



NATURAL CAPITALISM AND CIRCULAR ECONOMY

How to restore the planet
materials, businesses, and sustainable designing
Alejandro Pagés Tuñón

“ ... this book is an exhortation to modify patterns of behavior, which includes the development of a paradigm and public policies that direct us towards a prosperous, balanced and sustainable future...”

JUAN CARLOS BELAUSTEGUIGOITIA

Director of the Center for Energy and Natural Resources and academic of the Instituto Tecnológico Autónomo de México (ITAM)

“ ... governments will have no further pretext for not incorporating the environmental issue into their public policies. Pagés traces a path that leads from concern for the care of our planet to government action...”

JULIO FRANCO CORZO

Author of the best-selling book *Diseño de Políticas Públicas*

“ ... the author manages to make an interesting review of how humanity has reached this turning point, which demands collective, informed and organized action, for which it provides key elements for action...”

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President of the Cristina Cortinas' Foundation,
specialist in Circular Economy projects

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NATURAL CAPITALISM AND CIRCULAR ECONOMY

Alejandro Pagés skillfully guides us through a journey of awareness and renewal of human ties with nature, in order to direct actions towards the restoration of the Earth's biodiversity and the promotion of an articulated environmental economic agenda for companies and governments, based on a new paradigm of sustainable production and consumption, with fiscal public policies that tax waste and not employment, and financial policies that reconfigure the wasteful logic of the linear economy. The objective: to leave a legacy that allows the subsistence of the new generations and the survival of the species with which we share the planet.

HOW CAN THIS BOOK HELP YOU?

You will identify the elements that should be contemplated by green policies which, from the fiscal and financial aspects, contribute both to economic development and to the protection of the environment.



You will learn about some of the most resonant ecological problems of our time, the crises that have occurred, their devastating effects and their relationship with the linear economy.



You will learn two key concepts to question the logic of consumption and production today: natural capitalism and circular economy.



You will understand the relationship between ecosystem restoration and the logic of circular business models arranged in a model of natural circular capitalism.





Foto: Jesús Valdés Lima

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Graduated from the Master's Degree in Public Administration and Public Policy, from the London School of Economics, he also completed his B.A in Law, at the Universidad Nacional Autónoma de México (UNAM) and in Economics, at the Instituto Tecnológico Autónomo de México (ITAM).

He has more than 25 years of experience in positions of high level of responsibility, related to the execution and implementation of public policies, both in economic and financial areas, as well as infrastructure, energy and territorial management, for government and multinational institutions. Part of his work has earned him the recognition of the World Bank (WB), and the Organization for Economic Cooperation and Development (OECD).

He currently works in the financial sector, and has more than 5 years as a consultant in the analysis, formulation and evaluation of public policies, for governments at the federal and local level, as well as for the private sector.

In the academy he has taught the chairs of Macroeconomics and Monetary Policy; Law and Economics; and Economic Regulation in various collages. He is also author of the book *Banking Regulation and Financial Stability in Mexico: A Legal-Economic Analysis* (Editorial Porrúa, 2006).



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by Alejandro M. Pagés Tuñón

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To my mother's memory
Consuelo example of strength,
integrity, and joviality
beforelife. You will live forever
in my blood, my mind, and my
heart.

To my children Teté and Alex,
who inspired my efforts and
my struggle for the future.

To Esther my life...Everything I
do, I do it for you!



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Prologue

The reader has in their hands a text aimed at those who are concerned about the current and future state of the environment, as well as the environmental impacts on the well-being of the population and economic development, but also those who seek explanations and solutions to these problems. The book is also an ethical alert and an invitation to reflect on the extremely adverse conditions in which, if we continue our patterns of consumption and production, future generations will inhabit the planet. However, it is not an apocalyptic text, but an exhortation to change patterns of behavior, including the development of a paradigm and public policies that “direct us towards a prosperous and, at the same time, balanced and sustainable future.”

The book reflects the author’s great preparation and avidity for knowledge, Alejandro Pagés Tuñón, who holds a degree in Economics from ITAM, a law degree from UNAM and a master’s degree in Public Policy from the London School of Economics and Political Science. The first section, in which Alejandro offers the historical context and where he describes environmental problems critical to human development, reflects his training in Social Sciences and his eagerness to understand the scientific aspects of these problems. His training as an economist is appreciated in the analytical framework, highlighting the influences of the environmental economy and the ecological economy. In addition, his concern to propose public policies to drive the desired change, including fiscal and financial, reflects Alejandro’s passage through the public sector.

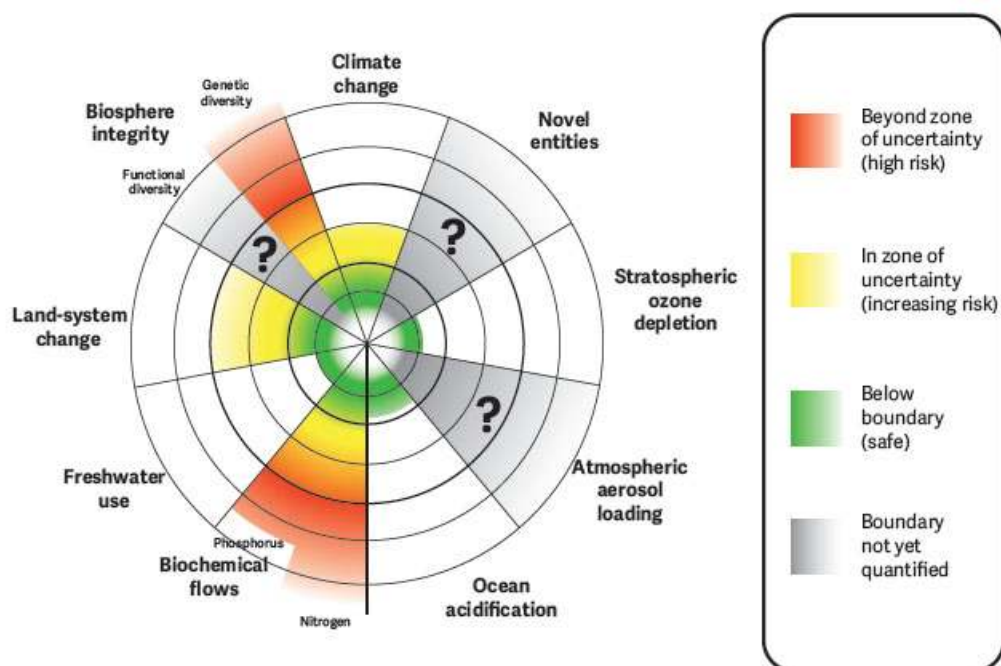
News about the environmental problems of Mexico and other parts of the world is becoming more common. Print media, social media, radio, television and even films address topics ranging from local (water, air, or soil) pollution issues to global issues such as climate change or ozone depletion in the stratosphere. We have more information because, like the media, universities, and other research centers, many governments and international agencies have included the environment among their priorities and allocate resources to measure environmental quality, resource deterioration and depletion, as well as their impact on well-being and economic development.

Mexico faces numerous environmental-related problems, which limit the well-being of current generations and constitute serious obstacles to development and sustainability. Reducing the loss and degradation of terrestrial and aquatic ecosystems, conserving biodiversity, ensuring water availability and quality, mitigating emissions of gases and greenhouse compounds, adapting to the effects of climate change, and improving air quality in many urban areas of the country are some of the most important.

The author gives an excellent description of environmental problems. Some of them, in addition to their local manifestations, have global impacts that could destabilize the complex balances of natural systems that have underpinned the growth and development of human societies for more than ten thousand years. Various groups of scientists have been tasked with identifying, at the planetary level, the natural systems at risk and quantifying that risk. Perhaps is that of planetary boundaries the best-known analytical framework (PB, *Planetary Boundaries*), proposed in 2009 by a group of scientists led by Johan Rockstrom, of the Stockholm Resilience Centre, and Will Steffen, of the National University of Australia.

The planetary boundary framework identifies nine problems and three levels of risk (see Figure 1). Problems include climate change, stratospheric ozone depletion, excess aerosols in the atmosphere, ocean acidification, biochemical flows affecting nitrogen and phosphorus cycles, freshwater use, land use changes, biosphere integrity, and chemical contamination. Climate change and biosphere integrity are recognized as *central problems*, due to their importance for other natural systems. With respect to risk levels, the planetary boundary framework identifies ranges for the variables that control each system (e.g., CO₂ in the case of climate change), where a threshold or turning point could be found, so that small increases in its value trigger a greater change, possibly catastrophic, in the problem (global warming), through feedback in the system itself.

Thresholds are difficult to find because systems are extraordinarily complex. Instead of setting the threshold value, the PB framework sets ranges, and assumes that the thresholds are within them. The planetary boundary framework defines the green zone as the safe operating space; the yellow one shows the area of uncertainty (increasing risk), and the red zone is a high-risk area. The planetary boundary is at the intersection of green and yellow. In addition to the three colors of the traffic light, figure 1 uses gray to show that the planetary boundaries associated with those problems have not yet been quantified.



Source: Stockholm University. Planetary Boundries. 2020.

<https://www.stockholmresilience.org/research/planetary-boundaries.html>.

Alejandro's economist training is evident both in the explanation of problems and in the suggestions for its attention and eventual solution. Concern about the depletion of natural resources or their relative scarcity as a brake on development has a long history, and Malthusian theory is the best-known antecedent about it. The economic analysis of pollution is relatively more recent and has its most notorious background in the work of Arthur Cecil Pigou (1877-1959), on the welfare economy (*The Economics of Welfare*), published in 1920. The fundamental principle of this work is the existence of market failures, in particular externalities, which limit market action as a promoter of social welfare. The concept of externality—the costs or benefits imposed by one economic operator on others, which the economic agent did not take into account—had already been explored by Alfred Marshall (1842-1924), but it

was Arthur Cecil Pigou who pictured him in the economic theory of well-being, and suggested possible solutions: taxes for negative externalities (such as pollution) and for activities with positive externalities (such as vaccines, to take a current example), subsidies.

The great development of economic pollution analysis in the 1960s and 1970s, was motivated by both events that captured global attention and the publication of works that analyzed the impacts and scopes of pollution-related problems. As for the events, one of the best known was the episode of air pollution in London (December 5-9, 1952), when a layer of those pollutants emitted by industry and the use of coal to heat homes and weather conditions (high pressure) resulted in the deaths of thousands of people. Another major episode was the accident at the *Three Mile Island's* nuclear plant in March 1979. As for the publications, *Silent Spring* (Rachel Carson, 1962), which describes and analyzes the negative impact of chemical pesticides, is one of those that had the greatest influence on public opinion.

The line of analysis and research on the depletion of natural resources has an important precedent in Harold Hotelling's 1931 article, "The Economics of Exhaustible Resources," in which he describes the conditions for optimal intertemporal extraction of an exhaustible resource (in other words, the extraction of resources over time, so that profits are maximized). In a similar line is Scott Gordon's work, *The economic theory of a common-property resource: The Fishery*, in 1954, in which he discusses how free access to the resource makes the search for profit for each of the participants in the fishery result in a suboptimal way of managing the resource from a social point of view, which could lead to the exhaustion of a resource, in principle, renewable. In 1968, Garrett Hardin, in his celebrated article "The Tragedy of the Commons", generalized the idea that a

decentralized system of exploitation of a resource (*i.e.*, a system in which there are many individuals or groups exploiting the resource and each of them does what is best for him from his point of view) resulting in an overexploitation of the resource.

As in the case of pollution, real-world events stimulated interest in these issues; like the increases in oil price promoted by the Organization of Petroleum Exporting Countries (OPEC) in 1973. OPEC's price control stimulated analysis of energy security, stability, and growth opportunities of oil net-import economies. A large number of academic publications that analyzed economic growth in a context of exhaustible resources, with different assumptions about the role of technological advancement and the possibility of replacing physical capital (such as infrastructure, machinery, and equipment) with natural capital were produced.

One which has influenced the most, and somehow joins the lines of research on pollution and depletion of natural resources, is the article written by Kenneth Boulding in 1966, "The Economics of the Coming Spaceship Earth." In his work, Boulding compares the planet to a spacecraft which can only survive if the ship's materials are reused and recycled. As for energy, it could have a renewable source: the Sun.

This essay is one of the most important backgrounds of various thought streams on the relationship of natural resources to growth, including the ecological economy and the circular economy. In the ecological economy, unlike the environmental economy, neither technological development nor the accumulation of physical capital can avoid the growth limits established by having fixed supplies of resources. In addition to the emphasis on physical limits to

growth, Boulding's ideas helped change perceptions of the scopes (time and space) of pollution-related externalities. Of course, the facts showed the validity of Boulding's ideas about pollution. In the second part of the last century, there began to be growing evidence of externalities going far beyond the local level, such as pollutants that appeared thousands of miles away from where they had been emitted. Moreover, as climate change proves, externalities can impact over very long periods. In other words, to avoid the negative impacts of such externalities, we must take care of both the flow of substances that create externalities as well as the stocks (accumulation). Alejandro makes exceptionally good use of this principle in his analysis of environmental problems.

The author's presentation on the importance of natural capital is especially relevant. The concept of sustainability is based on the ability of distinct types of assets (capital) to generate well-being on an uninterrupted basis. Capital has distinctive characteristics: there is capital created by people (such as machines and infrastructure), there is human capital (skills and work capacity), natural capital (natural resources) and social capital (institutions and organizations that allow productive interaction between people and groups). One condition for sustainability is that the sum of these assets (or forms of capital) *per capita* should increase over time. Of course, this definition of sustainability implies that the substitution between diverse types of capital is possible; for example, that the ability to generate goods and services from a depleted natural resource can be replaced by other types of capital. In this way, it can be concluded that the rule for sustainability is that each generation reaches the next generation with an endowment of the different forms of capital that allow it to generate growing per capita well-being.

As far as the use of policy instruments is concerned, Alejandro collects the elements of the double dividend theory (developed in the last quarter of the last century) and uses the recent and growing literature on green or sustainable finance to make an original proposal. The double dividend theory holds that, to generate tax resources, it is possible and desirable to reduce taxes on productive activities (such as investment and labor) and to compensate for this reduction with tax revenue, appraising activities or substances that cause harm to society. One of the best and most current examples of the above is the case of CO₂ emissions tax in the Canadian province of British Columbia.

Green or sustainable finances arise from two essential concerns. On the one hand, in the face of growing evidence of a necessary transition to low-carbon economies and the potential impacts of climate change and other environmental problems, central banks are concerned about the financial instability that the risks associated with these processes could cause. As a result, financial authorities in many countries, mainly the G20, have developed tools and methodologies to avoid the potential financial instability associated with climate change and other environmental problems. On the other hand, there is the need to finance the large investments needed to decarbonize economies. To give the reader an idea, it is estimated that decarbonizing USA's electric system will cost \$4.5 trillion of dollars. Globally, to reach the zero net emissions target by 2050, between one and two trillion dollars of investments per year would be missing, according to the Energy Transitions Commission.

There is broad scientific consensus that to avoid the worst impacts of climate change and other environmental problems, humanity needs to transform its consumption and

production patterns. As if that were not right, we should do it over a few decades. Failure to do so would surely be catastrophic. The book in your hands explains how we got to this situation and offers important reflections on how to transform economies to achieve a “prosperous but at the same time balanced and sustainable future.” Enjoy the text and reflections that it will undoubtedly awaken.



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Introduction

The mystery of life has always raised a question that is reflected in our very consciousness. It is that ability we have to reflect that nothing is eternal: everything is mutable and finite. Our passage through life, our own existence, is fleeting. However, that moment can and must be transformative, since we have the freedom to choose, for better or worse, and although it is impossible to detach our existence from the past or the present, we can link it to the future. The truth is that the latter will be our only contribution: it is what we will leave to our children and to humanity; that legacy that forms genetic heritage.

Since time immemorial, parents, to leave a promising future, have always thought about what heritage we will bequeath to our children. Therefore, the monarchs sought their heirs to maintain the right of blood on their lands or the right of the lands over their blood. Today, the difference is that heritage is not of one monarch, but of all, and future generations must inherit it from us. We cannot mortgage or squander what is not ours. So, seeing our advances as a species, it is worth carefully analyzing how far we have arrived, with all the costs and benefits that this entails, and what we will be leaving for our descendants. However, the vision does not look very encouraging.

Based on this proposition, I set out to evaluate what heritage we will leave to our children if we move forward with the trajectory of the last two centuries: the era of successive industrial revolutions that gave humanity the chance to grow, prosper, and move forward more vigorously since the dawn of human history. In my opinion, the most

important heritage is what nature gives us. This is natural capital, which can, should, and must multiply to give us more pure oxygen, more food, well-being, as well as physical and mental health, in its purest form. However, humanity, which has multiplied like never in the history of the planet, has consumed this stock at alarming rates.

Today, the benefits achieved are immense, but the associated costs have been disproportionate. We live in the age of greatest deterioration of ecosystems and their vital functions and contributions to the biosphere. Scientists have quantified that the nine natural planetary boundaries have overflowed, meaning that nature cannot replenish its capabilities at the rate with which they are being used by humans. The risks we see, those foreseen and those that materialize are of magnitudes of hecatomb; in addition, every year and season are exacerbated.

Thus, manifestations of extreme climates are daily news anywhere in the world. Natural and provoked disasters, such as floods, fires, or droughts, affect us all the time. Also, the degradation of the oceans, the disappearance of entire forests, the desertification of vast areas, the flanking of rivers and dams of waterways, the disappearance of wetlands, the bleaching and destruction of ancient coral reefs, and indiscriminate exploitation of coastal areas and mangroves, as well as the increasingly obvious retreat of polar and mountainous glaciers, are symptoms of an acute condition of biblical proportions. Similarly, environmental contingencies from air pollution, spills and eutrophication have become common and everyday living in all continents and regions of the globe.

Nature lives one of the worst crises affecting much of life on the planet, which is already on the edge of unprecedented mass extinction. This biodiversity crisis has

been caused and aggravated by a handful of direct drivers, all derived from human action and which, in themselves, are critical. The questions are whether we are on the edge of a path without return and whether human action itself, with its knowledge and technologies, institutional capacities, and collective action, is able to correct its course in time. Then, correcting involves transforming the paradigm which brought us to this moment. This transformation comprises a new thought, as well as renewed attitudes and behaviors. Therefore, systemic thinking must be the starting point.

The reality of the world in which we live has led us to visualize, think, analyze, and develop complex systems, from the observation of the phenomena around us. From the atomic level to the stellar or universal scale of the cosmos, everything acts and manifests itself at a system level. The natural sciences no longer visualize boundaries between their disciplines but interact to further understand their events. The same is true in human and social sciences, which must be understood as interdisciplinary. Computer technology and informatics have contributed greatly to reveal the mysterious and complex interrelationships of the phenomena that happen to us and affect us. So, we are understanding that human thought and development are complex nonlinear phenomena that must, can, and have to feed back. Thus, today we are no longer talking about relationships between things, but about ecosystems in which everything coexists and contributes. In this way, human society can size that its existence is part of an intricate network of phenomena, from which it cannot be disassociated. Thus, it cohabits with infinite number of life forms that deserve to exist, and we cannot be the ones to determine its future.

This reflection reaffirms my conviction: what has brought us to this civilizing moment must re-mutate, to force us to

see nature, its habitats, ecosystems and ways of life, in order to find a shared and viable alternative. However, the task is not simple, as it requires that, in a noticeably short period of time, we will root out everything we have built throughout history, particularly during industrial revolutions. Ideas, concepts, and cultures must change to formulate a path of transformation that leads us to a prosperous and, at the same time, balanced and sustainable future. Thus, nature can be recovered to provide us with more satisfiers, public goods, or vital contributions. Therefore, we must start from a common understanding of the problem we face: what has caused it, what are and will be the consequences of maintaining the state of things, what proportions it can achieve, and what effects have begun to be unleashed. Similarly, we must share the path and the solution alternative.

Thus, to restore the strength of natural ecosystems it is necessary to recover the ancestral wisdom of the native cultures of all continents regarding the value of Mother Earth. Paradoxically, today's science and technology will complement the paths to a transformative solution based on the natural. By leveraging the knowledge that exists today and the capabilities of innovation and technological and scientific development, we can model the future, starting to think and design a new paradigm.

To address this approach, I divided this essay into three parts. The first aims to place us in the current context of the anthropogenic era, with its scope, achievements, risks, and effects on the planet; it assesses the most relevant critical aspects, according to extensive and consensual scientific information. Thus, I stress that the most severe damage has been to biodiversity and its ecosystems, placing in its right dimension the direct drivers, among which global warming stands out. This first part is divided into three chapters. In