes, it may not make much difference if the world population levels off at 8 or 15 billion people. One of the sides of the trilemma will not support the pressure and will suffer a breakdown in either case. Long before these billions are transformed into consumers, the chaos of unsustainability will have been inaugurated, resurrecting both Malthusian and Marxist threats. Of course, if a more

sustainable approach to development were to be effectively adopted, it would inevitably contain the seeds of fertility decline.

## Conclusion: prospects and limitations in the generalization of "progress"

Malthus perceived only the demographic threat while Ehrlich saw Malthusian limits from an ecological perspective. Lam considers that capitalism, rationality and technology can solve the problem. Marx believed that a communist revolution would solve everything. Obviously it failed to do so, but he was correct in assuming that if the capitalist system did not include the poor and marginalized, social conflicts would tend to increase.

We do witness today the multiplication of conflicts, fragmented and dispersed protests, dissatisfaction and resistance. Growing discontent is observable in those sectors that do not participate in the ideology of the benefits of the hegemonic model. The protests labelled as "Springs..." in different parts of the world, along with rebellious manifestations by fundamentalist movements denote a growing tension stemming from a profound economic and political crisis in the world. Globalization intensified the desire for increased welfare and consumption but satisfied it in a reduced portion of the world's population while greatly accentuating inequality on different levels. Waves of forced migrants and refugees cause bedlam at international borders and challenge traditional humanitarian efforts at the global level.

It can be expected that the voices of indignation will increase, in part because the world has never before been as totally connected as it is now. Enhanced communications facilitates intensified popular responses as well as the formation of radical factions through social media, often dispensing the need for explicit political leadership. Information concerning the differences in lifestyles and basic values as well as the depth of inequality are reaching even those social classes that have not acceded to the benefits of this development, creating a fertile breeding ground for revolt.

The economic, social and environmental crises reflect a general incapacity to manage the grave planetary problems provoked by the dominant development model. Humanity's greatest dilemma today consists in reducing poverty and inequality in the world without further transgressing planetary boundaries. The impressive reduction of poverty in recent years, which has also had a decisive impact on the improvement of several other indicators, is attributable to sustained economic growth, particularly since the end of the 1990s. Even detractors of the dominant neoliberal paradigm have to recognize that, despite increasing social inequalities, economic growth has supported income growth for an enormous mass of people while also shoring up the fiscal basis of the public sector in many countries, allowing them to implement more effective social redistribution programs. In this regard, the optimists who focus on the recent "success" of the throughput paradigm are victorious – at least temporarily.

Nevertheless, even the most cursory examination of environmental degradation, of the threats to planetary boundaries, and of mounting social inequality changes this perspective radically, by showing how this development has occurred to the detriment of ecosystems and social justice. Over the last 70 years, our system of production and consumption has exploited renewable and non-renewable resources with unparalleled intensity and expansion. Ecosystems are being disfigured, altered and destroyed at a previously unimaginable pace, while the demand for food, drinking water, wood, minerals, cement, energy and so forth expands in an unsustainable manner.

Economic growth is essential for the survival of capitalism and even for socialism (understood as capitalism of the State). Since human needs and demands are infinite and unlimited, both capitalists and workers desire, respectively, increasing profits and salaries. But natural resources are finite and limited and this creates an impasse that no technological development can ever bridge. As shown insistently by a number of scientists, human activities have already surpassed their planetary economic limits and have inaugurated an "economic de-growth" phase.

To re-establish some equilibrium, it will be necessary to pursue de-growth until the marginal utility curves and marginal disutility curves intersect. Once equilibrium is restored, the adoption of a stationary state would avoid further transgressions of economic sustainability limits. As Mill and other classical economists had already foreseen almost 200 years ago, the stationary state is imperative. Achieving this state before we reach diseconomic growth constitutes our only insurance against ecological catastrophes (DALY, 2014).

In short, we need a change in the course of humanity. In addition to vigorous de-growth, it is urgent that we reduce inequality within and between countries. Humanity needs to continue reducing poverty, but it needs to focus more on reducing inequality and less on the quantitative growth of the economy. Growth needs to be contained within planetary boundaries, without compromising the Earth´s biocapacity or the biodiversity of species. The "hegemonic system of production and consumption" (whether capitalist or socialist), does not have the ability to be simultaneously socially just and environmentally sustainable. Consequently, it is impossible for the model of development that we know to simultaneously maintain and promote the Three Pillars of sustainability; in practice, they have become humanity's main trilemma in the 21st century.

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## Resumo

*Economia, sociedade e meio ambiente no século 21: tripé ou trilema da sustentabilidade?*

O progresso humano baseado no crescimento econômico tem sido notável em quase todas as áreas nos últimos 70 anos. Entretanto surgem dúvidas sobre a continuidade e a extensão deste avanço. O crescimento econômico tem repousado no uso insustentável de recursos não-renováveis, na destruição da diversidade biológica e na emissão de gases de efeito estufa que aceleraram as crises ambientais globais, além de ter gerado fossos cada vez maiores entre ricos

e pobres. Com o aprofundamento da globalização, avistam-se graves problemas ecológicos, econômicos e sociais que exigem repensar o desenvolvimento à luz dos limites sendo impostos pela própria natureza. Este trabalho examina as interações entre os principais condicionantes da crise atual. Também observa como o atual contexto modifica o significado e a direção do debate tradicional a respeito do papel da dinâmica demográfica nesta equação. Por outro lado, constata que o tão sonhado 'desenvolvimento sustentável' passou a ser um oximoro. Como fica cada vez mais difícil conciliar crescimento econômico, bem-estar social e sustentabilidade ambiental, o tripé da sustentabilidade que foi o mote da Rio + 20 passou a ser, na realidade, um trilema.

**Palavras-chave:** Desenvolvimento sustentável. Degradação ambiental. Dinâmica demográfica.

## Resumen

*Economía, sociedad y medio ambiente en el siglo 21: triple vertiente o trilema de la sostenibilidad?*

El progreso humano basado en el crecimiento económico ha sido notable en casi todas las áreas durante los últimos 70 años. Sin embargo, surgen dudas al respecto de las posibilidades de continuar y extender estos avances. El crecimiento económico ha reposado en el uso insostenible de recursos naturales, en la destrucción de la diversidad biológica y en la emisión de gases de efecto invernadero que han acelerado la crisis ambiental global y generado brechas cada vez más grandes entre ricos y pobres. La profundización de la globalización ha creado graves problemas ecológicos, económicos y sociales que nos obligan a repensar el desarrollo a la luz de las limitaciones impuestas por la naturaleza. Este trabajo examina las interacciones entre los principales condicionantes de la crisis actual. También observa como el actual contexto modifica el significado y la dirección del debate tradicional sobre el papel de la dinámica demográfica en esta ecuación. Además, constata que el tan-deseado 'desarrollo sostenible' se ha transformado en un oxímoron. Dadas las dificultades crecientes para conciliar crecimiento económico, bien-estar social y sostenibilidad ambiental, la triple vertiente de Rio + 20 se ha transformado en trilema.

**Palabras clave**: Desarrollo sostenible. Degradación ambiental. Dinámica Demográfica.

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