The Safe Operating Space Treaty

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A New Approach to Managing Our Use of the Earth System

Edited by

Paulo Magalhães, Will Steffen,
Klaus Bosselmann, Alexandra Aragão
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In the first place, we wish to thank the Serralves Foundation, in Oporto, Portugal. Within the scope of the 25th anniversary commemoration of Environmental Education in Serralves, an international conference was held, on the 1st and 2nd of November, 2013, on the theme "Educating for the Common Heritage: From the Cultural Intangible to the Natural Intangible". It was within the realm of the conference's preparatory work that the publisher decided to challenge the editors to this endeavour. The conference was also the right venue for the first steps and discussions that brought us to the team and the content that gave life to the problems dealt with and the practical proposals suggested in this book.

Finally, we express also our gratitude to all those who directly or indirectly contributed to the completion of this collective ambition that aims for a better future for humankind and our home planet.

—The Editors

PREFACE

"Les hommes ont oublié cette vérité […] mais tu ne dois pas l'oublier. Tu deviens responsable pour toujours de ce que tu as apprivoisé."
—Le Petit Prince, Antoine de Saint-Exupéry.

This book opens a new chapter of world history, of our planet's history, and you are lucky to read it, to be part of it. And maybe you will soon live this history not as witnesses but as actors of it in your capacity as simple but nevertheless irreplaceable humans. You and your ancestors have tamed the Earth and you ought to care for it more than ever now. This is the unique last opportunity to do so. This treaty is about this opportunity – it brings to your attention a new concept for protecting the Earth as a system, a whole, from both a scientific and legal perspective, which comes as an obvious and necessary complement of the notion of ecology.

Ecological consciousness was really born when men first went to space and realized how small, how vulnerable our home looked when seen from above; "a pale blue dot" as Carl Sagan called it. When one goes away from the Earth, there are no frontiers – one can only see the oceans, the forests, the deserts, the biodiversity, and, above all, the atmosphere, so thin and so fragile, which nevertheless allows us, human beings, to live in our environment. Catastrophes caused by nature or by people can also be seen from space; in particular, one can see the pollution, the footprint of human activities, which started getting serious with the Industrial Revolution and escalated with what has been called the Great Acceleration some one hundred years later. Space programmes, with their satellite applications and services, help and support the observation of the Earth in all its components: the land (with its forests, deserts, water bodies, its human settlements and cultivated areas), the ocean (with its salinity and currents, winds and waves, and colour variations), the ice (with its glaciers and ice sheets), the atmosphere (with its chemical composition and meteorological variations), and the biosphere, which make the Earth with all its living species unique in the universe. Now with the new Earth observation programmes, such as Copernicus (with the Sentinels satellites), more data, soon available in an open-source mode, will enable us to have a much more comprehensive picture of our planet's elements

and their state of health as well as the other consequences of climate change (such as climate refugee flows). This will allow a sound monitoring of the Earth's condition and suggest associated concrete actions in favour of the environment. We must also realize that climate change represents one of the biggest threats for peace and democracy on Earth.

To better live on Earth and, above all, to face the upcoming disruption of resources combined with climatic disturbance, it is very instructive to see how it is possible to survive without atmosphere, in outer space, for instance. In the International Space Station, they have re-created a closed-loop system, a life-support base, and live with an economy of means because resources are limited; in short, it teaches us how to live in a sober manner, which is what we should be doing on Earth.

This is what we should do because the Earth is our home, our spaceship, a closed world with limited resources that will survive us, the only known place in the universe where we can live as humankind, worldwide citizens. We share common goods that we have to care for and protect in order to ensure the future of our planet and allow future generations to live after us.

This is all about sustainability: of human beings, other living species and resources.

When the concept of sustainable development was first officially defined in 1987 by Mrs Gro Harlem Brundtland in the United Nations framework, it was in more of a political context, mainly for the attention of sovereign states with a view of building up a global governance for planet Earth in all aspects of a modern society: environmental, social and economic. Step by step, both private and public sectors committed to sustainable development or the corporate social responsibility principles of accountability, and measured and assessed their performance and evolution under internationally recognized norms and standards. Sustainability has become a strategic tool with which to handle things, do business, create opportunities for innovation, measure data and report on achievements and performance towards share or stakeholders, but also to explain the cost of inaction. And when it comes to climate change, the cost of inaction is tremendous.

It is a good thing that companies and organizations are ensuring the sustainability of their mission but it is now time to endow all citizens with responsibility for their spaceship. We have already seen how powerful and educational the view of the Earth from space is; it has also raised in an intangible way a collective consciousness of how vital it is to act in favour of our home, our condominium, our common goods, our heritage, as this

treaty will further explore. We also saw how useful the space applications were as tools for gathering data for a sound monitoring of the Earth System, and there are many more space services available to citizens for monitoring and shaping the society and the planet of tomorrow. Governments can act on a global scale but citizens must act on a more local scale as this can give more tangible and realistic results; the merging of both streams will give an optimal result. A great and encouraging demonstration of this took place on 6 June, 2015 in the framework of the World Wide Views event: 10,000 citizens in 100 countries participated in the widest global citizens consultation organized ever. Their ideas and opinions regarding 30 questions on climate change and energy were collected and all the results have been transmitted to the negotiators of the COP21, the Paris Conference on Climate (30 November–11 December, 2015), where they will be duly taken into account.

The current treaty arrives at the optimal time for action. Within it, you will discover the state of affairs of planet Earth in a multidisciplinary manner and you will find that many theories, political and legal instruments, and tools have already been developed to protect the environment, a holistic approach combining science and law that was deeply needed. This is how the idea of this Treaty of the Safe Operating Space was born.

The environment used to be called “the silent stakeholder” and the Earth System had no *legal status per se*. Since 2014, the Earth has been recognized as a “client” by the European Court of Justice, and with the SOS Treaty, the environment won’t be silent any longer. Times are changing…

Nathalie Meusy
Head of the Coordination Office on Sustainable Development
at the European Space Agency (ESA)
30 July, 2015

PS. I would like to thank Paulo Magalhães for the great honour he provided me when he asked me to write this preface. I am confident that the collective efforts of this book will help change the world we are living in.

CHAPTER ONE

GLOBAL FREE RIDERS ...

PAULO MAGALHÃES[1]
FRANCISCO FERREIRA[2]

> "A human being is a part of a whole, called by us **universe**, a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest... a kind of optical delusion of his consciousness."
>
> —Albert Einstein

1. Tragedy Without Territory

It is now widely accepted that climate change is a "tragedy of the commons" on a global scale. When a tragedy is occurring simultaneously inside and outside all borders, it does not comply with the principle of territoriality of jurisdictions or of norms. It is a superimposed common reality in all territories, without having a territory. Also, in the dominant view of "territorial obsession", existing is to have territory; being global is not having territory. The underlying principle is the assumption that everything that goes beyond our limits should be considered as external to us – an externality, in the words of economists. Pollution from an aircraft is an externality for the economy and when performed outside the airspace of states, it becomes a legal non-existence for jurists.

Based on this vision, one can define common areas where theoretically all of humanity becomes sovereign over the international commons (*res communis omnium*), in which the "common" is what is left over (open sea,

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seabed, Antarctica), the remains of what could not be seized. Pureza (1998) considers that "the *res communis* own regime as a traditional framework for common international spaces is a sequence rather than an antithesis of the national sovereignty principle". The common is not that by which its nature and characteristics are truly common but what remains after appropriation.

In the confrontation between this one-dimensional simplification of the world and the highly complex and deeply interconnected Earth System, we are flooded with more questions than answers: Whose tragedy? Where does the responsibility for acting lie? Who has the instruments to act for the benefit of all? How can we speak about benefiting everyone if humanity, being global, has no territory; a fact that by itself gives rise to its legal non-existence? Yet, are there any organized people in a territorial political community that do not belong to humanity? If humanity exists materially, and is just one single family with a common origin, will it cease to exist just because it doesn't exist in a formally organized political territory? Can the concept of sovereignty exist without the prospect of an unlimited temporal projection into the next generations?

As sophisticated as societies and their technologies can be, the organization of social life leads us invariably to the same primary questions: What is mine? What is yours? What is common or public, or what doesn't belong to anyone? But the reality is always more complex than these simplified operations. To the questions whose simple solutions of separation serve as responses, we can add another: What is simultaneously mine, yours and everyone's in an overlapping and symbiotic way?

As we will see throughout this book, there is no simple answer to this complex question, especially if we look at property not only as a form of ownership over something but also as an organizing tool of social relations. It is at the crossroads of belonging to all, owned by no one, where 'belonging to' does not have any clear legal definition, and whose outcome is often resolved by resorting to *res nullius*. Cappelletti (1975) defines this dilemma as "belonging to all and to no one". Kiss (1982) came very close to the essence of the issue when he asked: "*How can a good that belongs to no one be subject to a legal regime*?" From this paradox, and because legal existence is inextricably linked to some form of "ownership", emerges what was classified as the doctrine of "complex property".

New questions always elicit new answers. However, it is interesting to note that even as we surpass the Earth's borders and launch into the conquest of space, the same classic questions invariably arise. Oosterlinck

(1996), in his article "Tangible and Intangible Property in Outer Space", states: "Property in space is certainly one of the most important issues for the future not only in the context of the more classical form of tangible property such as minerals but also intangible property such as orbital slots on the geostationary orbit, frequencies, etc."

Only with clear and precise legal answers to these primary questions might there surface an element of stability without which the construction of any organization, and therefore the construction of any future, are possible. Transferred from one earthly reality dominated by territorial and tangible dimensions, we are now involved in a spatial reality dominated by apparent emptiness and the intangible. Although within an environment that is strange and cannot be 'comprehended' by our senses, the ability to explore new resources and carry out activities that open new possibilities on Earth created the need to internally organize our relationships concerning the use of these new intangible spaces; therefore the classical questions arise again but with new variations.

Regulating the use of certain goods involves the ability to first describe, measure, locate, and name them, and then to classify them. In other words, in order to regulate the use of a certain good, we have to have defined it.

The legitimacy of a theoretical construction always depends on its explanatory capacity of reality. In space, unlike on Earth, the classification of any legal regime should take as its starting point the reality of the intrinsic characteristics of the goods and not a previous theoretical construction later applied to the goods in question. This process, whose initial impulse is the well-known reality, was similar to the approach carried out by Roman law, which therefore continues to be used in space today. According to Oosterlinck (1996), "Under Roman Law, 'Res', or things, are classified into *res corporals* and *res incorporales*". It was in the Roman legal system where the "emptiness" of space found a concept *(res incorporales)* to explain the new reality of the *areas in outer space or langrangian points, orbits including specific slots of certain orbits, trajectories and to certain extended frequency spectrum.* But even so, "Within *res corporals* a certain number of things are excluded from trade '*res quarum commercium non est*', normally referred to as *res extra commercium*" (Kaser & Wubbe 1971). That is, there are other features regarding the nature of the good itself that makes its trading impossible, and are essential elements in the definition of the legal regime.

This qualitative approach of Roman law differs immediately from the current approach of monistic simplification, which is merely

spatial/geographic, between the things that are within the territory of states and those that are outside the jurisdiction of states.

For Roman law, the *res communis omnium* are available to all and cannot be owned by anyone, not even by a state; for example, the air, rain, flowing river water, the sea, and the shore. Therefore, the origin of the *res communis omnium* was not one territorial division, an abstract criterion where the common is only the part remaining after appropriations; the good's intrinsic qualities led to the classification of its legal status.

It is very interesting to note the distinction between *source* and *resource* in the analysis of the Roman legal system and the constraints that this distinction imposes on the use and exercise of property. In practice, the Romans looked differently upon the issue when considering the sea as a whole and when considering its constituents. In the former case, they qualified it *res communis omnium* and the latter *res nullius*. Or, in more general terms, "*res communis* differs from *res nullius* in that the *source of resources* cannot be appropriated but the resources themselves are amenable to appropriation. (…) *Res nullius* may be subject to appropriation through effective occupation and the will expressed by the (new) owner to exercise ownership (*corpore et animo*)" (Oosterlinck 1996). The intrinsic quality of the good and the possibility of its effective possession, to acquire ownership, were decisive in the classification of the regime applied to it.

The "ocean the whole" was the source, which by its very nature was inappropriable, and the fish in it one appropriable resource. The fact that it is inappropriable and common to all, and therefore global, does not necessarily mean that it doesn't exist or that some of its constituents may be physically appropriable.

That being said, another crucial problem in defining the use and ownership regime was the feature of inexhaustibility.

> These resources were looked at as inexhaustible and their appropriation was physically possible and would moreover only be partial, leaving thus the possibility to others for future exploitation and use of the sea. Hugo Grotius evokes however, though briefly, the possibility that fish could be an exhaustible resource of the sea but in his view this would not alter the legal status of the sea as a whole. (Oosterlinck 1996)

> (…) if it were possible to prohibit any of these things, say for example, fishing, for in a way it can be maintained that fish are exhaustible, still it would not be possible to prohibit navigation, for the sea would not be exhausted by that use. (Grotius 1916)

Therefore, in summary, we can pose some questions that are central in determining property regimes: the possibility to appropriate the good or otherwise; if the good has an in- or exhaustible character, or, better yet, if the use of the good, without a physical appropriation of it, may or may not lead to the exhaustion of it. Throughout the article, the author, using a theoretical analogy between ocean and space, between source and resource, analyses the existing legal regime and the options whose, in his opinion, performance is still required in the organization of the use of this new frontier where natural intangible resources are also limited (as in the spectrum of frequencies or the geostationary orbit). As in all areas in which the law has been called into action, a precise clarification of the various types of ownership is needed in space in order to organize the relationships established around the use of sources and resources, which, by being exhaustible, cannot be used according to a free-access regime.

Synthesizing the previous analysis:

1) Roman law distinguishes between the source that is not appropriable and the resource that can be physically appropriated.
2) Grotius analyses the exhaustible or inexhaustible character, which is decisive in defining the ownership regime, access or use of the good.
3) There are some uses of the good, although not corresponding to a physical appropriation, that can lead to its exhaustion.
4) In the outer space law, intangible property is not only confined to human intellectual property.

Based on this summary, we realize that there are also natural intangible resources in the Earth System that can be exhausted by some uses although they can escape our senses.

With climate change and the discovery that a stable climate is not an inexhaustible factor, that is, the *incorporales* biogeophysical conditions that determine the state of the Earth System have upper and lower limits and therefore are exhaustible, the "appropriation/ownership" of this resource is not realized through a physical occupation but rather through its use, that is, as a change in the qualitative state of its incorporeal characteristics.

One should consider the recent period of relative climate stability, the Holocene (the last 11,700 years after the last ice age), which has been the basis for the development of human civilization (the history of the human species corresponds to a period of about 200,000 years), as a particularly favourable state of the Earth System for our species and for others that

share the same ecological conditions. Every time a state, company or an individual contributes to a change in the biogeochemical conditions of this period of stability, which has benefited all humankind, an "externality" in the natural *res incorporales* is generated, affecting all other users of this favourable state as less resource (considering the stable state of the Earth System as a resource) is available to all agents.

The biogeochemical conditions that ensure a stable climate and the favourable conditions of the Holocene are a natural intangible limited resource on Earth. The favourable conditions of the Holocene arose in an evolutionary fashion throughout Earth's history and it is through this evolutionary process, involving the living part of the planet as well as the geophysical, that, for example, the relative concentrations of gases have remained rather constant through time. In essence, it is the integration of the geophysical properties of the planet with the living biosphere that forms the intangible Earth System, a single global system incapable of any legal abstraction of division.

In the source/resource Roman law perspective, the source of this favourable state is the living biosphere and its interactions with the geophysical components. In other words, the sources are the ecological infrastructures, and the resource the biogeochemical conditions of the state of the Earth System.

We have been exploiting a vital resource we did not even know existed; nor did we know if it was exhaustible or inexhaustible. The stable climate was, quite simply, pre-acquired data. The possibility of it being affected by human activity was a hypothesis that did not even arise. The only value we truly recognized was the tangible sources of this unknown global resource. The lack of knowledge was one of the most relevant primary activator of the massive destruction of a huge amount of sources (for example, more than 80% of the original forests).

This is a new situation in regard to its possible classification. First, the natural resource is intangible and as such is not physically appropriated. Second, this good does not recognize land, air or ocean borders. It refers to a specific biochemical structure of the atmosphere and of the oceans, and its integration with the geophysical properties of the planet with the living biosphere that forms the intangible Earth System. In this respect, taking into account their characteristics and the ways in which these *res incorporales* were being perceived over time, we can identify some similar elements in four possible categories:

1) ***Terra Incognita****:* The intangible higher level of integration of the Earth System, because it was unknown, can be considered a true

terra incognita, an "unknown space", traditionally defined as regions never mapped or documented.

2) ***Res Nullius:*** The change in the biochemical structure at the higher level of the Earth System can be considered to have been carried out under the *open-access regime* condition, without rules, and in this sense is a *res nullius*. A good, being a *res incorporales* and an unknown resource, is not suited to traditional effective occupation, that is, a conscious will to ownership (*corpore e animo*). However, its use can lead to its exhaustion.
3) ***Terra Nullius:*** In the Middle Ages, *terra nullius* was used to define unclaimed or unoccupied territories, usually situated between fiefdoms and used as dumps for garbage and deposits. Although intangible and non-territorial, the fact that pollution legally disappears in the legal inexistence of the Earth System allows us to consider it a no-man's land, the place to send waste, and therefore an externality.
4) ***Res Communis Omnium:*** The Earth System is available to all and cannot be appropriated by anyone, not even by a state. When this common property extends to all humankind, the goods come to be considered as *res omnium.* They are the common heritage of humankind so all human beings, both the present and future generations, have the right to access them in a favourable state. However, given its character as an exhaustible resource, it is necessary to create a legal framework for both the use and the benefits realized in the common good.

2. Legal Black Hole

The "global" is, therefore, a new reality that is outside the legal frameworks built to date. Within existing classifications, although we can find some elements that partially adapt to this new reality, there is no legal asset that is simultaneously global and *res incorporales* with the ability to reflect the harmful changes of the biochemical structure of this specific favourable state of the Earth System. In the same manner, there is no way to capture or account for the benefits provided by ecosystems in the maintenance of a favourable state and enjoyed by all on a global scale. This new reality, already accepted and recognized by science and clearly visible from space, still remains invisible to the law.

If we take as a starting point the current prevailing view that the common is not by its nature truly common but what remains after appropriation, and if to this view we join the legal invisibility of the higher

level of the Earth System as a whole, what remains is not a *terra incognita* but truly an *incognita sine terra*.

Terra incognita was the term used in the 15th and 16th centuries to mark unknown land – the regions that had never been mapped or documented. After *terra incognita* had disappeared from our maps and the planet had "become spherical", where one could go back to the point of origin without going backwards, a first major step was taken towards realizing the overall unity of the planet at the geographical level of integration. We had, however, to wait until almost the end of the 20th century to realize that the planet and its operating system had more than a well-defined geographical, physical and palpable dimension. A new reality was revealed when we discovered that the gases and substances emitted into the atmosphere not only did not disappear in space but were also interchanged with the land and the oceans, or that what was released into the sea did not disappear into an ocean of infinity. Step by step, science was uncovering the upper level of integration of an Earth System with global and complex interconnections that were difficult to observe and define. However, despite their intangible and systemic nature, these relationships are not an abstract abstraction. Although this higher level of integration requires an abstraction to be considered as such and also explained, it is nonetheless incredibly obvious, based *in res incorporales*, that we are talking about a real world that everyone and everything is part of.

The Earth System is still considered to be *an unidentified legal object* – a ULO (Melot & Pélisse 2008)[3] – resulting in a large *legal black hole* through which vital positive flows (benefits to the state of the Earth System) and negative flows (harm to the state of the Earth System) "disappear" as externalities. The economic externalities are a social disappearance that do not correspond to a ecological disappearance. If the principle of disjunction in natural sciences "hid everything which connects, interacts, and interferes" in law, the paradigm of division "made believe that the arbitrary cut of the real was the real itself" (Morin 1990). The concept of a "system" emphasises the concept of the medium, that is, not only the *physis* as a material basis but also a mediation mechanism of biogeochemical cycles and thermodynamics "in which reciprocal interactions inside the system between the framework and its processes contribute to the regulation of dynamics and the maintenance of their organization, in particular thanks to feedback phenomena" (Lévêque

[3] See Chapter 5 of this book, written by Alexandra Aragão

2002). This enables a well-defined characteristic functioning as a single global complex ecosystem, which in reality is a life-support system for the entire biosphere, including humans, on Earth. Of course, the biosphere itself is a critical part of the Earth System, fully integrated with the geophysical components of the system itself.

The legal inexistence of the *favourable state* of the Earth System as an object of law which corresponds to a social invisibility, is a structural problem that hides the most vital factors for human life and prevents the construction of just and equitable solutions.

It is this vision that considers as remaining and *res nullius* everything that does not fit the concept of national sovereignty, which turns us into true *free riders* of the Earth System to which we belong and on which we depend, opening the doors for a collective tragedy.

3. The Greatest Market Failure

While it is true that it is materially or legally impossible to deny any human being free use of the Earth System, the enjoyment of truly common goods without any effective rules means that each individual is compelled to indefinitely increase his/her use of common resources associated with a particular state of the Earth System (e.g., the atmosphere with a particular concentration of constituent gases) because, if one does not do it, another will. All users have an incentive to increase their use without concern for the impact their actions may have on others (and perhaps themselves), and a disincentive in promoting the maintenance and improvement of the common good.

This is the well-known tragedy of the commons model described by Hardin (1968), in which free and unregulated use of a common resource based on the logic of *first-come, first-served* results in a rational actor maximizing individual interest. This places the common resource under such pressure that it becomes degraded and eventually exhausted as a result of overexploitation, thus the "tragedy". "The dilemma is that if a user retracts his/her use and the others do not, the resource will run out in the same way and the user will have lost the short-term benefit that was obtained by others" (Hardin 1968).

The model is now being reproduced on a global scale, with the difference that the good (resource) was until recently unknown and not definable. In this global-scale model, each state, following its own interest, will not be concerned about limiting pollution or maintaining its ecosystems for the purpose of contributing to a well-functioning Earth System in a stable and accommodating state, as the good is freely

available to be exploited by all. As there is no legal status for the global good, everyone uses it as *res nullius*, considering it will provide an endless stream of benefits to everyone, where their use does not reduce the potential for use by others (contrary to what is true of the commons).

Incidentally, this legal black hole has also been identified by economists in the *Stern Report*:

> Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen. The economic analysis must therefore be global, deal with long-term horizons, have the economics of risk and uncertainty at centre stage, and examine the possibility of major, non-marginal change. (2006)

The failure to recognize the existence of the Earth System results in the inability of nations to cope with the challenges on a planetary scale. One consequence is that all the benefits from, or damage to, the Earth System are legally non-existent. Without the existence of this common good or the identification of what is the good that presents simultaneously beyond and within all states but needs to be maintained in good condition for the functioning of the Earth System as a whole, we will not be able to turn ourselves into stewards of our common home. An Earth System that does not exist is a matricial failure and theoretical gap, which prevents filling the void that this recently recognized scientific reality requires.

4. Global Free Riders... Get It While You Can

At the heart of this problem are deep theoretical concepts that require some prior conceptual clarification on the characteristics of property, property rights and underlying relations. Since human relations expanded on a global scale through global systemic financial, economic and political interconnections (but ignored the biogeophysical interconnections that underpin the functioning of the Earth System), it is essential to realize how some of these principles of law led to the overexploitation and consequent tragedy of the commons.

The right of private property confers on its owner the power to *exclusively* use a resource, even if such use is rarely done absolutely. This means that, even though an owner has full power over something *plena in re potestas*, meaning the right to use, enjoy and abuse a thing, *ius utendi, fruendi et abutendi res sua* means that he or she is limited by the rules of society.

Rights to common property are held by groups of individuals, excluding access to the resources for all those outside the group but considering rights and duties regarding the use and conservation of the resource.

The *open-access* regime (*res nullius*), the concept of ownerless property, is completely non-exclusive, meaning that the access to goods/resources cannot be denied to any individual. In these cases, one cannot identify a group of users or owners because the available benefits flow to all without any, or almost any, duty regarding the use, preservation or maintenance of the resource.

In economic theory, this inability to exclude any individual's use of a good led to the rise of the *free rider* (Samuelson 1954) issue, in which any individual can benefit from a good without contributing to its production. An individual, following self-interest, will not contribute to the costs of the existence and maintenance of a good but will make use of its existence since it is available to everyone. The individual benefits from the principle of non-exclusion.

The problem of the tragedy of commons is based on the characteristics of free access and the unregulated use of a natural resource, which is limited by nature. Climate change is a tragedy of the commons on a global scale, in which this intrinsically common good, which was overexploited (a specific stable climate of a well-defined state of the Earth System), is not only difficult to define and establish boundaries around but also no human being can be excluded from access to it.

In a situation where either the damage or the benefit is common, without an organization of collective use through a system of accounting benefits and harm, everyone will act as a *global free rider.* Therefore, this is a tragedy not of material resource exhaustion but of the individual occupation of a certain quantity of the biogeophysical space of the Earth System carried out through a change that contributes to destabilising the favourable stable state of the system. In other words, pollution is a contribution to a change this specific state, the *healthiness of the Earth System*. This new form of occupation does not correspond to the traditional concept of territory or a physical appropriation of tangible resources; rather, the new reality must be recognized and conceptualized in order to organize the use of the Earth System. Although a subversive perspective of the dominant view today, the indivisible "whole" makes the issue of management of common goods (i.e., the Earth System) the basic fundamental theoretical question for all discussions on global environmental goods and possible alternative ways of building a sustainable society.

5. A Long Looking-For Period

When we look at the pathway traced by science in perspective, the history of environmental civil society movements and all the high-level negotiations that have been taking place for many decades, we realize that along this route of searching for solutions, the vision that the "common" is just the leftovers after appropriation unfortunately continues to be the starting point from which reality is framed. However, a great effort by the victims of this structural failure is being made and it is imperative to continue this standard negotiations track, even accepting that progress in reaching a solution for our troubled planet has been too slow.

Ten years after Rachel Carson published *Silent Spring*, a book that challenged the idea of the supposed capacity of the environment to absorb toxic pollutants such as agriculture pesticides, the 1972 United Nations Conference on Human Environment, held in Stockholm under the leadership of Maurice Strong, is a decisive mark on the sustainability timeline. While the regional pollution situation in Sweden and the surrounding Nordic and Central European countries achieved a particular focus, it was the first major step at the global level to give environmental issues a high priority. The creation of a sustainable development concept, with the view of integrating different fields of development, which until that time had been fully separated into a cohesive vision solving the environmental versus development dilemma, was a clear breakthrough. *Limits to Growth,* by the Club of Rome, the best-selling environmental book, was published in 1972, one year before the oil crisis. The analysis, interconnections and particularly the results sent a shockwave through both developed and developing countries. The conference led to the establishment of numerous national environmental protection agencies and, most importantly, the creation of the United Nations Environment Programme (UNEP).

During the 1970s, while relevant international agreements such as the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) in 1975 and the adoption of the Convention on Long-Range Transboundary Air Pollution in 1979 came into effect, the world became acquainted with dramatic global environmental problems, including the discovery by Rowland and Molina in 1974 of the role chlorofluorocarbons (CFCs) play in damaging the stratospheric ozone layer, and catastrophes with a symbolic impact that became calls for world action like the 1978 Amoco Cadiz oil spill affecting the coasts of Brittany in France.

The ’80s broadened the scope of international action in different areas of the environment. The first World Conservation Strategy was released by the International Union for Conservation of Nature in 1980 with the significant subtitle: “Living Resource Conservation for Sustainable Development”. In the document’s foreword, it states that “human beings (…) must come to terms with the reality of resource limitation and the carrying capacities of ecosystems, and must take into account the needs of future generations”. At the end, the “Towards Sustainable Development” section identifies the main agents of habitat destruction as poverty, population pressure, social inequity, and the terms of trade, and calls for a new international development strategy. While the principles were not disruptive at that time, they started to frame a vision for the next decades concerning the complex relationships between human beings and nature.

The concept of the ‘common heritage of mankind’, first mentioned in a 1954 convention related with the protection of cultural property under armed conflicts and in the Outer Space Treaty of 1967, achieved a greater maturity in 1982 within the United Nations Law of the Sea Treaty.

In 1987, the publication of *Our Common Future*, or the so-called Brundtland Report, gave a comprehensive vision of the problems affecting the planet and the need for global solutions mostly through the promotion of sustainable development.

The United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 was a real breakthrough. By mobilizing an incredibly larger number of stakeholders and high-level representatives from all over the globe before, during, and after the conference, the Earth Summit or ECO/92 framed the United Nations as the unquestionable international core for further advances in the implementation of solutions for a safer planet with a better quality of life. The publication of Agenda 21, the signature of the Convention on Biological Diversity and the Framework Convention on Climate Change, the Rio Declaration, and a statement of non-binding forest principles probably turned the event into the most important political mark on the sustainable development timeline. The parallel non-governmental organization Forum also added a set of alternative strategies and visions relevant for the framing of a critical view compared to the less ambitious, slow, and sometimes painful negotiation track along the formal venues of the United Nations.

Throughout the 1990s, two major challenges should be highlighted as crucial steps to a better understanding of the international framework concerning sustainable development and the most important global long-term problem for humanity that is climate change – the beginning of the Conferences of the Parties, after the entry into force of the United Nations

Framework Convention on Climate Change (UNFCCC) in 1995 and the further signature of the Kyoto Protocol by 1997, and all the preparatory work for the approval of the United Nations Millennium Development Goals by 2000, where world leaders agreed to a set of time-bound and measurable goals for combating poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women, to be achieved by 2015.

In 2000, after a decade of global cross-cultural dialogue on common goals and shared values, the Earth Charter was launched. It began as a United Nations' initiative but it was then developed through the involvement of the global civil society, and is currently endorsed by more than 6000 organizations. The Earth Charter proposes an ethical framework for building a just, sustainable and peaceful global society for the 21st century. With 16 principles, the Charter emphasises the need to respect and care for the community of life along the first four principles, with a statement (principle 2a) that frames a relationship between humans and the rest of nature: "Accept that with the right to own, manage, and use natural resources comes the duty to prevent environmental harm and to protect the rights of people."

During the first decade of the 21st century, another paradigm should also be noted – the relationship between the intensive work of more than 3000 experts from the Intergovernmental Panel on Climate Change between science and forecasted policy scenarios, and all the negotiations towards the mitigation and adaptation to climate change, clearly deserving of the Nobel Peace Prize awarded in 2007.

6. The Inevitable Global and Multiple Approach

Even admitting that the negotiations pathway will gradually convey better approximations of a solution, the structural problem still exists, making inevitable a confrontation where "sovereignty defies reality" (Brunnée 1998). This author, in a paper about the conflicts between sovereignty and water management and the difficulties of international law in dealing with shared resources, states:

> My contention is simple: International Water Law, and States, will not meet the "challenges of water" until the reality of interdependence is addressed in its full complexity. This means that international environmental law and international water law must become integrated to treat water for what it is: a component of the environment. From this integration, in turn, must emerge a concept of sovereignty that reflects rather than defies environmental reality.

With the knowledge we have today of the Earth System, a division between the water component and the other system components is not sound but the statement is still valid on the need for sovereignty to reflect the environmental reality.

It has become obvious that solutions are necessary. Within the political framework architecture of existing institutions, we must consider that without a new theoretical approach able to support a new global paradigm for the management of the commons within an international landscape characterised by the multiplication of territorial units, it will be impossible to avoid the effects of a congenital degeneration.

In this context, the preliminary works concerning the ecological footprint, the first quantifiable and integrated analyses on a global scale, date from the beginning of the 1990s. It was more recently, in 2006, that the standardization of this instrument enabled it to evaluate and compare activities, countries and regions worldwide. The ecological footprint enables us to measure human demand on nature and evaluate the availability of resources in a constrained world that is becoming ever-more populated.

The footprint represents both the asset side through biocapacity, the planet's renewable resources such as biologically productive land areas, including our forests, pastures, cropland, and fisheries, and a demand side, with humanity's consumption of natural resources.

Upon reaching 2015, the target date of the Millennium Development Goals, the United Nations took an important broader step, adopting in this same year the 17 sustainable development goals (SDGs). Considered a consequence of the Rio+20 outcome document "The Future We Want", an inclusive and transparent intergovernmental process on SDGs opened to all stakeholders with a view to developing global sustainable development goals: ending poverty and hunger goes hand in hand with the need to ensure sustainable consumption and production patterns; take urgent action to combat climate change and its impacts; conserve and promote sustainable use of the oceans, seas and marine resources; protect, restore and promote the sustainable use of terrestrial ecosystems; sustainably manage forests; combat desertification; and halt and reverse land degradation and biodiversity loss.

Therefore, and with a thorough description of the historical application and usefulness of tracking sustainable development, new guiding principles for assessment system indicators are suggested throughout this book.

However, the ecological footprint does not account for certain key thresholds within our biophysical system, the so-called planetary

boundaries (Steffen et al. 2015a; Rockström et al. 2009) that correspond to biogeophysical features of the geological period in the Holocene. This intangible structure that defines the *favourable state* of the Earth System is referred to by the scientific community as the "safe operating space for humanity", a space without territory, a true natural *res incorporales* that is simultaneously inside and outside all sovereignties, which through the cumulative pressure of humanity may drive the Earth System to an undesirable state.

This new known reality, this true environmental *grundnorm*, therefore, should be the basis for any positive law of general acceptance and reasonableness (Rakhyun & Bosselmann 2013). The ULO (Melot & Pélisse 2008) could now have a set of parameters and guidelines that define its stability and existence.

While science is key for evaluating the progress towards a more sustainable planet, the daily reality embraces long worldwide negotiations, with thousands of negotiators talking about (more than defining) a set of policies on multiple dimensions, including the economy, society, the environment, and other aspects such as governance.

Departing from the "current system of nation-state based governance is inadequate for tackling such issues as climate change-induced global warming, pandemic diseases and other threats to human security and prosperity",[4] this book conveys the idea of an Earth Condominium model, and a new global trusteeship as a paradigm shift necessary for overcoming the difficulties the United Nations has had in the last decades to achieve a better planetary outcome concerning different environmental-related matters. Indeed, the perception of informed citizens worldwide is that the UN has not been able to deliver the necessary commitments, measures and actions to tackle many of the issues agreed on within the sustainable development area. However, it is completely unrealistic to rapidly change the modus operandi of this planetary institution. Even though we are far from the desired goals, one has to recognize that the negotiations have been progressing with some relevant achievements. The alternative to bilateral or group country agreements would increase the dictatorship of the will of a few countries, extending the already existing unnecessary divisions.

In fact, the high complexity of the climate change issue makes the science and technical expertise conveyed through the Intergovernmental Panel on Climate Change almost as determinant as political will.

[4] See Chapter 12 of this book, written by, Kul Gautam.

The extensive accumulation of negotiation, knowledge and consensus, including the signature of the Kyoto Protocol in 1997, with all the accessory mechanisms such as the clean development mechanism, joint implementation and emission trading between countries, involved a huge process of approval, tracking and monitoring not common to other UN conventions.

The pathway where long-frozen concepts, such as the so-called "firewall" that has been dividing countries into two major groups – developed and the developing, which have been questioned since greenhouse gas emission targets have had to be applied to a much larger number of countries in the post-2020 era, is a paradigm of crucial importance that the negotiations are trying to finally overcome. . The Paris Agreement tries to overcome some of the previously identified difficulties, creating an ongoing bottom-up process based on national contributions with increased ambition to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. While in some areas, such as financing, the differences between developed and developing countries are still marked, there is optimism that this new push will contribute for some positive steps towards avoiding catastrophic climate change consequences.

The future has to incorporate a combination of strategies where champion countries have to lead the way and engage other countries, and where multilateral negotiations have to unfold and at least partially meet the objectives considered necessary for the minimization of impacts on humanity and ecosystems. Simultaneously, a new legal paradigm where the "commons" are the basis of a new configuration of the relationships between the countries is vital, and should be implemented within a medium or long-term perspective in a parallel but active process that should start as soon as possible. A pragmatic perspective would be the one that takes into account the current *real politic* but at the same time acknowledges the huge theoretical challenge to law to convey a favourable state of "*healthiness"* of the Earth System "which it is not restricted to the global commons but also spans across areas subject to national jurisdiction" (Borg 2007).

A complementary strategy that does not stop or close the ongoing negotiation processes but shifts and integrates them within a new conceptual framework is the challenge embraced by this book. Only a truly accepted agreement can be both binding and implemented and, therefore, successful.

7. The Double Tragedy and Double Challenge

The work of Hardin generated pessimism around the "commons", turning common property management into a failure. The failure deepens when even those who genuinely care about future sustainability and the common good come to the conclusion that the restriction of exploitation of the resource will lead to a comparative economic loss. This is an altruistic feeling that will lead to the self-elimination of the agents resulting from a natural selection process. This logic is valid not only for the exploitation of the resource but also applies to the benefits that can be realized in maintaining/improving the common good.

In the context of the Earth System, one can designate the current situation as a dual tragedy: On one hand, the classical tragedy of exploitation embodied in the destabilisation of the relatively stable Holocene state of the Earth System by unregulated resource exploitation and pollution; on the other hand, and using the Roman source/resource analysis, as no country will enjoy just for itself all the benefits provided from its own sources of the resource (ecological/geophysical infrastructure) in the state of Earth System (common resource), there are no advantages in promoting actions to maintain the Earth System in a stable state. As there is no incentive for individual initiatives to maintain or improve the sources of common good, in the context of competition and legal and economic shortcomings in managing a common resource, it is normal to allow the degradation of the sources to sell raw materials or to obtain other economic gains. The vital benefits provided by the sources of the common resource are worth zero as they are still shared by all on a global scale.

The logic of the tragedy of the commons is doubly valid for the exhaustion of the *resource* and for the destruction of the *sources of the resource*, "the ecological infrastructure" that can deliver benefits to all societies. The short-term logic will prevail unless structural measures that have the ability to change these initial conditions and generate new systemic collaborative effects are implemented. The logic of the tragedy of the commons undoubtedly depends on a set of assumptions related to the motivation of people operating under rules governing the use of the common and defining the very nature of the resource.

A pragmatic approach to this dual challenge has to be innovative. This implies a structural intervention in the framework basics of the sovereign international system that allows the benefits achieved in the state of the Earth System, which currently economically disappear into a black legal hole, to have economic visibility through an accounting system and

compensation for the "stewardship of the Earth System". For this structural change to become possible, the global benefits made in the "common resource", which is the Earth System in a favourable state, must be caught in a global legal instrument (Figure 1).

With the work of Elinor Ostrom and the recognition of the Nobel Prize awarded to her, the commons are no longer an impossibility. For Ostrom (2010), "the crucial factor will be a combination of structural features that lead many involved to trust each other, and are willing to take joint action that adds value to their own short-term costs because both see a long-term benefit for themselves and others, believing that most others will comply". This building of trust and reciprocity, as she claims, requires structural features. We argue that the first structural feature in organizing the collective use of a common resource is to define the resource to be managed, and to recognize that it has to exist. Once identified, the natural *res incorporales* state of the Earth System, although physically inappropriable, can be managed. Hugo Grotius (1916), however, defends an exception: "If any part of these things is by nature susceptible of occupation, it may become the property of the one who occupies it but only in so far as such occupation does not affect its common use".

Ostrom (2010) also acknowledged that "it is obviously much easier to build solutions for collective action problems related to small-scale resources than for those related to a global common good". Despite the magnitude of the challenge, there is no other feasible alternative. This is the approach that we will explore throughout this book.

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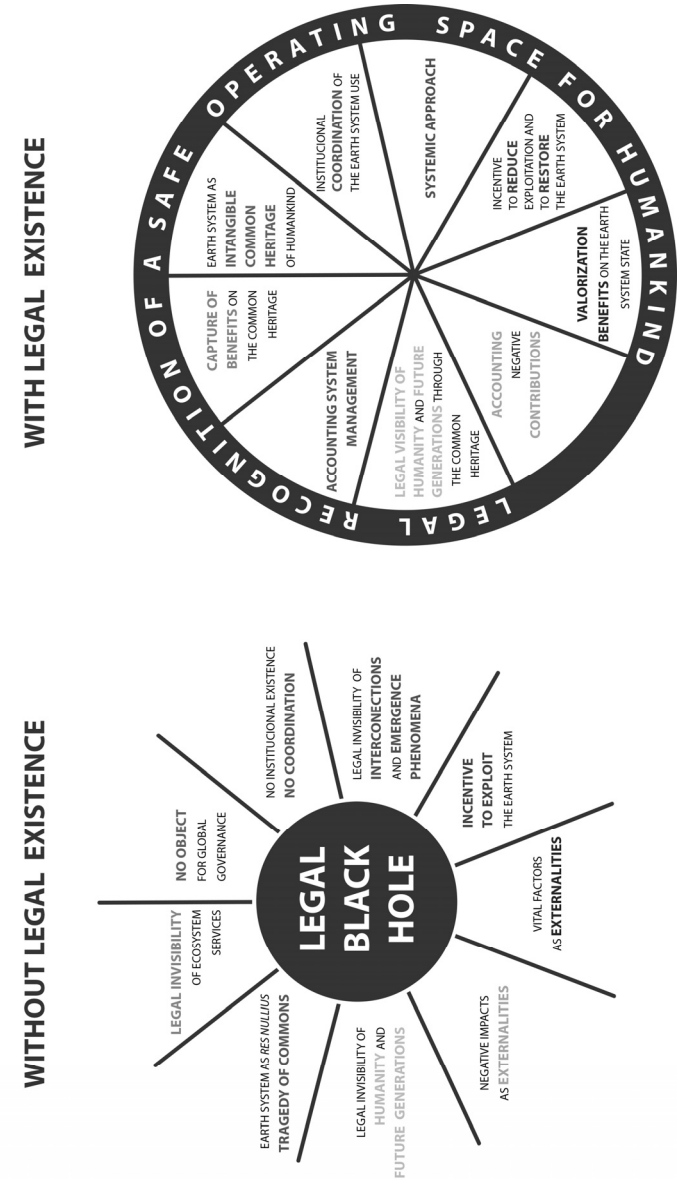

Figure 1. A comparison of the existing and proposed Earth System management regimes