

LUISS



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Comparative History of Political Systems

Environmental security in the XXI century: Investigating the role of temporality

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Alla mia famiglia italiana - che mi ha aiutato ad iniziare questo percorso tra un vaccino ed una pizza alle Piramidi;

a mi familia argentina - que me ayudó a terminarlo entre unos mates y unos viajes.

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Abstract

This work aims at constituting an academic contribution to the growing securitization process characterizing the international order by providing an intellectual linkage between the study of Temporality and that of Environmental security. Through a multidisciplinary approach analyzing subjective time and objective time in their respective fields of studies, the work will try uncovering the nature of the human perception of time, to later contextualize it into XXI century environmental security with the purpose of investigating how such a perception of time shapes humans' ability to effectively tackle the environmental challenges currently posed before them. This integration of temporality into today's environmental security will expose a cognitive "temporal trap" that the work will attempt to solve by turning to the study of visions of the future in the form of dystopias. It will therefore be argued that *the Self can envision unfamiliar futures without disrupting its sense of stability through a creative dystopia provoking the familiar feeling of anxiety embedded in human beings.*

Keywords: Environmental Security; Temporality; Anthropocene; Identity; Utopia/Dystopia.

Introduction

The rise of liberalism in XVIII century Europe created a state structure that based its functioning on a number of freedoms carefully crafted by the government in a constant balancing against security. The heart of this new governmental reason was therefore a dialectic between *freedom* and *security* - that is, between the individual interest of the citizen and the collective interest of the community.¹ This interplay between freedom and security - unchanged by the consequent introduction of democracy to the liberal order - assumed different equilibriums throughout the following two centuries, based on the perceived societal needs of the liberal order in its different historical contexts, thus leading to periods in which the former prevailed over the latter, and vice versa. In his book “Civilization and Its Discontents” Sigmund Freud characterized modernity (a eurocentric term roughly comprising the XIX and early XX century West) as an age in which men, under the strict imperative of order, favored security over freedom.² The “malaise of modernity” was thus an excessive suppression of individual liberty, which reached a climax with the different forms of authoritarianism characterizing several European nations during the first half of the XX century, and led to history’s most brutal international conflict.

The collective psychological reaction to the horrors of WWII called for a radical change in the balance between freedom and security: the preference for the latter ended with the War (along with modernity), creating a new historical era - often been called “postmodernity” (keeping the debate around its validity aside) - in which the newly re-established liberal democracy would grant freedom the upper hand over security. The pursuit of order was now replaced with a search for pleasure, ultimately represented by 1960’s counterculture and the resulting civil rights movements. This age brought an existential anguish similar to that of modernity, though originating from an opposite tendency: a pursuit of individual liberty so unrestrained as to hinder the human need for security.³

The beginning of the XXI century saw a historic event whose impact on the psyche of liberal democracies was to be equal to that of WWII, albeit in the opposite direction: the *9/11 attacks*.

¹ Foucault, M. (2010). *The Birth of Biopolitics: Lectures at the Collège de France, 1978–1979* (M. Senellart, Ed.; G. Burchell, Trans.). Palgrave Macmillan. pg. 63-65.

² Freud, S. (1989). *Civilization and its Discontents* (J. Strachey, Ed.; J. Strachey, Trans.). W.W. Norton.

³ Bauman, Z. (2002). *Il disagio della postmodernità* (postmodernity and its discontents) (V. Verdiani, Trans.). Mondadori Bruno. pg. XII.

The turning point that WWII represented for the shift in the balance between security and freedom (in favor of the latter) was now constituted by the 2001 terrorist attacks, which greatly increased the amount of liberty that the individual was ready to give up in order to reduce risk⁴, thereby orienting democracies towards a renewed pursuit of security. This tendency was consolidated in the following years, when liberal democracy was forced to meet with a series of challenges that its previous political, social, and economic structures had been nurturing for the past centuries, but that had only now openly manifested themselves altogether: international economic crisis and migratory flows, acute environmental changes, the rise of Islamic fundamentalism, cyberattacks, and last but not least - the Covid-19 pandemic; as the historical events that followed WWII were used as a further legitimation of the growing momentum acquired by freedom (the Vietnam War, Decolonization, Third-Worldism, etc.), so were those after 9/11 used to strengthen security's legitimacy, making it once again the focus of societal and intellectual discourses appealing to citizens, politicians, and scholars with a vigor unmatched in the previous half a century (it is no coincidence that the author of this thesis is a master's student majoring in Security studies). Simultaneously, the interconnected nature of the challenges faced by the XXI century - each phenomenon being caused and being the cause of another - created a vicious cycle of instability that liberal democracy found itself unprepared to face, causing a gradual erosion of its prestige and authority in the eyes of society. Through the waning of its reputation, liberal democracy suffered a crisis of legitimacy that was used by frustrated, opportunistic individuals - who saw an opportunity to prosper in an environment different from the democratic one in which they did not thrive - to question the values on which their society had been relying for the previous decades (or centuries). These individuals often took advantage of incomplete social transformations or recent historical events too hastily swept under the rug to fuel latent anti-democratic sentiments within their societies. Populism, radical political movements, extremist organizations, all now openly criticized the very system thanks to which their rise was allowed, exploiting well-spread popular fears to target even those characteristics of liberal democracy not connected to such agents of social anxiety in the first place (long-established minorities, secular democratic practices, etc.), in what many saw as a validation of Popper's Paradox of Tolerance.⁵

⁴ Waldron, J. (2003). Security and Liberty: The Image of Balance. *The Journal of Political Philosophy*, 11(2). pg. 191-194.

⁵ Popper, K. R. (2002). *The Open Society and Its Enemies*. Routledge. pg. 668.

Similarly to the shift that led the modernist search for security to gradually embrace authoritarianism, the XXI century is therefore witnessing a gradual decline of democracy, matched by a growing autocratization. The rise of authoritarianism is *global*, characterizing all continents and affecting both recently established democracies as well as traditional ones.⁶ The Covid-19 pandemic proved to be *the* ultimate accelerator of such a tendency, providing a justification for the more “agile” executive powers to gradually replace the slower legislators in what was depicted as a race against time for securitization.⁷ Within this context of existential uncertainty, academics are beginning to analyze the causes behind the deterioration of democratic socio-political values, so as to try to understand whether Democracy is doomed to fail, or a path for its revitalization is still possible. While not dealing directly with Democracy itself, this work aims to serve as a contribution to the debate.

The balance between security and freedom is a pillar of liberal democracy, for its “alternating” nature allows democracy to better adapt to the exigencies of the historical period in which it finds itself. As modernism and postmodernism have shown, each of the two kinds of equilibria resulting from this balancing (favoring security over freedom; favoring freedom over security) carries with it positive as well as negative socio-political consequences; studying democracy’s survival should not therefore be aimed at advocating for one equilibrium over the other, it should rather aspire to find optimal ways through which democracy can thrive in both equilibria. As the world is currently witnessing a historical period of securitization, a relevant study of democracy’s survival today would need to focus on the challenges that the world is facing in such a context - that is: *XXI century security issues*.

Where to go from here? Given the complexity and vastness of topics populating the field of security studies, it would be quite hard for a single work to analyze comprehensively all the security challenges that a democracy might be facing today: while patterns and structural characteristics of democracy that would generally prove relevant for all of its security challenges could be uncovered (as it will be shown later in this work), there nonetheless is a certain degree

⁶ Sangtong, K. (2021, March 14). *V-Dem report 2021: Global wave of autocratization accelerates*. Democracy Without Borders. Retrieved February 13, 2022, from <https://www.democracywithoutborders.org/16165/v-dem-report-2021-global-wave-of-autocratization-accelerates/>

⁷ Schäfer, A., & Merkel, W. (2021, September). The Temporal Constitution of Democracies. *The Oxford Handbook of Time and Politics*. pg. 13-15.

of specificity for each security area that demands a individual approaches. It is therefore appropriate to focus on single fields of security separately.

Starting from the end of the Cold War, a new field within security studies began to emerge - that of *environmental security*; while its characteristics and scope are still somehow under debate⁸ (as it will be shown in the first chapter of this work), several of its concerns constitute some of the major challenges that humankind will have to face in the (at least nearby) future - among which climate change, widely considered “the defining challenge of our time”⁹. Centering this work on environmental security will then allow us to analyze a field which is gradually becoming one of - if not *the* - most important areas of security studies.

A fundamental guiding principle in (environmental) security is that of *Time* - indeed, major headlines fill the world’s newspaper and academic articles everyday with titles such as “What Earth might look like in 80 years [...]”¹⁰, or “Net-zero by 2050”¹¹ - yet, the great focus given to time within the academic debate is mostly limited to techno-scientific and socioeconomic research in which time is identified with “clock and calendrical reckoning”¹², and it merely serves as a given “language” with which to illustrate concepts and issues (the number of years within which a certain environmental policy is to be achieved; the social or economic effects of the rising sea levels by 2070; etc.). This has so far left little attention paid to the actual anthropological and sociopolitical nature of time - that is, “how time is constructed (...) by whom, for what purpose, and to what effect”¹³; nonetheless, it is this inherently human characteristic of time that shapes people’s understanding of past, present and future, consequently forging societies - thus states - down to their most intimate components, and ultimately affecting policies at both the national and international level. An analysis of time’s socially constructed nature would then allow us to grasp a deeper comprehension of a fundamental component - that is, *Time* - of one of the (increasingly) most important fields within

⁸ Allenby, B. R. (2000). Environmental Security: Concept and Implementation. *International Political Science Review / Revue internationale de science politique*, 21(1). pg. 5.

⁹ UNFCCC. (2018). *UN Climate Change ANNUAL REPORT 2017*. pg. 4.

¹⁰ Mosher, D., & Woodward, A. (2019, October 17). What Earth might look like in 80 years if we're lucky — and if we're not. *Business Insider*.

<https://www.businessinsider.com/paris-climate-change-limits-100-years-2017-6?r=US&IR=T>

¹¹ IEA. (2021). *Net Zero by 2050*. IEA. <https://www.iea.org/reports/net-zero-by-2050>

¹² Hom, A. R. (2018). Timing is Everything: Toward a Better Understanding of Time and International Politics. *International Studies Quarterly*, 62(1). pg. 69.

¹³ ECPR. (2021). *Featured Roundtable: The role of temporality in climate change activism* [ECPR General Conference, Virtual Event, 30 August - 3 September 2021].

security studies - that is, *Environmental security*. This will be the topic of the work presented here.

While time has always been a major pillar of philosophy and physics, its study in the political science discipline has only begun in the second half of the XX century, thanks to authors such as S. P. Huntington who advocated a shift from social sciences' predominantly ahistorical approach to politics¹⁴, and N. Elias, who transposed time-related philosophical dilemmas into the social sciences¹⁵. The instability characterizing the XXI century (described in this work a few pages behind) has accelerated such a growth of interest in the study of time and temporality within social sciences, as scholars moved away from atemporal socio political theories (that usually reflect the optimistic, well-defined historical period of stability in which they've been conceived rather than an alleged "atemporal history"), to focus on "change rather than continuity"¹⁶.

S.E. Hanson provides a useful summary of the state-of-the-art academic debate on time in the political science discipline¹⁷; he identifies two strands of scholars: those who focus on *objective time*, and those who focus on *subjective time*. Scholars studying objective time - a time that is "linear, unidirectional, and consistently measurable"¹⁸ (the second chapter of this work will thoroughly elaborate on the different concepts related to and conceptions of time here briefly introduced) - come from the *comparative historical analysis tradition* (CHA), a tradition that counts among its members some of the founding fathers of modern social sciences (such as Alexis de Tocqueville, Adam Smith and Karl Marx), and that it is distinguished by "its emphasis on historically contextualized comparisons explicitly aimed at producing causal arguments about the macro-sociological phenomena"¹⁹. The last decades have been characterized by a resurgence of CHA²⁰, which is now well present in sociology ("comparative historical sociology") - thanks to authors such as Jack Goldstone, Dietrich Rueschemeyer, Theda Skocpol, and Ronald

¹⁴ Huntington, S. P. (1971). The Change to Change: Modernization, Development, and Politics. *Comparative Politics*, 3(3). pg. 283-322.

¹⁵ Elias, N. (1993). *Time: An Essay* (E. Jephcott, Trans.). Blackwell.

¹⁶ Hanson, S. E. (2019, October). Objective and Subjective Time in Comparative Politics. *The Oxford Handbook of Time and Politics*. pg. 2.

¹⁷ Ibid.

¹⁸ Ibid., pg. 6.

¹⁹ Della Porta, D. (Ed.). (2014). *Methodological Practices in Social Movement Research*. Oxford University Press. pg. 1.

²⁰ Mahoney, J., & Rueschemeyer, D. (2014). *COMPARATIVE HISTORICAL ANALYSIS: ACHIEVEMENTS AND AGENDAS* (J. Mahoney & D. Rueschemeyer ed., Vol. Comparative Historical Analysis in the Social Sciences). Cambridge University Press. pg. 4.

Aminzade; in comparative politics - through the works of James Mahoney, Paul Pierson, Thomas Ertman and Kathleen Thelen; in international relations - carried on by Martha Finnemore, Immanuel Wallerstein and Michael Trachtenberg; and in American Political Development (APD) - thanks to Stephen Skowronek, Ira Katznelson, Richard Bense and John S. Lapinski.²¹

The second strand of scholars is instead focused on subjective time, which is “the way individuals subjectively perceive and evaluate the passing of their personal “objective” lifetime”²², and it has its roots in *social psychology* (Kurt Lewin, Leon Festinger, Gordon Allport, Henri Tajfel etc.) and *behavioral economics* (Amos Tversky, Daniel Kahneman, Richard Thaler, etc.). As noted by Hanson, these two literatures have developed largely isolated from one another, due to the difference in their subjects of analysis as well as ontological conceptions of time: CHA focuses on the collectivity and a time that exists per se - therefore scientifically measurable; social psychology and behavioral economics focus instead on the individual and a time that exists within him alone - and thus differs for every individual in society. The quasi-absence of interaction between these two “schools of time” in the political science discipline has not allowed to study the intersection between objective and subjective temporality - that is, how an individual perception of time can evolve into a collective understanding of time; nonetheless, *it is precisely this institutionalization of temporality that* (as previously mentioned) *serves as a basis for collective political action.*

This work aims at constituting an academic contribution to the growing securitization process characterizing the international order by providing an intellectual linkage between the study of Temporality and that of Environmental security. Through a multidisciplinary approach analyzing subjective time and objective time in their respective fields of studies, the work will try uncovering the nature of the human perception of time, to later contextualize it into XXI century environmental security with the purpose of investigating how such a perception of time shapes humans’ ability to effectively tackle the environmental challenges currently posed before them. This integration of temporality into today’s environmental security will expose a cognitive “temporal trap” that the work will attempt to solve by turning to the study of visions of the future in the form of dystopias. It will therefore be argued that *the Self can envision unfamiliar futures*

²¹ Katznelson, I., & Lapinsky, J. S. (2006). At the Crossroads: Congress and American Political Development. *Perspectives on Politics*, 4(2). pg. 244.

²² Gabrian, M., Dutt, A. J., & Wahl, H.-W. (2017). Subjective Time Perceptions and Aging Well: A Review of Concepts and Empirical Research – A Mini-Review. *Gerontology*, 63(4). pg. 350.

without disrupting its sense of stability through a creative dystopia provoking the familiar feeling of anxiety embedded in human beings.

The first chapter will deal with environmental security: it will start by introducing the concept of environmental security - its birth, the academic debate around it, and the understanding of the concept employed in this work - to later move in the second section to the two main paradigms currently employed to make sense of the current historical environmental period. The third section of the chapter will illustrate the XXI century global socioeconomic structure brought by the Great Acceleration and its repercussions on the Earth system, to later provide a scientific account of the major environmental challenges posed before humankind and the margins within which it can safely develop. In its fourth and last section, the chapter will end by outlining the changes that the work believes would be needed at the intellectual and political level to allow humankind to pursue environmental security in the rapidly changing world of the XXI century.

The second chapter will turn to temporality: the first part will begin by linking security to time, uncovering their objective/subjective dichotomy, to later more clearly define time and the focus of this work - that is, temporality. The second section will trace a short history of temporality, so as to provide a better understanding of the causes that led to its specific nature in the XXI century. The second chapter's third section will try to uncover temporality's underlying nature, to later shift to a major human process - vital to environmental security - embedded in temporality: identity formation. By linking temporality to identity, this part of the work will move away from the previous section's historical approach and instead adopt a more psychological one. This section will finally illustrate the role of temporality in environmental security, as well as present the underlying issue (arising from the relation between temporality and environmental security) uncovered by the work: the "temporal trap". The fourth section will be focused on finding solutions to the temporal trap previously presented: it will start with an account of Heidegger's work on temporality, to later draw on utopian studies to uncover the role played by visions of the future - in the form of dystopias - in allowing humans to overcome the temporal trap. Lastly, a conclusion will summarize the main points presented in the work, to later indicate a few thematics from which to start future analysis.

I

Environmental Security

I.I Defining “Environmental Security”

The end of the bipolar world and the acceleration of globalization brought by the collapse of the USSR led to a reshaping of the security paradigm that had prevailed up to that time, imprinting four key changes to it²³: the shift in focus from territory to *people*; the increasing importance of *risk* (immeasurable and often involving intangibles); the blurring of the distinction between local, national and global; and the growing attention paid to unconventional modes of armed conflict. These changes in strategic thinking led to a departure from the exclusive focus on a “traditional” (state) security agenda - which deals with “the threats against the essential values of the State like territorial integrity and political sovereignty (...with means such as) weapons, armaments systems and the militaries”²⁴ - typical of periods characterized by a clearly defined balance of power between states, and enlarged the scope of security studies so as to include (albeit with reservations voiced from some parts of the academic debate) what came to be known as “non-traditional security issues”. While there is no agreement on the definition of non-traditional security issues, the Consortium of Non-Traditional Security Studies in Asia provides a comprehensive one:

*“Non-traditional security issues are challenges to the survival and well-being of peoples and states that arise primarily out of non-military sources, such as climate change, resource scarcity, infectious diseases, natural disasters, irregular migration, food shortages, people smuggling, drug trafficking and transnational crime. These dangers are often transnational in scope, defying unilateral remedies and requiring comprehensive—political, economic, social—responses, as well as humanitarian use of military force.”*²⁵

Including non-traditional security issues into the agenda paved the way for the analysis of new kinds of threats, thereby creating new fields of study - most importantly: health security; energy

²³ Evans, M. (2007). Towards an Australian National Security Strategy: A Conceptual Analysis. *Security Challenges*, 3(4). pg. 113-130.

²⁴ Attinà, F. (2015). Traditional security issues. In W. Song & J. Wang (Eds.), *China, the European Union, and the International Politics of Global Governance*. Palgrave Macmillan. pg. 1.

²⁵ *About Non-Traditional security – NTS-Asia*. (n.d.). NTS-Asia. Retrieved May 14, 2022, from <https://rsis-ntsasia.org/about-nts-asia/>

security; migration security; environmental security²⁶; and food security. This allowed security studies to adapt to the reality of an increasingly interconnected and rapidly evolving world in which states were no longer the primary agents of threat, and military weapons no longer the primary means.

Leanne Jennifer Smythe gives us a clear understanding of non-traditional security issues by dividing them into three categories²⁷: Fragile and Failing States (being a cradle for the flourishing of multiple security threats such as black markets, contraband, etc.); Global Terrorism; and Transnational Political Challenges. The third category has traditionally been dealt with by non-security institutions, and has only recently started being tackled by security agencies, due to the attention drawn by the increasingly drastic consequences of its issues. The category is further divided into two subcategories: human behavior-driven (smuggling, trafficking, etc.), and natural processes-driven; environmental security deals with the latter - that is, *non-traditional security threats consisting of transnational political challenges caused by natural processes*.

Before proceeding any further, we should first ask ourselves whether it is correct to speak of environmental “security”, or whether environmental hazards, their impacts on states and societies, and possible solutions to them would be more appropriately represented by a term different from that of “security”. The concept of “environmental security” started gaining prominence following the 1994 Human Development Report of the United Nations Development Programme, in which environmental security was listed among the core components of the newly formulated notion of “human security”²⁸. Since then, an academic debate has persisted as to what the concept of “*environmental security*” consists of, and whether it is a useful one or not: Nina Græger (being herself reluctant towards the concept) argues that conceptually linking the environment to security has four logical reasons²⁹: the state of the environment has repercussions on human security and life itself; environmental degradation can be a source of violent conflict; there is a “conceptual kinship”³⁰ between the classic concept of military security and that of

²⁶ Le Gloannec, A.-M., Irondelle, B., & Cadier, D. (2013). New and Evolving Trends in International Security. *Transworld - The Transatlantic Relationship and the future Global Governance, Working paper 13*. pg. 18.

²⁷ Smythe, L. J. (2013). NON-TRADITIONAL SECURITY IN THE POST-COLD WAR ERA: IMPLICATIONS OF A BROADENED SECURITY AGENDA FOR THE MILITARIES OF CANADA AND AUSTRALIA. *THE FACULTY OF GRADUATE STUDIES (Political Science) - THE UNIVERSITY OF BRITISH COLUMBIA*.

²⁸ UNDP. (1994). *HUMAN DEVELOPMENT REPORT 1994*. Oxford University Press.

²⁹ Græger, N. (1996). Environmental Security? *Journal of Peace Research*, 33(1). pg. 109-111.

³⁰ Lodgaard, S. (1990, March 30). *Environmental Conflict Resolution* [paper presented at the UNEP meeting on "Environmental Conflict Resolution"]. Nairobi. pg. 17.

environmental protection, as they both rely on predictability and control; the cognitive linkage between environment and security has already been established and translated into political discourses. Arthur H. Westing³¹ and Sverre Lodgaard claim that associating security with the environment creates the sense of urgency and political awareness needed to tackle environmental challenges. On the other side of the debate, authors such as Daniel Deudney believe the concept of “security” to be related to confrontational practices connected to the military, thus being unsuited for environmental discourses.³² Similarly, Barry Buzan, Ole Wæver and Jaap H. de Wilde argue that securitizing environmental issues would make them part of the exclusive realm of high politics, thereby greatly limiting the range of actions available to tackle them.³³ I believe that the solution to the debate is intelligently provided by Maria Julia Trombetta, who argues that the securitization of the environment does not transpose classic security practices and paradigms (based on contingency and short-term emergency) into the sphere of the environment, but rather shapes and adapts them to the needs of environmental protection: *prevention and long-term management*.³⁴ It is therefore appropriate to talk about “environmental security”, and in doing so, change the nature and meaning of security itself.

Having illustrated the history behind the birth of the concept of “environmental security” and solved the debate on its legitimacy, we should now provide a clearer definition of it. After an initial understanding solely based on states’ access to natural resources,³⁵ environmental security evolved so as to increasingly focus (as previously said) on non-traditional security threats that consist of transnational political challenges resulting from natural processes. The scope of environmental security was thus enlarged by including threats arising from nature itself - most importantly those consequences of anthropogenic environmental degradation. This extended subject of concern (access to natural resources; consequences of natural processes) now constitutes the basis of environmental security studies, and it is seen - and studied - within the

³¹ Westing, A. H. (Ed.). (1989). *Comprehensive Security for the Baltic: An Environmental Approach*. SAGE Publications.

³² Deudney, D. (1990). The case against linking environmental degradation and national security’. *Millennium: Journal of International Studies*, 19(3). pg. 461-476.

³³ Buzan, B., Wæver, O., & de Wilde, J. H. (1995). Environmental, Economic and Societal Security. *Centre for Peace and Conflict Research. Working Papers*, (10).

³⁴ Trombetta, M. J. (2008). Environmental security and climate change: analysing the discourse. *Cambridge Review of International Affairs*, 21(4). pg. 585-602.

³⁵ Horrigan, B. L., Karasik, T., & Lalgee, R. (2022). Security Studies. *Encyclopedia of Violence, Peace, & Conflict (Third Edition)*, 1. pg. 160-167.

field as either a source of violent conflict (a historically major area of studies³⁶), a barrier to human well-being, or a means to resolve or mitigate insecurity.³⁷ Importantly, as the most prominent works on environmental security derive from established international relations theories - centered on national security³⁸ - the concept of environmental security came to focus (and still focuses) primarily on the *nation-state*³⁹ (the threats posed to it, and its margin of action), leaving other actors (individuals, other states, the environment itself) as indirect subjects of analysis. The upcoming sections will illustrate why this approach rather draws the world towards environmental *insecurity*.

In order to conclude this segment of the work, we should define environmental security's aim. Giovanni Zurlini and Felix Müller help to this purpose by giving an effective definition of it:

*"Environmental security, in an objective sense, aims to evaluate the level of threats to acquire and sustain ecosystem values in terms of ecosystem goods and services at multiple scales and, in a subjective sense, represents the level of fear that such values will be attacked and possibly lost."*⁴⁰

Environmental security thus has a two-fold nature consisting of both the *objective* (scientifically measured) risk of losing ecosystem goods and the *subjective* (non-scientific) perception of such risk. Environmental security studies should then not only focus on objective risks (as it has almost always been the case in the past decades), but should instead include the analysis of how these risks are understood by societies and individuals.⁴¹ This work tries to move in this direction by linking environmental studies to an important component of human (subjective) perception - that is, temporality. The next three sections of this first chapter will illustrate the objective risks with which environmental security is concerned (those deriving from access to natural resources and from natural processes) and the historical context in which they are taking place; the second

³⁶ Whyte, A. V. (2001). Environmental Security. *International Encyclopedia of the Social & Behavioral Sciences*. pg. 4663-4667.

³⁷ Scott, C. A., & Thapa, B. (2015). Environmental Security. In *Environmental Science*.

³⁸ Barnett, J. (2019). Environmental Security. In A. Kobayashi (Ed.), *International Encyclopedia of Human Geography* (2nd ed.). Elsevier Science. pg. 247-251.

³⁹ Barnett, J. (2009). Environmental Security. In R. Kitchin & N. Thrift (Eds.), *International Encyclopedia of Human Geography*. Elsevier Science. pg. 553-557.

⁴⁰ Zurlini, G., & Müller, F. (2008). Environmental Security. In S.E. Jorgensen & B. Fath (Eds.), *Encyclopedia of Ecology* (Vol. 2). Elsevier Science. pg. 1353.

(The two authors further provide a useful scheme summarizing the most authoritative definitions of environmental security provided by the intellectual debate so far - pg. 1352.)

⁴¹ Ibid.

(Another short scheme is provided by the authors in order to illustrate the cases in which subjective and objective risk coincide, and those in which they do not. I have decided not to add it to this work for it not to be too burdensome, it is however worth being looked at.)

chapter will then deal with temporality, so as to try to partly uncover how the previously illustrated objective risks can be subjectively perceived.

The tables below will provide two useful schematizations of the topics just debated in this first section of the chapter: the first one concerns the composition of security studies; the second one illustrates the different aspects of the environmental security concept.

Table 1. *Areas of Security Studies*⁴²

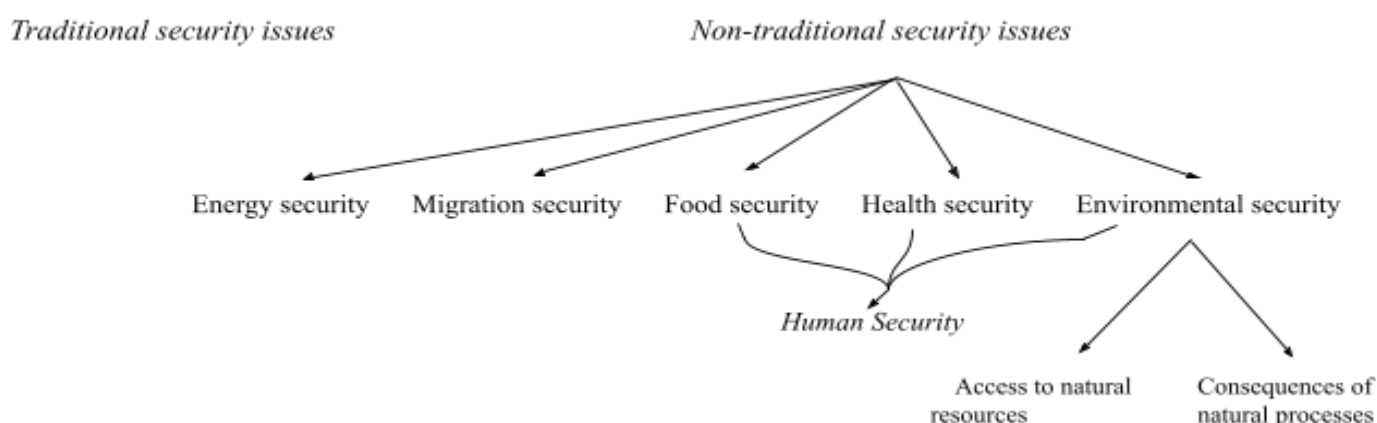


Table 2. *Key aspects of Environmental Security*

Area of concern	
<ul style="list-style-type: none"> - Access to natural resources - Consequences of natural processes 	<ul style="list-style-type: none"> → Source of violent conflict → Barrier to human well-being → Mean to resolve or mitigate insecurity
Nature	
<ul style="list-style-type: none"> - <i>Objective</i>: scientific measure of the risk of losing ecosystem goods and services - <i>Subjective</i>: personal perception of the risk of losing ecosystem goods and services 	
Subject of focus	
<ul style="list-style-type: none"> - Nation-states (<i>direct</i>) - Individuals; other states; the environment (<i>indirect</i>) 	

⁴² (This scheme does not intend to be a comprehensive illustration of Security Studies, it rather aims at providing a summary of those topics mentioned in this work that constitute part - but not the entirety - of Security Studies and its several branches.)

I.II The beginning of a new era: The Anthropocene and the Noösphere

Before proceeding with the analysis of the current environmental security issues, we should first illustrate the historical context in which they are taking place. The rapid technological developments brought by the Second Industrial Revolution led scientists and intellectuals in the second half of the XIX century to begin analyzing the impact that humankind was increasingly having on the Earth System (the interaction of the Earth's geosphere, biosphere, cryosphere, hydrosphere, and atmosphere that produces the environments characterizing the planet⁴³). Such a quest for explanations gained momentum following the exacerbation of anthropogenic environmental impact brought by the Great Acceleration, and it ultimately culminated in two opposite paradigms: the *Anthropocene* and the *Noösphere* (representing two opposite sides of the academic debate). Studying these two paradigms is fundamental to explain the present historical context (and its perception by the academic community), which is itself necessary to understand the issues currently dealt with by environmental security. This section will focus on such a task.

The Anthropocene

During its 4.5 billion years of existence, the Earth has undergone major geological events that transformed its habitat, consequently altering the flora and fauna present within it. To better understand and classify such changes, the scientific community decided to create a geological time scale with which to divide the Earth's history into different stages⁴⁴, each having specific characteristics distinguishing it from all of the others. Such a time scale is composed of five temporal units: eons, eras, periods, epochs, and ages.⁴⁵ Eons are the broadest geological unit of time; they are a total of four, with the *Phanerozoic* (from greek - "visible life") - beginning 541 million years ago - being the current one. Eons are subdivided into eras; the *Phanerozoic* is divided into three of them, of which the *Cenozoic* (from greek - "recent life") - started 66 million years ago - is the present one. Eras are further subdivided into periods, with the *Cenozoic* era being divided into three periods. The current period - beginning 2.8 million years ago - is called the *Quaternary*. Periods are themselves subdivided into epochs; the *Quaternary* consists of two

⁴³ Nicklen, P. (2022, May 19). *Earth's Systems*. National Geographic Society. Retrieved July 9, 2022, from <https://education.nationalgeographic.org/resource/earths-systems>

⁴⁴ Hendricks, J. R. (n.d.). 3. *Geological time scale*. Digital Atlas of Ancient Life. Retrieved July 5, 2022, from <https://www.digitalatlasofancientlife.org/learn/geological-time/geological-time-scale/>

⁴⁵ Cohen, K. M., Finney, S. C., Gibbard, P. L., & Fan, J. X. (2013 - updated). The ICS International Chronostratigraphic Chart. *International Union of Geological Sciences*, (36). pg. 199-204.

epochs, of which the *Holocene* (from greek - “entirely new”) - started roughly 11.700 years ago - is the current one. Ultimately, epochs are divided into ages, with the Holocene being divided into three of them. The latest age is the *Meghalayan*, going from 2250 B.C. to today.

To summarize and make sense of what has been said so far (a clear schematization of the Earth’s geological time scale will nonetheless be provided in a few pages): the Earth is currently in the Meghalayan age of the Holocene epoch of the Quaternary period of the Cenozoic era of the Phanerozoic eon. While the official geological time recognized by the whole scientific community does not (so far) include further distinctions from 2250 B.C. to nowadays (as it is all considered part of the Meghalayan age), the last two centuries have nevertheless witnessed a growing academic debate on the need to introduce a new geological time period - mostly identified with the term “*Anthropocene*”: George Perkins Marsh’s “*Man and Nature*” moved against the positivist idea of an essentially benign “human intervention” on nature and warned against the negative impact of Man’s activity on the environment⁴⁶, while Antonio Stoppani’s concept of the “*Anthropozoic*” revolutionarily distinguished the geological stage marked by human presence.⁴⁷ The first appearance of the word “*Anthropocene*” (firstly written as “*anthropogene*”) dates back to 1922, when scientist Aleksey Pavlov suggested it being used to describe the current geological epoch, characterized by the dominant geological force of human activity.⁴⁸ The word resurged to great popularity in the 1960’s, when Soviet scientists intent on satisfying Moscow’s economic and military strategies began to study ways in which humans could modify climate.⁴⁹ The earliest wider employment of the term was within this context, in order to identify the Quaternary period (the current geological period previously mentioned); however, it was only in 2000 that the name “*Anthropocene*” gained worldwide fame, thanks to Paul J. Crutzen and Eugene F. Stoermer’s usage of it when delineating the geological epoch characterized by vast-scale environmental human impact started in the last decades of the eighteenth century.⁵⁰ Nowadays the word “*Anthropocene*” has become a cultural zeitgeist⁵¹ occupying a central spot within the scientific and non-scientific academic debate; yet, its

⁴⁶ Marsh, G. P. (2003). *Man and nature* (D. Lowenthal, Ed.). University of Washington Press.

⁴⁷ Stoppani, A. (1873). *Corso di Geologia* (Vol. 2). Bernardoni e Brigola.

⁴⁸ Fratto, E., & Brookes, A. (2020). Towards a Russian Literature of the Anthropocene. Introduction. *Russia Literature*, 114-115. pg. 8.

⁴⁹ Doose, K. (2021). Hiding the Anthropocene. *Encyclopédie d'histoire numérique de l'Europe*.

⁵⁰ Crutzen, P. J., & Stoermer, E. F. (2000). The ‘Anthropocene’. *Global Change Newsletter*, (41). pg. 17-18.

⁵¹ Malhi, Y. (2017). The Concept of the Anthropocene. *Annual Review of Environment and Resources*, 42(1). pg. 5-6.

increasing popularity hasn't resulted in a clear definition accepted worldwide, but it has instead served as a catalyst for a variety of academic debates that produced multiple dichotomies throughout the different scholarly disciplines. These dichotomies reflect pre existing intellectual polarizations on the impact of human action on the Earth System. Among the most important of such dichotomies are the *philosophical* one - focused on Man's belonging or not to nature, and the utopian versus dystopian outcomes of the anthropocene - and the *political* one - centered on the conservative versus liberal argument transposed to the context of the growing human impact on the environment. These two dichotomies and the arguments resulting from them greatly influence the scientific community in its debate on the Anthropocene. The need for a formal or informal definition of Anthropocene, and whether the origin of such a period can be traced back in history or it is inherently modern are therefore no longer solely a matter of objective, hard science, but are increasingly being influenced by ideological positions spilling over from other disciplines.⁵² While authors see this as a process (intentionally or not) paving the way for an "ideology of the anthropocene" that reflects current dominant political discourses and power structures⁵³, and that overemphasizes human power and control over the planet⁵⁴ - thus advocating the need to move away from the political rather than scientific concept of "Anthropocene"⁵⁵ - others such as Parllsson et al. perceive such interaction between natural and social sciences as the proof of the need to include the study of human systems into the study of an Earth System increasingly dependent on humans⁵⁶ - consequently encouraging the idea of an "Anthropocene" and seeing its surrounding debate as the gateway to such a phenomenon. Both sides of the debate provide valuable arguments (that this paper won't touch upon for simple reasons of space) in their attack or defense of the concept; nonetheless, this work agrees with the second strand of thought here mentioned, and it will therefore make use of the concept of "Anthropocene" not for the sake of promoting its official recognition as geological time, but to

⁵² Autin, W. J. (2016). Multiple dichotomies of the Anthropocene. *The Anthropocene Review*, 3(3). pg. 218-230.

⁵³ Baskin, J. (2014). *The Ideology of the Anthropocene?* University of Melbourne, Melbourne Sustainable Society Institute. pg. 13.

⁵⁴ Mathews, A. S. (2020). Anthropology and the Anthropocene: Criticisms, Experiments, and Collaborations. *Annual Review of Anthropology*, 49(1). pg. 67-82.

⁵⁵ Finney, S. C., & Edwards, L. E. (2016). The "Anthropocene" epoch: Scientific decision or political statement? *The Geological Society of America*, 26(3). pg. 9.

⁵⁶ Palsson, G., Szerszynski, B., Sörlin, S., Marks, J., Avril, B., Crumley, C., Hackmann, H., Holm, P., Ingram, J., Kirman, A., Pardo Buendía, M., & Weehuizen, R. (2013). Reconceptualizing the 'Anthropos' in the Anthropocene: Integrating the social sciences and humanities in global environmental change research. *Environmental Science & Policy*, 28. pg. 3-13.

use it as an intellectual bridge to move to a more comprehensive understanding of the current historical period (as it will be shown in a few pages).

After having briefly described the concept's history, we should now proceed to a clearer and more structured explanation of what the Anthropocene consists of. Given the large debate around the concept and the consequent several understandings and definitions of it, this work will only focus on the Anthropocene as understood by the *Anthropocene Working Group (AWG)* - an “interdisciplinary research group dedicated to the investigation of the Anthropocene”⁵⁷ led by geologist Jan Zalasiewicz and comprising the leading scientists and intellectuals engaged in promoting the addition of the Anthropocene to the Geological Time Scale⁵⁸.

What does the concept of Anthropocene refer to then? The Anthropocene is a proposed geological epoch characterized by “the transformation of the Earth’s surface environments by human activity”⁵⁹. There have been several attempts to establish the beginning of such an epoch: the original proposal by Paul J. Crutzen (previously mentioned in this work) envisaged the start of the Anthropocene in the latter part of the 18th century, coinciding with the invention of the steam engine in 1784⁶⁰; paleoclimatologist William Ruddiman believed that it instead began with the growth of agriculture between eight thousand and five thousand years ago⁶¹ (what came to be known as “The early anthropogenic hypothesis”⁶²); others see the discovery of the Americas in 1492 (and the consequent change of the continent’s environment due to the alteration of its population) as the triggering event behind the Anthropocene⁶³; and another group of scientists goes so far as to trace the beginning of anthropogenic environmental change back to fifty thousand years ago, with the mass extinctions of the Late Pleistocene and Holocene.⁶⁴ During the 35th International Geological Congress held in Cape Town in 2016, the AWG discussed all of

⁵⁷ Haus der Kulturen der Welt. (n.d.). *Home*. Home | Anthropocene Curriculum. Retrieved July 7, 2022, from <https://www.anthropocene-curriculum.org/contributors/anthropocene-working-group>

⁵⁸ *Working Group on the 'Anthropocene' | Subcommission on Quaternary Stratigraphy*. (n.d.). Subcommission on Quaternary Stratigraphy. Retrieved July 7, 2022, from <http://quaternary.stratigraphy.org/working-groups/anthropocene/>

⁵⁹ Zalasiewicz, J., Williams, M., Haywood, A., & Ellis, M. (2011). Introduction: The Anthropocene: a new epoch of geological time? *Philosophical Transactions: Mathematical, Physical and Engineering Sciences*, 369(1938). pg. 838.

⁶⁰ Crutzen, P. J. (2002). Geology of mankind. *Nature*, 415(23).

⁶¹ Ruddiman, W. F. (2003). The Anthropogenic Greenhouse Era Began Thousands of Years Ago. *Climatic Change*, 61(3). pg. 261-293.

⁶² Ruddiman, W. F., He, F., Vavrus, S. J., & Kutzbach, J. E. (2020). The early anthropogenic hypothesis: A review. *The early anthropogenic hypothesis: A review*, 240.

⁶³ Lewis, S. L., & Maslin, M. A. (2015). Defining the Anthropocene. *Nature*, 519. pg. 171-180.

⁶⁴ Braje, T. J., & Erlandson, J. M. (2013). Human acceleration of animal and plant extinctions: A Late Pleistocene, Holocene, and Anthropocene continuum. *Anthropocene*, 4. pg. 14-23.

the major characteristics that the proposed Anthropocene was to have, and ultimately decided to consider the Anthropocene a proper geological stage; to categorize it as an epoch (thus marking the end of the Holocene epoch); and to set its beginning in the mid-twentieth century - corresponding with the “*Great Acceleration*” (because it was the only historical event that altered the structure of the Earth System as a *whole*). Further procedural steps and requirements (that this work won’t deal with, as they are not directly relevant to its thematics) will need to be satisfied for the Anthropocene to be officially recognized as a unit of the Geological Time Scale, nonetheless, the concept has already attracted major intellectuals throughout several scholarly disciplines, drawing attention to the drastic changes in the Earth System that the growth of human activity after the end of WWII has caused.

The Noösphere

Alongside the concept of “Anthropocene”, the last two centuries have been characterized by a parallel academic interest in the notion of “Noösphere”. The latter was ultimately introduced into the international scientific debate in 1945, through a paper with which biogeochemist Vladimir Vernadsky completed theorizing the concept. The Noösphere has its intellectual roots in the work of geologist Eduard Suess, who first advanced the idea of a “biosphere”: the Earth’s sphere - functioning as a region of interaction between the lithosphere (the outermost layer of the geosphere) and the atmosphere - capable of supporting life⁶⁵. Drawing on this notion of biosphere, Vernadsky⁶⁶ - together with Pierre Teilhard de Chardin and Édouard Le Roy - developed the idea of a *Noösphere* (from greek - "sphere of intelligence"): the latest stage of the Earth’s evolution, characterized by Man’s capacity to geologically shape the planet through his technological advancements and growingly interconnected population.⁶⁷ The Noösphere can be understood as the “planet’s thinking layer”⁶⁸, for it consists of the sum-total of mental activity produced by a collective human complex⁶⁹ and processed by its technology, both made possible by the global interconnectedness and technological advancements resulting from the Great Acceleration. The reason why the Noösphere is the third (and latest) stage in the Earth’s

⁶⁵ Suess, E. (1875). *Die Entstehung der Alpen*. W. Braumüller.

⁶⁶ Trubetskova, I. L. (2010). From biosphere to noosphere: Vladimir Vernadsky's theoretical system as a conceptual framework for universal sustainability education. *University of New Hampshire - Doctoral dissertations*, 612.

⁶⁷ Vernadsky, W. I. (1945). THE BIOSPHERE AND THE NOÖSPHERE. *American Scientist*, 33(1). pg. 1-12.

⁶⁸ Lahoz-Beltra, R. (2014). The "crisis of noosphere" as a limiting factor to achieve the point of technological singularity. *Complutense University of Madrid, Faculty of Biological Sciences Madrid, Spain*. pg. 1.

⁶⁹ Teilhard de Chardin, P. (1947). The formation of the Noösphere. *Revue des Questions Scientifiques*.

development is thus because it was preceded by first the coming into existence of the geosphere, atmosphere, hydrosphere, cryosphere (solid earth, water, air, etc.), and second the development of the biosphere (all living creatures) - to put it simply: for a conscience to exist there needs to be a body, and for a body to exist there needs to be a habitat. However, unlike the geosphere and the biosphere, giving a material nature to this “sphere of intelligence” is complicated, for it does not rely on tangible things directly. Some academics then point to the growth of means and technologies of communication (internet cables, satellites, mobile phones, etc.) as the physical essence of the Noösphere.

While the Anthropocene focuses on the *temporal* aspect of human activity (setting the impact of Man as the trigger of a new geological epoch) the Noösphere instead stresses the importance of its *spatial* nature (creating a new Earth’s sphere consisting of all human interactions produced by globalization). The two paradigms center their attention on the *planetary* nature of human impact, however, they differ substantially in both the consequences of it and the means with which this impact is achieved: the Anthropocene highlights the *rupture* between the previous geological epochs and the new one, and sees the alteration of *matter and energy cycles* as the cause of it - therefore resting on a purely physical level (anthropos/ἄνθρωπος: (physical) “man”; in opposition to theos/θεός: (metaphysical) “God”). The Noösphere instead focuses on the *development* of the Earth towards a new era, and regards the global interconnection of all *minds and cultures* into a single one as the reason behind such evolution - thus moving to the metaphysical level (noos/vóος: “mind”, shared by both the anthropos and the theos). The different stances of the Anthropocene and the Noösphere paradigms towards the growing influence of Man on the Earth System lead to two opposite (often conflicting) intellectual frameworks: by assuming a predominantly pessimistic outlook towards the material changes brought by the Great Acceleration, the Anthropocene leaves a message of *crisis and warning* about future further disruption; in opposite direction, by adopting an optimistic attitude towards the growing interconnectedness characterizing the last 70 years, the Noösphere transmits an idea of *transformation and hope*, of a rapidly growing collective conscience able to take awareness and tackle the environmental challenges posed before it.⁷⁰

⁷⁰ Shoshitaishvili, B. (2021). From Anthropocene to Noosphere: The Great Acceleration. *Earth's Future*, 9(2). pg. 3-7.

Given the stark contrast between the two paradigms, it is no wonder that the intellectuals oriented towards the former moved criticisms against the latter, and vice versa. Within this context, the Anthropocene is mostly criticized for its often eco-catastrophist narrative of the future (particularly expressed in the works of Clive Hamilton⁷¹), which focuses on the negative consequences of the new human-centered age without providing many viable solutions to them. Radical and critical theorists further go against the generalization of humankind as a “single entity” disrupting the planet, pointing at the stark socioeconomic differences - thus the different levels of responsibility and duty - that have historically been characterizing the international system.⁷² On the other side of the debate, critics of the Noösphere denounce the scientific vagueness of this new sphere of thought’s metaphysical nature, often confining the entire paradigm to a mere religious mysticism⁷³ (idea further fueled by the fact that Regarding Teilhard - one of the three intellectuals behind the concept of Noösphere - was a priest). A further point of contention is raised by radical and critical theorists (as with the Anthropocene), who highlight the socioeconomic differences preventing the existence of a truly global interconnection.

The two paradigms provide considerably different ways of perceiving our historical epoch, its causes and possible solutions; nonetheless, as Shoshitaishvili suggests⁷⁴, there can be a benefit from trying to reconcile these two outlooks so as to provide a single, more comprehensive understanding of the challenges posed before us by the Great Acceleration. The efforts in this direction have so far been little, with two notably standing out: the first one is provided by William C. Clark et al, who perceive the Anthropocene as a point of no return - produced by the Great Acceleration - that can either be “a very short era in which humankind blindly careens forward, continuing to transform the Earth until the planet loses its capacity to support us”⁷⁵, or it can speed up the process leading to the formation of a collective conscience capable of building a sustainable human niche. Within this outlook, the Anthropocene becomes a point of rupture serving as a two-way bridge that leads either to catastrophe or to the Noösphere. The second attempt to integrate the Anthropocene with the Noösphere consists of merging the protagonist of

⁷¹ Hamilton, C. (2017). *Defiant Earth: The Fate of Humans in the Anthropocene*. Wiley.

⁷² Sharp, H. (2020). Not all Humans, Radical Criticism of the Anthropocene Narrative. *Environmental Philosophy*, 17(1).

⁷³ Vidal, C. (2021). What is the Noosphere? Planetary Superorganism, Transition and Emergence. *Center Leo Apostel - Vrije Universiteit Brussel*. pg. 2.

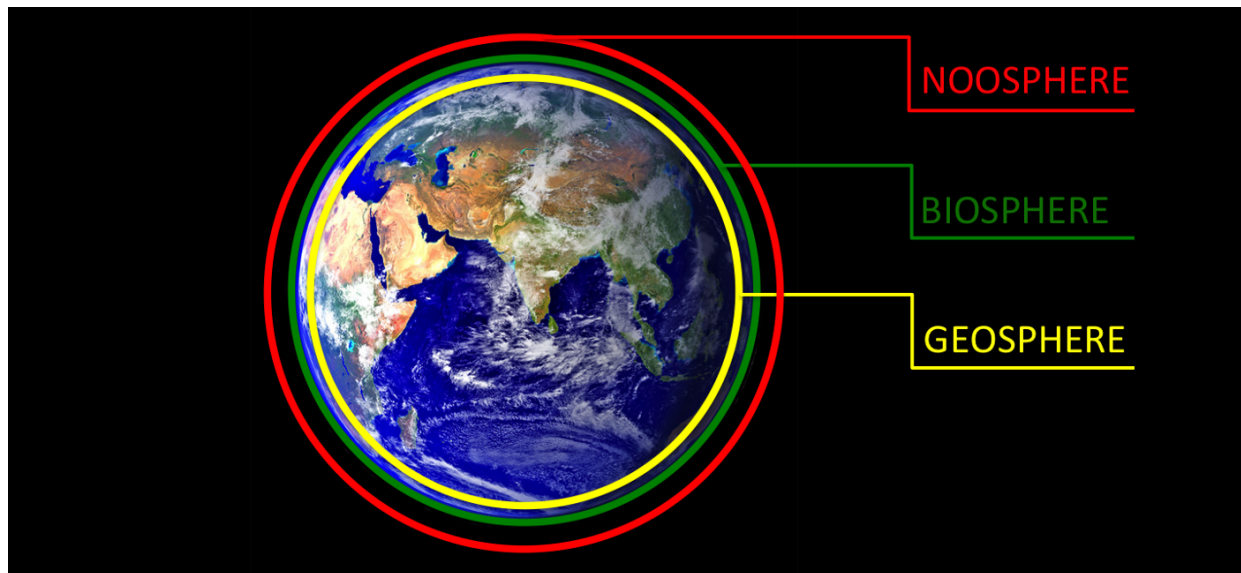
⁷⁴ Shoshitaishvili. (2021). Ibid. pg. 7.

⁷⁵ Clark, W. C., Crutzen, P., & Schellnhuber, H. J. (2005). Science for Global Sustainability: Toward a New Paradigm. *Center for International Development, Harvard University, Working Paper No. 120*. pg. 6.

the former (the Man) with the one of the latter (the global conscience), as done in the work of astrobiologist David Grinspoon, in which he perceives the Anthropocene as beginning not from the moment human-activity started to globally affect the Earth System, but from the moment in which humankind has become aware of such impact.⁷⁶ By giving the Anthropocene this “mature” nature, Grinspoon draws the Man of the Anthropocene closer to the responsible global conscience of the Noösphere.

Further efforts will need to be undertaken in order to integrate the Anthropocene and the Noösphere into a comprehensive paradigm able to let us understand the changes brought by the Great Acceleration. This would in turn strengthen environmental security studies, allowing humankind to find better solutions to the challenges placed before it. Providing a clear explanation of what the Great Acceleration and the environmental disruption brought by it consist of is an important step in this direction. The next section will try to do this by discussing the Planetary Boundaries framework and inserting the Great Acceleration within its context. Before proceeding any further, a set of schemes will provide a clearer understanding of the concept of Noösphere and that of Anthropocene, as well as summarize their key differences and similarities, and the efforts to integrate them - as presented in this section of the work.

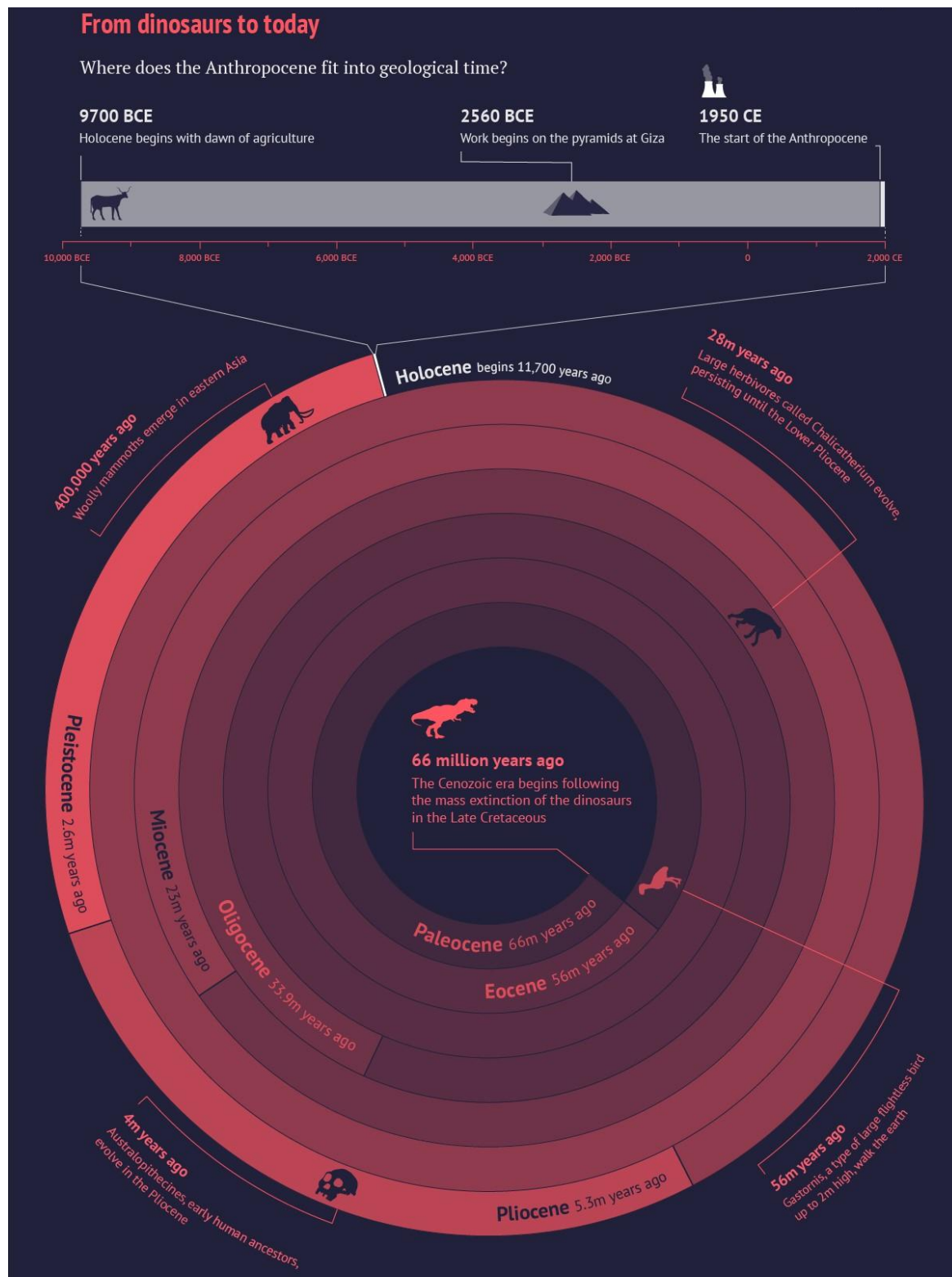
Figure 1.⁷⁷ *The Noösphere as part of the Earth System*



⁷⁶ Grinspoon, D. (2016). *Earth in Human Hands: Shaping Our Planet's Future*. Grand Central Publishing.

⁷⁷ (Image taken from) Medium. (2021). *What is the noosphere, and how do we harness its power?* YouTube. Retrieved July 12, 2022, from <https://thumblesteen.medium.com/what-is-the-noosphere-and-how-do-we-harness-its-powers-5eb882eb75a>

Figure 2.⁷⁸ *The Anthropocene as part of the Geological Time Scale*



⁷⁸ (Image taken from) Pearce, R. (2016, October 5). Anthropocene: The journey to a new geological epoch. *Carbon Brief*. <https://www.carbonbrief.org/anthropocene-journey-to-new-geological-epoch/>

Table 3.⁷⁹ Key differences and similarities between the Anthropocene and the Noösphere

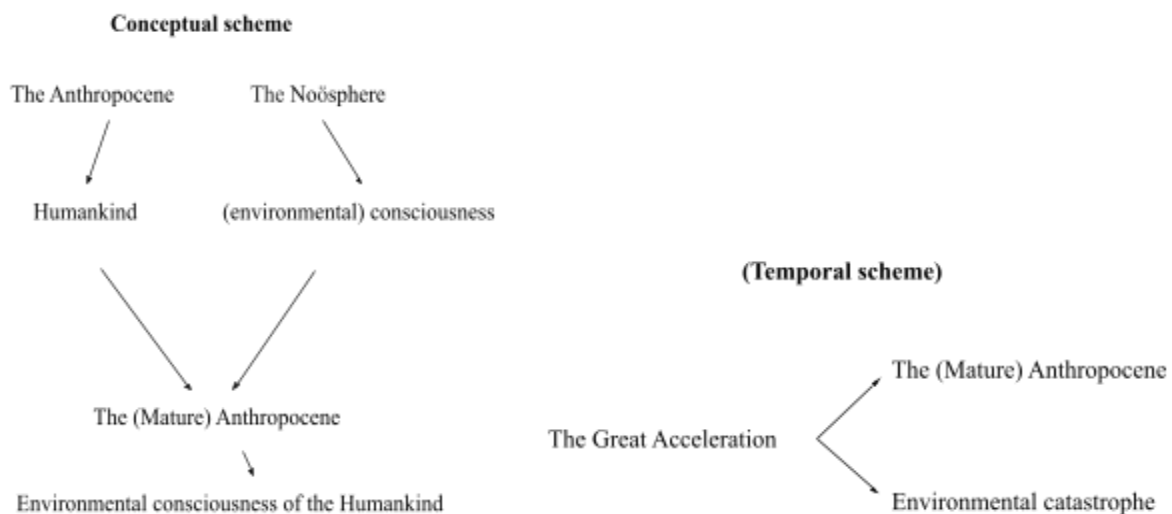
<i>Paradigm</i>	Anthropocene	Noösphere
<i>Spatiotemporal emphasis</i>	Time	Space
<i>Spatial mode</i>	Planetary	Planetary
<i>Temporal mode</i>	Rupture	Development
<i>Primary medium</i>	Matter & energy (anthropos)	Mind & culture (noos)
<i>Primary mood</i>	Crisis & warning	Transformation & hope

Table 4. Integrating the Anthropocene with the Noösphere

1.



2.



⁷⁹ (Scheme adapted from) Shoshitaishvili. (2021). Ibid. pg. 7.

I.III From the Great Acceleration to a “safe operating space”: environmental (in)security in the XXI century

After having discussed the present historical period through the illustration of the two major paradigms elucidating it, it is time to move to the analysis of the environmental challenges characterizing it. By adopting a more scientific approach (compared to the previous section's historical account), this segment of the work focuses on the major environmental security issues that Democracy (and the international community as a whole) is facing and will have to face in the upcoming decades. To this purpose, it is useful to connect this section to the previous one by briefly discussing the Great Acceleration; in fact, despite the many differences characterizing the two paradigms previously illustrated, both the Anthropocene and the Noösphere have their origin (as agreed by the majority of the academic community in favor of either paradigm) in this specific historical event: the Anthropocene paradigm uses the Great Acceleration to mark the beginning of that geological epoch characterized by the environmental consequences of a rapidly increasing human activity; the Noösphere paradigm instead sees the Great Acceleration as the factor behind the technological and social developments that allowed the creation of the planet's “sphere of thought”. Regardless of the paradigm used to make sense of the current historical period, the Great Acceleration emerges as the cause of it. Before analyzing the environmental security issues characterizing the XXI century, it is therefore appropriate to illustrate what is believed to be their common origin. Let us turn to the Great Acceleration then.

The first intellectual efforts to uncover the Post-WWII radical shift in humankind's impact on the Earth System emerged in the 1960s, when a group of radical ecologists began - each individually - to analyze the effects of specific US governmental policies on the environment: Rachel Carson focused on the ecological footprint of DDT insecticide usage in agriculture, inserting it in a wider worrying scenario of “contamination of man's total environment”⁸⁰ that started after the end of World War II; along the same path, Murray Bookchin highlighted modern humankind's disruptive effects on “all the basic cycles of nature and (...) the stability of the environment on a worldwide scale”.⁸¹ However, the first scientist to provide a more comprehensive socioeconomic analysis of the increasing anthropogenic environmental disruption beginning after the Second World War was Barry Commoner. In his book “*The Closing Circle: Nature, Man & Technology*”,

⁸⁰ Carson, R. (2002). *Silent spring*. Houghton Mifflin. pg. 8.

⁸¹ Bookchin, M. (1964). *Ecology and Revolutionary Thought. Comment*.

Commoner drew attention to the qualitative changes in productive technologies in the US (and as a consequence, western Europe) following the beginning of World War II, identifying them as the “counter-ecological pattern of growth”⁸² key factor behind the current environmental crisis: as a classic historical trend that repeats itself across all continents and throughout all centuries, war provided humankind with the stimulus necessary to secure advancements in several fields of science and technology⁸³, thanks to a collaboration between scientists and the military⁸⁴ that allowed earlier XX century scientific discoveries (particularly in the fields of physics and chemistry) to be further developed and improved for combat purposes. As the war ended, such scientific and technological progresses were commercialized and redirected into the wider sectors of agriculture and industry, completely reshaping the economic structure of the world into one that fueled an environmental disruption different in both quantity (larger) and quality (longer-lasting). With the passing of decades, the growing impact of human action on planet Earth was subsequently addressed by historians such as Christian Pfister - in his concept of “the 1950s syndrome”, with which he addressed the socioeconomic changes happening in Europe during the 1950s⁸⁵ - and John Robert McNeill, who saw the quasi-global “conversion to a fossil fuel-based energy system and very rapid population growth, [together with the consolidation of an] ideological and political commitment to economic growth and military power”⁸⁶ as the reasons behind the large environmental change characterizing the XX century.

These works and personalities laid the intellectual foundations for a wider academic debate on the XX century anthropogenic impact on the environment; such a debate influenced Paul J. Crutzen (see the previous section) in his formulation of the “Anthropocene”, and it ultimately led to the first systematic scientific study of the increasing human pressure on the Earth System. The study was carried out by the International Geosphere-Biosphere Programme (a research programme lasting from 1987 to 2015 whose aim was “to coordinate international research on global-scale and regional-scale interactions between Earth's biological, chemical and physical

⁸² Commoner, B. (2020). *The Closing Circle: Nature, Man, and Technology*. Dover Publications. pg. 154.

⁸³ Burton, K. D. (n.d.). *The Scientific and Technological Advances of World War II*. The National WWII Museum. Retrieved July 16, 2022, from <https://www.nationalww2museum.org/war/articles/scientific-and-technological-advances-world-war-ii>

⁸⁴ Fortun, M., & Schweber, S. S. (1993). Scientists and the Legacy of World War II: The Case of Operations Research (OR). *Social Studies of Science*, 23(4). pg. 595-642.

⁸⁵ Pfister, C. (1992). Das 1950er Syndrom. Der Energieverbrauch unserer Zivilisation in historischer Perspektive. *Natur und Mensch*, 34. pg. 1-4.

⁸⁶ McNeill, J. R. (2001). *Something New Under the Sun: An Environmental History of the Twentieth-Century World (The Global Century Series)*. W. W. Norton. pg. 235.

processes and their interactions with human systems”⁸⁷) as a key component of a wider synthesis project⁸⁸ (conducted from 1999 to 2003) aimed at providing a comprehensive understanding of the structure and functioning of the Earth System; it consisted of twenty four graphs depicting twelve indicators of the “human enterprise” (socioeconomic trends) and twelve of the major Earth System trends. Given the initial proposal by Crutzen of placing the start date of the Anthropocene at the end of the XVIII century, the IGBP chose to conduct its analysis over a period beginning in 1750 (so as to include the effects of the Industrial Revolution) and ending in 2000 (the latest possible year providing a comprehensive set of data). Aside from marking an increase in all of the human activity indicators following the beginning of the Industrial Revolution (as expected), the graphs showed a sharp growth in anthropogenic impact after the end of WWII. The work gained popularity fastly, directing the attention of the scientific debate to the post-war exponential increase in the human imprint on the Earth System. A year after the publication of the study, a working group (including Crutzen, McNeill and Steffen) in a 2005 Dahlem Conference on the history of the human-environment relationship used the term “Great Acceleration” for the first time⁸⁹, in order to describe this general picture portrayed by the twenty four graphs. The expression achieved worldwide fame in 2007, thanks to an article by Crutzen, McNeill and Steffen that further associated the post-war trends shown in the 2004 study with the term “Great Acceleration”, and inserted both within the wider paradigm of the Anthropocene.⁹⁰ Nowadays the concept of “Great Acceleration” - and its twenty four graphs, updated in 2015 - occupies a central spot in the wider academic debate, playing a key role in both the Anthropocene and the Noösphere paradigm (see the previous section), and helping us understand the changes occurring in the Earth System and the role played in them by humans. In the words of Steffen:

“...the ‘Great Acceleration’, echoing Karl Polanyi’s 1944 holistic societal analysis ‘The Great Transformation’. The Great Acceleration expressed a similarly holistic, comprehensive and

⁸⁷ IGBP. (n.d.). *About*. IGBP. Retrieved July 17, 2022, from <http://www.igbp.net/about.4.6285fa5a12be4b403968000417.html>

⁸⁸ Turner, B. L., Schellnhuber, H.-J., Matson, P. A., Oldfield, F., Sanderson, A., Steffen, W., Moore III, B., Tyson, P. D., Jäger, J., Richardson, K., & Wasson, R. J. (2005). *Global Change and the Earth System: A Planet Under Pressure* (W. Steffen, Ed.). Springer.

⁸⁹ Hibbard, K. A., Crutzen, P. J., Lambin, E. F., & et al. (2006). Decadal interactions of humans and the environment. Group Report. In R. Costanza, L. Graumlich, & W. Steffen (Eds.), *Sustainability or Collapse? An Integrated History and Future of People on Earth*. MIT Press. pg. 341-375.

⁹⁰ Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature? *Ambio*, 36(8). pg. 614-621.

interlinked depiction of post-1950 changes covering socio-economic factors and biophysical processes as well as environmental and climatic changes. It represents both a range of overwhelming human impacts from the mid-20 century onwards and the Earth System responses to them.”⁹¹

It is then important to analyze the graphs that uncovered the Great Acceleration, so as to better understand its complexity. Let us do that. Important to stress, the next pages of the work do not claim to provide a comprehensive explanation of the socioeconomic inputs and Earth system outputs produced by the Great Acceleration (far more pages and personal knowledge would be needed), they rather aim at giving an overall understanding of the causes and effects of the major human and planet Earth’s transformations brought by it.

The twenty four graphs (shown here in a few pages) illustrate the trends that characterized the last two centuries of some of the most important components of both the humankind and Earth system. Such trends are interconnected between them, as an increase or decrease in one of the socioeconomic components leads to an alteration of the one or more Earth system elements (or other socioeconomic ones) connected to it, and vice versa. Let us first explain the twelve socioeconomic graphs: the advancements in medicine and healthcare made during the Second World War increased life expectancy and reduced infant mortality, leading in the 1950’s to an unprecedented demographic growth (that often sparked fears of overpopulation, leading to labels such as “The Population Bomb”⁹²). The booming population pushed up water use and food consumption - the latter, together with the Haber Bosch process discovered in chemistry (“a process that fixes nitrogen with hydrogen to produce ammonia - a critical part in the manufacture of plant fertilizers”⁹³), stimulated a rapid growth in the consumption of fertilizers and further promoted the ongoing demographic explosion. Simultaneously, the industrial and technological improvements produced by the Industrial Revolution and perfected by the two Wars spread globally following the growing economic interdependence brought by the Cold War; this led to an increase in GDP, foreign direct investment and an overall improvement of living conditions. The growing industrialization and the higher standards of living in turn increased energy

⁹¹ Head, M. J., Steffen, W., Fagerlind, D., Waters, C. N., Poirier, C., Syvitski, J., Zalasiewicz, J. A., Barnosky, A. D., Cearreta, A., Jeandel, C., Leinfelder, R., McNeill, J. R., Rose, N. L., Summerhayes, C., Waprich, M., & Zinke, J. (2021). The Great Acceleration is real and provides a quantitative basis for the proposed Anthropocene Series/Epoch. *Episodes*. pg. 2.

⁹² Ehrlich, P. R. (1978). *The Population Bomb*. Ballantine Books.

⁹³ Briney, A. (2019, April 10). *Overview of the Haber-Bosch Process*. ThoughtCo. Retrieved July 23, 2022, from <https://www.thoughtco.com/overview-of-the-haber-bosch-process-1434563>

consumption (which led to a growth in dams being built), urbanization (as people left the rural areas to move to the growing industrial cities), and paper production (as more people started writing and reading). The increase in urbanization led to a growth in transportation and telecommunications (further allowed and diversified by technological developments just quoted); these two were further increased by the advent of mass international tourism (touristic flights are a product of the Great Acceleration), itself a consequence of the increased standards of living and economic (hence cultural) interconnectedness.

How did the changes just described impact the other side of the coin - that is, the Earth System? The growing food consumption brought by the booming population and the improved living standards increased both seafood and meat demand; higher seafood demand led to an unbalanced growth in marine fish capture known as “overfishing” (which has a destructive impact on the ecosystem and the seabed biodiversity⁹⁴) and subsequently - when marine fish capture was no longer able to satisfy the increasing food demand - a rapid rise in aquaculture (which through its wide use of antibiotics leads to antimicrobial resistance⁹⁵ detrimental to human health, and can further disrupt the global food system⁹⁶). Higher meat demand instead caused a growth of water consumption (to feed more animals) and an expansion of domesticated land (for such animals to graze and subsequently for them to be locked in cages for intensive farming), which in turn increased tropical forest loss (as countries strongly relying on the meat industry such as Brazil were motivated to deforest in order to have more space to breed animals⁹⁷), therefore terrestrial biosphere degradation. The deforestation and consequent biosphere degradation caused by the growing meat industry, together with the gas (yes, burps and farts) emitted by cows and other ruminant animals within it led to a large growth of greenhouse gas emissions⁹⁸ (represented in the graphs by the three main ones: carbon dioxide; nitrous oxide; methane), which in turn

⁹⁴ Thrush, S. F., Ellingsen, K. E., & Davis, K. (2015). Implications of fisheries impacts to seabed biodiversity and ecosystem-based management. *ICES Journal of Marine Science*, 73(suppl_1). pg. i44-i50.

⁹⁵ Reverter, M., Sarter, S., Caruso, D., Avarre, J., Combe, M., Pepey, E., Pouyau, L., Vega-Heredía, S., de Verdal, H., & Gozlan, R. E. (2020). Aquaculture at the crossroads of global warming and antimicrobial resistance. *Nature Communications*, 11(1870).

⁹⁶ Troell, M., Naylor, R. L., Metian, M., Beveridge, M., Tyedmers, P. H., Folke, C., Arrow, K. J., Barrett, S., Crépin, A., Ehrlich, P. R., Gren, Å., Kautsky, N., Levin, S. A., Nyborg, K., Österblom, H., Polasky, S., Scheffer, M., Walker, B. H., Xepapadeas, T., & de Zeeuw, A. (2014). Does aquaculture add resilience to the global food system? *Proceedings of the National Academy of Sciences*, 111(37). pg. 13257-13263.

⁹⁷ Schiffman, R. (2022, March 9). Amazon deforestation is fueled by meat demand. Shoppers can make choices that help. The Washington Post.

<https://www.washingtonpost.com/climate-solutions/2022/03/09/amazon-rainforest-deforestation-beef/>

⁹⁸ González, N., Marquès, M., Nadal, M., & Domingo, J. L. (2020). Meat consumption: Which are the current global risks? A review of recent (2010–2020) evidences. *Food Research International*, 137(109341).

increased surface temperatures. The higher greenhouse gas emissions (in large part deriving from meat production, which emits roughly double the GHG than the plant-based food production⁹⁹) were partly absorbed by the ocean (from the beginning of the Industrial Revolution until 2007, oceans absorbed around 30 percent of human carbon dioxide emissions¹⁰⁰); while this on the one hand slowed global warming (as less CO₂ went to the atmosphere), on the other it led to ocean acidification (as the CO₂ captured by the oceans altered the chemistry of seawater), which further damaged the marine biosphere¹⁰¹. Nonetheless, oceans did not (and do not) manage to absorb all of the emitted CO₂, which led to an increase in the concentration of carbon dioxide in the atmosphere; this had three further consequences: shrinkage of the sea-ice volume; loss of the glacial-ice mass; acceleration of the sea-level rise.¹⁰² The booming urbanization increased domesticated land, therefore forest loss and biosphere degradation; the increase in the construction of dams to meet the growing energy demands coming from the cities altered river systems (which negatively impacted regional biosystems), while the increasing paper production pushed up deforestation. The excessive consumption of (nitrogen) fertilizers to sustain the large ever-growing food demand ramped up the quantity of nitrogen present in the atmosphere, thereby altering the nitrogen cycle (“a biogeochemical process through which nitrogen is converted into many forms, consecutively passing from the atmosphere to the soil to organism and back into the atmosphere.”¹⁰³); this had three major negative effects: the loss of biodiversity (especially in coastal marine zones, where the large inputs of nitrogen received cause eutrophication, a process that leads to an overabundance of algae that later on decomposes producing CO₂¹⁰⁴; this carbon dioxide gets absorbed by the ocean, leading to ocean acidification,

⁹⁹ Xu, X., Sharma, P., Shu, S., Lin, T., Ciais, P., Tubiello, F. N., Smith, P., Campbell, N., & Jain, A. K. (2021). Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nature Food*, 2. pg. 724-732.

¹⁰⁰ Gruber, N., Clement, D., Carter, B. R., Feely, R. A., Van Heuven, S., Hoppema, M., Ishii, M., Key, R. M., Kozyr, A., Lauvset, S. K., Lo Monaco, C., Mathis, J. T., Murata, A., Olsen, A., Perez, F. F., Sabine, C. L., Tanhua, T., & Wanninkhof, R. (2019). The oceanic sink for anthropogenic CO₂ from 1994 to 2007. *Science*, 363(6432). pg. 1193-1199.

¹⁰¹ Shutler, J., & Watson, A. (2020, September 28). Guest post: The oceans are absorbing more carbon than previously thought. *Carbon Brief*.

<https://www.carbonbrief.org/guest-post-the-oceans-are-absorbing-more-carbon-than-previously-thought/>

¹⁰² Syvitski, J., Waters, C. N., Day, J., Milliman, J. D., Summerhayes, C., Steffen, W., Zalasiewicz, J., Cearreta, A., Galuszka, A., Hajdas, I., Head, M. J., Leinfelder, R., McNeill, J. R., Poirier, C., Rose, N. L., Shotyk, W., Wagreich, M., & Williams, M. (2020). Extraordinary human energy consumption and resultant geological impacts beginning around 1950 CE initiated the proposed Anthropocene Epoch. *Communications Earth & Environment*, 1(32). pg. 4.

¹⁰³ *Nitrogen Cycle Explained - Definition, Stages and Importance*. (n.d.). Byju's. Retrieved July 23, 2022, from <https://byjus.com/biology/nitrogen-cycle/>

¹⁰⁴ Herbert, R. A. (1999). Nitrogen cycling in coastal marine ecosystems. *FEMS Microbiology Reviews*, 23(5). pg. 563–590.

which negatively impacts the well-being of the marine biodiversity¹⁰⁵); the exacerbation of the greenhouse effect; and the loss of stratospheric ozone¹⁰⁶ (which through the thinning of the Ozone layer created the hole in the Ozone¹⁰⁷).

In the end of the XX century, some of the trends - as visible in the “Great Acceleration graphs” - began to decelerate: the construction of large dams and marine fish capture ceased their exponential growth, the former because almost all rivers able to sustain a dam already had one, the second because overfishing caused the exhaustion of marine fisheries (in simple terms: there are no longer fish to catch); the increase in domesticated land slowed down (beginning from the 1950s), mostly because of the little amount of land left to be domesticated (the same motivation behind fish capture and dams construction)¹⁰⁸; the stratospheric ozone became stable, thanks to effective international efforts that decreased the emission of those substances responsible for the growth of the Antarctic Ozone hole.¹⁰⁹ Some critics of the Great Acceleration - such as Nielsen - pointed to such trends of deceleration to question the importance of the Great Acceleration and the concept of “Anthropocene”¹¹⁰; nonetheless, a decrease in the intensity of growth still implies a growth - that is, despite at a slower pace, such trends continue, together with the negative repercussions that they have on the Earth System. This does not mean that the Great Acceleration will last forever (for no exponential growth can be sustained over a long period of time): it will sooner or later come to an end either through the gradual return to the status-quo, the collapse, or the stabilization of its growth - depending on the future actions of humankind and Earth System’s response to them¹¹¹; however, the negative consequences that it brought (rising sea levels, increasing atmospheric CO2 concentrations, etc.) will outlive it. As explained by McNeill:

“Thus, to date, the Anthropocene and the Great Acceleration coincide. But they will not for long. The Anthropocene will last long into the future, barring some calamity that removes humankind from the

¹⁰⁵ *What is eutrophication?* (2021, February 26). National Ocean Service. Retrieved July 23, 2022, from <https://oceanservice.noaa.gov/facts/eutrophication.html>

¹⁰⁶ Hu, J. (2018). Human Alteration of the Nitrogen Cycle and Its Impact on the Environment. *IOP Conference Series Earth and Environmental Science*, 178(1). pg. 1-4.

¹⁰⁷ Langematz, U. (2019). Stratospheric ozone: down and up through the anthropocene. *ChemTexts*, 5(8).

¹⁰⁸ Steffen, W., Broadgate, W., Deutsch, L. M., & Gaffney, O. (2015). The Trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review*. pg. 8-10.

¹⁰⁹ WMO. (2015). *Assessment for Decision Makers: Scientific Assessment of Ozone Depletion 2014*. World Meteorological Organisation. pg. ES-1-ES-2.

¹¹⁰ Nielsen, R. W. (2021). The Great Deceleration and proposed alternative interpretation of the Anthropocene. *Episodes*, 44(2).

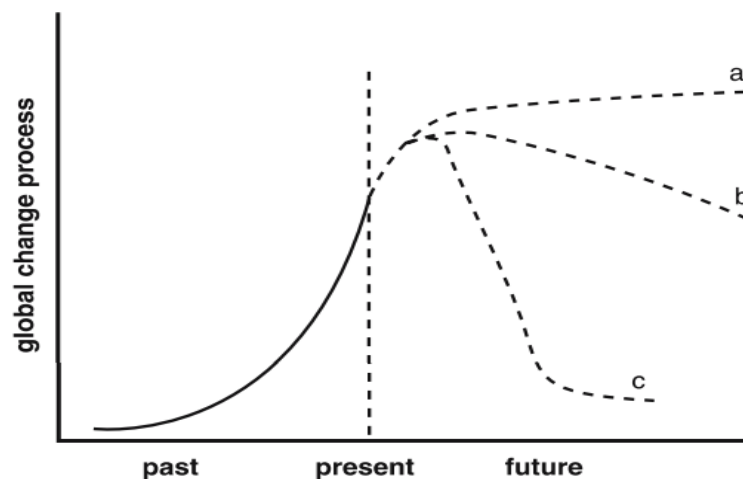
¹¹¹ Schellnhuber, H.-J., Turner, B. L., Tyson, P. D., Sanderson, A., Richardson, K., Wasson, R. J., Jäger, J., Oldfield, F., Steffen, W., Matson, P. A., & Moore III, B. (2005). *Global Change and the Earth System: A Planet Under Pressure* (W. Steffen, Ed.). Springer. pg. 134.

scene. Indeed, even if every human immigrated to another planet tomorrow, our impacts of the past few generations will linger for millennia in the Earth's crust, in the fossil record, and in climate. But the Great Acceleration will not last long. It need not and it cannot. The burst in human population growth is already coming to an end. And, less clearly but no less surely, the age of fossil fuels will come to an end. These trends should be sufficient to decelerate the Great Acceleration and moderate the human impact on the Earth. That will not end the Anthropocene but will bring it to another stage."¹¹²

The Great Acceleration is thus a temporary event showing us a permanent future in which humanity and the Earth System are comprehensively interconnected to the point at which any action of the former leads to a reaction of the latter. This highlights the need for humankind to reach the level of awareness and responsibility towards the Earth System proportionate to its technological capacity to alter it - in fact, the way humankind will interpret this new reality brought by the Great Acceleration, and deal with the long-lasting effects produced by it, will within the next decades either determine whether we are moving towards a Great Disaster or we have found our "safe operating space" in which to thrive.

Let us now move to these two future scenarios by analyzing what such a sustainable space would consist of. First, here illustrated are the Great Acceleration graphs and its future scenarios.

Figure 3.¹¹³ *The Great Acceleration in its possible future scenarios*



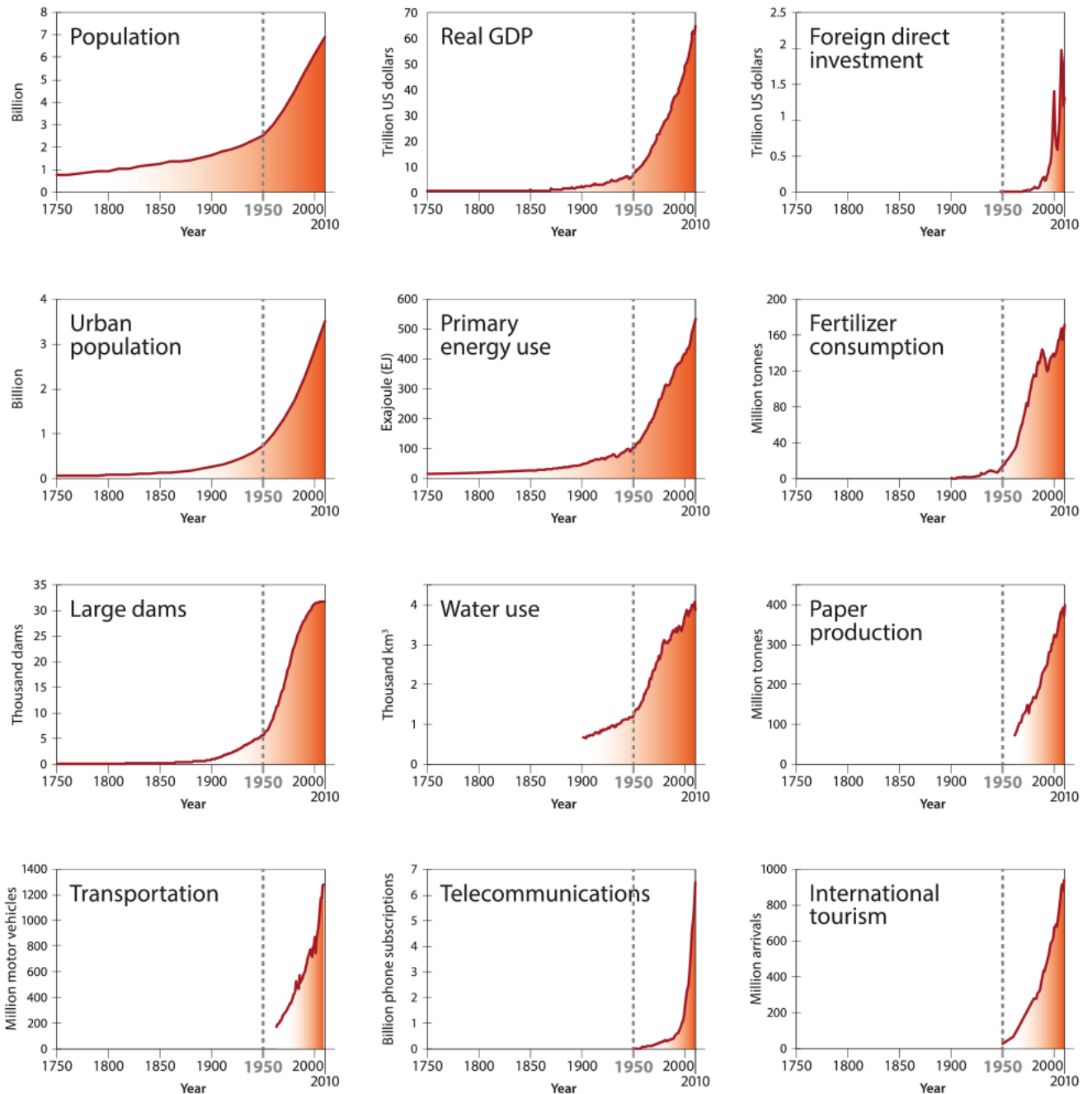
¹¹² McNeill, J. R., & Engelke, P. (2016). *The Great Acceleration: An Environmental History of the Anthropocene Since 1945*. Harvard University Press. pg. 208-209.

¹¹³ (Image taken from) Schellnhuber, H.-J., Turner, B. L., Tyson, P. D., Sanderson, A., Richardson, K., Wasson, R. J., Jäger, J., Oldfield, F., Steffen, W., Matson, P. A., & Moore III, B. Ibid.

"Schematic diagram showing possible future trajectories of current exponential changes: a - stabilisation at a new state of the system; b - relaxation of the system to its previous state at a manageable rate; and c - a rapid or catastrophic change of the system to its previous state or to a different state."

Figure 4. - 5.¹¹⁴ *The Great Acceleration in its 24 graphs*

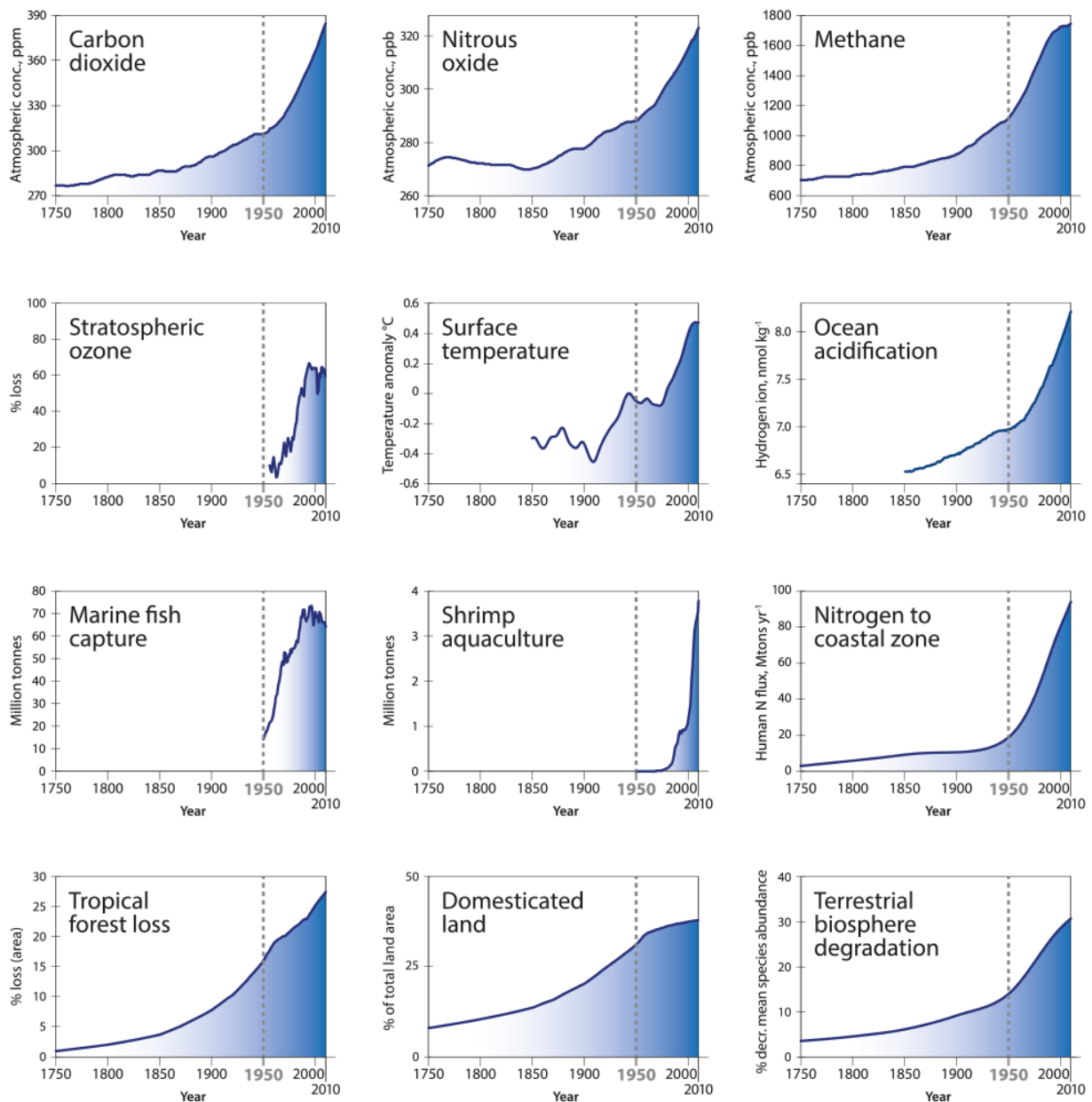
Socio-economic trends



¹¹⁴ (Images taken from) Steffen, W., Broadgate, W., Deutsch, L. M., & Gaffney, O. (2015). Ibid. pg. 4, 7.

(Several Earth System trends will be explained in more detail in a few pages, when illustrating the planetary boundaries framework)

Earth system trends



The rapid changes brought by the Great Acceleration and their negative effects on the Earth System made many within the scientific community begin to question the current global socioeconomic system, and look for alternative models of development that could ensure the wellbeing brought by the Great Acceleration while simultaneously avoiding its disruptive tendencies. To this purpose, a scientific group led by Johan Rockström proposed (inspired by the work of the Club of Rome) in 2009 a framework known as the “*Planetary Boundaries*”, which rapidly became the most influential scientific approach to providing humanity a *safe operating space* (which can be defined as “the situation where the capacity of the planet Earth to provide life-support systems for humanity is not endangered, and the adaptive capacities of human societies might not be overburdened”¹¹⁵) in which to develop, impacting the work of the UN and several other international organizations addressing global sustainability¹¹⁶. The framework uncovers the current major disruptive processes within the planet’s biophysical subsystems, and assigns each of them a number of key control variables (particular elements that characterize the process, thus keeping track of it) and associated thresholds that if crossed could rapidly shift the control variable - therefore the process - into a new, unknown state with potentially disastrous consequences for the Earth System and humankind (for example, the ongoing desertification of a territory might reach a point where the quantity of perennial plants remained is no longer enough to ensure the soil-plant interactions that create the conditions for a stable perennial plant cover¹¹⁷; as a result, such plants are no longer able to recolonize the already desertic territory¹¹⁸). The framework subsequently adds to each variable a planetary boundary which does *not* correspond to the threshold, but it instead comes long before it and it delimitates the safe operating space for that control variable. Each variable therefore has a space in between its planetary boundary and its biophysical threshold which represents an area of potential risk (because it’s out of the safe operating space) but not yet a probable shift to a new ecological state (because it’s within the threshold); such a buffer zone serves as a “wake-up call” for society, in that it signals the

¹¹⁵ EEAC. (2014). Safe Operating Space [Current State of Debate and Considerations for National Policies]. In *EEAC Conclusions Report: BMUB/EEAC Expert Workshop*. Entitat Autònoma del Diari Oficial i de Publicacions. pg. 5.

¹¹⁶ UN. (2012, October 16). *Human Life Dependent on 'Planetary Boundaries' that Should Not Be Crossed, Says Panellist in Second Committee Special Event* | UN Press. Meetings Coverage and Press Releases. Retrieved July 25, 2022, from <https://press.un.org/en/2012/gaef3341.doc.htm>

¹¹⁷ van de Koppel, J., Rietkerk, M., & Weissing, F. J. (1997). Catastrophic vegetation shifts and soil degradation in terrestrial grazing systems. *Trends in Ecology and Evolution*, 12(8). pg. 352-356.

¹¹⁸ Scheffer, M., Carpenter, S. R., Foley, J. A., Folke, C., & Walker, B. (2001). Catastrophic shifts in ecosystems. *Nature*, 413. pg. 594.

beginning of a dangerous trend while it is still possible to invert it (as logic suggests, the more a variable moves towards the threshold and away from the planetary boundary, the higher the chances of a disruptive shift in the state of an ecological process). Planetary boundaries are therefore thresholds for the key aspects of the current major disruptive ecological processes, and are aimed at preventing the exceeding of more serious biophysical thresholds that would cause an “unacceptable environmental damage”¹¹⁹ to the Earth system. To put it more simply, planetary boundaries can be thought of as answering the question: “up to what limits will the Earth system be able to absorb anthropic pressures without compromising the living conditions of the human species?”¹²⁰.

In 2015 the same scientific group updated the original 2009 version of the framework, creating the nine planetary boundaries currently used¹²¹ (some minor changes in names and the inclusion of a few control variables were done in the following years), which in turn represent nine disruptive ecological processes: *climate change*; *ocean acidification*; *stratospheric ozone depletion*; *biogeochemical flows*; *changes in biosphere integrity*; *freshwater use*; *land-system change*; *atmospheric aerosol loading*; *introduction of novel entities*. These processes are aimed at providing a comprehensive understanding of the XXI century Earth System by representing its major characteristics: the global biogeochemical cycles (water, nitrogen, carbon, and phosphorus); the major planetary physical circulation systems (ocean systems, climate, stratosphere); the biophysical features of the planet ensuring its system of self-regulation (terrestrial and marine biodiversity, land-systems); and the two major anthropogenic global changes (introduction of novel entities, atmospheric aerosol loading).¹²²

The control variables (which, as already said, are the key aspects that constitute the ecological process; for example: one of the control variables of climate change is the atmospheric

¹¹⁹ Rockström, J., Steffen, W., Noone, K., Persson, Å., Stuart Chapin, F., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... Foley, J. A. (2009). A safe operating space for humanity. *Nature*, 461. pg. 472-475.

¹²⁰ Bon Pote. (2022, July 2). *The 5th planetary boundary has been officially crossed (and nobody cares)*. Bon Pote. Retrieved July 25, 2022, from <https://bonpote.com/en/the-5th-planetary-boundary-has-been-officially-crossed-and-nobody-cares/>

¹²¹ Stockholm Resilience Centre. (n.d.). *Planetary boundaries*. Stockholm Resilience Centre. Retrieved July 26, 2022, from <https://www.stockholmresilience.org/research/planetary-boundaries.html>

¹²² Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... Foley, J. (2009). Planetary boundaries:exploring the safe operating space for humanity. *Ecology and Society*, 14(2).

concentration of CO₂) associated with each process can be divided into two categories: those having a singular, quantifiable global/continental/ocean basin level threshold (for example, a certain level of atmospheric concentration of CO₂, which is a single, quantifiable global factor), and those consisting of slower, more complex trends that do not have clear evidence of a global threshold - many of them have instead thresholds at the local or regional level - but are nonetheless globally disruptive (an example could be land-system change, which happens at the local level but - if aggregating several land-system changes happening in different continents - can have serious impacts on the Earth System as a whole¹²³). Planetary boundaries are given for each of the control variables - regardless of whether they have a clear global threshold or not - because they are collectively important to uncover the Earth System's resilience and limits, and should therefore be kept track of. The control variables and the processes that they form are deeply interconnected *between* them (for example, climate change might produce changes in the biosphere integrity, as some animal or plant species unable to adapt to the new climate might go extinct); this highlights the importance of paying a comprehensive attention to all planetary boundaries, as focusing on single control variables wouldn't prevent them from exceeding their planetary boundary, because disruptive effects could spill over from other ones. Similarly, control variables and processes are also deeply interconnected *within* them: changes at the regional/local level can have critical repercussions at the overall Earth system level (and vice versa); it is therefore important to have subglobal boundaries (apart, and integrated into the planetary ones) able to keep track of those changes happening at the regional/local level that can greatly influence the global one (this is especially relevant for those ecological processes with a strong regional character: land-system change, biogeochemical flows, atmospheric aerosol loading, freshwater use, biosphere integrity)¹²⁴. Two boundaries - changes in biosphere integrity and climate change - are particularly important: they are deeply interconnected to all others, as not only they are regulated by the other planetary boundaries, but they in turn "provide the planetary-level overarching systems within which the other boundary processes operate"¹²⁵.

¹²³ Crossman, N. D., Bryan, B. A., de Groot, R. S., Lin, Y.-P., & Minang, P. A. (2013). Land science contributions to ecosystem services. *Current Opinion in Environmental Sustainability*, 5(5). pg. 509-514.

¹²⁴ Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223). pg. 1259855-2 - 1259855-10.

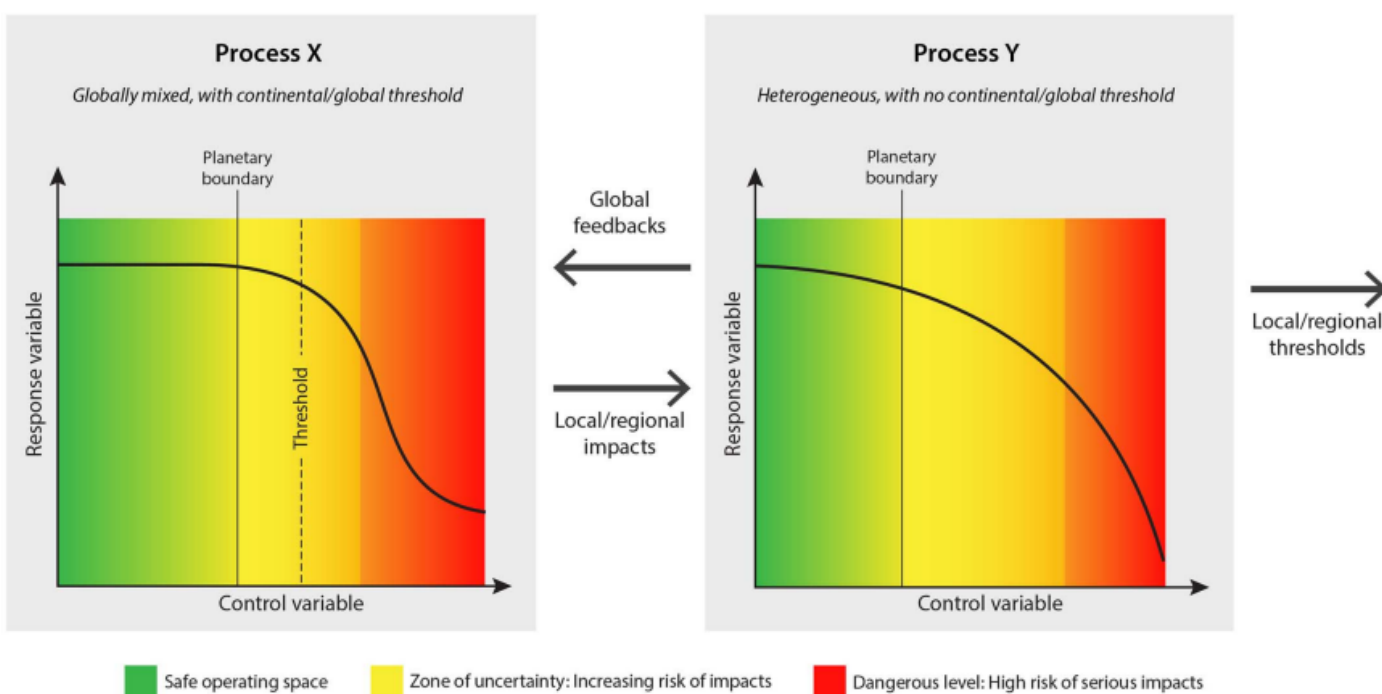
(The article provides the subglobal boundaries of the five processes mentioned in this work in brackets; I have decided not to include them, as they are not particularly relevant to the purpose of this work.)

¹²⁵ *Ibid.* pg. 1259855-8.

Dramatic changes in either one of them are therefore individually sufficient to push the Earth System into a new state (this does not happen with the other boundaries, for which exceeding their threshold might lead to serious consequences and impact other boundaries, but not shift the whole Earth System into a new state). This is why the planetary boundaries framework provides a two-level hierarchy in which biosphere integrity and climate change are considered “core planetary boundaries” having a higher importance than the other remaining seven boundaries.

In 2022, two groups of scientists updated the findings on the planetary boundaries and included a few control variables, providing the latest version of the framework. Of the nine planetary boundaries, six of them have been transgressed: changes in biosphere integrity; climate change; land-system change; biogeochemical flows; introduction of novel entities; and freshwater use¹²⁶. Let us now analyze each planetary boundary and their developments in more detail; first - to clarify what has been said so far - the work will provide a scheme illustrating the conceptual framework of the planetary boundaries, and another one illustrating their current status.

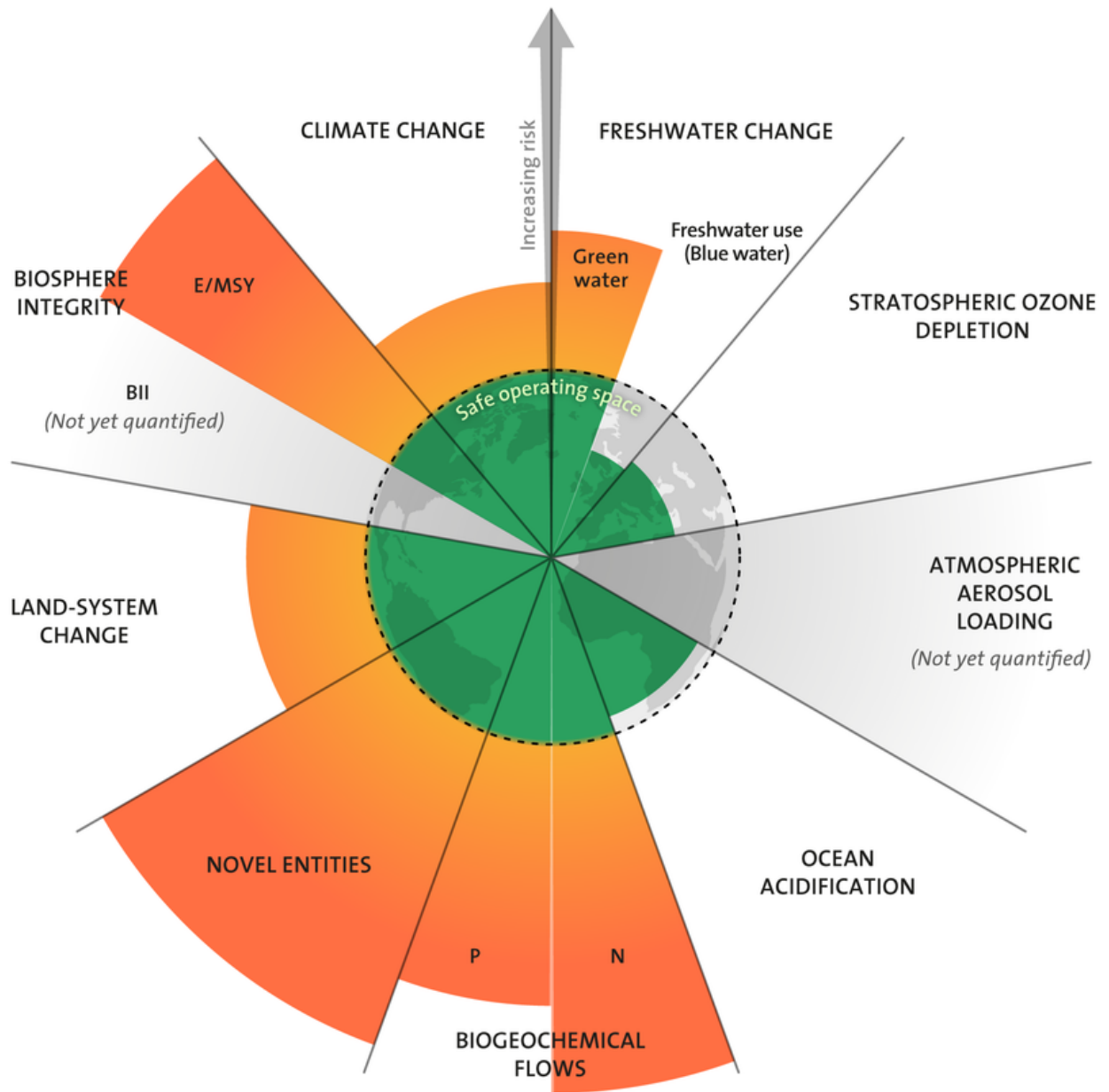
Figure 6.¹²⁷ The conceptual framework of the planetary boundaries framework



¹²⁶ Planetary boundaries update: freshwater boundary exceeds safe limits — Potsdam Institute for Climate Impact Research. (2022, April 26). Potsdam Institute for Climate Impact Research. Retrieved July 27, 2022, from <https://www.pik-potsdam.de/en/news/latest-news/planetary-boundaries-update-freshwater-boundary-exceeds-safe-limits>

¹²⁷ (Image taken from) Steffen, W., Richardson, K., Rockström, J., et al. (2015). Ibid. pg. 1259855-2.

Figure 7.¹²⁸ *The planetary boundaries and the current status of their control variables*



¹²⁸ (Image taken from) Rockström, J., & Wang, L. (2022, April 26). *Freshwater boundary exceeds safe limits*. Stockholm Resilience Centre. Retrieved July 27, 2022, from <https://www.stockholmresilience.org/research/research-news/2022-04-26-freshwater-boundary-exceeds-safe-limits.html>

Climate change¹²⁹

Climate change consists of “long-term shifts in temperatures and weather patterns”¹³⁰, and it represents one of the two core boundaries (as previously said) functioning as pillars of the Earth System’s resilience. The process is represented by two control variables: *atmospheric concentration of CO2* and *radiative forcing*. Atmospheric CO2 concentration matters because carbon dioxide is the most important of the greenhouse gasses (gasses that contribute to the warming of the Earth’s surface by absorbing the heat coming from it and re-releasing in all directions - including the Earth¹³¹) responsible for global warming. Radiative forcing (the difference between the amount of energy that enters the Earth’s atmosphere - in the form of solar radiations - and the amount of energy that leaves it - in the form of heat) is extremely relevant because the more radiations enter the atmosphere without subsequently exiting it the more the atmosphere’s temperature will increase¹³²; the agents responsible for such an energy balance are called “climate forcings”, and can be either natural or anthropogenic - the largest climate forcing now are the anthropogenic greenhouse gasses, which cause positive forcing (more energy entering the atmosphere than exiting), thus warming the planet¹³³.

Already in 2015 (the year in which the latest comprehensive version of the framework was published) climate change had exceeded the planetary boundary for both its control variables; this trend hasn’t been inverted: atmospheric concentration of CO2 is currently in its “zone of uncertainty” (the area in between the planetary boundary and the threshold described a few pages ago); on the other hand, radiative forcing (which is measured in the increase in radiations present in the atmosphere since 1750 - the “preindustrial year” chosen as the first from which to start the measurement¹³⁴) is well over its planetary boundary as well as its threshold. The main factor

¹²⁹ (For it not to be too burdensome, the description of the individual boundaries here following won’t illustrate all the scientific measurements used and current values of their control variables; for all of the specific data, consult the 2015 article by Rockström quoted in this work, and integrate it with the newest updates provided by the Stockholm Resilience Centre - <https://www.stockholmresilience.org/>)

¹³⁰ *What Is Climate Change?* | United Nations. (n.d.). the United Nations. Retrieved July 28, 2022, from <https://www.un.org/en/climatechange/what-is-climate-change>

¹³¹ Lindsey, R. (2022, June 23). *Climate Change: Atmospheric Carbon Dioxide* | NOAA Climate.gov. Climate.gov. Retrieved July 28, 2022, from

<https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>

¹³² Emanuel, K. (2020, September 25). *Radiative Forcing* | MIT Climate Portal. MIT Climate Portal. Retrieved July 28, 2022, from <https://climate.mit.edu/explainers/radiative-forcing>

¹³³ Hansen, J. E., & Sato, M. (2001). Trends of measured climate forcing agents. *Proceedings of the National Academy of Sciences of the United States of America*, 98(26). pg. 14778-14783.

¹³⁴ IPCC. (2013). Summary for Policymakers. In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Stocker, T.F.,

behind the rise in the two control variables is the combustion of fossil fuels (oil, coal, natural gas - mostly for energy, transportation, and industrial purposes), which is the biggest cause of CO₂ emissions¹³⁵ - fundamental in both control variables. This highlights the interconnection between environment and energy, and the consequent need to ensure energy security in order to reach an environmental one. The ongoing climate change has major disruptive effects on the Earth System: hotter temperatures (with serious repercussions on human health); more severe storms (having destructive consequences on infrastructure); increased drought (greatly damaging agriculture therefore increasing famines); a warming, rising ocean (threatening the existence of coastal regions and islands); loss of species (the second planetary boundary, with which we will now deal); poverty and displacement (as a growing number of communities is unable to cope with the increasing disruption brought by climate change).¹³⁶

Biosphere integrity

This second core boundary keeps track of “the ability of ecosystems to continue to provide goods and services to human society, and the risk of these benefits being threatened due to biodiversity loss”¹³⁷. It is composed of two control variables: *genetic diversity* and *functional diversity*. Genetic diversity consists of the range of different traits inherited by a species, and it is fundamental because the more genetically diverse the species, the higher its capacity to adapt to a changing environment¹³⁸; the current (more appropriate ones are being sought) unit of measure used for this control variable is the extinction rate - that is, how many species out of a million go extinct every year. Functional diversity instead represents the range of (biological) activities carried out by organisms within an ecosystem¹³⁹, and it is important in that it affects many important components of the ecosystem’s functioning¹⁴⁰, thereby affecting its overall resilience.

D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley ed.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. pg. 13.

¹³⁵ EPA. (2022, May 16). *Overview of Greenhouse Gases* | US EPA. Environmental Protection Agency. Retrieved July 29, 2022, from <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>

¹³⁶ UN. (n.d.). *Causes and Effects of Climate Change* | United Nations. the United Nations. Retrieved July 29, 2022, from <https://www.un.org/en/climatechange/science/causes-effects-climate-change>

¹³⁷ Hurley, I., & Tittensor, D. P. (2020). The uptake of the biosphere integrity planetary boundary concept into national and international environmental policy. *Global Ecology and Conservation*, 22. pg. 2.

¹³⁸ IMET. (2020, May 18). *What is genetic diversity?* | imet. Institute of Marine and Environmental Technology. Retrieved July 29, 2022, from <https://imet.usmd.edu/activities/what-genetic-diversity>

¹³⁹ Petchey, O. L., & Gaston, K. J. (2006). Functional diversity: back to basics and looking forward. *Ecology Letters*, 9(6). pg. 741-758.

¹⁴⁰ Goswami, M., Bhattacharyya, P., Mukherjee, I., & Tribedi, P. (2017). Functional Diversity: An Important Measure of Ecosystem Functioning. *Advances in Microbiology*, 7(1). pg. 82-93.

The unit of measure for this second control variable is the Biodiversity Intactness Index, - “an estimated percentage of the original number of species that remain and their abundance in any given area, despite human impacts”¹⁴¹. Both the planetary boundary and the subsequent threshold for genetic diversity have been largely exceeded; with regards to functional diversity, as no global BII measurement has been undertaken so far, we cannot yet quantify whether its planetary boundary has been reached or the variable is still within its safe operating space (a BII study was conducted in southern Africa, where functional diversity was found to have slightly exceeded its planetary boundary, moving therefore into its area on uncertainty).

The causes of the erosion of the biosphere’s integrity can be traced back to the increasing urbanization and food demand brought by the Great Acceleration (described a few pages back); among its consequences are instead the worsening of climate change (given the great interconnectedness between these two core boundaries) and the many repercussions on the other Earth System trends (also described a few pages back).

Land-system change

A land-system is “an area or group of areas with a recurring pattern of landforms, soils and vegetation”¹⁴². The third boundary deals with the changes in land-systems resulting from the conversion of natural environments into land for human-use. Anthropogenic land-use have disruptive environmental consequences (as described before), especially since the deforestation of forests to create croplands (with the following usage of nitrogen fertilizers) and pastures releases large emissions of greenhouse gasses into the atmosphere¹⁴³, fueling climate change. The control variable for land-system change is the *amount of forest cover remaining* (taking pre-industrial forest cover for comparison), and it is regulated by a global boundary that is further divided into three regional boundaries corresponding to the three kinds of forest existing (tropicate, temperate, boreal¹⁴⁴ - of these three types, tropical and boreal forests have a stronger

¹⁴¹ *About the Biodiversity Intactness Index*. (n.d.). Natural History Museum. Retrieved July 29, 2022, from <https://www.nhm.ac.uk/our-science/data/biodiversity-indicators/about-the-biodiversity-intactness-index.html>

¹⁴² Wilson, L. (1968). Land systems. *Geomorphology*. pg. 641.

¹⁴³ Verburg, P. H., Crossman, N., Ellis, E. C., Heinimann, A., Hostert, P., Mertz, O., Nagendra, H., Sikor, T., Erb, K., Golubiewski, N., Grau, R., Grove, M., Konaté, S., Meyfroidt, P., Parker, D. C., Chowdhury, R. R., Shibata, H., Thomson, A., & Zhen, L. (2015). Land system science and sustainable development of the earth system: A global land project perspective. *Anthropocene*, 12. pg. 29-41.

¹⁴⁴ *Forest Biome*. (2022, May 19). National Geographic Society. Retrieved July 30, 2022, from <https://education.nationalgeographic.org/resource/forest-biome>

influence on the global climate system¹⁴⁵; for this reason, these two have a higher planetary boundary and threshold, aimed at ensuring a higher protection). The global planetary boundary for land-system change (which is the weighted average of the three regional ones) has been exceeded: the process is currently in its zone of uncertainty in between its planetary boundary and its threshold; a critical factor in the increasing land-system changes is the deforestation of tropical forests - a particularly strong trend in Latin America (the third chapter will deal with this).

Novel entities

Novel entities are defined as “new substances, new forms of existing substances and modified life forms that have the potential for unwanted geophysical and/or biological effects [...such as...] chemicals and other new types of engineered materials or organisms not previously known to the Earth system as well as naturally occurring elements (for example, heavy metals) mobilized by anthropogenic activities”¹⁴⁶. These entities pose a serious threat at the global level when they exhibit persistence; mobility across scale (allowing them to spread widely); and possible negative impacts on Earth System processes or subsystems that are vital¹⁴⁷. The introduction of novel entities into the Earth system rose dramatically since the Great Acceleration, as the rising living standards led to an increasing demand for products resulting from chemical processes (electronics, textiles, cosmetics, etc.)¹⁴⁸. Among such novel entities, *plastic* is widely regarded as one of the most dangerous, in that its exceptionally slow degradation rate (how long it takes for the substance to be eliminated from the environment¹⁴⁹) and chemical composition have a wide range of repercussions on both the environment and human health; for example: the large quantities of plastic produced make it hard to dispose, often leading to it being buried deep in landfills - where it can spread dangerous chemicals into groundwater - or being thrown into the oceans - where it is ingested by marine species, poisoning

¹⁴⁵ Snyder, P. K., Delire, C., & Foley, J. (2004). Evaluating the Influence of Different Vegetation Biomes on the Global Climate. *Climate Dynamics*, 23(3). pg. 279-302.

¹⁴⁶ Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Ibid. pg. 1259855-7.

¹⁴⁷ Ibid.

¹⁴⁸ UNEP. (2019). *Global Chemicals Outlook II: From Legacies to Innovative Solutions: Implementing the 2030 Agenda for Sustainable Development*. UNEP. pg. 2.

¹⁴⁹ EFSA. (n.d.). *degradation rate* | EFSA. EFSA. Retrieved July 31, 2022, from <https://www.efsa.europa.eu/en/glossary/degradation-rate>

them and consequently poisoning the humans consuming them.¹⁵⁰ A major problem with novel entities is that they often have unknown negative environmental effects which are discovered only after a large quantity of such entities has been already released into the Earth system (for example: several synthetic chemicals thought to be harmless were later discovered to have disruptive effects on the stratospheric ozone layer); furthermore, the large number, characteristics, and effects of novel entities, as well as the quasi-complete absence of pre-human standards for comparison (as they are mostly anthropogenic) makes it hard to delineate control variables and consequently quantify a planetary boundary for this ecological process. For this reason, the official planetary boundary framework created by Rockström and his group does not provide either of the two; nonetheless, an influential 2022 study (apart from proposing a number of control variables to keep track of the process) has found the planetary boundary for the introduction of novel entities to have been exceeded, in that “annual production and releases increase at a pace that outstrips the global capacity for assessment and monitoring”¹⁵¹.

Biogeochemical flows

Biogeochemical flows (or cycles) consist of “the fluxes of chemical elements among different parts of the Earth: from living to non-living, from atmosphere to land to sea, and from soils to plants”¹⁵². These fluxes are fundamental to the Earth system in that such movements of matter transform it into usable forms able to support the functioning of ecosystems¹⁵³; an example could be the oxygen cycle, here greatly simplified: plants use carbon dioxide to produce oxygen through photosynthesis; aerobic organisms - such as animals - inhale oxygen; aerobic organisms exhale carbon dioxide, which is once again used by plants. The Great Acceleration has strongly altered many of the biogeochemical cycles, leading to major disruptive environmental changes

¹⁵⁰ Knoblauch, J. A. (2009, July 2). Plastic Not-So-Fantastic: How the Versatile Material Harms the Environment and Human Health. *Scientific American*. <https://www.scientificamerican.com/article/plastic-not-so-fantastic/>

¹⁵¹ Persson, L., Carney Almroth, B. M., Collins, C. D., Cornell, S., de Wit, C. A., Diamond, M. L., Fantke, P., Hassellöv, M., MacLeod, M., Ryberg, M. W., Søgaard Jørgensen, P., Villarrubia-Gómez, P., Wang, Z., & Zwicky Hauschild, M. (2022). Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. *Environmental Science & Technology*, 56(14). pg. 1517.

¹⁵² Galloway, J., Schlesinger, W., Clark, C. M., Grimm, N. B., Jackson, R. B., Law, B. E., Thornton, P. E., Townsend, A. R., & Bellmore, R. A. (2014). Biogeochemical Cycles. In J. M. Melillo, T. (C.). Richmond, & G. W. Yohe (Eds.), *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program. pg. 351.

¹⁵³ Brusseau, M. L. (2019). Ecosystems and Ecosystem Services. In M. L. Brusseau, I. L. Pepper, & C. P. Gerba (Eds.), *Environmental and Pollution Science* (3rd ed.). Academic Press. pg. 89-102.

such as biodiversity loss, climate change, GHG emissions, water pollution, and air pollution¹⁵⁴ (as for example described in the previous pages with regards to the nitrogen cycle). Biogeochemical flows are regulated in the PB (planetary boundary) framework by two control variables: *phosphorus* and *nitrogen*¹⁵⁵. Phosphorus has both a planetary boundary and a regional-level boundary: the planetary boundary measures the quantity of phosphorus flowing from freshwater systems into the ocean (as excessive quantities of phosphorus into the oceans lead to its deoxygenation¹⁵⁶ - which has severe consequences for marine ecosystems), while the regional-level boundary measures the flow of phosphorus from (phosphorus) fertilizers to erodible soils (because phosphorus fertilizers penetrate erodible soils to later contaminate the freshwater systems beneath them, leading to the process of eutrophication described a few pages back). With regards to Nitrogen, there is only a planetary boundary, measured by the quantity of industrial and intentional biological nitrogen fixation (as the industrial fixation of nitrogen causes the eutrophication of aquatic ecosystems, as described in the earlier pages of this paragraph). The planetary boundary for biogeochemical flows has been exceeded for both its control variables (nitrogen has even exceeded its threshold - therefore moving out of its zone of uncertainty, into the area of high irreversible consequences for the Earth system). For both nitrogen and phosphorus, the high usage of fertilizers in specific agricultural regions is what makes the variables exceed their boundaries; redistributing their usage from areas with a higher density to areas with a lower one could help invert the disruptive trend, bringing the process back into its safe operating space.¹⁵⁷

¹⁵⁴ Shibata, H., Branquinho, C., McDowell, W. H., Mitchell, M. J., Monteith, D. T., Tang, J., Arvola, L., Cruz, C., Cusack, D. F., Halada, L., Kopáček, J., Máguas, C., Sajidu, S., Schubert, H., Tokuchi, N., & Záhora, J. (2015). Consequence of altered nitrogen cycles in the coupled human and ecological system under changing climate: The need for long-term and site-based research. *Ambio*, 44(3). pg. 178.

¹⁵⁵ (While these variables correspond to two of the major biogeochemical cycles, several other cycles play a fundamental role in the Earth system, and should therefore - as noted by Rockström himself - be included into the framework within the next few years.)

¹⁵⁶ Watson, A. J., Lenton, T. M., & Mills, B. J.W. (2017). Ocean deoxygenation, the global phosphorus cycle and the possibility of human-caused large-scale ocean anoxia. *Philosophical transactions of the Royal Society A*, 375(2102). pg. 1.

¹⁵⁷ Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Ibid. pg. 1259855-7.

Ocean acidification

This planetary boundary is closely intertwined with CO₂ emissions (as previously illustrated, together with its effects on the Earth system - which won't be repeated here) - therefore with climate change and its planetary boundary; it is measured by the aragonite saturation rate (which measures carbonate ion concentration - a decreasing carbonate ion concentration poses a threat to marine wildlife¹⁵⁸), comparing its current rate to its pre-industrial one. The planetary boundary for ocean acidification has yet not been exceeded; nonetheless, the current global acidification trend shades a dark light on the next decades.

Atmospheric aerosol loading

Atmospheric aerosols consist of solid, liquid, or mixed particles (highly variable in size and chemical composition) suspended in the atmosphere.¹⁵⁹ They absorb sunlight (solar radiations) and scatter it back into space, and affect clouds' capacity to absorb and reflect it - thereby changing the amount of radiations entering and exiting the Earth and consequently triggering climate changes¹⁶⁰ (see the radiative forcing concept previously illustrated); they can also serve as sites for chemical reactions to take place - among which, those responsible for stratospheric ozone depletion - and cause serious harm to human health.¹⁶¹ There are three types of aerosols that greatly alter the Earth system: volcanic aerosol (following eruptions - think of Pompeii); desert dust; and human-made aerosol (mostly consisting of smoke resulting from burning forests). The effects of aerosols is opposite to that of GHGs: while greenhouse gasses cause the planet's warming by absorbing radiations and releasing them (in part) towards the Earth, aerosols cause the planet's cooling by absorbing radiations and scattering them into space; however, unlike GHGs, the effect of aerosols is regional (limited to industrial areas), not global¹⁶² - this further alters the ecological equilibrium between regions causing environmental disruption.

¹⁵⁸ NOAA. (2015, November 12). *Ocean Acidification: Saturation State - Science On a Sphere*. Science On a Sphere. Retrieved July 31, 2022, from <https://sos.noaa.gov/catalog/datasets/ocean-acidification-saturation-state/>

¹⁵⁹ Myhre, G., Lund Myhre, C. E., Samset, B. H., & Storelvmo, T. (2013). Aerosols and their Relation to Global Climate and Climate Sensitivity. *Nature Education Knowledge*, 4(5).

¹⁶⁰ Bellouin, N., Quaas, J., Gryspeerd, E., Kinne, S., Stier, P., Watson-Parris, D., Boucher, O., & al. (2020). Bounding Global Aerosol Radiative Forcing of Climate Change. *Reviews of Geophysics*, 58.pg. 1-2.

¹⁶¹ Fox, C., & Scherer, G. (2022, March 3). *Aerosol pollution: Destabilizing Earth's climate and a threat to health*. Mongabay. Retrieved August 1, 2022, from

<https://news.mongabay.com/2022/03/aerosol-pollution-destabilizing-earths-climate-and-a-threat-to-health/>

¹⁶² NASA. (1996, August 1). *Atmospheric Aerosols: What Are They, and Why Are They So Important?* NASA. Retrieved August 1, 2022, from <https://www.nasa.gov/centers/langley/news/factsheets/Aerosols.html>

The control variable for atmospheric aerosol loading in the PB framework is *aerosol optical depth* (“the measure of aerosols [...] distributed within a column of air from the [...] Earth’s surface to the top of the atmosphere”¹⁶³). The complexity of atmospheric aerosols did not allow for the quantification of a planetary boundary; however, a regional boundary has been established for the Indian subcontinent, where aerosols can alter the monsoon system. This regional boundary has been exceeded, with atmospheric aerosol loading currently being in its zone of uncertainty. Further research will need to be done in order to establish a planetary boundary allowing to keep track of the process at a global level.

Stratospheric ozone depletion

Ozone is an oxygen molecule mostly present in the lower part of the stratosphere (the second layer of the Earth’s atmosphere, extending from an altitude of 10km to one 50km), and it has the fundamental function of absorbing part of the radiations coming from the sun (UVB radiations, particularly harmful to human health¹⁶⁴), thus preventing them from reaching the Earth’s surface.¹⁶⁵ The depletion of stratospheric ozone (whose causes and effects have been illustrated a few pages above) pushed Rockström and his team to grant it a planetary boundary within the PB framework, having as a control variable the *stratospheric concentration of ozone* (O3). Thanks to the efforts of the international community, the depletion of the stratospheric ozone has now been inverted (the Antarctic ozone hole is expected to close by the 2060s, while in other regions the ozone layer is expected to recover even earlier¹⁶⁶), pushing the process back within its boundary, which is currently not been exceeded; however, the recovery of the ozone layer might be hindered by the spreading of wildfires¹⁶⁷ caused by exceeding other processes’ planetary boundaries. These two emotionally contrasting pieces of information prove two things: the

¹⁶³ SDSN. (n.d.). *Indicator 75. Aerosol optical depth (AOD)*. Indicators and a Monitoring Framework. Retrieved August 1, 2022, from <https://indicators.report/indicators/i-75/>

¹⁶⁴ WHO. (2017, October 16). *Radiation: The known health effects of ultraviolet radiation*. WHO | World Health Organization. Retrieved August 1, 2022, from <https://www.who.int/news-room/questions-and-answers/item/radiation-the-known-health-effects-of-ultraviolet-radiation>

¹⁶⁵ Fahey, D. W., McFarland, M., Montzka, S. A., & Nash, E. R. (2021, October 7). *Basic Ozone Layer Science* | US EPA. Environmental Protection Agency. Retrieved August 1, 2022, from <https://www.epa.gov/ozone-layer-protection/basic-ozone-layer-science>

¹⁶⁶ UNEP. (2021, September 15). *Rebuilding the ozone layer: how the world came together for the ultimate repair job*. UNEP. Retrieved August 1, 2022, from <https://www.unep.org/news-and-stories/story/rebuilding-ozone-layer-how-world-came-together-ultimate-repair-job>

¹⁶⁷ Briggs, H. (2022, March 1). Wildfires may slow recovery of ozone layer - study. *BBC*. <https://www.bbc.com/news/science-environment-60563378>

importance and ability of the international community to successfully keep humanity within its safe operating space; and the interconnectedness of the planetary boundaries, with consequent need to deal with them comprehensively.

Freshwater change

There are two kinds of water: salt water (constituting 97% of all water and being mostly present in oceans and seas) and freshwater (accounting only for 3% of all water and being found in lakes, rivers, glaciers, groundwater, etc.¹⁶⁸); the ninth boundary deals with the changes in the latter. Freshwater is fundamental, in that it ensures the survival of living beings; however, global warming, excessive consumption and pollution (all described a few pages ago) are threatening both the quality and quantity of freshwater, thereby posing a direct threat to humankind's survival. The latest study in 2022 divided the boundary into two sub-boundaries: *blue water* and *green water*.¹⁶⁹ Blue water can be defined as “surface and groundwater that is stored in rivers, lakes, aquifers and dams and can be extracted for human use”¹⁷⁰, while green water consists of site-specific precipitations contributing to the moisture of soil temporarily to later be consumed by the ecosystem.¹⁷¹ The blue water sub-boundary (whose control variable is the “amount of consumptive blue water use”) has currently not been exceeded (despite several of its regional boundaries being transgressed)¹⁷²; the green water sub-boundary (having a control variable based on root-zone soil moisture) is instead believed to have been exceeded. Given the importance of green water in the Earth system (for it regulates most terrestrial biosphere processes, such as the biogeochemical cycles, the carbon cycle and the water cycle), exceeding its boundary means causing disruptive effects on terrestrial ecosystems and hydroclimatic regimes.¹⁷³

¹⁶⁸ WWF. (n.d.). *What is Freshwater and Where is it Found?* WWF. Retrieved August 1, 2022, from <https://www.worldwildlife.org/industries/freshwater-systems>

¹⁶⁹ Wang- Erlandsson, L., Tobian, A., van der Ent, R. J., Fetzer, I., & al. (2022). A planetary boundary for green water. *Nature Reviews Earth & Environment*, 3. pg. 380–392.

¹⁷⁰ Mao, G., Liu, J., Han, F., Meng, Y., Tian, Y., Zheng, Y., & Zheng, C. (2020). Assessing the interlinkage of green and blue water in an arid catchment in Northwest China. *Environmental Geochemistry and Health*, 42. pg. 934.

¹⁷¹ Falkenmark, M., & Rockström, J. (2006). The New Blue and Green Water Paradigm: Breaking New Ground for Water Resources Planning and Management. *Journal of Water Resources Planning and Management*, 132(3). pg. 129-132.

¹⁷² Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Ibid. pg. 1259855-7.

¹⁷³ Gleeson, T., Wang-Erlandsson, L., Porkka, M., Zipper, M., Jaramillo, S. C., Gerten, F., & al. (2020). Illuminating water cycle modifications and Earthsystem resilience in the Anthropocene. *Water Resources Research*, 56.

The Planetary Boundaries framework has received wide range of criticisms for several reasons:¹⁷⁴ among the most common are the argument that it does not take the “equity issue” into account - that is, it does not provide guidance on how to divide the burden of action between industrialized and non industrializing countries - therefore potentially constraining the growth of developing countries; the more scientific criticism that included regional-level processes have yet not shown major evidence of threshold behavior; and the political-economic critique of not providing a more pragmatic guideline on how to ensure development within the safe-operating space. Despite such criticisms (often accepted by the authors of the framework themselves), the Planetary Boundary framework provides (to this day) the most comprehensive and widely accepted account of the major environmental threats that planet Earth is and will be facing in the upcoming decades, further delineating a safe-operating space within which humankind can pursue its prosperity without threatening its survival. In doing this, the framework highlights how such threats are interconnected between one another, and how they are interconnected within themselves - that is, how the disruption of one ecological process can lead to the disruption of another, and how regional trends can spread at the global level. This ultimately proves how classic understandings of environmental security (described in the first section of this chapter) having the sovereign nation-state as their exclusive subject of focus are not only no longer effective, but often even detrimental to the achievement of the international cooperation and bottom-up approaches (stemming from citizens) needed to effectively tackle environmental challenges. The framework should then be understood not as the ultimate means to achieve environmental security, rather as *the scientific foundations on which to build comprehensive political guidelines* able to address those aspects of environmental security that the framework does not include, as highlighted by its criticisms.

¹⁷⁴ Biermann, F., & Kim, R. E. (2020). The Boundaries of the Planetary Boundary Framework: A Critical Appraisal of Approaches to Define a “Safe Operating Space” for Humanity. *Annual Review of Environment and Resources*, 45(1). pg. 497-521.

I.IV Rethinking Environmental Security

This chapter has started by analyzing how environmental security is currently understood, its different characteristics and subjects of analysis; in doing this, it has explained the causes behind the birth of environmental security as well as the great relevance (previously described in the introduction) that it holds in the XXI century. The second section has continued through the illustration of the current “environmental era” and the intellectual debate around it, proving that - if environmental security is to be achieved - the role of humankind as a primary force in the shaping of the Earth system can no longer be ignored. Indeed, both paradigms of Anthropocene and Noösphere point to how the Great Acceleration has created a radically different environmental era in which human actions cause Earth system reactions that in turn affect the livelihood of societies, regions, and planet Earth as a whole. Lastly, the third section has examined the challenges that environmental security is (and will be) facing, uncovering the environmental successes of comprehensive international cooperation and political action, as well as the disruption caused to the Earth system through those ecological processes in which comprehensive international cooperation and political action are yet to come.

The chapter altogether illustrates how the world has moved away from the ecological stability characterizing the Holocene¹⁷⁵, and how our understanding not only of environmental security, but of security as a whole will need to acknowledge such changes for humankind (and several others species) to prosper. In particular, the international community will need to abandon the current old-fashioned understandings of security aimed at ensuring the sole survival of the nation-state within a logic of rivalry between sovereign states¹⁷⁶; these approaches cause further harm to the planet and the international community itself, as they first do not allow for the cooperation needed to tackle environmental challenges - thus worsening the disruption of the Earth system - and then radicalize the competition between states when the worsening Earth system conditions inevitably lead to the deterioration of resources.¹⁷⁷ Instead, environmental

¹⁷⁵ Rockström, J. (2016, September 22). *Goodbye forever, friendly Holocene*. GEF. Retrieved August 2, 2022, from <https://www.thegef.org/news/goodbye-forever-friendly-holocene>

¹⁷⁶ Buzan, B., & Wæver, O. (2009). Macrosecuritisation and security constellations: reconsidering scale in securitisation theory. *Review of International Studies*, 35(2). pg. 253-276.

¹⁷⁷ (This thematic is addressed by that branch of environmental security studies analyzing climate change as a source of violent conflict [see “Ide, T., Brzoska, M., Donges, J. F., & Schleussner, C. (2020). Multi-method evidence for when and how climate-related disasters contribute to armed conflict risk. *Global Environmental Change*, 62.”] or as a “conflict catalyst” [see “Ward, B. (2014, September 22). Climate change as catalyst of conflict » Yale Climate Connections. *Yale Climate Connections*. <https://yaleclimateconnections.org/2014/09/climate-change-as-catalyst-of-conflict/>”]. This work has not dealt with

security should increasingly be dealt with by international organizations, local governmental entities (city administrations, regional administrations, etc.) and citizens themselves - that is, supranational and local realities better equipped at dealing with the global and regional character of XXI century environmental threats. This will need a drastic revisiting of the concept of national sovereignty (tackling the intellectual and political oppositions that it might face), as well as the “restructuring” of international organizations¹⁷⁸ and the promotion of forms of democratic participation so as to allow them to better carry out their new enhanced roles within environmental security (an example could be the creation of a “World Environmental Organization”¹⁷⁹ and the new bottom-up approaches increasingly stemming from local non-profit organizations). Together with the change in its actors, environmental security should also shift its focus: traditional environmentalist discourses of “doing no harm to planet Earth” that do not take into account the need to ensure the nation-state’s development would be as disruptive as those taking only the nation-state’s development into account, for the simple fact that they would largely be ignored by political actors, who would feel legitimized (by the utopian character of such discourses) to further reiterate the pre-existing security frameworks previously mentioned. To this purpose, it is fundamental (as mentioned in the third section of this chapter) to understand and study environmental security in relation to other branches of security - energy security in the first place (it is no coincidence that the Russian invasion of Ukraine has pushed several EU members to reconsider coal as an energy source: coal was the fastest and cheapest way to replace the gas imports from Russia). In the end, humankind’s ability to take (firstly) responsibility and (secondly) action will largely determine whether in the next decades planet Earth will gradually recover from the disruption caused by the Great Acceleration or rapidly escalate into what would likely be the collapse of the Earth system, and that of humankind consequently.

After having illustrated the objective threats characterizing XXI century environmental security, the work will now turn to their subjective perception - the next chapter will thus deal with

the arguments of this branch and its consequent criticisms simply because violent conflict - be it actually correlated to climate change or not - would just be the prelude to the far more important and scientifically proved disruption of the Earth system that - for these two reasons - is largely illustrated throughout the last two sections of this chapter.)

¹⁷⁸ Dalby, S. (2018). Environmental change. In P. D. Williams & M. McDonald (Eds.), *Security Studies: An Introduction* (3rd ed.). Routledge. pg. 534-539.

¹⁷⁹ Birman, F., & Perry, E. (2007). Reforming global environmental governance. From UNEP towards a world environment organization. In L. Swart (Ed.), *Global Environmental Governance. Perspectives on the Current Debate*. Center for UN Reform Education. pg. 103-123.

temporality. First, this chapter will end with a scheme (as usual) summarizing the main contents illustrated in it.

Table 5. *Rethinking Environmental Security*

<i>Key aspects</i>	Traditional Environmental Security	New Environmental Security
<i>Actors</i>	<ul style="list-style-type: none"> - Nation-states 	<ul style="list-style-type: none"> - Nation-states - International organizations (“World Environmental Organization” ?) - Local governmental entities (city administrations, regional administrations, etc.) - Citizens (local non-profit organizations? and?)
<i>Mode of interaction</i>	<ul style="list-style-type: none"> - Competition 	<ul style="list-style-type: none"> - Cooperation
<i>Subject of focus</i>	<ul style="list-style-type: none"> - National development (or) - Preservation of the Earth System 	<ul style="list-style-type: none"> - Sustainable Development (national development within the preservation of the Earth system)

II

Time and Temporality

II.I Linking Security and Time: the objective and the subjective

As the previous sections of this work have illustrated, the XXI century has (so far) been a period of growing securitization - in fact, all historical transitory epochs serving as a bridge between a socioeconomic reality no longer sustainable and one not yet achievable are characterized by an instability that pushes humans towards the pursuit of security, the XXI century being no exception to this. But what does security consist of? The definition of security that has become the standard for IR¹⁸⁰ was provided by Arnold Wolfers in 1952:

"Security, in an objective sense, measures the absence of threats to acquired values, in a subjective sense, the absence of fear that such values will be attacked".¹⁸¹

This understanding of security has influenced the academic debate as well as the major international and supranational organizations working in the field of security, which now include in their policies and theoretical frameworks components of both subjective and objective security (an example could be the European Union Agency for Law Enforcement Training¹⁸²). In the last years, several academics have however gone against this idea of a bi-dimensional security, increasingly questioning security's objective dimension: Mariana Valverde points to human aims, assumptions, fears and moods as constituting the basis on which projects aimed at pursuing what is perceived to be "security" are carried out¹⁸³; similarly, Francesc Guillén i Lasierra highlights the essentially subjective nature of security deriving from the subjective elements (such as the consideration of what risks are acceptable, and the choice what is worth protecting) on which it rests.¹⁸⁴ While this argument could be acceptable for those types of security dealing with threats

¹⁸⁰ Møller, B. (2001, September 8-10). Mediterranean Conflict Prevention Security and the Environment in the Mediterranean in the 20 Century - Conceptualising Security and Environmental Conflicts [Paper presented at the 4 Pan-European Conference at the University of Kent at Canterbury]. In *Global, National, Societal and Human Security, A General Discussion with a Case Study from the Middle East*. UK.

¹⁸¹ Wolfers, A. (1952). "National Security" as an Ambiguous Symbol. *Political Science Quarterly*, 67(4). pg. 481-502.

(This definition has inspired the environmental security one provided in the first section of the first chapter, which adapts the same concept to the environmental context)

¹⁸² <https://www.cepol.europa.eu/tags/subjective-security>

¹⁸³ Valverde, M. (2014). Studying the governance of crime and security: Space, time and jurisdiction. *Criminology and Criminal Justice*, 14(4). pg. 379-391.

¹⁸⁴ Lasierra, F. G. (2021). The fallacy of objective security and its consequences. *International e-Journal of Criminal Sciences*, (16).

solely to “acquired values” whose value is purely given by humans, the all-encompassing impact of the menaces with which environmental security is concerned grants it a nature nonetheless objective: in fact, the “ecosystem values in terms of ecosystem goods and services at multiple scale”¹⁸⁵ with which environmental security is concerned have a subjective human value (as they are goods and services for humans), but also an intrinsically objective value, in that they are fundamental components of an Earth system that exists outside of humanity. For example: the absence of freshwater can or cannot be perceived by humankind to threaten its own survival, but it nonetheless threatens the survival of several other animal species existing independently of humankind and its understanding of security. Discourses that grant (environmental) security an exclusively subjective nature stem from anthropocentric biases pushing us to mistake Earth system objectivity for human subjectivity, and are detrimental in that they could further detach humankind from the objectively existing environmental threats that it has to face, whether (subjectively) aware of it or not. Environmental security is thus both objective and subjective¹⁸⁶.

A large space was dedicated in the previous chapter to the scientific description of environmental security threats; while this might seem excessive for a soft sciences’ work, I believe it to be fundamental to capture the objectivity of environmental threats, which must be addressed by any work dealing with environmental security in order to create a solid base of knowledge from which to later move to the other side of security - subjective security. Having dealt with objective security, the work can now turn to subjective security.

Shifting from objective to subjective security pushes us into the realm of *perception* - that is, how a person understands a given objective threat. The previous chapter has shown that the red thread connecting all aspects of environmental security is *time*: from analyzing the changes brought by the Great Acceleration, to illustrating the new environmental reality uncovered by the Anthropocene and Noösphere paradigms, to quantifying the thresholds in the Planetary Boundary framework (how many years remain before a certain planetary boundary will be exceeded; etc.); indeed, time is a central component of security as a whole, for it represents a key parameter through which it is understood: security is based on a reality that is a product of the *past*, it deals with threats and risks in the *present*, and it tries to ensure their absence in the

¹⁸⁵ Zurlini, G., & Müller, F. (2008). Ibid.

¹⁸⁶ See scheme at pg. 15.

future.¹⁸⁷ Yet, the time with which this work has so far dealt with is what is often referred to as “objective time” or “clock time” - that is, the time indicated by the clock and the calendar providing an “objective, quantitative measure of the flow of an all-encompassing time”¹⁸⁸; this is because objective security can only be measured in objective time - thus, attempting a scientific description of environmental security can only be done through the kind of time employed by the scientific method. However, as we now move to the analysis of subjective security, so shall the kind of time analyzed change: in fact, *subjective time measures subjective security to the extent that objective time measures objective security*. To put it simply: if the moment in which planet Earth reaches a certain increase in global temperature is measured in years, then the perception of such a moment should be measured in the perception of such years.

The importance of subjective time in environmental security is also a major conclusion of the Anthropocene and Noösphere paradigms previously illustrated, as they strongly advocate the need for humankind to become aware of having entered a new age, of the past causes behind it, and of the changes in both the Earth system and the global socioeconomic structure that the future entails. As argued by Christophe Bonneuil and Jean-Baptiste Fressoz, the Anthropocene makes us question our understanding of environmental and human futures as well as our interpretation of the past motivations leading to the present situation.¹⁸⁹ An analysis of subjective security then demands us to focus on subjective time - that is, “our sensitivities to the orders and intervals [dictated by the clock]”.¹⁹⁰

Studying human perception of time is nonetheless a complicated task: despite its relevance, the study of time in the social sciences is relatively recent - in fact, this branch of the academic world has until the 1990s been analyzing international social and economic changes through a predominantly *spatial* perspective. There could be several explanations behind the large neglect of time in the field: Barbara Adam points to the dominant role played by the clock in the understanding of time in both social theories and society as a whole, explaining how the seemingly objective nature of time provided by the clock makes humans take time for granted,

¹⁸⁷ Crawford, A. (2018). Temporalities in security: Long-term sustainability, the everyday and the emergent in the Anthropocene. In C. D. Shearing & C. Holley (Eds.), *Criminology and the Anthropocene*. Taylor & Francis Group. pg. 10.

¹⁸⁸ Michelle Bastian. (2012, May 30). Is clock time really objective? *Michelle Bastian*. <https://www.michellebastian.net/home/is-clock-time-really-objective>

¹⁸⁹ Fressoz, J.-B., & Bonneuil, C. (2017). *The Shock of the Anthropocene: The Earth, History and Us* (D. Fernbach, Trans.). Verso Books.

¹⁹⁰ Lloyd, D., & Arstila, V. (Eds.). (2014). *Subjective Time: The Philosophy, Psychology, and Neuroscience of Temporality*. MIT Press. pg. 657.

impeding further analysis and reflection on it.¹⁹¹ Robert Hassan analyzes how the social, economic, and technological changes brought by globalization diverted attention from time onto space, as academics needed to explain the growing interconnectedness of the world.¹⁹² Kimberly Hutchings instead sees the Cold War as the cause behind the disregard of time, for the ongoing opposition between the two blocs gradually pushed scholars into assuming that international relations would have consisted of such a balance of power repeated throughout the centuries - as if “frozen in time”.¹⁹³ As a result, the end of the Cold War (and of the several political, social, and economic conditions that had characterized the world from the end of WWII onwards) pushed in the early 1990s a growing body of intellectuals to begin questioning the predominantly spatially-oriented approach of social sciences and start instead focusing on *time* - that is, humankind’s perception of it. This adjustment to the equilibrium between space and time in the social sciences’ perspective came to be known as the “Temporal turn”, and it allowed for a more balanced understanding of the social world, one in which space and time are both equally important components of human reality.

Before proceeding any further, we should clarify the key concepts of this new chapter: until now, the work has talked about “objective time” and “subjective time”; this was done in order to highlight the duality of time, and create an easy cognitive connection to that of security. This work will not however focus on subjective time as a whole, it will rather focus on a specific aspect of it called “*temporality*”. Temporality is the component of subjective time providing the comprehensive human understanding of past, present, and future; it is only a component of subjective time in that subjective time also consists of what could be called “short-run clock time perception” - subjective but immediate, not connected to a wider existential context like temporality, which is instead the understanding of the “time of our lives”.¹⁹⁴ It is precisely this wider understanding given by temporality that enables the pursuit of security, which (as previously said) rests on the three components of time: past, present and future.

In order to avoid any kind of confusion with the usage of the word “time”, and move away from the multi-faceted term of “subjective time” - the work will from now use the word “time” to refer

¹⁹¹ Adam, B. (1992). Modern Times: The Technology Connection and its Implications for Social Theory. *Time & Society*, 1(2). pg. 175.

¹⁹² Hassan, R. (2010). Globalization and the "Temporal Turn": Recent Trends and Issues in Time Studies. *The Korean Journal of Policy Studies*.

¹⁹³ Hutchings, K. (2008). *Time and world politics : thinking the present* (J. Simons & S. Tormey, Eds.). Manchester University Press. pg. 11.

¹⁹⁴ Hoy, D. C. (2012). *The Time of Our Lives: A Critical History of Temporality*. MIT Press. pg. xiii.

to objective time (clock time, universal time, etc. - they all refer to the same thing), and the word “temporality” to refer to subjective time existentially structured into a wider system of past, present and future.

Despite social sciences’ late arrival to the study of time, human temporality has nonetheless existed since humankind itself, being “categorized and theorized, whether explicitly or implicitly, both in the realm of social life itself and in the ways in which that life is explained and judged”¹⁹⁵. Turning to the history and nature of temporality would then provide the intellectual basis needed to understand the trends uncovered by the temporal turn in social sciences; this is what the next section will deal with.

Importantly, physics has historically been the other major field (together with philosophy) engaged in the study of time; its focus has however been on objective time, and not the human perception of it. This is the reason why this work will not cover the hard-science debate on time, for whether time is a true component of the physical reality of the universe or it is merely an illusion that only exists within humans does not affect our everyday understanding of it - in the words of Tim Stevens:

*“Whether time is a dimension of the fabric of the universe or not is mostly irrelevant to our everyday conception of what time is or might be. It is not unimportant in cosmological terms, but to discover the reality or otherwise of time as a component of physical reality would not materially change the social existence of the human animal, at least not immediately.”*¹⁹⁶

However, for us not to be completely ignorant about the nature of objective time - which is nonetheless the other side of the coin, complementary to subjective time - let us provide a very brief summary of the scientific discussion on objective time: the hard-science understanding of time was until the XX century based on the work of Isaac Newton, who perceived time and space to be true and immutable, “without relation to anything external”¹⁹⁷ - that is, *absolute*. This understanding of absolute time was changed at the beginning of the XX century by Albert Einstein¹⁹⁸, with the discovery that time is not independent from everything else, but instead

¹⁹⁵ Hutchings, K. (2008). Ibid. pg. 5.

¹⁹⁶ Stevens, T. (2016). *Cyber Security and the Politics of Time*. Cambridge University Press. pg. 44.

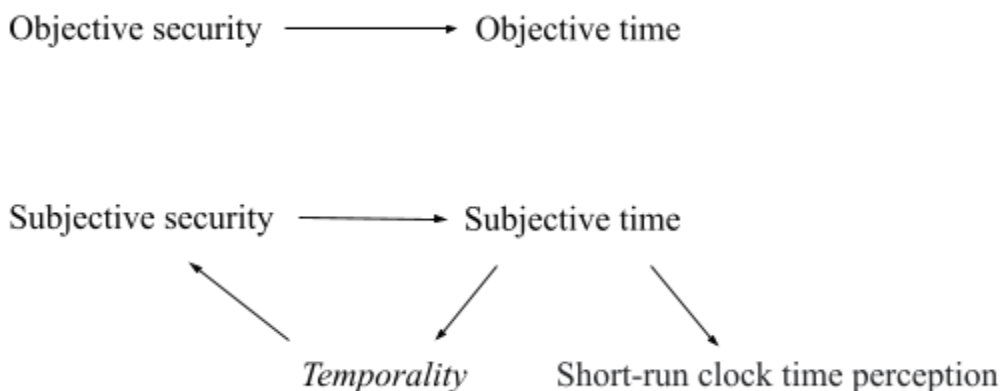
¹⁹⁷ Newton, I., & Motte, A. (2008). *Newton's Principia: The Mathematical Principles Of Natural Philosophy (1846)*. Kessinger Publishing, LLC. pg. 77.

¹⁹⁸ Sivaram, C., Kenath, A., & Kiren, O. V. (2015). Evolution of Time Concept in Physics and in Philosophy. *Physics International*, 6(2). pg. 68-77.

depends both on the location in space and speed of the person measuring it - time is therefore *relative*.¹⁹⁹ In his 2018 fascinating book “The order of Time”, theoretical physicist Carlo Rovelli further elaborated on the relativity of time: after having illustrated the complexity of time - something that the more we study it the less unified and independent it appears - he suggests to dismiss our concept of time and its components of past, present and future, arguing how time and its structures are “useful approximations”²⁰⁰ invented by humankind to make sense of the universe and itself rather than an actual reality.

This brief summary on the study of objective time highlights two phenomena: *the growing relativization of objective time* (for time seems increasingly dependent on a variety of factors of the person’s frame of reference, and a product of our need to understand the world rather than a reality itself), and *the strengthening of the space-time duality* (as time is not independent but depends on the location in space in which it is measured). Both of these two conclusions are relevant to this work, as they encourage the study of (subjective) time in social sciences, within the space-time duality revitalized by the Temporal turn - this is because the absence of an objective reality resting on the two pillars of space and time draws more attention to its equivalent subjective one. Let us then move to temporality. First, a scheme summarizing the arguments of this section.

Table 6. *Uncovering Temporality*



¹⁹⁹ Einstein, A. (2017). *Relativity : the Special and General Theory: Original Version*. CreateSpace Independent Publishing Platform.

²⁰⁰ Rovelli, C. (2018). *The Order of Time* (S. Carnell & E. Segre, Trans.). Penguin Publishing Group. pg. 10. (His work is still to be considered speculative, though highly promising, as it starts from the two major theoretical frameworks of physics - *quantum mechanics* and *general relativity*)

II.II A short history of temporality: the rise of standard (clock) time and Western linear temporality

In the decades preceding the temporal turn in social sciences academics made extensive usage of time in their intellectual frameworks; yet, such usage rested on historical notions of time implicitly taken as both universal and eternal, thus pushing scholars to deal with time without analyzing the very way in which time is measured. Nonetheless, time's unit of measurement is shaped - and itself shapes - the temporality of society. It is then important to analyze the historical developments that first created and later spread what is today's globally accepted measurement of time, and contextualize them in the multiple temporalities of history, as the interaction between these two factors traces the path that led to the temporality through which environmental security is (at least, at the "official" level) understood in the XXI century. Let us do that.

The global time reckoning technique of today is that of the clock (based on the "continuous indication of equal hours" reflecting celestial motions²⁰¹), an invention of humankind reflecting a specific temporality - product of a particular geographical and historical context - that in turn replaced others existing before it. In order to understand how this new temporality came into being, we should first briefly illustrate the kind of temporalities existing in the historical contexts preceding it, though focusing only on a few of historical eras and regions that are the most relevant to understand the rise of today's temporality (for otherwise it would be too burdensome for this work).

Two²⁰² distinctive and mutually exclusive categories of temporality have historically existed: *cyclical temporality* and *linear temporality*.²⁰³ Cyclical temporality perceives past, present and

²⁰¹ Dohrn-van Rossum, G. (1996). *History of the hour : clocks and modern temporal orders* (T. Dunlap, Trans.). University of Chicago Press. pg. 282.

²⁰² (There are two further developments on the concept of temporality that I have not included in this work because of the little weight that they have so far been given in the international academic debate:

1. The first one is the inclusion of another category - apart from linear/cyclical - with which to classify temporality: that of *qualitative/quantitative*, where quantitative temporality is universal and objective while qualitative temporality is concrete and subjective - Maki, Y (2008) *Jikan no hikaku shakaigaku [Comparative sociology of time]* (Tokyo: Iwanami).

2. The second one is the inclusion of a third kind of temporality together with cyclical and linear: that of *static* temporality - MacDonald, P. S. (2013). PALAEO-PHILOSOPHY: ARCHAIC IDEAS ABOUT SPACE AND TIME. *Comparative Philosophy*, 4(2). pg. 82-117.

²⁰³ Shimizu, K., & Noro, S. (2020). An East Asian approach to temporality, subjectivity and ethics: bringing Mahāyāna Buddhist ontological ethics of Nikon into international relations. *Cambridge Review of International Affairs*. pg. 3.

future events as a cycle endlessly repeating itself²⁰⁴, whereas linear temporality perceives time as fundamentally moving unidirectionally from the past to the future²⁰⁵, like an arrow. Several pre-industrial civilizations had a cyclical temporality, being heavily influenced by the cyclical rhythms of the agricultural year²⁰⁶: Classical India (IV-VI century CE) for example perceived time as constituted of four “world ages” (*yugas*) in constant repetitive succession²⁰⁷; in a similar fashion, several Pre-Columbian civilizations such as the Aztecs had a notion of time that “simply treats the present as a reflection of the past”²⁰⁸. In opposition to this cyclical temporality, the Christian tradition - based on both the cyclical teleological temporality of Judaism (moving towards an ultimate telos within a cyclical time²⁰⁹) and the Aristotelian paradigm of time (that introduced a linear temporality in the western thought²¹⁰) - developed a linear teleological temporality that perceived time as flowing from past to future, towards an ultimate *telos* (the Apocalypse). The spreading of Christianity in Europe during the Medieval period allowed this linear temporality to uniformly expand throughout the continent under the “supervision” of the Roman Catholic Church, which held absolute control of time’s reckoning by setting working and praying hours, religious festivities, etc.²¹¹ This role of the Church as the sole actor keeping track of time instilled a religious connotation to the process, which in turn provided the motivation needed to perceive time as a commodity and subsequently rationalize it so as to maximize the usage made of it: monasteries following the “*Ora et Labora*” needed to carefully plan their day so as to be able to both work (in order to make the monastery function) and pray (in order to pay their service to God), as the more time was wasted the less time was spent worshipping God. This view of time subsequently spread to the secular world in the XII century²¹²; it is in this context that mechanical reckoning became diffused later in the XIII century²¹³, thanks to the large

²⁰⁴ MacDonald, P. S. (2013). Ibid

²⁰⁵ Cullmann, O. (2018). *Christ and Time, 3rd Edition*. Wipf & Stock Publishers.

²⁰⁶ Corfield, P. J. (2007). *Time and the Shape of History*. Yale University Press. pg. 83.

²⁰⁷ Rocher, L. (2004). Concepts of Time in Classical India. In R. M. Rosen (Ed.), *Time and Temporality in the Ancient World*. University of Pennsylvania Press, Incorporated. pg. 91-111.

²⁰⁸ Davies, N. (1987). *The Aztec empire : the Toltec resurgence*. University of Oklahoma Press. pg. 3.

²⁰⁹ Brettler, M. (2004). Cyclical and Teleological time in the Hebrew Bible. In R. M. Rosen (Ed.), *Time and Temporality in the Ancient World*. University of Pennsylvania Press, Incorporated.

²¹⁰ Valderrama, N., Ramos-Amzquita, S., Bernal, S., & Negron, A. (2009). Linear Temporality: A Cultural Perspective of the Origin of Life. *Origins of Life and Evolution of the Biosphere*, 39(3-4). Pg. 388-389.

²¹¹ Spruyt, H. (1996). *The Sovereign State and Its Competitors: An Analysis of Systems Change*. Princeton University Press. pg. 70.

²¹² Landes, D. S. (2000). *Revolution in Time: Clocks and the Making of the Modern World*. Viking. pg. 50-56.

²¹³ Andrewes, W. J. (2006, February 1). A Chronicle Of Timekeeping. *Scientific American*.
<https://www.scientificamerican.com/article/a-chronicle-of-timekeeping-2006-02/>

investments of the church, which needed such mechanical devices in order to more precisely and easily coordinate an increasingly complex and diversified human life.

When Secular²¹⁴ power gained the upper hand over Spiritual power - thus causing the control over temporality to shift from the Church to the Sovereign - the linear teleological temporality created by Christianity and the subsequent rationalization and mechanization imprinted by the Church were so embedded in the European civilization that they were not brought into question, thereby causing secular society to “reproduce and refine [temporality] rather than challenge or alter it (...) [the reason for which] *the roots of modern time can be found in religious authority*”²¹⁵. The growth of cities in Early modern Europe thus strengthened the existing temporality and its characteristics: Protestantism adapted the linear teleological temporality of the Church into the new socio economic framework of mercantilism (working was now the mean to ensure reaching salvation when the telos at the end of times would have arrived)²¹⁶, and the creation of the mechanical clock in the XIV century provided a more stable and precise way to regulate all aspects of life in an urban society moved by the growing number of social and commercial obligations. The socio economic system developed by mercantilism brought a growing need for resources that pushed European nations towards the pursuit of foreign territories to exploit²¹⁷. Such a quest for colonies demanded long-distance travels that were only made possible thanks to more accurate time reckoning devices allowing the measurement of longitude.²¹⁸ Colonizing powers began to export their temporality and clock time (often referred to as “standard time”) to their newly established colonies, as they needed a single understanding and measurement of time in order to efficiently coordinate their empires. Thus, *the more (western) time became defined, the more it became powerful, along with the temporality it expressed*.

The historical progressivism (the belief in the possibility for humankind to improve over time through political action) brought by the Enlightenment based itself on the existing linear teleological temporality, but ultimately secularized its telos, in culmination of the gradual detachment from religion that had been developing in the previous centuries: humanity was still

²¹⁴ (I here refer to “Temporal power” - I have decided not to use the word “temporal” so as not to cause confusion with the other time-related concepts used in this work)

²¹⁵ Hom, A. R. (2010). Hegemonic metronome: the ascendancy of Western standard time. *Review of International Studies*, 36(4). pg. 1155.

²¹⁶ Weber, M. (2013). *The Protestant Ethic and the Spirit of Capitalism*. Merchant Books.

²¹⁷ Belshaw, J. D. (2015). *Canadian History: Pre-Confederation* (1st ed.). Victoria, B.C.: BCampus. pg. 180.

²¹⁸ Howse, D. (1980). *Greenwich time and the discovery of the longitude*. Oxford University Press.

moving forward towards a telos; however, this ultimate aim was no longer the Apocalypse, but instead the final victory of human reason and rationality, achievable through the actions of humans themselves.²¹⁹ Humankind became the new master of the same Time.

The mechanization of production and the working conditions brought by the Industrial Revolution in the XVIII century increased society's sensitivity to the organization of time²²⁰, as employers had an interest in ensuring an efficient usage of time able to maximize profit while minimizing losses, and employees had an interest in maximizing their leisure time and minimizing their working time. As in the previous centuries had been first in the *church* and then in the *city*, now in the *factory* time became once again the subject of contention, following the same dynamics of the previous epochs that further reiterated the existing temporality. In the words of Andrew R. Hom:

*"In this manner, factory labourers, like city leaders before them, contested authority over time without challenging the authority of a particular type of time - they fought not against time, but about it'. As cities imported the Church's time within their walls, workers imported capitalist time into their daily lives (...) Much like urban serial engagements, such practices contributed to the further compartmentalisation of modern life and the embedding of rationalised time consciousness."*²²¹

The Second Industrial Revolution in the XIX century led to a rapid acceleration of colonialism, as the booming productivity of Europe demanded an ever increasing quantity of raw materials present in other continents.²²² However, while XVIII century mercantilist imperialism was inherently interested in the acquisition of commodities, XIX century nationalist imperialism, influenced by the historical progressivism brought the Enlightenment, enacted "a crusade to transmit [Western European] national culture and institutions to the periphery"²²³ - the so called "White Man's burden"²²⁴. This new colonial approach made western temporality and clock time penetrate from "the colony" into "the colonized", as subjugated locals were increasingly pushed

²¹⁹ Hom, A., McIntosh, C., & Stockdale, L. (Eds.). (2016). *Time, Temporality and Global Politics*. E-International Relations. pg. 8.

²²⁰ Dohrn-van Rossum, G. (1996). *History of the hour : clocks and modern temporal orders* (T. Dunlap, Trans.). University of Chicago Press. pg. 8.

²²¹ Hom, A. R. (2010). Ibid. pg. 1160.

²²² Parvanova, D. (2017). The industrial revolution was the force behind the New Imperialism. *ESSAI*, 15(30).

²²³ Hall, R. B. (1999). *National Collective Identity: Social Constructs and International Systems*. Columbia University Press. pg. 95.

²²⁴ Brooks, C., & Faulkner, P. (Eds.). (1996). *The White Man's Burdens: An Anthology of British Poetry of the Empire*. University of Exeter Press.

to absorb the culture (thus the temporality) of their colonizers in the hope of integrating into the new colonial society and ensuring better living conditions for themselves. This transformation implied a radical cultural shift for the societies of the colonies, which often had cyclical temporalities (like the ones introduced at the beginning of this section) opposite to the Western one that they had to adopt.

The XIX and XX century thus witnessed the larger and cultural spread of Western linear temporality and clock time internationally, as colonial empires needed a single, standardized time allowing them to interact both within and between their global empires. While ships exported western temporality and clock time to foreign territories, railroads and telegraphs ensured their uniform spreading within them, and colonial schools embedded them within their societies' ethos²²⁵ - ultimately leading at the beginning of the XX century to the "world-wide convergence of time".²²⁶ As a result, when decolonization arrived in the middle of the XX century, the same dynamic that had characterized previous historical transformations - the struggle over the control of time, without questioning the temporality at its roots - applied, because those intellectuals at the head of the decolonization movements had formed in the very institutions of the countries from which they were trying to liberate their own nations. Thus, as of today, Western clock time and its underlying linear temporality are what Hom calls "*modernity's most global hegemon*"²²⁷, constituting a fundamental pillar on which sovereignty rests, and shaping all aspects of national as well as international social, economic, and political relations.

Western linear temporality has however in recent years been the focus of feminist and postcolonialist studies, with a surge in academics claiming the need to abandon the idea of a single globally hegemonic temporality - rooted in colonial exploitation²²⁸ - and move towards the acceptance of the multiple temporalities that are in reality present (but obscured by the hegemonic western linear one) in the world and within individual societies themselves - what Hutchings identifies with the term "*heterotemporality*".²²⁹ Within this context, any work that does not accept any particular temporality a priori moves in the direction of such a task - this work included. Let us then move to the critical analysis of temporality.

²²⁵ Hom, A. R. (2010). Ibid. pg. 1160-1165.

²²⁶ Bayly, C. A., & Bayly, C. A. (2004). *The birth of the modern world, 1780-1914 : global connections and comparisons*. Wiley. pg. 17.

²²⁷ Hom, A. R. (2010). Ibid. pg. 1168.

²²⁸ Hunfeld, K. (2022). The coloniality of time in the global justice debate: de-centring Western linear temporality. *Journal of Global Ethics*, 18(1). pg. 100-117.

²²⁹ Hutchings, K. (2008). Ibid.

II.III Uncovering temporality: identity formation in the new environmental age

The previous segment of the work has illustrated the different kinds of temporality existing as well as their interaction and development throughout the centuries; apart from providing an understanding of the characteristics of the current temporality and the causes behind its birth, the aim of the section was to show the essentially relative character of temporality itself (and the time on which it's based): realizing that different civilizations had different temporalities depending on both their historical period and geographical location allows us to adopt a more critical stance towards the current temporality, as it is not the sole understanding of past, present and future to have ever existed. The absence of an "absolute" temporality should then make us shift our focus to the very nature of temporality, analyzing the motivations and dynamics behind its formation and existence - that is, why do humans structure time into the wider framework of past, present and future? This section aims at addressing such a question.

A fundamental contribution to the analysis of time in social sciences was provided by Norbert Elias in several influential works throughout his career. Instead of focusing primarily on temporality, Elias draws our attention to the concept of *timing*, which he perceives to be analytically prior to both time and temporality. Timing can be understood as the practice based on "people's capacity for connecting with each other two or more different sequences of continuous changes, one of which serves as a timing standard for the other"²³⁰. This phenomenon can be better understood by explaining the origins of it: timing first emerged in agricultural societies, who needed to coordinate their harvests with the seasonal changes in order to ensure survival; within this context, seasons provided the timing standard through which harvest could be organized (planting a species of plant in winter, reaping another one in summer, etc.). At the heart of this timing practice rests the human ability - and need - to make sense of the changes happening in the surrounding environment, thanks to his/her biological capacity to remember²³¹ and synthesize them into a meaningful whole. These changes are experienced in two main ways: *continuity/discontinuity* (an event taken as frame of reference to distinguish a before and after - for example: before the winter of two years ago the neighborhood was full of parrots; no parrots

²³⁰ Elias, N. (1993). *Time: An Essay* (E. Jephcott, Trans.). Blackwell. pg. 72.

²³¹ Bisaz, R., Travaglia, A., & Alberini, C. M. (2014). The neurobiological bases of memory formation: from physiological conditions to psychopathology. *Psychopathology*, 47(6). pg. 347-356.

have been seen since the winter of two years ago), and *recurrence* (the regular repetition of the same phenomenon, like the seasons or a particular holiday).²³²

Apart from ensuring the most basic human need for survival, timing also satisfies the more subtle existential necessity of assigning changes - therefore life - a meaning; this meaning in turn reflects and organizes the specific goals and values that any given society possesses and wishes to strengthen through a specific interpretation of change; for example: Christianity takes the birth of Jesus as the frame of reference with which to measure discontinuity - that is, change - and it gives this event the meaning of being the beginning of a new era. By assigning such meaning to the event, Christianity in turn expresses its belief in sacrifice, forgiveness and human redemption (which are the values expressed by the figure of Jesus, taken as a frame of reference).

Timing is thus an action undertaken to firstly ensure species survival and secondly satisfy existential and social necessities, and it has two characteristics: it is always relative (as the frame of reference according to which something is perceived as having changed or not is a matter of choice); it is always specific (as it is carried out from someone to make sense of specific changes).²³³

With the passing of centuries societies became increasingly more complex and interconnected, creating long chains of social relations that moved away from the purely local environment; within this context, more abstract frames of reference measuring change were needed, so that more and more people could understand a given timing process (a poet from the Kingdom of Venice wouldn't have understood when to meet a blacksmith from a village in England if the latter would have told him to meet on the month in which his village's cherry trees would blossom). Symbols that could more abstractly provide frames of reference were thus created; the concept of "time" being nothing but a product of such development: through symbolic language, the essential characteristics of a timing activity were transposed into a seemingly objective and freestanding time²³⁴, which was in turn provided with increasingly more universal, abstract and precise methods of reckoning (seen in the previous section). Therefore, what we perceive to be the "objective time" given by the calendar is in fact the product of a widely accepted - but nonetheless subjective - timing practice taking the calendar as the frame of reference to perceive

²³² Tabboni, S. (2001). The Idea of Social Time in Norbert Elias. *Time & Society*, 10(1). pg. 5-27.

²³³ Hom, A. R., & Solomon, T. (2016). Timing, Identity, and Emotion in International Relations. In A. Hom, L. Stockdale, & C. McIntosh (Eds.), *Time, Temporality and Global Politics*. E-International Relations. pg. 22.

²³⁴ Ibid. pg. 22-23.

change. Similarly, temporality has its origin in timing, because the human understanding of past, present and future depends on the frame of reference used to measure change (which is what differentiates past, present and future) and assign meaning to it. Both time and temporality are then simply the local result of a more meaningful underlying universal process through which humans seek to define themselves and what surrounds them. This is well summarized in the words of Simonetta Tabboni:

*“Human societies construct changeable ways of measuring time with the non-changeable purpose of connecting change to the meaning they intend to confer on collective works, history and individual life in general.”*²³⁵

Being a product of timing, temporality (and the time on which it rests) is consequently purely relative and positional, existing insofar as it is able to satisfy a specific purpose for a particular society or individual.²³⁶ Among such purposes is the vital process of *identity formation*, which plays a fundamental role in environmental security - the topic with which this work deals. Let us then turn to the analysis of such a process.²³⁷

While the study of identity formation is often limited to the stages of early life (childhood, adolescence²³⁸) during which identity is initially developed; increasing research points to the fact that identity continues to be formed throughout adulthood.²³⁹ This view is consistent with that of Erik Erikson (one of the most prominent figures in the study of identity), who believed the construction of identity to be a lifelong process (particularly important during adolescence).²⁴⁰ Identity formation can be understood as “the complex manner in which human beings establish a *unique* view of self (...) characterized by *continuity* and *inner unity*”²⁴¹: through social interaction

²³⁵ Tabboni, S. (2001). The Idea of Social Time in Norbert Elias. *Time & Society*, 10(1). pg. 9.

²³⁶ Hom, A. R., & Solomon, T. (2016). Ibid. pg. 23.

²³⁷ (The next paragraph is in part based on the work of Andrew R. Hom and Ty Solomon.)

²³⁸ Sokol, J. T. (2009). Identity Development Throughout the Lifetime: An Examination of Eriksonian Theory. *Graduate Journal of Counseling Psychology*, 1(2).

²³⁹ Kroger, J. (2016). Identity development through adulthood: The move toward "wholeness". In K. C. McLean & M. Syed (Eds.), *The Oxford Handbook of Identity Development*. Oxford University Press.

²⁴⁰ van Doeselaar, L., McLean, K. C., Meeus, W., Denissen, J. A., & Klimstra, T. A. (2020). Adolescents' Identity Formation: Linking the Narrative and the Dual-Cycle Approach. *Journal of Youth and Adolescence*, 49. pg. 818–835.

²⁴¹ Herman, W. E. (2011). Identity Formation. In J. A. Naglieri & S. Goldstein (Eds.), *Encyclopedia of Child Behavior and Development*. Springer. pg. 779-781.

with their surrounding environment²⁴², humans construct a mental representation of themselves (therefore subjective) which serves as a “fundamental organizing principle”²⁴³ able to synthesize their experiences in a way that provides them with a sense of continuity (perceiving the self as being the same over time²⁴⁴) and inner unity (perceiving the self as coherent across life domains²⁴⁵), as well as a feeling of uniqueness (a frame to differentiate between self and others)²⁴⁶. Continuity and inner unity are needed to provide the individual with a sense of stability, while uniqueness allows the individual to function autonomously from others.²⁴⁷

Given that a fundamental purpose for which temporality is created is that of forming identity, it is logical to assume that it will have to satisfy the three pillars on which identity rests - that is: continuity, inner unity and uniqueness. Therefore, this work argues that *human understanding of past, present and future is constructed so as to give humans a sense of being the same over time, being coherent across all life domains, and being different from others*. While this might be more burdensome to show at the individual level, we can attempt a simple example at the societal level (a more structured reasoning leading to such a statement will nonetheless be provided in the next page) by once again looking at one of the religions with which this work has dealt with in its previous section. This is because religions have historically provided the “intellectual” framework determining society’s temporality, as they were in control of all aspects of life not strictly material - identity formation being one of them. Let us then take the example of Christianity: Christianity traditionally²⁴⁸ adopts a non-evolutionary view of history that provides humans with continuity (being the same over time); it rests on the (eternal) future of Heaven or Hell²⁴⁹, which symbolizes the dichotomy of good and evil through which it strictly categorizes

²⁴² (The literature on identity development is complex and in continuous development: several recent authors point to the importance of social identities and their influence on individual ones; others instead focus on the hereditary aspects of identity. While surely interesting, these issues won’t be analyzed in this section, as they are not directly connected to the aim of the work.)

²⁴³ Ragelienė, T. (2016). Links of Adolescents Identity Development and Relationship with Peers: A Systematic Literature Review. *J Can Acad Child Adolesc Psychiatry*, 25(2). pg. 98.

²⁴⁴ Klein, S. B. (2014). Sameness and the Self: Philosophical and Psychological Considerations. *Frontiers in Psychology*, 5(29). pg. 1.

²⁴⁵ van Doeselaar, L., Becht, A. I., Klimstra, T. A., & Meeus, W. H.J. (2018). Ibid.

²⁴⁶ Erikson, E. H. (1968). *Identity: Youth and Crisis*. W. W. Norton.

²⁴⁷ Erikson, E. H. (1968). Ibid.

²⁴⁸ This work focuses only on the two largest branches of Christianity - that is, Catholicism and Protestantism - not taking into account the many other branches and sub-branches existing.

²⁴⁹ (Purgatory - apart from rising out of an economic necessity of the Catholic Church (the selling of the indulgences) rather than a real teleological will - was not conceptualized as an “ultimate destination” for souls, but instead as a temporary, intermediate place where souls would go to purify, in order to ultimately move to either Heaven or Hell. This further strengthens the good/bad dichotomy of Christianity.)

every person as belonging to either one of the two groups - thus providing humans with inner unity (being the same across all life domains); and it envisages a future in Hell for all those who die as non-Christians - thereby granting to its believers a feeling of uniqueness (being different from others).

Thus, in order to understand how temporality comes into being, one should look at the pillars on which identity rests (continuity, inner unity and uniqueness) and the conditions satisfying them.

This section has so far illustrated identity, its characteristics and the dynamics behind its (continuous) formation by resting on the assumption that a fundamental purpose of temporality is that of contributing to identity's development, and that therefore, for us to understand temporality's nature and reasons behind its creation (which is itself fundamental to environmental security - the ultimate subject of analysis of this work), we should draw our attention to the former.²⁵⁰ Yet, this work still has not explained the actual reason why temporality is a fundamental component of identity formation. This is because the very notion of "identity formation" (and that of "identity" itself) is complex, and needs to be elucidated - indeed, explaining the connection between two concepts (temporality and identity formation) without having illustrated one of them would have made this section both confusing and unproductive. Now that it has described identity and its characteristics, the work can move to a more clear explanation of the role played by temporality in identity formation (by focusing on identity's pillars, as previously said), to later analyze the relation between the two within the environmental security context.

Why is temporality fundamental to identity formation? To answer this question we can once again draw on the work of Erik Erikson: Erikson introduces the concept of "*temporal identity integration*", which can be defined as "the ability [of individuals] to reconcile and integrate their past experiences, current concerns, and future prospects."²⁵¹ This activity is aimed at providing "a sense of general continuity across time"²⁵², a narrative able to coherently synthesize the then,

²⁵⁰ (A set of schemes at the end of the section will schematize all concepts illustrated in this part of the work, as well as give a general understanding of the connection between environmental security, temporality, and identity.)

²⁵¹ Syed, M., & Mitchell, L. L. (2015). Temporal Identity Integration as a Core Developmental Process. In S. M. Kosslyn, R. A. Scott, M. C. Buchmann, & R. H. Scott (Eds.), *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary Searchable, and Linkable Reference for the 21st Century*. John Wiley & Sons, Incorporated. pg. 1.

²⁵² Syed, M., & McLean, K. C. (2015). Understanding identity integration: Theoretical, methodological, and applied issues. *Journal of Adolescence*. pg. 5.

now, and if/when.²⁵³ Identity formation is thus a process that constantly unfolds in the present moment (as this is the only time inhabited by humans, therefore the only one in which psychological activities are carried out) whose central subjects of analysis and constitutive elements however include the dimensions of past and future (that is: the subjective perception of them). The work of Ty Solomon provides a good account of this peculiar nature of identity, that he calls “temporally decentred”²⁵⁴: he argues that identity contains both a backward-facing and a forward-facing perspective through which humans analyze and understand their past experiences and future possible experiences in a way that enables them to make sense of their present self and consequently take action. Let us clarify this concept with a simple example: a man finds a lost wallet on the sidewalk, and thinks about what to do with it; he does this by analyzing his past actions (whether he has generally behaved in an honest way so as to justify returning a wallet, or not), as well as future possible ones (asking himself “would I return a lost wallet if I would find one?”). By looking at both his past and future, the man constructs his identity in the present and consequently takes action (he remembers to have always adhered to a good moral conduct, he thinks that if he were to find a wallet on the street he would return it, therefore he perceives himself as a righteous man who returns wallets, and returns the one he just found). Indeed, as simplified in this example, no present identity could exist without the dimensions of past (provided by memory²⁵⁵) and future through which humans recall and project themselves.

It is important here to stress the purely subjective realm in which this process take place, as humans can only recall their past experiences and project their future ones within the realm of subjectiveness (no one apart from us, and no objective unit of measurement, would be able to determine how we remember to have felt at our birthday ten years ago, nor how we believe we will feel at our next birthday in two months). Temporality therefore plays a role in identity formation in that the continuous process through which identity is formed entails persons to look back at what they *perceive* their past to have been (through memory²⁵⁶), and look forward to what they *believe* their future will be. What characteristics does this purely subjective understanding

²⁵³ Pasupathi, M. (2016). Autobiographical reasoning and my discontent: alternative paths from narrative to identity. In M. Syed & K. C. McLean (Eds.), *The Oxford Handbook of Identity Development*. Oxford University Press. Pg. 166 -181.

²⁵⁴ Solomon, T. (2014). Time and Subjectivity in World Politics. *International Studies Quarterly*, 58(4). pg. 671-681.

²⁵⁵ (The importance of memory to identity formation has historically been a major subject of study in both philosophy and psychology: Locke famously argued in his 1690 work “*An Essay Concerning Human Understanding*” that personal identity rests on memory, and therefore can only be possible to the extent that memory exists.)

²⁵⁶ Klein, S. B., & Nichols, S. (2012). Memory and the Sense of Personal Identity. *Mind*, 121(483).

of past and future have? Given its purpose of forming identity, this temporality is constructed so as to satisfy the pillars on which identity rests. The work can now reconnect to the earlier statement that “human understanding of past, present and future is constructed so as to give humans a sense of being the same over time, being coherent across all life domains, and being different from others”.

Having established that temporality is shaped so as to satisfy the pillars of identity, the work should (and will) now concretely illustrate *what* kind of temporality is able to satisfy such pillars. Although analyzing all three components of identity would surely yield interesting points of reflection for the social sciences, this work will only focus on *continuity*, because it believes it to be directly connected to the topic of environmental security with which this work ultimately deals.²⁵⁷ Let us then turn to the temporality needed to provide the self with a sense of continuity. Continuity entails humans to re elaborate their past and perceive their future so as to confirm their present identity²⁵⁸ - presenting it as a constant and ever-existing factor. As explained by Andrew R. Hom and Ty Solomon:

*“The subject is thus an open self, produced at the ever-changing nexus of these ‘backward’ and ‘forward’ temporalities and constituted through identity practices simultaneously facing in both temporal directions. Both retro- and pro-spection come together in an evolving present, where the subject takes actions or reacts to situations in accordance with her commitments. All of which is to say that the social agent’s identity poses the standard by which all the changes she experiences are integrated and coordinated into a coherent, consistent, and intelligible story of her life that produces and confirms who she is.”*²⁵⁹

What kind of temporality is needed to provide the self with such a sense of being the same over time? Hom and Solomon point to the connection between a sense of stable self and that of a stable time, in that the temporal qualities of identity require a stable sense of time for there to be a stable sense of self. In their words:

²⁵⁷ (Inner unity and uniqueness do not share the direct temporal quality of continuity, and are therefore less relevant to works focused on temporality such as this one; this does not mean however that they would not be relevant to studies on environmental security.)

²⁵⁸ To confirm their *present* identity - because there is no other identity apart from the one humans perceive in the present, as explained in the beginning of this paragraph.

²⁵⁹ Hom, A. R., & Solomon, T. (2016). Ibid. pg. 25.

*“It is not just that we want a stable sense of who we are, we also desire a stable and full sense that the time we inhabit is consistent, reliable, and orderly rather than some onrushing and untamable river of unintelligible events.”*²⁶⁰

Indeed, identity and temporality are deeply interconnected, as both entail the “integration of past, present, and future into a sense of continuity.”²⁶¹

As the feeling of being the same over time provides the self with a sense of stability (as previously explained), human perception of past and future is ultimately shaped to this purpose. It can therefore be argued that *humans construct stable temporalities with the (constant) aim of providing themselves with a stable sense of self.*

Such a stable temporality consists of perceiving the flow of time as stable, therefore of a future perceived as a continuation of the present (because the present is where past events are accommodated into a coherent understanding of the flow of time). When imagining the future, humans will thus think of a time characterized by the same kind of events as the ones that they now live in the present and remember to have lived in the past, as the unfolding of unprecedented events would disrupt the sense of continuity that their identity needs.²⁶² Since identity in turn determines action (as previously explained), *humans act imagining the future as being characterized by the same kind of events characterizing the present.*

How does this relate to environmental security? A large part of the previous chapter was dedicated to the changes in the Earth System leading to what many scientists believe to be a “new environmental era”²⁶³: the Anthropocene and Noösphere paradigms - despite having different outlooks on the future - both acknowledge the beginning of a new “era” for planet Earth, highlighting the risks as well as opportunities coming from it²⁶⁴; the Great Acceleration graphs and the Planetary Boundary Framework provide the scientific backing to such a claim, and outline the ecological thresholds to be respected for humankind to thrive within this new

²⁶⁰ Ibid. pg. 31.

²⁶¹ Rappaport, H., Enrich, K., & Wilson, A. (1982). Ego Identity and Temporality: Psychoanalytic and Existential Perspectives. *Journal of Humanistic Psychology*, 22(4). pg. 53.

²⁶² (This is consistent with research on trauma, which points to how violent and unexpected experiences break our temporality, with consequent repercussions on identity – see Jenny, E., & Edkins, J. (2003). *Trauma and the Memory of Politics*. Cambridge University Press.)

²⁶³ Whether this new era can be classified as a geological epoch or not does not have substantial importance, the work rather refers to a new historical period marked by an unprecedented relation between humankind and the Earth system.

²⁶⁴ Dalby, S. (2020). *Anthropocene Geopolitics: Globalization, Security, Sustainability*. University of Ottawa Press.

historical context and avoid a series of unprecedented ecological disruptive changes; finally, the last section of the chapter highlights some of the major “reforms” that will need to be undertaken at the political and socioeconomic level for humankind to ensure an effective pursuit of environmental security in the future. Thus, the bigger picture emerging from the previous chapter is that of having entered a new historical period marked by a different relation between humankind and the Earth system, and the necessity for humankind to acknowledge the future unprecedented ecological changes (human extinction being a possible one of them) that this new environmental era will have if the current socioeconomic and ecological trends are to continue, and effectively take action so as to prevent them from happening.²⁶⁵ This chapter has however proved that human perception of the future cannot accommodate changes that are unprecedented, because they would disrupt the sense of continuity needed by identity. As the ability to take action rests on identity, and identity rests on temporality, the inability of the current temporality to accommodate such changes translates into the inability of humankind to take effective action against the increasing deterioration of the Earth System; this conclusion can be proved by the preoccupying findings shown in the planetary boundary framework, thoroughly illustrated in the third section of the first chapter of this work. This in turn directly impacts the pursuit of environmental security.

Therefore, it can be argued that *humans construct a kind of temporality²⁶⁶ unable to acknowledge the changes that the new environmental era entails - because such changes would deprive the human self of the sense of stability on which it rests - consequently preventing effective action against environmental disruption from being taken, and ultimately hindering the pursuit of environmental security in the XXI century.*

We can try to provide a general rule on which to base the concept stated above by saying that *reality is a victim of temporality, which is in turn a victim of the self.* The work here uses the word “reality” so as to stress (once again, as done at the beginning of this chapter) the objective threat constituted by the disruption of the Earth System; while the usage of this word might be arguable (this section does not intend to embark on a philosophical discussion as to the actual

²⁶⁵ (The work here refers to “ecological changes” in order to indicate the disruptive tendencies characterizing the Earth System, and “action” in order to indicate the changes in the socioeconomic and political human system needed to prevent such tendencies. The two are in fact deeply interconnected: actions changing the human system will need to happen in order to avoid negative changes in the Earth System. Drastic changes will therefore happen; whether such changes will be of a socioeconomic and political or ecological nature will largely depend on humankind.)

²⁶⁶ (The work here does not refer to any specific temporality, rather the general human process of temporality construction stemming from intellectual - therefore biological - needs.)

existence of an objectivity), this work believes that the non-exclusively human repercussions of the threats affecting environmental security demand granting them a non-exclusively human nature - that is, existing outside of human subjectivity: objective.

This section has tried illustrating the complex relation between identity, temporality and environmental security; in doing this, it has set out the central issue with which this work deals. It is now appropriate to move to the analysis of this issue; to this purpose, the next section will move away from the psychological approach adopted here, in favor of a more philosophical one. Let us first summarize the concepts so far introduced here with a set of schemes.

Table 7. *The temporal nature of identity*

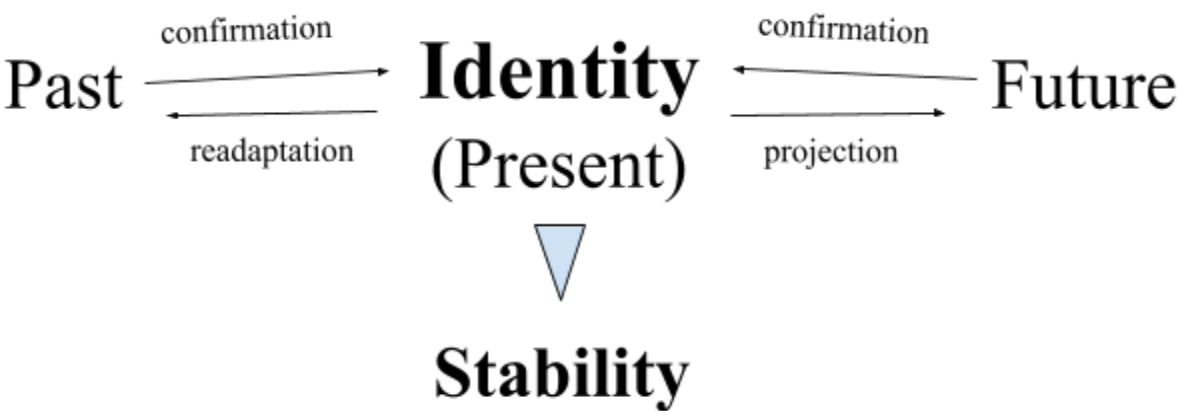
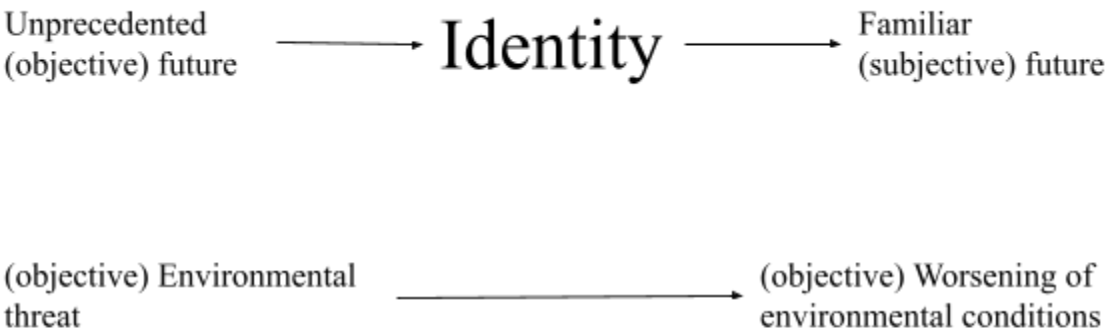


Table 8. *The “temporal trap”: identity, environmental security, temporality in the XXI century*



II.IV Overcoming the temporal trap: provoking anxiety through creative dystopias

*El tiempo es la sustancia de que estoy hecho.
El tiempo es un río que me arrebató, pero yo soy el río;
es un tigre que me destroza, pero yo soy el tigre;
es un fuego que me consume, pero yo soy el fuego.*²⁶⁷
- Jorge Luis Borges.

The issue raised in the previous section is not an easy one to be solved: it has been argued that the inherently biological need for a stable identity pushes humans towards the construction of a temporality that in the XXI century has the direct effect of hindering the pursuit of environmental security. How to escape this *temporal trap*? The most immediate answer to this - further confirmed by the overall negative picture presented by the Planetary Boundary Framework - is that there is no way of escaping it, and indeed, humankind is doomed to continue its disruption of the Earth System until such a disruption will eventually lead to the extinction of humankind itself (unless humans will have in the meantime found ways to colonize other planets, which, according to the most recent technological developments, seems rather unlikely). Yet, such a conclusion is of no use to the field of environmental security, as it provides no solution - therefore action - against environmental disruption. Since I believe that any action should either be useful or provide happiness, and I do not gain happiness from writing this thesis, it follows that my work must nonetheless continue in order to try providing viable (therefore useful) solutions to the temporal trap presented in the previous section. This part of the work will try to fulfill this task.

The root underlying the problem contained in the temporal trap is the inherently *unprecedented* nature of the ecological events threatening planet Earth: if the stability on which our identity rests can only be provided by an underlying sense of stable time in which the past is remembered and the future is imagined so that both can serve as a confirmation of the present (identity), the possibility of unprecedented events in the future would automatically cause our “coherent, comprehensive, and clean vision of our self to falter.”²⁶⁸ Within this context, the only way to

²⁶⁷ Borges, J. L. (1960). Nueva refutación del tiempo. In *Otras inquisiciones*. Emecè, Buenos Aires. pg. 301.

²⁶⁸ Hom, A. R., & Solomon, T. (2016). Ibid. pg. 27.

solve the temporal trap is to *find a way for humans to imagine unprecedented events in a way that does not disrupt their identity's stability*. In order to do this, it is important to focus on the human perception of the dimension from which these events stem - that is: the future.

One of the major figures to have contributed to the study of temporality - especially in its future dimension - is Martin Heidegger; this section of the work will partly draw on his work on the topic, ultimately expressed in his revolutionary 1927 book "*Being and Time*".

Heidegger goes against the classic philosophical tradition (stemming from Descartes) of dividing the world into two distinctly separated categories of substances - thinking things (capable of thought: human beings) and extended things (incapable of thought: the world made of objects surrounding humans)²⁶⁹ - by highlighting the essential nature of human beings²⁷⁰ as "being-in-the-world": humans are not isolated subjects detached from the world (as in those movies in which aliens would come visit planet Earth and cold-bloodedly analyze it), they are rather beings "immersed" in it, in a world that constitutes the environment surrounding them as they live their everyday life. The world is part of who human beings are, as human beings cannot exist apart from their relationship with the world - that is: their everyday life, which in turn rests on moods (happiness, fear, boredom, love, etc.). Let us clarify this concept with an example: a man won't be able to exist independently from the world in which he is immersed as he lives his everyday life, because who the man is will depend on the love that he has for his significant other, the boredom that he feels when he watches cheap superhero movies at the cinema, the fear of spiders that he has had since childhood, the affection towards his siblings, etc. This argument is consistent with the study of identity introduced in the previous section, which illustrated identity as shaped by the social interaction with one's surrounding environment, rather than a thing existing per se, outside of the world in which one lives.

Humans are therefore "thrown" into a world (in the meaning that every human was - not by his own choice - given birth to, and consequently forced to having to deal with the matters of life²⁷¹; inspiring Jim Morrison's lyrics "into this world we're thrown"²⁷²) that they make part of their

²⁶⁹ Critchley, S. (2009, June 22). Being and Time, part 3: Being-in-the-world | Simon Critchley. *The Guardian*. <https://www.theguardian.com/commentisfree/belief/2009/jun/22/heidegger-religion-philosophy>

²⁷⁰ (Heidegger refers to the human being as "*Dasein*" - a word which can be translated in many ways, but it is best rendered as "being-there". This work won't use neither this term nor several other terms deployed by Heidegger, as it is not of direct relevance to it and it might complicate the section in an unnecessary way.)

²⁷¹ Chabot, R. (2018). Life is Suffering: Thrownness, Duhkha, Gaps, and the Origin of Existential-Spiritual Needs for Information. *Proceedings of the Annual Conference of CAIS / Actes Du congrès Annuel De l'ACSI*.

²⁷² The Doors. (1971). Riders on the Storm. In *L.A. Woman*.

own Self as they experience it in life. If our sense of Self is formed throughout the life that we experience, then it is not a fixed thing, but a process - not a being, but better understood as a *becoming* which leaves the Self always incomplete, since humans continuously experience new events as their life goes on. This conclusion is in line with the previous section of this work, which described identity as consisting of an on-going process of looking back into one's past and forward into one's future, rather than it being a fixed constant attribute²⁷³.

The life that humans experience is however finite, as we can only exist in the period in between our birth and our death, which is the ultimate certainty that characterizes the human being and that puts an end to the becoming of the Self (as we can no longer experience the world and turn these experiences into our self). Human beings are therefore incomplete - in constant construction of their own Self - until their death. This "permanent incompleteness"²⁷⁴ that characterizes human beings (always constructing their sense of Self through new experiences) gives them a strong orientation towards the future, as that is where new experiences come from. However, the ultimate future experience that makes the Self complete - death (because, simply put, it is the last thing to happen to humans, and it certainly happens to all of them) - is known but it cannot be truly understood, as it cannot be experienced in life (remembering Epicurus: "when we exist, death is not yet present, and when death is present, then we do not exist."²⁷⁵). This orientation towards the future and the contrasting inability of truly understanding (despite knowing) the ultimate future event making the human Self complete (death) produces the mood of *anxiety*. Unlike all other moods that push human beings to engage in the world of their everyday life, anxiety pulls them away from it.²⁷⁶ Anxiety can thus be understood as the breaking of Maya's veil: "the experience of detachment from things and from others where I can begin to think freely for myself"²⁷⁷ - a feeling similar to Jean-Paul Sartre's "nausea"²⁷⁸ through which the insignificance of the world is disclosed.²⁷⁹ Thanks to the feeling of anxiety humans uncover their

²⁷³ (Although it is perceived as a fixed attribute by those that hold such an identity - because of the human need for continuity described in the previous section.)

²⁷⁴ Berenskoetter, F. (2011). Reclaiming the Vision Thing: Constructivists as Students of the Future. *International Studies Quarterly*, 55(3). pg. 653.

²⁷⁵ Hicks, R. D., Yonge, C. D., & Epicurus. (2019). *Principal Doctrines and The Letter to Menoeceus (Greek and English, with Supplementary Essays)*. Lulu.com.

²⁷⁶ Whalen, J. T. (2015). Anxiety, the Most Revelatory of Mood. *Akadimia Filosofia*, 1(1). pg. 29.

²⁷⁷ Critchley, S. (2009, July 6). Being and Time, part 5: Anxiety | Simon Critchley. *The Guardian*. <https://www.theguardian.com/commentisfree/belief/2009/jul/06/heidegger-philosophy-being>

²⁷⁸ Sartre, J.-P. (2013). *Nausea* (L. Alexander & R. Howard, Trans.). New Directions Publishing Corporation.

²⁷⁹ Magrini, J. (2006). "Anxiety" in Heidegger's Being and Time: The Harbinger of Authenticity. *Philosophy Scholarship, Paper 15*. pg. 85.

finite nature of beings thrown into the world towards death.²⁸⁰ This existential understanding of death simultaneously allows humans (the ones who choose to acknowledge it) to uncover their potential (freedom) in life, which ultimately depends on the choices that they make within the possibilities given by their finite nature - indeed, time finds its meaning in death.²⁸¹ Simon Critchley summarizes well the general idea here illustrated:

*“Being is time. That is, what it means for a human being to be is to exist temporally in the stretch between birth and death. Being is time and time is finite, it comes to an end with our death. Therefore, if we want to understand what it means to be an authentic human being, then it is essential that we constantly project our lives onto the horizon of our death, what Heidegger calls “being-towards-death.”*²⁸²

Let us clarify this overall concept with an example: a person wins a vacation to Egypt and gets sent to the country (she is “thrown into Egypt” - metaphorically); she spends her first three weeks there without knowing how long she will stay there nor what to do. Suddenly, she discovers that she will only have another week before her holiday is over, and that this time is sufficient to visit the Valley of the Kings, which is located in the country in which she currently is. Having uncovered this information, after a moment of negative feeling resulting from having discovered that her holiday will be over, she decides to spend the remainder of her holiday to the fullest, and starts planning to visit the destinations that she has the possibility of visiting in the country in which she finds herself for the time that she has left.

The future is thus the most important part of temporality, because it allows the being, who constantly projects itself into it, to uncover the possibility of what it can be, and consequently take action in the present.²⁸³ This conception of the human being as embedded in time (as being time) is consistent with the temporality of identity formation illustrated in the previous section, which described identity as “temporally decentered”, in that it constantly reshapes the past and projects itself into the future in order to shape the present understanding of itself.

How does Heidegger’s work on temporality (the part illustrated in this paragraph) relate to the issue dealt with by this section - that is: the temporal trap and its possible solutions? The answer to this question is the concept of “having-been-ness”: when projecting themselves into the future,

²⁸⁰ Heidegger, M. (2019). *Being and Time* (E. S. Robinson & J. MacQuarrie, Trans.). Martino Fine Books. pg. 356.

²⁸¹ Alweiss, L. (2002). Heidegger and ‘the concept of time’. *HISTORY OF THE HUMAN SCIENCES*, 15(3). pg. 117.

²⁸² Critchley, S. (2009, June 5). Being and Time, part 1: Why Heidegger matters Simon Critchley. *The Guardian*. <https://www.theguardian.com/commentisfree/belief/2009/jun/05/heidegger-philosophy>

²⁸³ Heidegger, M. (1992). *The concept of time* (W. McNeill, Trans.). Wiley.

human beings project their “personal and cultural baggage”²⁸⁴; therefore, the possibilities that they envisage in the future are not illogical expectations detached from their personal experiences, but are instead a product of it. The future Self is thus the one that the current Self has understood that it could become - that it sees within its range of possibilities. This range of possibilities (something Heidegger calls “room of maneuver”) that the Self has understood that it can become is not a single, ultimate one, but consists of an ever-unfolding process in which the Self continuously envisions new futures, new possibilities of being.

This understanding of the Self (which can be seen as the philosophical equivalent of identity - previously described with a more psychological approach in its formation process) confirms the conclusion reached in the previous section: due to the underlying need to provide themselves with a sense of stability (serving as a mean to control anxiety - in the understanding provided by Heidegger), humans envisage futures – shaped so as to confirm their life experiences – in which to imagine themselves. However, Heidegger provides a useful addition to this framework by uncovering the process through which the Self constantly envisages new possible kinds of futures, and how such *visions* of the future guide the Self and stimulate it to take action, leading it to eventually becoming the possibilities that it has envisaged.

Felix Berenskoetter expands on such a role that visions have in guiding the Self in its projection towards the future, and does this by creating an interesting bridge that connects the Self’s understanding of its possible futures with the role played by utopias and dystopias.²⁸⁵ In the pursuit of a solution to the temporal trap previously illustrated, further analyzing the role of *visions of the future - in the form of utopias and dystopias - as “instruments” capable of introducing to the present Self unprecedented futures without disrupting its sense of stability* could provide interesting results. The next paragraph will thus focus on the importance of utopias and dystopias in the temporal processes characterizing identity formation, and it will do this by drawing on the work carried out by Felix Berenskoetter and a few major authors within Utopian Studies.

²⁸⁴ Critchley, S. (2009, July 27). Heidegger's Being and Time, part 8: Temporality | Simon Critchley. *The Guardian*. <https://www.theguardian.com/commentisfree/belief/2009/jul/27/heidegger-being-time-philosophy>

²⁸⁵ Berenskoetter, F. (2011). *Ibid.*

The current chapter has so far analyzed temporality's nature from a purely psychological and philosophical point of view, thus drawing on fields primarily focused on the study of the individual; however, the environmental security thematic constituting the backbone of this work demands to move away from the individual, in order to focus on the collectivity, which constitutes the pillar on which environmental security ultimately rests (as lengthily shown in the previous chapter). It is then important to analyze the way in which the problems and concepts introduced in the last two sections manifest themselves in the collectivity. This means asking ourselves whether the anxiety and stability mechanisms of identity formation exist at the collective level or not.²⁸⁶ Indeed, if the temporal trap (constituting the central problematic of this chapter) would not reproduce itself at the collective level, temporality's role in environmental security would be rather different from the one discussed until now.

In his studies on collective identity formation²⁸⁷ Alexander Wendt argues that communities possess a "collective consciousness" that - as for individuals - provides them with cognitive and emotional desires.²⁸⁸ Ned Lebow instead illustrates how social units - being composed of individuals - act so as to satisfy human needs and motives, despite having no inherent feelings²⁸⁹; this argument can further serve as a point to validate Benedict Anderson's claim of the importance of future collective visions as constituents (together with collective memory) of a sense of collectivity on which communities rest²⁹⁰ - because if the future is fundamental to the individual Self (in that it shapes and it is shaped by its identity and sense of stability), then it must indeed be to the collective one, which is constituted²⁹¹ by the sum of individuals. Based on the arguments brought forward by the scholars here illustrated, it is reasonable to assume that the human characteristics underlying the temporal trap transpose themselves to the collective level. It is then logical to continue with the analysis of possible collective solutions to what is (also) a collective issue - that is: utopias and dystopias, as previously discussed.

²⁸⁶ Berenskoetter, F. (2011). Ibid. pg. 654.

²⁸⁷ Wendt, A. (1994). Collective Identity Formation and the International State. *The American Political Science Review*, 88(2). pg. 384-396.

²⁸⁸ Wendt, A. (1999). *Social Theory of International Politics*. Cambridge University Press.

²⁸⁹ Lebow, R. N. (2009). *A Cultural Theory of International Relations*. Cambridge University Press. pg. 114-117.

²⁹⁰ Anderson, B. (2016). *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso Books.

²⁹¹ (I do not intend to claim here that the collectivity consists exclusively of the sum of individuals, the work rather argues that if the collectivity is based on the sum of individuals, it must indeed have at its base the psychological characteristics - the ones discussed in this chapter - proper to the individual.)

Moving towards the analysis of how visions of the future motivate collective action and influence decision making is not a simple task, for the topic has historically been largely ignored within the academic world. Such a lack of deeper analysis becomes particularly evident when moving to the study of utopia (and consequently dystopia). Utopia in fact suffers to this day from a heavy stigmatization among scholars, mostly originating from the two world wars - which, on the one hand washed away with their horrors all positivist utopian claims of humanity's infinite progress, and on the other constructed through the authoritarian regimes rising in Europe new visions of the future (dystopic, one might say) that proved the powerful destructive force of utopia. As a result, post-WWII social sciences moved away from the study of utopia, considering it as either a naive mental structure detaching humans from reality or a possible shortcut to totalitarianism (which could be exemplified by the argument brought forward by Karl Popper in his critique of utopias as a mean to violence²⁹²). This trend assumed a particularly strong character in international relations, as the harsh critique of utopia found in the famous book by Edward Hallett Carr "*The Twenty Years' Crisis, 1919-1939*"²⁹³ diffused the widely held view of "the death (...) of utopianism as a respectable intellectual tradition"²⁹⁴. The diffidence towards utopia was further encouraged by the rise of dystopian literature, with works such as George Orwell's "*1984*"²⁹⁵ and Aldous Huxley's "*Brave New World*"²⁹⁶ influencing the public opinion of the wider society, consequently pushing politics to move away from any mention of utopia. The end of the XX century nonetheless witnessed a renewed interest towards it, with international relations academics reapproaching the concept - in line with the developments in cognitive science uncovering the importance of the perception of the future in identity formation processes (described in the previous section) - by reanalyzing Carr's work: Ken Booth goes against the simplification of Carr's book carried by realists, arguing how the author's arguments cannot be regarded as a strict critique of utopia²⁹⁷; while Michael Boyle²⁹⁸ and David Jason

²⁹² Popper, K. (1986). Utopia and Violence. *World Affairs*, 149(1).

²⁹³ Carr, E.H. (2016). *The Twenty Years' Crisis, 1919-1939: Reissued with a New Preface from Michael Cox* (M. Cox, Ed.). Palgrave Macmillan UK.

²⁹⁴ Porter, B. (1989). David Davies: A Hunter after Peace. *Review of International Studies*, 15(1). pg. 32.

²⁹⁵ Orwell, G. (2021). *1984*. Intra.

²⁹⁶ Huxley, A. (2006). *Brave New World (P.S.)*. HarperCollins.

²⁹⁷ Booth, K. (1991). Security in Anarchy: Utopian Realism in Theory and Practice. *International Affairs (Royal Institute of International Affairs 1944-)*, 67(3). pg. 527-545.

²⁹⁸ Boyle, M. (2004). Utopianism and the Bush foreign policy. *Cambridge Review of International Affairs*, 17(1). pg. 81-103.

Karp²⁹⁹ draw on his work to point out the importance of utopia as a fundamental component of political thinking. This section of the work draws on the renewed trend of focusing attention to the importance of utopia in political science. Before venturing any further, it is however appropriate to briefly illustrate the origin and development of the concepts of “utopia” and “dystopia” leading to the modern conception of them within the field of international relations, as well as illustrate this work’s understanding of the terms.

The word “utopia” first came into being in Thomas More’s 1516 omonymous book, as the name of a fictional island characterized by great lawfulness and “wonderful” inhabitants.³⁰⁰ More’s idea of utopia was inspired by the humanist belief in people’s ability to construct a better society (not a perfect one, for that would have resembled heaven - thereby be an heresy) for themselves through the use of reason³⁰¹, a new philosophical attitude that developed in opposition to the previous belief in pure predestination (an already predetermined future that humans merely have to accept) common throughout the Middle Age. More’s invention of the term “utopia” does not however mean that he invented utopianism - that is, the aspiration to a better life - which rested on a long intellectual tradition having as its pillars major works among which Plato’s “*Republic*”³⁰² and Saint Augustine’s “*The City of God*”.³⁰³ Given such an historical human disposition towards utopianism, it is no wonder that the term “utopia” has throughout the centuries following its birth assumed a great fluidity of meaning³⁰⁴ in an even greater number of contexts, leading to long discussions within the academic circles that only created further confusion as to the meaning of the concept.³⁰⁵ Ruth Levitas’s influential work categorizes historical understandings of the concept of “utopia” to fall within one of these four categories: the better context into which a society imagines itself; the literary form characterizing early utopian thinking; the function of utopia (the effect that it provokes); the desire for a better life - grounded in hope - originating in the dissatisfaction with the current society.³⁰⁶ Felix

²⁹⁹ Karp, D. J. (2008). The utopia and reality of sovereignty: Social reality, normative IR and 'Organized Hypocrisy'. *Review of International Studies*, 34(2). pg. 313 - 335.

³⁰⁰ More, T. (2003). *Utopia* (P. Turner, Trans.). Penguin Publishing Group.

³⁰¹ Vieira, F. (2010). The concept of utopia. In G. Claeys (Ed.), *The Cambridge Companion to Utopian Literature*. Cambridge: Cambridge University Press. pg. 4.

³⁰² Lee, H. D. P., & Lane, M. (2007). *The Republic (Penguin Classics)* (H. D. P. Lee & D. Lee, Trans.). Penguin Publishing Group.

³⁰³ Augustine, S. (2014). *The City of God*. Beloved Publishing LLC.

³⁰⁴ Niklas, U. (2001). Utopia and Modern Times: Thomas More, Hannah Arendt, and Suppression of the Political. *History of Philosophy Quarterly*, 18(2). pg. 207-226.

³⁰⁵ Stillman, P. (1991). The Concept of Utopia by Ruth Levitas. *Utopian Studies*, 2(1/2). pg. 220-222.

³⁰⁶ Levitas, R. (1990). *The Concept of Utopia*. Syracuse University Press.

Berenskoetter adopts an understanding of utopia that falls within the first category, while Fátima Vieira embraces the definition provided in the last category. This work takes a path in between the two definitions, and sees utopia as *a vision of a better (not perfect) future in which the Self can be located, which generates dissatisfaction with the present situation and stimulates action towards the achievement of the envisioned future*. This understanding of utopia tries to mediate between the two authors' positions just mentioned, so as to try reducing the biases underlying both of the definitions of which it is composed: in fact, while the concept of utopia promoted by Berenskoetter "is based on a subjective conception of what is or is not desirable, and envisages utopia as being essentially in opposition to the prevailing ideology"³⁰⁷, the one accepted by Vieira does not explain the origin behind the dissatisfaction with the current present situation that leads to the desire for a better life (if one has lived all his life under certain conditions, how could he be dissatisfied by them if there are no others with which to compare them?). This definition of utopia implies several characteristics now largely taken for granted; however, these aspects of utopia have not always existed, but are a product of its historical development - that is, how the envisioning of better worlds developed throughout history. Turning to a short sketch of the history of utopia will then help to understand the reasons behind the current understanding of it. Until the Enlightenment utopia's wish for a better life was not grounded in an actual possibility of becoming, but - influenced by the Christian concept of perpetuity (always having existed, having no past nor future) - was limited to imagining atemporal unreachable better societies, such as the island in More's book (from here the etymology of the word "utopia": "u" (not) and "tòpos" (place) - the "no place"). The Enlightenment thus signaled a break in the conception of utopia: by moving away from Christian influence and placing the better world imagined by humans into their reachable future on Earth³⁰⁸, the Enlightenment gave humankind the motivation needed to take action so as to reach such a future. Simultaneously, the global theory of evolution developed out of the XVIII century scientific discoveries changed the spatial dimension of the now reachable utopia by granting it a new universal scope, further encouraged

³⁰⁷ Vieira, F. (2010). The concept of utopia. In G. Claeys (Ed.), *The Cambridge Companion to Utopian Literature*. Cambridge: Cambridge University Press. pg. 6.

³⁰⁸ (This concept is what is often referred to as "*euchronia*" (the good place in the future), in opposition to "*utopia*". This work won't deal with such a subtle definition, so as not to create confusion; it will instead keep on relying on the term "utopia", albeit with a different understanding of it, as illustrated here.)

by the earliest stages of globalization. Global utopian *ideologies*³⁰⁹ thus came into being. Among such ideologies was Marxism, which by merging the determinism provided by the recent scientific discoveries with the future dimension of utopia³¹⁰ defined utopia as a reality achievable at the end of a certain historic process.³¹¹ Utopia therefore became something concretely achievable by humans (because through the “killing of God”³¹² humans became masters of their own future) in the time of their future, in the space of their social context. This absolute freedom however opened the doors to horrors such as those witnessed in the first half of the XX century (as guessed by Dostoevskij: “if God doesn’t exist, everything is permitted”³¹³), thereby introducing what might be thought of as utopia’s “other side of the coin” - that is, dystopia. *Dystopia consists of a vision of a worse future in which the Self can find itself stimulating action against that possible future from coming into being.*

To summarize, utopias and dystopias rest on a comparison between the present and a hypothetical future, and have the aim of stimulating action so as to reduce (for utopia) or increase (for dystopia) the distance between the actual situation and the hypothetical one.³¹⁴

This section has so far worked towards introducing an idea: the idea that visions of the future - in the form of utopias and dystopias - can be used as means to overcome the temporal trap by allowing humans to imagine unprecedented future events without disrupting their identity’s sense of stability. The obvious question arising from this statement is *how can such visions of the future arise, and where from*. If not carefully illustrated and grounded in rationality, the discourse on the importance and origin of “visions” could likely degenerate into some form of mysticism, moving the work away from the field of social sciences and closer to that of religion. Indeed, visions of the future have historically been within the domain of religion; we can try uncovering the motivations behind this by following a simple logical path: the fact that temporality has

³⁰⁹ (Note the stress on the word “ideology”: indeed, religions having a global dimension existed before the XVIII century; however, such religions - like Christianity - did not envision a better future within human life (thus reachable by humans), but instead focused on the afterworld.)

³¹⁰ Vieira, F. (2010). Ibid. pg. 14.

³¹¹ Mannheim, K. (1991). *Ideology and Utopia: An Introduction to the Sociology of Knowledge* (L. Wirth, Trans.). Routledge.

³¹² Nietzsche, F. (2008). *Thus Spoke Zarathustra: A Book for Everyone and Nobody* (G. Parkes, Trans.). OUP Oxford.

³¹³ Dostoevsky, F. (2021). *The Brothers Karamazov (Bicentennial Edition): A Novel in Four Parts With Epilogue* (R. Pevear & L. Volokhonsky, Trans.). Picador.

³¹⁴ Berenskoetter, F. (2011). Ibid. pg. 657.

historically been shaped by religion (as illustrated in this chapter's second section) means that religion has throughout the centuries been the intellectual framework having to deal with the temporal trap characterizing it (which is present in XXI century environmental security, but it is not exclusive its, for the temporal trap might characterize any kind of security in any historical epoch, as long as unprecedented future events disrupting the Self's sense of stability come into play). This³¹⁵ might explain why the usage of visions, in the form of utopias and dystopias, has been so frequent in religion - be it the utopian *Heaven* and the dystopian *Hell* of Christianity³¹⁶ or the utopian *Jannah* and dystopian *Jahannam* of Islam³¹⁷, among many others - and consequently why religion constituted the primary source of utopianist thought until the Enlightenment (as previously explained).

As this work does not intend to promote utopianism based on religious mysticism, it is important to carefully illustrate the origin of the visions here believed to be able to overcome the temporal trap - that is, explain the reasons why humans conceive a certain future as possible (within their room of maneuver, as illustrated by Heidegger). In order to do this, we should move to the study of vision of the future within the field of political science.

The study of visions of the future within political science has traditionally followed two approaches, based on the field's different academic branches; these are what Berenskoetter calls "*robust visions*" approach and "*creative visions*" approach.³¹⁸ Let us analyze each of them in greater detail.

Robust visions approach: this approach has its origin in realist authors, and it's based on evaluating the possible success of a vision based on its degree of embeddedness within the existing historical structures. This approach adopts a moderate position with regards to visions by on the one hand illustrating their importance, and on the other highlighting the need for them to be grounded in a current reality product of specific historical developments. The earliest major conceptualization of robust visions was that of Ernst Bloch, who when rehabilitating utopia³¹⁹ as

³¹⁵ (Perhaps other aspects of temporality entailing visions of the future might further contribute to the usage of visions; however, focusing on them is of no use here. Instead, it is sufficient to show that the temporal trap is one of them, as this is the one this work deals with.)

³¹⁶ Revelation. (2010). In *The Bible*. Cambridge University Press. vv. 20:14.

³¹⁷ *The Qur'an* (M. A. Abdel Haleem, Trans.). (2008). OUP Oxford. vv. 17:21.

³¹⁸ Berenskoetter, F. (2011). Ibid. pg. 657.

³¹⁹ Levitas, R. (1990). Educated Hope: Ernst Bloch on Abstract and Concrete Utopia. *Utopian Studies*, 1(2). pg. 13-26.

a fundamental aspect of human consciousness³²⁰ differentiated between “abstract utopia” (a compensatory wishful thinking expressing a mere desire, not followed by an actual will to turn that desire into reality) and “concrete utopia” (an anticipatory wilful thinking not only expressing desire, but also generating the hope necessary to transform it into reality).³²¹ This belief in visions having to rest on pre existing social structures for them to be effective was later on taken by Karl Mannheim (when calling for visions of the future “‘organically’ and harmoniously integrated into the world-view characteristic of the period”³²²) and Carr (who illustrates the dialectic between concrete utopia and reality in which an achievable utopia materializes into reality - ceasing to be a utopia - to later be challenged by a new utopia³²³). More recent authors such Jeffrey C. Alexander³²⁴, Lyman Tower Sargent³²⁵ and Heikki Patomäki³²⁶ have further promoted this belief in visions of the future having to be embedded in historical structures in order to be considered possible, and successfully transformed into reality. Therefore, as explained by Berenskoetter, the robust vision approach has an understanding of visions that:

*“rests on the acknowledgment that humans can escape neither their genes nor their environment and, consequently, that visions must integrate enduring traits and trends into their designs. In that sense, it expects a conception of the future in which some things remain more or less, but not quite, the same, [and it argues that] agency is required to either enhance the desired path (in the case of Utopia) or close an undesirable one (in the case of dystopia).”*³²⁷

Analyzing visions based on their “robustness” is a tool aimed at discouraging the dangerous practice of “day-dreaming” - that is, imagining unrealistic futures that have no probability of turning into reality and that by detaching humans from it often have the opposite effect of leading to worse futures. An example of a fragile (not robust) utopia and its negative effects could be the 2004 Afghani constitution: constitutions make an interesting example in that they can be considered “documented” utopias. Indeed, being the highest representation of a country’s

³²⁰ Bloch, E. (2000). *The Spirit of Utopia* (1st ed.). Stanford University Press.

³²¹ Bloch, E. (1986). *The Principle of Hope*. Wiley–Blackwell.

³²² Mannheim, K. (1991). *Ideology and Utopia: An Introduction to the Sociology of Knowledge* (L. Wirth, Trans.). Routledge.

³²³ Carr, E.H. (2016). *The Twenty Years' Crisis, 1919-1939: Reissued with a New Preface from Michael Cox* (M. Cox, Ed.). Palgrave Macmillan UK.

³²⁴ Alexander, J. C. (2001). Robust Utopias and Civil Repairs. *International Sociology*, 16(4). pg. 579-591.

³²⁵ Sargent, L. T. (2005). The necessity of utopian thinking: A Cross-National perspective. In J. Rüsen, M. Fehr, & T. W. Rieger (Eds.), *Thinking Utopia*. New York: Berghahn Book.

³²⁶ Patomäki, H. (2003). Problems of Democratizing Global Governance: Time, Space and the Emancipatory Process. *European Journal of International Relations*, 9(3). pg. 347-376.

³²⁷ Berenskoetter, F. (2011). *Ibid.* pg. 658-659.

identity³²⁸, constitutions are the simple (written) reflection of a process in which the “fathers of the nation” envisage the Self (here the collective Self - the nation-state) in a better future³²⁹ (for no constitution is written having a worse future in mind). For such a vision of the future to be robust, it would then have to be grounded in the historical trends characterizing the country for which the constitution is being drafted; this is in line with the common argument that constitutions reflect the cultural and social factors of the historical context in which they were drafted.³³⁰ The 2004 Afghani constitution however stood in opposition with this “requirement”: having been drafted under the strong influence of the United States of America following the 2001 liberation of the country from the Taliban³³¹, the document did not sufficiently take into account the country’s history and peculiar sociocultural conditions deriving from it (high ethnic fragmentation, religious diversity, etc.³³²). As a result of this “flawed constitution”³³³, the country witnessed a radicalization of several of its socioeconomic issues that strengthened the Taliban³³⁴ and ultimately facilitated their new rise to power.

Analyzing this case from a robust visions approach, it can be argued that the Afghani/US constitution of 2004 was a utopia - in that it envisioned the Self in a better future (a stable and prosperous Afghanistan free from religious extremism) - but it was not a robust one - in that it ignored the historical reality of the country - thus leading to a worse future (an unstable and unprosperous Afghanistan imprisoned by religious extremism).

³²⁸ (There is here a rather long and burdensome discussion on the difference between the “constitutional identity” and “national identity” of a country; this work won’t deal with such a discussion, as it is not relevant to the overall topic of the section. For a more in-depth analysis of the thematic, see “*The politics*” by Aristotle; “Constitutional Identity. *The Review of Politics*, 68(3)” by Jacobsohn, G. J.; “*The Identity of the Constitutional Subject: Selfhood, Citizenship, Culture, and Community*. Routledge.” by Rosenfeld, M.; and “Constitutional identity in 3D: A model of individual, relational, and collective self and its application in Poland. *International Journal of Constitutional Law*, 13(1).” by Śledzińska-Simon, A.

³²⁹ (Be it that of a new independent nation, a liberated nation, a renovated nation, etc. - all of the possible causes behind the drafting of a constitution.)

³³⁰ Rosenfeld, M. (2010). *The Identity of the Constitutional Subject: Selfhood, Citizenship, Culture, and Community*. Routledge.

³³¹ Reynolds, A. (2021, September 8). Perspective | The U.S. helped design Afghanistan's constitution. It was built to fail. *The Washington Post*. <https://www.washingtonpost.com/outlook/2021/09/08/afghanistan-constitution-failure/>

³³² Byrd, W. (2012). Lessons from Afghanistan’s History for the Current Transition and Beyond [SPECIAL REPORT]. In *United States Institute of Peace*.

³³³ Blanc, J. (2020, March 12). *Afghanistan's Election Disputes Reflect Its Constitution's Flaws*. Carnegie Endowment for International Peace. Retrieved September 20, 2022, from <https://carnegieendowment.org/2020/03/12/afghanistan-s-election-disputes-reflect-its-constitution-s-flaws-pub-81274>

³³⁴ Pillalamarri, A., & Tiezzi, S. (2021, August 12). Afghanistan's Failed Constitution – The Diplomat. *The Diplomat*. <https://thediplomat.com/2021/08/afghanistans-failed-constitution/>

While the robust utopia approach avoids following impossible utopias by carefully analyzing the robustness of each vision of the future, it presents three possible pitfalls:

- Being the analysis of visions of the future carried out by human beings with ultimately subjective opinions and beliefs, utopias/dystopias can often be mistaken for being impossible while they are simply undesirable to the one assessing their robustness.
- Regarding utopias/dystopias as strict products of historical processes can allow actors to use an allegedly objective “path of history” to justify their subjective beliefs (a good example could be the common practice by dictators of claiming clairvoyance of the direction of history).
- Regarding utopias/dystopias as strict products of historical processes can constrain human action to merely being the result of pre-existing dynamics, greatly limiting human potential for change (being it negative or positive) and only focusing on “how the past is pushing rather than how the future is pulling”³³⁵.

Creative visions approach: the second approach differs from the first in that it is not based on evaluating the possibility of visions effectively turning into reality based on their embeddedness in the existing historical dynamics, but instead focuses on their power to create new possible futures that depart from the existing order. Within this understanding, utopias and dystopias have the capacity of impacting human imagination and act as a “*productive power*”³³⁶ that allows humans to envisage new possible future directions previously believed impossible. This approach aims at empowering the role of the individual and emotions, while simultaneously downplaying the importance of its surrounding environment and rationality. At the basis of this understanding lies Hanna Arendt’s concept of “natality”, for which the uniqueness of every man allows each of them to bring “something uniquely new (...) into the world”³³⁷, therefore change the future in unexpected, creative ways. This does not however mean that envisioned futures can be completely detached from reality, for they would not be perceived as possible nor attractive³³⁸ - indeed, if the projection towards the future is a human mechanism to form (and confirm) identity in the present, such a projection must have a certain degree of connection to the present; this

³³⁵ Berenskoetter, F. (2011). Ibid. pg. 660.

³³⁶ Brincat, S. (2009). Reclaiming the Utopian Imaginary in IR Theory. *Review of International Studies*, 35(3). pg. 582.

³³⁷ Arendt, H. (1958). *The Human Condition*. Chicago: University of Chicago Press. pg. 178.

³³⁸ Berenskoetter, F. (2011). Ibid. pg. 661.

means that the creative vision of the future occurs through the past (itself readapted in the present) and the present. This simply confirms the previous sections illustrating Heidegger's philosophy and the identity formation processes.³³⁹

Unlike the robust visions approach judging visions as effective or not based on their embeddedness in historical dynamics, the creative visions approach thus focuses on the ahistorical ability of individuals to provide new visions of the future (however drawing on their experience) provoking an emotional response³⁴⁰ that inspires humans to take action.

The two frameworks through which visions are understood and evaluated should not be perceived as standing in opposition to one another, but instead as complementing each other: while the robust vision approach provides pragmatism by highlighting the importance for visions to be grounded in historical dynamics, it nonetheless presents limitations due to this very historicity; on the other side of the spectrum, the creative vision approach frees human action from its historical environment, but risks of excessively empowering the individual, possibly leading to personalism and irrationality. Visions of the future should then be evaluated through both frameworks, so as to pay attention in the analysis of them to both history and the individual, rationality and creativity.

Having illustrated the two approaches through which visions are understood and evaluated, we should now transpose them to the topic of this work. This means asking ourselves what kind of vision of the future is relevant to the temporal trap introduced here. As the future scenarios to be imagined for humans to understand the seriousness of the current environmental situation are purely negative, the vision of the future needed is that of a *dystopia* - that is: a vision of a worse future in which the Self can find itself stimulating action against that possible future from coming into being. How would such a dystopia be able to satisfy the conditions underlying both approaches - that is: be both robust and creative?

Based on what this section has so far illustrated, it can be argued that a *vision of the future in the form of a dystopia can be considered robust if based on the historical socioeconomic*

³³⁹ Koselleck, R. (1985). *Futures Past: On the Semantics of Historical Time*. Cambridge, MA: MIT Press. pg. 270.

³⁴⁰ (What Berenskoetter calls the "emotional pull factor".)

*developments*³⁴¹ leading to the current environmental situation illustrated by the Planetary Boundary Framework.

A robust vision is nonetheless insufficient to solve the temporal trap with which this work deals - if this was the case, the several negative future scenarios outlined by scientists in the last decades would have been able to invert many of the socioeconomic trends illustrated in the previous chapter, consequently providing a very different Planetary Boundary Framework scenario than the one here shown. This further legitimizes the need to focus on the creative aspect of visions: indeed, the unprecedented nature of the possible future disruptive ecological changes awaiting planet Earth demands a creative vision able to allow the envisioning of events believed to be impossible. How should such a vision be, in order to be able to overcome the temporal trap? As argued above, creative visions do not base themselves on compelling arguments illustrating the pre existing dynamics that justify their coming into being, but instead lay their success on their capacity to stir emotions. The emotional response generated by a dystopia is of course a negative one, provoked by envisioning a worse future. As it has been illustrated through both the account of identity formation processes and Heidegger's philosophy, humans constantly project themselves into the future; if they project themselves into the future, they also project the feelings characterizing them (the moods - by using Heidegger's terminology) - among which is the feeling of anxiety³⁴². Thus, a vision of the future stirring the emotion of anxiety would be able to overcome the temporal trap, in that it would provide the Self with the confirmation of a feeling that it already experiences in the present. This work then argues that *the Self can envision unfamiliar futures without disrupting its sense of stability through a creative dystopia provoking the familiar feeling of anxiety embedded in human beings.*

³⁴¹ (It might perhaps be time now to reread the second and third sections of the first chapter, dealing with the Anthropocene/Noosphere, and The Great Acceleration.)

³⁴² (The work refers here to the anxiety conceptualized by Heidegger.)

Conclusion

This work has tried connecting a field of security studies still (unfortunately) quite under investigated - environmental security - with a topic almost completely ignored - temporality. At the heart of what might seem like an unusual connection between two uncommon subjects of analysis lies the firm belief in putting all of our best efforts in the pursuit of solutions to the undergoing environmental disruption characterizing planet Earth. This entails attempting to construct linkages between fields and subjects where no relations have been established before. The work presented here can be read in this perspective: the first chapter has extendedly elaborated on environmental security by mediating between a necessary political discussion on the meaning and characteristics of environmental security in the XXI century and an even more necessary scientific account of the current ecological changes affecting the Earth System; the second chapter has tried integrating the topic of temporality into this pre existing intellectual structure by analyzing objective and subjective time in the fields of political science, sociology, history, psychology and philosophy. While this multidisciplinary approach might constitute the work's weak spot - in that it risks touching upon several topics without focusing exclusively on one - it nonetheless enriches it with argumentations and ideas originating from several (and often opposing) academic fields and traditions , allowing the work to provide an original outlook on an original topic.

The arguments illustrated here are not absolute nor ultimate: environmental security can be analyzed through several different approaches and be linked to several different topics - so temporality; similarly, the conclusions reached in this work do not put an end to the study of temporality's role in environmental security, they rather aim to serve as a point of departure for further analysis on the topic. To this purpose, the importance of creative visions of the future (be them utopias or dystopias) as a mean to overcome the temporal trap paves the way to several questions here left untouched due to the lack of space, but that nonetheless need to be answered: among the most important is the question of *who* is able to construct such creative visions and motivate others to believe in them, which points to the role played by leaders, the types of leadership existing (a long study beginning with Weber's three types of legitimate domination³⁴³

³⁴³ Weber, M., & Wittich, C. (2013). *Economy and Society* (G. Roth, Ed.; 1st ed., Vol. 2). University of California Press.

and recently focusing on the figure of the “trickster”³⁴⁴), and the origins of leadership (in which the chicken-or-the-egg dilemma arises: does the leader origin from society, or does society origin from the leader?). Another important question is *what* should such a creative dystopia consist of, which demands to analyze the different sociocultural environments that give rise to different “affective narrative expressions”³⁴⁵ in turn shaping different perceptions of what constitutes a dystopia.

As we can see, the work ahead of us is much, and it will require a great intellectual effort of which this thesis is nothing but the tip of the iceberg. Yet, as argued by Ernest Hemingway in his 10-cent words: “the world is a fine place and worth the fighting for.”³⁴⁶ It is in our power to render the first statement true by believing in the latter.

³⁴⁴ Forlenza, R., & Thomassen, B. (2016, April 28). Decoding Donald Trump: The Triumph of Trickster Politics. *Public Seminar*.

³⁴⁵ Chabay, I. (2019). Vision, identity, and collective behavior change on pathways to sustainable futures. *Evolutionary and Institutional Economics Review*, 17. pg. 151.

³⁴⁶ Hemingway, E. (1995). *For whom the bell tolls*. Scribner. ch. 43.

References

About Non-Traditional security – NTS-Asia. (n.d.). NTS-Asia. Retrieved May 14, 2022, from

<https://rsis-ntsasia.org/about-nts-asia/>

About the Biodiversity Intactness Index. (n.d.). Natural History Museum. Retrieved July 29,

2022, from

<https://www.nhm.ac.uk/our-science/data/biodiversity-indicators/about-the-biodiversity-intactness-index.html>

Adam, B. (1992). Modern Times: The Technology Connection and its Implications for Social Theory. *Time & Society*, 1(2).

Alexander, J. C. (2001). Robust Utopias and Civil Repairs. *International Sociology*, 16(4).

Allenby, B. R. (2000). Environmental Security: Concept and Implementation. *International Political Science Review / Revue internationale de science politique*, 21(1), 5-21.

Alweiss, L. (2002). Heidegger and 'the concept of time'. *HISTORY OF THE HUMAN SCIENCES*, 15(3).

Anderson, B. (2016). *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso Books.

Andrewes, W. J. (2006, February 1). A Chronicle Of Timekeeping. *Scientific American*.
<https://www.scientificamerican.com/article/a-chronicle-of-timekeeping-2006-02/>

Arendt, H. (1958). *The Human Condition*. Chicago: University of Chicago Press.

Aristotle. (2009). *Politics*. Wilder Publications, Incorporated.

Attinà, F. (2015). Traditional security issues. In W. Song & J. Wang (Eds.), *China, the European Union, and the International Politics of Global Governance*. Palgrave Macmillan.

- Augustine, S. (2014). *The City of God*. Beloved Publishing LLC.
- Autin, W. J. (2016). Multiple dichotomies of the Anthropocene. *The Anthropocene Review*, 3(3).
- Barnett, J. (2009). Environmental Security. In R. Kitchin & N. Thrift (Eds.), *International Encyclopedia of Human Geography*. Elsevier Science.
- Barnett, J. (2019). Environmental Security. In A. Kobayashi (Ed.), *International Encyclopedia of Human Geography* (2nd ed.). Elsevier Science.
- Baskin, J. (2014). *The Ideology of the Anthropocene?* University of Melbourne, Melbourne Sustainable Society Institute.
- Bauman, Z. (2002). *Il disagio della postmodernità* (V. Verdiani, Trans.). Mondadori Bruno.
- Bayly, C. A., & Bayly, C. A. (2004). *The birth of the modern world, 1780-1914 : global connections and comparisons*. Wiley.
- Bellouin, N., Quaas, J., Gryspeerd, E., Kinne, S., Stier, P., Watson-Parris, D., Boucher, O., & al. (2020). Bounding Global Aerosol Radiative Forcing of Climate Change. *Reviews of Geophysics*, 58.
- Belshaw, J. D. (2015). *Canadian History: Pre-Confederation* (1st ed.). Victoria, B.C.: BCampus.
- Berenskoetter, F. (2011). Reclaiming the Vision Thing: Constructivists as Students of the Future. *International Studies Quarterly*, 55(3).
- Biermann, F., & Kim, R. E. (2020). The Boundaries of the Planetary Boundary Framework: A Critical Appraisal of Approaches to Define a “Safe Operating Space” for Humanity. *Annual Review of Environment and Resources*, 45(1).
- Birmann, F., & Perry, E. (2007). Reforming global environmental governance. From UNEP towards a world environment organization. In L. Swart (Ed.), *Global Environmental Governance. Perspectives on the Current Debate*. Center for UN Reform Education.

- Bisaz, R., Travaglia, A., & Alberini, C. M. (2014). The neurobiological bases of memory formation: from physiological conditions to psychopathology. *Psychopathology*, 47(6).
- Blanc, J. (2020, March 12). *Afghanistan's Election Disputes Reflect Its Constitution's Flaws*. Carnegie Endowment for International Peace. Retrieved September 20, 2022, from <https://carnegieendowment.org/2020/03/12/afghanistan-s-election-disputes-reflect-its-constitution-s-flaws-pub-81274>
- Bloch, E. (1986). *The Principle of Hope*. Wiley–Blackwell.
- Bloch, E. (2000). *The Spirit of Utopia* (1st ed.). Stanford University Press.
- Bon Pote. (2022, July 2). *The 5th planetary boundary has been officially crossed (and nobody cares)*. Bon Pote. Retrieved July 25, 2022, from <https://bonpote.com/en/the-5th-planetary-boundary-has-been-officially-crossed-and-nobody-cares/>
- Bookchin, M. (1964). Ecology and Revolutionary Thought. *Comment*.
- Booth, K. (1991). Security in Anarchy: Utopian Realism in Theory and Practice. *International Affairs (Royal Institute of International Affairs 1944-)*, 67(3).
- Borges, J. L. (1960). Nueva refutación del tiempo. In *Otras inquisiciones*. Emecè, Buenos Aires.
- Boyle, M. (2004). Utopianism and the Bush foreign policy. *Cambridge Review of International Affairs*, 17(1).
- Braje, T. J., & Erlandson, J. M. (2013). Human acceleration of animal and plant extinctions: A Late Pleistocene, Holocene, and Anthropocene continuum. *Anthropocene*, 4.
- Brettler, M. (2004). Cyclical and Teleological time in the Hebrew Bible. In R. M. Rosen (Ed.), *Time and Temporality in the Ancient World*. University of Pennsylvania Press, Incorporated.

- Briggs, H. (2022, March 1). Wildfires may slow recovery of ozone layer - study. *BBC*.
<https://www.bbc.com/news/science-environment-60563378>
- Brincat, S. (2009). Reclaiming the Utopian Imaginary in IR Theory. *Review of International Studies*, 35(3).
- Briney, A. (2019, April 10). *Overview of the Haber-Bosch Process*. ThoughtCo. Retrieved July 23, 2022, from
<https://www.thoughtco.com/overview-of-the-haber-bosch-process-1434563>
- Brooks, C., & Faulkner, P. (Eds.). (1996). *The White Man's Burdens: An Anthology of British Poetry of the Empire*. University of Exeter Press.
- Broughton, O. (2022, July 17). Under Jair Bolsonaro, Meat Is Becoming an Unaffordable Luxury Item for Most Brazilians. *Jacobin*.
<https://jacobin.com/2022/07/brazilian-meat-beef-prices-affordability-inflation>
- Brusseau, M. L. (2019). Ecosystems and Ecosystem Services. In M. L. Brusseau, I. L. Pepper, & C. P. Gerba (Eds.), *Environmental and Pollution Science* (3rd ed.). Academic Press.
- Burton, K. D. (n.d.). *The Scientific and Technological Advances of World War II*. The National WWII Museum. Retrieved July 16, 2022, from
<https://www.nationalww2museum.org/war/articles/scientific-and-technological-advances-world-war-ii>
- Buzan, B., & Wæver, O. (2009). Macrosecuritisation and security constellations: reconsidering scale in securitisation theory. *Review of International Studies*, 35(2).
- Buzan, B., Wæver, O., & de Wilde, J. H. (1995). Environmental, Economic and Societal Security. *Centre for Peace and Conflict Research. Working Papers*, (10).

- Byrd, W. (2012). Lessons from Afghanistan's History for the Current Transition and Beyond [SPECIAL REPORT]. In *United States Institute of Peace*.
- Carbon Dioxide | Vital Signs – Climate Change: Vital Signs of the Planet. (n.d.). NASA Climate Change. Retrieved July 28, 2022, from <https://climate.nasa.gov/vital-signs/carbon-dioxide/>
- Carr, E.H. (2016). *The Twenty Years' Crisis, 1919-1939: Reissued with a New Preface from Michael Cox* (M. Cox, Ed.). Palgrave Macmillan UK.
- Carson, R. (2002). *Silent spring*. Houghton Mifflin.
- Chabay, I. (2019). Vision, identity, and collective behavior change on pathways to sustainable futures. *Evolutionary and Institutional Economics Review*, 17.
- Chabot, R. (2018). Life is Suffering: Thrownness, Duhkha, Gaps, and the Origin of Existential-Spiritual Needs for Information. *Proceedings of the Annual Conference of CAIS / Actes Du congrès Annuel De l'ACSI*.
- Clark, W. C., Crutzen, P., & Schellnhuber, H. J. (2005). Science for Global Sustainability: Toward a New Paradigm. *Center for International Development, Harvard University, Working Paper No. 120*.
- Cohen, K. M., Finney, S. C., Gibbard, P. L., & Fan, J. X. (2013 - updated). The ICS International Chronostratigraphic Chart. *International Union of Geological Sciences*, (36).
- Commoner, B. (2020). *The Closing Circle: Nature, Man, and Technology*. Dover Publications.
- Corfield, P. J. (2007). *Time and the Shape of History*. Yale University Press.
- Crawford, A. (2018). Temporalities in security: Long-term sustainability, the everyday and the emergent in the Anthropocene. In C. D. Shearing & C. Holley (Eds.), *Criminology and the Anthropocene*. Taylor & Francis Group.

Critchley, S. (2009, June 5). Being and Time, part 1: Why Heidegger matters Simon Critchley. *The Guardian*.

<https://www.theguardian.com/commentisfree/belief/2009/jun/05/heidegger-philosophy>

Critchley, S. (2009, June 22). Being and Time, part 3: Being-in-the-world | Simon Critchley. *The Guardian*.

<https://www.theguardian.com/commentisfree/belief/2009/jun/22/heidegger-religion-philosophy>

Critchley, S. (2009, July 6). Being and Time, part 5: Anxiety | Simon Critchley. *The Guardian*.

<https://www.theguardian.com/commentisfree/belief/2009/jul/06/heidegger-philosophy-being>

Critchley, S. (2009, July 27). Heidegger's Being and Time, part 8: Temporality | Simon Critchley. *The Guardian*.

<https://www.theguardian.com/commentisfree/belief/2009/jul/27/heidegger-being-time-philosophy>

Crossman, N. D., Bryan, B. A., de Groot, R. S., Lin, Y.-P., & Minang, P. A. (2013). Land science contributions to ecosystem services. *Current Opinion in Environmental Sustainability*, 5(5).

Crutzen, P. J. (2002). Geology of mankind. *Nature*, 415(23).

Crutzen, P. J., & Stoermer, E. F. (2000). The 'Anthropocene'. *Global Change Newsletter*, (41).

Cullmann, O. (2018). *Christ and Time, 3rd Edition*. Wipf & Stock Publishers.

Dalby, S. (2018). Environmental change. In P. D. Williams & M. McDonald (Eds.), *Security Studies: An Introduction* (3rd ed.). Routledge.

- Dalby, S. (2020). *Anthropocene Geopolitics: Globalization, Security, Sustainability*. University of Ottawa Press.
- Davies, N. (1987). *The Aztec empire : the Toltec resurgence*. University of Oklahoma Press.
- Della Porta, D. (Ed.). (2014). *Methodological Practices in Social Movement Research*. Oxford University Press.
- Deudney, D. (1990). The case against linking environmental degradation and national security'. *Millennium: Journal of International Studies*, 19(3).
- Dohrn-van Rossum, G. (1996). *History of the hour : clocks and modern temporal orders* (T. Dunlap, Trans.). University of Chicago Press.
- Dohrn-van Rossum, G. (1996). *History of the hour : clocks and modern temporal orders* (T. Dunlap, Trans.). University of Chicago Press.
- The Doors. (1971). Riders on the Storm. In *L.A. Woman*.
- Doose, K. (2021). Hiding the Anthropocene. *Encyclopédie d'histoire numérique de l'Europe*.
- Dostoevsky, F. (2021). *The Brothers Karamazov (Bicentennial Edition): A Novel in Four Parts With Epilogue* (R. Pevear & L. Volokhonsky, Trans.). Picador.
- EEAC. (2014). Safe Operating Space [Current State of Debate and Considerations for National Policies]. In *EEAC Conclusions Report: BMUB/EEAC Expert Workshop*. Entitat Autònoma del Diari Oficial i de Publicacions.
- EFSA. (n.d.). *degradation rate* | EFSA. EFSA. Retrieved July 31, 2022, from <https://www.efsa.europa.eu/en/glossary/degradation-rate>
- Ehrlich, P. R. (1978). *The Population Bomb*. Ballantine Books.
- Einstein, A. (2017). *Relativity : the Special and General Theory: Original Version*. CreateSpace Independent Publishing Platform.

- Elias, N. (1993). *Time: An Essay* (E. Jephcott, Trans.). Blackwell.
- Emanuel, K. (2020, September 25). *Radiative Forcing* | *MIT Climate Portal*. MIT Climate Portal. Retrieved July 28, 2022, from <https://climate.mit.edu/explainers/radiative-forcing>
- EPA. (2022, May 16). *Overview of Greenhouse Gases* | *US EPA*. Environmental Protection Agency. Retrieved July 29, 2022, from <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>
- Erikson, E. H. (1968). *Identity: Youth and Crisis*. W. W. Norton.
- Evans, M. (2007). Towards an Australian National Security Strategy: A Conceptual Analysis. *Security Challenges*, 3(4).
- Fahey, D. W., McFarland, M., Montzka, S. A., & Nash, E. R. (2021, October 7). *Basic Ozone Layer Science* | *US EPA*. Environmental Protection Agency. Retrieved August 1, 2022, from <https://www.epa.gov/ozone-layer-protection/basic-ozone-layer-science>
- Falkenmark, M., & Rockström, J. (2006). The New Blue and Green Water Paradigm: Breaking New Ground for Water Resources Planning and Management. *Journal of Water Resources Planning and Management*, 132(3).
- Finney, S. C., & Edwards, L. E. (2016). The “Anthropocene” epoch: Scientific decision or political statement? *The Geological Society of America*, 26(3).
- Forest Biome*. (2022, May 19). National Geographic Society. Retrieved July 30, 2022, from <https://education.nationalgeographic.org/resource/forest-biome>
- Forlenza, R., & Thomassen, B. (2016, April 28). Decoding Donald Trump: The Triumph of Trickster Politics. *Public Seminar*.
- Fortun, M., & Schweber, S. S. (1993). Scientists and the Legacy of World War II: The Case of Operations Research (OR). *Social Studies of Science*, 23(4).

- Foucault, M. (2010). *The Birth of Biopolitics: Lectures at the Collège de France, 1978--1979* (M. Senellart, Ed.; G. Burchell, Trans.). Palgrave Macmillan.
- Fox, C., & Scherer, G. (2022, March 3). *Aerosol pollution: Destabilizing Earth's climate and a threat to health*. Mongabay. Retrieved August 1, 2022, from <https://news.mongabay.com/2022/03/aerosol-pollution-destabilizing-earths-climate-and-a-threat-to-health/>
- Fratto, E., & Brookes, A. (2020). Towards a Russian Literature of the Anthropocene. Introduction. *Russia Literature*, 114-115.
- Fressoz, J.-B., & Bonneuil, C. (2017). *The Shock of the Anthropocene: The Earth, History and Us* (D. Fernbach, Trans.). Verso Books.
- Freud, S. (1989). *Civilization and its Discontents* (J. Strachey, Ed.; J. Strachey, Trans.). W.W. Norton.
- Gabrian, M., Dutt, A. J., & Wahl, H.-W. (2017). Subjective Time Perceptions and Aging Well: A Review of Concepts and Empirical Research – A Mini-Review. *Gerontology*, 63(4).
- Galloway, J., Schlesinger, W., Clark, C. M., Grimm, N. B., Jackson, R. B., Law, B. E., Thornton, P. E., Townsend, A. R., & Bellmore, R. A. (2014). Biogeochemical Cycles. In J. M. Melillo, T. (C.). Richmond, & G. W. Yohe (Eds.), *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program.
- Gleeson, T., Wang-Erlandsson, L., Porkka, M., Zipper, M., Jaramillo, S. C., Gerten, F., & al. (2020). Illuminating water cycle modifications and Earthsystem resilience in the Anthropocene. *Water Resources Research*, 56.

- González, N., Marquès, M., Nadal, M., & Domingo, J. L. (2020). Meat consumption: Which are the current global risks? A review of recent (2010–2020) evidences. *Food Research International*, 137(109341).
- Goswami, M., Bhattacharyya, P., Mukherjee, I., & Tribedi, P. (2017). Functional Diversity: An Important Measure of Ecosystem Functioning. *Advances in Microbiology*, 7(1).
- Græger, N. (1996). Environmental Security? *Journal of Peace Research*, 33(1).
- Grinspoon, D. (2016). *Earth in Human Hands: Shaping Our Planet's Future*. Grand Central Publishing.
- Gruber, N., Clement, D., Carter, B. R., Feely, R. A., Van Heuven, S., Hoppema, M., Ishii, M., Key, R. M., Kozyr, A., Lauvset, S. K., Lo Monaco, C., Mathis, J. T., Murata, A., Olsen, A., Perez, F. F., Sabine, C. L., Tanhua, T., & Wanninkhof, R. (2019). The oceanic sink for anthropogenic CO₂ from 1994 to 2007. *Science*, 363(6432).
- Hall, R. B. (1999). *National Collective Identity: Social Constructs and International Systems*. Columbia University Press.
- Hamilton, C. (2017). *Defiant Earth: The Fate of Humans in the Anthropocene*. Wiley.
- Hansen, J. E., & Sato, M. (2001). Trends of measured climate forcing agents. *Proceedings of the National Academy of Sciences of the United States of America*, 98(26).
- Hanson, S. E. (2019, October). Objective and Subjective Time in Comparative Politics. *The Oxford Handbook of Time and Politics*.
- Hassan, R. (2010). Globalization and the "Temporal Turn": Recent Trends and Issues in Time Studies. *The Korean Journal of Policy Studies*.

- Haus der Kulturen der Welt. (n.d.). *Home*. Home | Anthropocene Curriculum. Retrieved July 7, 2022, from <https://www.anthropocene-curriculum.org/contributors/anthropocene-working-group>
- Head, M. J., Steffen, W., Fagerlind, D., Waters, C. N., Poirier, C., Syvitski, J., Zalasiewicz, J. A., Barnosky, A. D., Cearreta, A., Jeandel, C., Leinfelder, R., McNeill, J. R., Rose, N. L., Summerhayes, C., Waple, M., & Zinke, J. (2021). The Great Acceleration is real and provides a quantitative basis for the proposed Anthropocene Series/Epoch. *Episodes*.
- Heidegger, M. (1992). *The concept of time* (W. McNeill, Trans.). Wiley.
- Heidegger, M. (2019). *Being and Time* (E. S. Robinson & J. MacQuarrie, Trans.). Martino Fine Books.
- Hemingway, E. (1995). *For whom the bell tolls*. Scribner.
- Hendricks, J. R. (n.d.). 3. *Geological time scale*. Digital Atlas of Ancient Life. Retrieved July 5, 2022, from <https://www.digitalatlasofancientlife.org/learn/geological-time/geological-time-scale/>
- Herbert, R. A. (1999). Nitrogen cycling in coastal marine ecosystems. *FEMS Microbiology Reviews*, 23(5).
- Herman, W. E. (2011). Identity Formation. In J. A. Naglieri & S. Goldstein (Eds.), *Encyclopedia of Child Behavior and Development*. Springer.
- Hibbard, K. A., Crutzen, P. J., Lambin, E. F., & et al. (2006). Decadal interactions of humans and the environment. Group Report. In R. Costanza, L. Graumlich, & W. Steffen (Eds.), *Sustainability or Collapse? An Integrated History and Future of People on Earth*. MIT Press.

- Hicks, R. D., Yonge, C. D., & Epicurus. (2019). *Principal Doctrines and The Letter to Menoeceus (Greek and English, with Supplementary Essays)*. Lulu.com.
- Hom, A., McIntosh, C., & Stockdale, L. (Eds.). (2016). *Time, Temporality and Global Politics*. E-International Relations.
- Hom, A. R. (2010). Hegemonic metronome: the ascendancy of Western standard time. *Review of International Studies*, 36(4).
- Hom, A. R. (2018). Timing is Everything: Toward a Better Understanding of Time and International Politics. *International Studies Quarterly*, 62(1).
- Hom, A. R., & Solomon, T. (2016). Timing, Identity, and Emotion in International Relations. In A. Hom, L. Stockdale, & C. McIntosh (Eds.), *Time, Temporality and Global Politics*. E-International Relations.
- Horrigan, B. L., Karasik, T., & Lalgee, R. (2022). Security Studies. *Encyclopedia of Violence, Peace, & Conflict (Third Edition)*, 1.
- Howse, D. (1980). *Greenwich time and the discovery of the longitude*. Oxford University Press.
- Hoy, D. C. (2012). *The Time of Our Lives: A Critical History of Temporality*. MIT Press.
- Hu, J. (2018). Human Alteration of the Nitrogen Cycle and Its Impact on the Environment. *IOP Conference Series Earth and Environmental Science*, 178(1).
- Hunfeld, K. (2022). The coloniality of time in the global justice debate: de-centring Western linear temporality. *Journal of Global Ethics*, 18(1).
- Huntington, S. P. (1971). The Change to Change: Modernization, Development, and Politics. *Comparative Politics*, 3(3).

- Hurley, I., & Tittensor, D. P. (2020). The uptake of the biosphere integrity planetary boundary concept into national and international environmental policy. *Global Ecology and Conservation*, 22.
- Hutchings, K. (2008). *Time and world politics : thinking the present* (J. Simons & S. Tormey, Eds.). Manchester University Press.
- Huxley, A. (2006). *Brave New World (P.S.)*. HarperCollins.
- Ide, T., Brzoska, M., Donges, J. F., & Schleussner, C. (2020). Multi-method evidence for when and how climate-related disasters contribute to armed conflict risk. *Global Environmental Change*, 62.
- IEA. (2021). *Net Zero by 2050*. IEA. <https://www.iea.org/reports/net-zero-by-2050>
- IGBP. (n.d.). *About*. IGBP. Retrieved July 17, 2022, from <http://www.igbp.net/about.4.6285fa5a12be4b403968000417.html>
- IMET. (2020, May 18). *What is genetic diversity?* | *imet*. Institute of Marine and Environmental Technology. Retrieved July 29, 2022, from <https://imet.usmd.edu/activities/what-genetic-diversity>
- IPCC. (2013). Summary for Policymakers. In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley ed.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Jacobsohn, G. J. (2006). Constitutional Identity. *The Review of Politics*, 68(3).
- Jenny, E., & Edkins, J. (2003). *Trauma and the Memory of Politics*. Cambridge University Press.

- Karp, D. J. (2008). The utopia and reality of sovereignty: Social reality, normative IR and 'Organized Hypocrisy'. *Review of International Studies*, 34(2).
- Katznelson, I., & Lapinsky, J. S. (2006). At the Crossroads: Congress and American Political Development. *Perspectives on Politics*, 4(2).
- Klein, S. B. (2014). Sameness and the Self: Philosophical and Psychological Considerations. *Frontiers in Psychology*, 5(29).
- Klein, S. B., & Nichols, S. (2012). Memory and the Sense of Personal Identity. *Mind*, 121(483).
- Knoblauch, J. A. (2009, July 2). Plastic Not-So-Fantastic: How the Versatile Material Harms the Environment and Human Health. *Scientific American*.
<https://www.scientificamerican.com/article/plastic-not-so-fantastic/>
- Koselleck, R. (1985). *Futures Past: On the Semantics of Historical Time*. Cambridge, MA: MIT Press.
- Kroger, J. (2016). Identity development through adulthood: The move toward "wholeness". In K. C. McLean & M. Syed (Eds.), *The Oxford Handbook of Identity Development*. Oxford University Press.
- Lahoz-Beltra, R. (2014). The "crisis of noosphere" as a limiting factor to achieve the point of technological singularity. *Complutense University of Madrid, Faculty of Biological Sciences Madrid, Spain*.
- Landes, D. S. (2000). *Revolution in Time: Clocks and the Making of the Modern World*. Viking.
- Langematz, U. (2019). Stratospheric ozone: down and up through the anthropocene. *ChemTexts*, 5(8).
- Lasierra, F. G. (2021). The fallacy of objective security and its consequences. *International e-Journal of Criminal Sciences*, (16).

- Lebow, R. N. (2009). *A Cultural Theory of International Relations*. Cambridge University Press.
- Lee, H. D. P., & Lane, M. (2007). *The Republic (Penguin Classics)* (H. D. P. Lee & D. Lee, Trans.). Penguin Publishing Group.
- Le Gloannec, A.-M., Irondelle, B., & Cadier, D. (2013). New and Evolving Trends in International Security. *Transworld - The Transatlantic Relationship and the future Global Governance, Working paper 13*.
- Levitas, R. (1990). *The Concept of Utopia*. Syracuse University Press.
- Levitas, R. (1990). Educated Hope: Ernst Bloch on Abstract and Concrete Utopia. *Utopian Studies, 1*(2).
- Lewis, S. L., & Maslin, M. A. (2015). Defining the Anthropocene. *Nature, 519*.
- Lindsey, R. (2022, June 23). *Climate Change: Atmospheric Carbon Dioxide* | NOAA Climate.gov. Climate.gov. Retrieved July 28, 2022, from <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>
- Lloyd, D., & Arstila, V. (Eds.). (2014). *Subjective Time: The Philosophy, Psychology, and Neuroscience of Temporality*. MIT Press.
- Lodgaard, S. (1990, March 30). *Environmental Conflict Resolution* [paper presented at the UNEP meeting on "Environmental Conflict Resolution"]. Nairobi.
- MacDonald, P. S. (2013). PALAEO-PHILOSOPHY: ARCHAIC IDEAS ABOUT SPACE AND TIME. *Comparative Philosophy, 4*(2).
- Magrini, J. (2006). "Anxiety" in Heidegger's Being and Time: The Harbinger of Authenticity. *Philosophy Scholarship, Paper 15*.

- Mahoney, J., & Rueschemeyer, D. (2014). *COMPARATIVE HISTORICAL ANALYSIS: ACHIEVEMENTS AND AGENDAS* (J. Mahoney & D. Rueschemeyer ed., Vol. Comparative Historical Analysis in the Social Sciences). Cambridge University Press.
- Malhi, Y. (2017). The Concept of the Anthropocene. *Annual Review of Environment and Resources*, 42(1).
- Mannheim, K. (1991). *Ideology and Utopia: An Introduction to the Sociology of Knowledge* (L. Wirth, Trans.). Routledge.
- Mao, G., Liu, J., Han, F., Meng, Y., Tian, Y., Zheng, Y., & Zheng, C. (2020). Assessing the interlinkage of green and blue water in an arid catchment in Northwest China. *Environmental Geochemistry and Health*, 42.
- Marsh, G. P. (2003). *Man and nature* (D. Lowenthal, Ed.). University of Washington Press.
- Mathews, A. S. (2020). Anthropology and the Anthropocene: Criticisms, Experiments, and Collaborations. *Annual Review of Anthropology*, 49(1).
- McNeill, J. R. (2001). *Something New Under the Sun: An Environmental History of the Twentieth-Century World (The Global Century Series)*. W. W. Norton.
- McNeill, J. R., & Engelke, P. (2016). *The Great Acceleration: An Environmental History of the Anthropocene Since 1945*. Harvard University Press.
- Medium. (2021). *What is the noosphere, and how do we harness its power?* YouTube. Retrieved July 12, 2022, from <https://thumblesteen.medium.com/what-is-the-noosphere-and-how-do-we-harness-its-powers-5eb882eb75a>
- Michelle Bastian. (2012, May 30). Is clock time really objective? *Michelle Bastian*. <https://www.michellebastian.net/home/is-clock-time-really-objective>

- Møller, B. (2001, September 8-10). Mediterranean Conflict Prevention Security and the Environment in the Mediterranean in the 20 Century - Conceptualising Security and Environmental Conflicts [Paper presented at the 4 Pan-European Conference at the University of Kent at Canterbury]. In *Global, National, Societal and Human Security, A General Discussion with a Case Study from the Middle East*. UK.
- More, T. (2003). *Utopia* (P. Turner, Trans.). Penguin Publishing Group.
- Mosher, D., & Woodward, A. (2019, October 17). What Earth might look like in 80 years if we're lucky — and if we're not. *Business Insider*.
<https://www.businessinsider.com/paris-climate-change-limits-100-years-2017-6?r=US&IR=T>
- Myhre, G., Lund Myhre, C. E., Samset, B. H., & Storelvmo, T. (2013). Aerosols and their Relation to Global Climate and Climate Sensitivity. *Nature Education Knowledge*, 4(5).
- NASA. (n.d.). *About the Earth as a System: Background Information | MyNASADData*. My NASA Data. Retrieved July 12, 2022, from
<https://mynasadata.larc.nasa.gov/basic-page/about-earth-system-background-information>
- NASA. (1996, August 1). *Atmospheric Aerosols: What Are They, and Why Are They So Important?* NASA. Retrieved August 1, 2022, from
<https://www.nasa.gov/centers/langley/news/factsheets/Aerosols.html>
- Newton, I., & Motte, A. (2008). *Newton's Principia: The Mathematical Principles Of Natural Philosophy (1846)*. Kessinger Publishing, LLC.
- Nicholson, M. (1987). *The New Environmental Age*. Cambridge University Press.
- Nicklen, P. (2022, May 19). *Earth's Systems*. National Geographic Society. Retrieved July 9, 2022, from <https://education.nationalgeographic.org/resource/earths-systems>

- Nielsen, R. W. (2021). The Great Deceleration and proposed alternative interpretation of the Anthropocene. *Episodes*, 44(2).
- Nietzsche, F. (2008). *Thus Spoke Zarathustra: A Book for Everyone and Nobody* (G. Parkes, Trans.). OUP Oxford.
- Niklas, U. (2001). Utopia and Modern Times: Thomas More, Hannah Arendt, and Suppression of the Political. *History of Philosophy Quarterly*, 18(2).
- Nitrogen Cycle Explained - Definition, Stages and Importance*. (n.d.). Byju's. Retrieved July 23, 2022, from <https://byjus.com/biology/nitrogen-cycle/>
- NOAA. (2015, November 12). *Ocean Acidification: Saturation State - Science On a Sphere*. Science On a Sphere. Retrieved July 31, 2022, from <https://sos.noaa.gov/catalog/datasets/ocean-acidification-saturation-state/>
- Orwell, G. (2021). *1984*. Intra.
- Palsson, G., Szerszynski, B., Sörlin, S., Marks, J., Avril, B., Crumley, C., Hackmann, H., Holm, P., Ingram, J., Kirman, A., Pardo Buendía, M., & Weehuizen, R. (2013). Reconceptualizing the ‘Anthropos’ in the Anthropocene: Integrating the social sciences and humanities in global environmental change research. *Environmental Science & Policy*, 28.
- Parlasca, M. (2022, April 25). Meat consumption must fall by at least 75 percent: However, in small quantities it can be quite sustainable. *ScienceDaily*. <https://www.sciencedaily.com/releases/2022/04/220425135937.htm>
- Parvanova, D. (2017). The industrial revolution was the force behind the New Imperialism. *ESSAI*, 15(30).

- Pasupathi, M. (2016). Autobiographical reasoning and my discontent: alternative paths from narrative to identity. In M. Syed & K. C. McLean (Eds.), *The Oxford Handbook of Identity Development*. Oxford University Press.
- Patomäki, H. (2003). Problems of Democratizing Global Governance: Time, Space and the Emancipatory Process. *European Journal of International Relations*, 9(3).
- Pearce, R. (2016, October 5). Anthropocene: The journey to a new geological epoch. *Carbon Brief*. <https://www.carbonbrief.org/anthropocene-journey-to-new-geological-epoch/>
- Persson, L., Carney Almroth, B. M., Collins, C. D., Cornell, S., de Wit, C. A., Diamond, M. L., Fantke, P., Hassellöv, M., MacLeod, M., Ryberg, M. W., Søgaard Jørgensen, P., Villarrubia-Gómez, P., Wang, Z., & Zwicky Hauschild, M. (2022). Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. *Environmental Science & Technology*, 56(14).
- Petchey, O. L., & Gaston, K. J. (2006). Functional diversity: back to basics and looking forward. *Ecology Letters*, 9(6).
- Pfister, C. (1992). Das 1950er Syndrom. Der Energieverbrauch unserer Zivilisation in historischer Perspektive. *Natur und Mensch*, 34.
- Pillalamarri, A., & Tiezzi, S. (2021, August 12). Afghanistan's Failed Constitution – The Diplomat. *The Diplomat*. <https://thediplomat.com/2021/08/afghanistans-failed-constitution/>
- Planetary boundaries update: freshwater boundary exceeds safe limits — Potsdam Institute for Climate Impact Research*. (2022, April 26). Potsdam Institute for Climate Impact Research. Retrieved July 27, 2022, from

- <https://www.pik-potsdam.de/en/news/latest-news/planetary-boundaries-update-freshwater-boundary-exceeds-safe-limits>
- Popper, K. (1986). Utopia and Violence. *World Affairs*, 149(1).
- Popper, K. R. (2002). *The Open Society and Its Enemies*. Routledge.
- Porter, B. (1989). David Davies: A Hunter after Peace. *Review of International Studies*, 15(1).
- The Qur'an* (M. A. Abdel Haleem, Trans.). (2008). OUP Oxford.
- Ragelienė, T. (2016). Links of Adolescents Identity Development and Relationship with Peers: A Systematic Literature Review. *J Can Acad Child Adolesc Psychiatry*, 25(2).
- Rappaport, H., Enrich, K., & Wilson, A. (1982). Ego Identity and Temporality: Psychoanalytic and Existential Perspectives. *Journal of Humanistic Psychology*, 22(4).
- Revelation. (2010). In *The Bible*. Cambridge University Press.
- Reverter, M., Sarter, S., Caruso, D., Avarre, J., Combe, M., Pepey, E., Pouyaud, L., Vega-Heredía, S., de Verdal, H., & Gozlan, R. E. (2020). Aquaculture at the crossroads of global warming and antimicrobial resistance. *Nature Communications*, 11(1870).
- Reynolds, A. (2021, September 8). Perspective | The U.S. helped design Afghanistan's constitution. It was built to fail. *The Washington Post*.
<https://www.washingtonpost.com/outlook/2021/09/08/afghanistan-constitution-failure/>
- Robinson, R. (1995). *Aristotle's Politics: Books 3 and 4*. Oxford: Clarendon Press.
- Rocher, L. (2004). Concepts of Time in Classical India. In R. M. Rosen (Ed.), *Time and Temporality in the Ancient World*. University of Pennsylvania Press, Incorporated.
- Rockström, J. (2016, September 22). *Goodbye forever; friendly Holocene*. GEF. Retrieved August 2, 2022, from <https://www.thegef.org/news/goodbye-forever-friendly-holocene>

- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... Foley, J. (2009). Planetary boundaries:exploring the safe operating space for humanity. *Ecology and Society*, 14(2).
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Stuart Chapin, F., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... Foley, J. A. (2009). A safe operating space for humanity. *Nature*, 461.
- Rockström, J., & Wang, L. (2022, April 26). *Freshwater boundary exceeds safe limits*. Stockholm Resilience Centre. Retrieved July 27, 2022, from <https://www.stockholmresilience.org/research/research-news/2022-04-26-freshwater-boundary-exceeds-safe-limits.html>
- Rosenfeld, M. (2010). *The Identity of the Constitutional Subject: Selfhood, Citizenship, Culture, and Community*. Routledge.
- Rosenfeld, M. (2010). *The Identity of the Constitutional Subject: Selfhood, Citizenship, Culture, and Community*. Routledge.
- Rovelli, C. (2018). *The Order of Time* (S. Carnell & E. Segre, Trans.). Penguin Publishing Group.
- Ruddiman, W. F. (2003). The Anthropogenic Greenhouse Era Began Thousands of Years Ago. *Climatic Change*, 61(3).
- Ruddiman, W. F., He, F., Vavrus, S. J., & Kutzbach, J. E. (2020). The early anthropogenic hypothesis: A review. *The early anthropogenic hypothesis: A review*, 240.

- Sangtong, K. (2021, March 14). *V-Dem report 2021: Global wave of autocratization accelerates*. Democracy Without Borders. Retrieved February 13, 2022, from <https://www.democracywithoutborders.org/16165/v-dem-report-2021-global-wave-of-autocratization-accelerates/>
- Sargent, L. T. (2005). The necessity of utopian thinking: A Cross-National perspective. In J. Rüsen, M. Fehr, & T. W. Rieger (Eds.), *Thinking Utopia*. New York: Berghahn Book.
- Sartre, J.-P. (2013). *Nausea* (L. Alexander & R. Howard, Trans.). New Directions Publishing Corporation.
- Schäfer, A., & Merkel, W. (2021, September). The Temporal Constitution of Democracies. *The Oxford Handbook of Time and Politics*.
- Scheffer, M., Carpenter, S. R., Foley, J. A., Folke, C., & Walker, B. (2001). Catastrophic shifts in ecosystems. *Nature*, 413.
- Schellnhuber, H.-J., Turner, B. L., Tyson, P. D., Sanderson, A., Richardson, K., Wasson, R. J., Jäger, J., Oldfield, F., Steffen, W., Matson, P. A., & Moore III, B. (2005). *Global Change and the Earth System: A Planet Under Pressure* (W. Steffen, Ed.). Springer.
- Schiermeier, Q. (2019). Eat less meat: UN climate-change report calls for change to human diet. *Nature*, 572.
- Schiffman, R. (2022, March 9). Amazon deforestation is fueled by meat demand. Shoppers can make choices that help. *The Washington Post*. <https://www.washingtonpost.com/climate-solutions/2022/03/09/amazon-rainforest-deforestation-beef/>
- Scott, C. A., & Thapa, B. (2015). Environmental Security. In *Environmental Science*.

- SDSN. (n.d.). *Indicator 75. Aerosol optical depth (AOD)*. Indicators and a Monitoring Framework. Retrieved August 1, 2022, from <https://indicators.report/indicators/i-75/>
- Sharp, H. (2020). Not all Humans, Radical Criticism of the Anthropocene Narrative. *Environmental Philosophy*, 17(1).
- Shibata, H., Branquinho, C., McDowell, W. H., Mitchell, M. J., Monteith, D. T., Tang, J., Arvola, L., Cruz, C., Cusack, D. F., Halada, L., Kopáček, J., Máguas, C., Sajidu, S., Schubert, H., Tokuchi, N., & Záhora, J. (2015). Consequence of altered nitrogen cycles in the coupled human and ecological system under changing climate: The need for long-term and site-based research. *Ambio*, 44(3).
- Shimizu, K., & Noro, S. (2020). An East Asian approach to temporality, subjectivity and ethics: bringing Mahāyāna Buddhist ontological ethics of Nikon into international relations. *Cambridge Review of International Affairs*.
- Shoshitaishvili, B. (2021). From Anthropocene to Noosphere: The Great Acceleration. *Earth's Future*, 9(2).
- Shutler, J., & Watson, A. (2020, September 28). Guest post: The oceans are absorbing more carbon than previously thought. *Carbon Brief*.
<https://www.carbonbrief.org/guest-post-the-oceans-are-absorbing-more-carbon-than-previously-thought/>
- Sivaram, C., Kenath, A., & Kiren, O. V. (2015). Evolution of Time Concept in Physics and in Philosophy. *Physics International*, 6(2).
- Śledzińska-Simon, A. (2015). Constitutional identity in 3D: A model of individual, relational, and collective self and its application in Poland. *International Journal of Constitutional Law*, 13(1).

- Smythe, L. J. (2013). NON-TRADITIONAL SECURITY IN THE POST-COLD WAR ERA: IMPLICATIONS OF A BROADENED SECURITY AGENDA FOR THE MILITARIES OF CANADA AND AUSTRALIA. *THE FACULTY OF GRADUATE STUDIES (Political Science) - THE UNIVERSITY OF BRITISH COLUMBIA*.
- Snyder, P. K., Delire, C., & Foley, J. (2004). Evaluating the Influence of Different Vegetation Biomes on the Global Climate. *Climate Dynamics*, 23(3).
- Sokol, J. T. (2009). Identity Development Throughout the Lifetime: An Examination of Eriksonian Theory. *Graduate Journal of Counseling Psychology*, 1(2).
- Solomon, T. (2014). Time and Subjectivity in World Politics. *International Studies Quarterly*, 58(4).
- Spruyt, H. (1996). *The Sovereign State and Its Competitors: An Analysis of Systems Change*. Princeton University Press.
- Steffen, W., Broadgate, W., Deutsch, L. M., & Gaffney, O. (2015). The Trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review*.
- Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature? *Ambio*, 36(8).
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223).
- Stevens, T. (2016). *Cyber Security and the Politics of Time*. Cambridge University Press.
- Stillman, P. (1991). The Concept of Utopia by Ruth Levitas. *Utopian Studies*, 2(1/2).

Stockholm Resilience Centre. (n.d.). *Planetary boundaries*. Stockholm Resilience Centre.

Retrieved July 26, 2022, from

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

Stoppani, A. (1873). *Corso di Geologia* (Vol. 2). Bernardoni e Brigola.

Suess, E. (1875). *Die Entstehung der Alpen*. W. Braumüller.

Syed, M., & McLean, K. C. (2015). Understanding identity integration: Theoretical, methodological, and applied issues. *Journal of Adolescence*.

Syed, M., & Mitchell, L. L. (2015). Temporal Identity Integration as a Core Developmental Process. In S. M. Kosslyn, R. A. Scott, M. C. Buchmann, & R. H. Scott (Eds.), *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary Searchable, and Linkable Reference for the 21st Century*. John Wiley & Sons, Incorporated.

Syvitski, J., Waters, C. N., Day, J., Milliman, J. D., Summerhayes, C., Steffen, W., Zalasiewicz, J., Cearreta, A., Gałuszka, A., Hajdas, I., Head, M. J., Leinfelder, R., McNeill, J. R., Poirier, C., Rose, N. L., Shotyk, W., Wagerich, M., & Williams, M. (2020). Extraordinary human energy consumption and resultant geological impacts beginning around 1950 CE initiated the proposed Anthropocene Epoch. *Communications Earth & Environment*, 1(32).

Tabboni, S. (2001). The Idea of Social Time in Norbert Elias. *Time & Society*, 10(1).

Teilhard de Chardin, P. (1947). The formation of the Noösphere. *Revue des Questions Scientifiques*.

Thrush, S. F., Ellingsen, K. E., & Davis, K. (2015). Implications of fisheries impacts to seabed biodiversity and ecosystem-based management. *ICES Journal of Marine Science*, 73(suppl_1).

- Troell, M., Naylor, R. L., Metian, M., Beveridge, M., Tyedmers, P. H., Folke, C., Arrow, K. J., Barrett, S., Crépin, A., Ehrlich, P. R., Gren, Å., Kautsky, N., Levin, S. A., Nyborg, K., Österblom, H., Polasky, S., Scheffer, M., Walker, B. H., Xepapadeas, T., & de Zeeuw, A. (2014). Does aquaculture add resilience to the global food system? *Proceedings of the National Academy of Sciences*, 111(37).
- Trombetta, M. J. (2008). Environmental security and climate change: analysing the discourse. *Cambridge Review of International Affairs*, 21(4).
- Trubetskova, I. L. (2010). From biosphere to noosphere: Vladimir Vernadsky's theoretical system as a conceptual framework for universal sustainability education. *University of New Hampshire - Doctoral dissertations*, 612.
- Turner, B. L., Schellnhuber, H.-J., Matson, P. A., Oldfield, F., Sanderson, A., Steffen, W., Moore III, B., Tyson, P. D., Jäger, J., Richardson, K., & Wasson, R. J. (2005). *Global Change and the Earth System: A Planet Under Pressure* (W. Steffen, Ed.). Springer.
- UN. (n.d.). *Causes and Effects of Climate Change* | *United Nations*. the United Nations. Retrieved July 29, 2022, from <https://www.un.org/en/climatechange/science/causes-effects-climate-change>
- UN. (2012, October 16). *Human Life Dependent on 'Planetary Boundaries' that Should Not Be Crossed, Says Panellist in Second Committee Special Event* | *UN Press*. Meetings Coverage and Press Releases. Retrieved July 25, 2022, from <https://press.un.org/en/2012/gaef3341.doc.htm>
- UNDP. (1994). *HUMAN DEVELOPMENT REPORT 1994*. Oxford University Press.
- UNEP. (2019). *Global Chemicals Outlook II: From Legacies to Innovative Solutions: Implementing the 2030 Agenda for Sustainable Development*. UNEP.

- UNEP. (2021, September 15). *Rebuilding the ozone layer: how the world came together for the ultimate repair job*. UNEP. Retrieved August 1, 2022, from <https://www.unep.org/news-and-stories/story/rebuilding-ozone-layer-how-world-came-together-ultimate-repair-job>
- UNFCCC. (2018). *UN Climate Change ANNUAL REPORT 2017*.
- Valderrama, N., Ramos-Amzquita, S., Bernal, S., & Negron, A. (2009). Linear Temporality: A Cultural Perspective of the Origin of Life. *Origins of Life and Evolution of the Biosphere*, 39(3-4).
- Valverde, M. (2014). Studying the governance of crime and security: Space, time and jurisdiction. *Criminology and Criminal Justice*, 14(4).
- van de Koppel, J., Rietkerk, M., & Weissing, F. J. (1997). Catastrophic vegetation shifts and soil degradation in terrestrial grazing systems. *Trends in Ecology and Evolution*, 12(8).
- van Doeselaar, L., Becht, A. I., Klimstra, T. A., & Meeus, W. H.J. (2018). A Review and Integration of Three Key Components of Identity Development. *European Psychologist*, 23(4).
- van Doeselaar, L., McLean, K. C., Meeus, W., Denissen, J. A., & Klimstra, T. A. (2020). Adolescents' Identity Formation: Linking the Narrative and the Dual-Cycle Approach. *Journal of Youth and Adolescence*, 49.
- Verburg, P. H., Crossman, N., Ellis, E. C., Heinimann, A., Hostert, P., Mertz, O., Nagendra, H., Sikor, T., Erb, K., Golubiewski, N., Grau, R., Grove, M., Konaté, S., Meyfroidt, P., Parker, D. C., Chowdhury, R. R., Shibata, H., Thomson, A., & Zhen, L. (2015). Land system science and sustainable development of the earth system: A global land project perspective. *Anthropocene*, 12.

- Vernadsky, W. I. (1945). THE BIOSPHERE AND THE NOÖSPHERE. *American Scientist*, 33(1).
- Vidal, C. (2021). What is the Noosphere? Planetary Superorganism, Transition and Emergence. *Center Leo Apostel - Vrije Universiteit Brussel*.
- Vieira, F. (2010). The concept of utopia. In G. Claeys (Ed.), *The Cambridge Companion to Utopian Literature*. Cambridge: Cambridge University Press.
- Waldron, J. (2003). Security and Liberty: The Image of Balance. *The Journal of Political Philosophy*, 11(2).
- Wang- Erlandsson, L., Tobian, A., van der Ent, R. J., Fetzer, I., & al. (2022). A planetary boundary for green water. *Nature Reviews Earth & Environment*, 3.
- Ward, B. (2014, September 22). Climate change as catalyst of conflict » Yale Climate Connections. *Yale Climate Connections*.
<https://yaleclimateconnections.org/2014/09/climate-change-as-catalyst-of-conflict/>
- Watson, A. J., Lenton, T. M., & Mills, B. J.W. (2017). Ocean deoxygenation, the global phosphorus cycle and the possibility of human-caused large-scale ocean anoxia. *Philosophical transactions of the Royal Society A.*, 375(2102).
- Weber, M. (2013). *The Protestant Ethic and the Spirit of Capitalism*. Merchant Books.
- Weber, M., & Wittich, C. (2013). *Economy and Society* (G. Roth, Ed.; 1st ed., Vol. 2). University of California Press.
- Wendt, A. (1994). Collective Identity Formation and the International State. *The American Political Science Review*, 88(2).
- Wendt, A. (1999). *Social Theory of International Politics*. Cambridge University Press.

- Westing, A. H. (Ed.). (1989). *Comprehensive Security for the Baltic: An Environmental Approach*. SAGE Publications.
- Whalen, J. T. (2015). Anxiety, the Most Revelatory of Mood. *Akadimia Filosofia*, 1(1).
- What Is Climate Change?* | United Nations. (n.d.). the United Nations. Retrieved July 28, 2022, from <https://www.un.org/en/climatechange/what-is-climate-change>
- What is eutrophication?* (2021, February 26). National Ocean Service. Retrieved July 23, 2022, from <https://oceanservice.noaa.gov/facts/eutrophication.html>
- WHO. (2017, October 16). *Radiation: The known health effects of ultraviolet radiation*. WHO | World Health Organization. Retrieved August 1, 2022, from <https://www.who.int/news-room/questions-and-answers/item/radiation-the-known-health-effects-of-ultraviolet-radiation>
- Whyte, A. V. (2001). Environmental Security. *International Encyclopedia of the Social & Behavioral Sciences*.
- Wilson, L. (1968). Land systems. *Geomorphology*.
- WMO. (2015). *Assessment for Decision Makers: Scientific Assessment of Ozone Depletion 2014*. World Meteorological Organisation.
- Wolfers, A. (1952). "National Security" as an Ambiguous Symbol. *Political Science Quarterly*, 67(4).
- Working Group on the 'Anthropocene' | Subcommission on Quaternary Stratigraphy*. (n.d.). Subcommission on Quaternary Stratigraphy. Retrieved July 7, 2022, from <http://quaternary.stratigraphy.org/working-groups/anthropocene/>
- WWF. (n.d.). *What is Freshwater and Where is it Found?* WWF. Retrieved August 1, 2022, from <https://www.worldwildlife.org/industries/freshwater-systems>

- Xu, X., Sharma, P., Shu, S., Lin, T., Ciais, P., Tubiello, F. N., Smith, P., Campbell, N., & Jain, A. K. (2021). Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nature Food*, 2.
- Zalasiewicz, J., Williams, M., Haywood, A., & Ellis, M. (2011). Introduction: The Anthropocene: a new epoch of geological time? *Philosophical Transactions: Mathematical, Physical and Engineering Sciences*, 369(1938).
- Zurlini, G., & Müller, F. (2008). Environmental Security. In S.E. Jorgensen & B. Fath (Eds.), *Encyclopedia of Ecology* (Vol. 2). Elsevier Science.

Summary

Introduction

Starting from the end of the Cold War, a new field within security studies began to emerge - that of environmental security; while its characteristics and scope are still somehow under debate (as it will be shown in the first chapter of this work), several of its concerns constitute some of the major challenges that humankind will have to face in the (at least nearby) future - among which climate change, widely considered “the defining challenge of our time” . Centering this work on environmental security will then allow us to analyze a field which is gradually becoming one of - if not the - most important areas of security studies. A fundamental guiding principle in (environmental) security is that of Time - indeed, major headlines fill the world’s newspaper and academic articles everyday with titles such as “What Earth might look like in 80 years [...]”, or “Net-zero by 2050” - yet, the great focus given to time within the academic debate is mostly limited to techno-scientific and socioeconomic research in which time is identified with “clock and calendrical reckoning”, and it merely serves as a given “language” with which to illustrate concepts and issues (the number of years within which a certain environmental policy is to be achieved; the social or economic effects of the rising sea levels by 2070; etc.). This has so far left little attention paid to the actual anthropological and sociopolitical nature of time - that is, “how time is constructed (...) by whom, for what purpose, and to what effect”; nonetheless, it is this inherently human characteristic of time that shapes people’s understanding of past, present and future, consequently forging societies - thus states - down to their most intimate components, and ultimately affecting policies at both the national and international level. An analysis of time’s socially constructed nature would then allow us to grasp a deeper comprehension of a fundamental component - that is, Time - of one of the (increasingly) most important fields within security studies - that is, Environmental security. This will be the topic of the work presented here.

This work aims at constituting an academic contribution to the growing securitization process characterizing the international order by providing an intellectual linkage between the study of Temporality and that of Environmental security. Through a multidisciplinary approach analyzing subjective time and objective time in their respective fields of studies, the work will try uncovering the nature of the human perception of time, to later contextualize it into XXI century

environmental security with the purpose of investigating how such a perception of time shapes humans' ability to effectively tackle the environmental challenges currently posed before them. This integration of temporality into today's environmental security will expose a cognitive "temporal trap" that the work will attempt to solve by turning to the study of visions of the future in the form of dystopias. It will therefore be argued that *the Self can envision unfamiliar futures without disrupting its sense of stability through a creative dystopia provoking the familiar feeling of anxiety embedded in human beings.*

I. Environmental Security

I.I Defining "Environmental Security"

After an initial understanding solely based on states' access to natural resources, environmental security evolved so as to increasingly focus (as previously said) on non-traditional security threats that consist of transnational political challenges resulting from natural processes. The scope of environmental security was thus enlarged by including threats arising from nature itself - most importantly those consequences of anthropogenic environmental degradation. This extended subject of concern (access to natural resources; consequences of natural processes) now constitutes the basis of environmental security studies, and it is seen - and studied - within the field as either a source of violent conflict (a historically major area of studies), a barrier to human well-being, or a means to resolve or mitigate insecurity.

Environmental security has a two-fold nature consisting of both the objective (scientifically measured) risk of losing ecosystem goods and the subjective (non-scientific) perception of such risk. Environmental security studies should then not only focus on objective risks (as it has almost always been the case in the past decades), but should instead include the analysis of how these risks are understood by societies and individuals. This work tries to move in this direction by linking environmental studies to an important component of human (subjective) perception - that is, temporality.

I.II The beginning of a new era: The Anthropocene and the Noösphere

Before proceeding with the analysis of the current environmental security issues, we should first illustrate the historical context in which they are taking place. The rapid technological

developments brought by the Second Industrial Revolution led scientists and intellectuals in the second half of the XIX century to begin analyzing the impact that humankind was increasingly having on the Earth System (the interaction of the Earth's geosphere, biosphere, cryosphere, hydrosphere, and atmosphere that produces the environments characterizing the planet). Such a quest for explanations gained momentum following the exacerbation of anthropogenic environmental impact brought by the Great Acceleration, and it ultimately culminated in two opposite paradigms: the Anthropocene and the Noösphere (representing two opposite sides of the academic debate). Studying these two paradigms is fundamental to explain the present historical context (and its perception by the academic community), which is itself necessary to understand the issues currently dealt with by environmental security.

While the Anthropocene focuses on the temporal aspect of human activity (setting the impact of Man as the trigger of a new geological epoch) the Noösphere instead stresses the importance of its spatial nature (creating a new Earth's sphere consisting of all human interactions produced by globalization). The two paradigms center their attention on the planetary nature of human impact, however, they differ substantially in both the consequences of it and the means with which this impact is achieved: the Anthropocene highlights the rupture between the previous geological epochs and the new one, and sees the alteration of matter and energy cycles as the cause of it - therefore resting on a purely physical level (anthropos/ἄνθρωπος: (physical) "man"; in opposition to theos/θεός: (metaphysical) "God"). The Noösphere instead focuses on the development of the Earth towards a new era, and regards the global interconnection of all minds and cultures into a single one as the reason behind such evolution - thus moving to the metaphysical level (noos/vóos: "mind", shared by both the anthropos and the theos). The different stances of the Anthropocene and the Noösphere paradigms towards the growing influence of Man on the Earth System lead to two opposite (often conflicting) intellectual frameworks: by assuming a predominantly pessimistic outlook towards the material changes brought by the Great Acceleration, the Anthropocene leaves a message of crisis and warning about future further disruption; in opposite direction, by adopting an optimistic attitude towards the growing interconnectedness characterizing the last 70 years, the Noösphere transmits an idea of transformation and hope, of a rapidly growing collective conscience able to take awareness and tackle the environmental challenges posed before it.

The two paradigms provide considerably different ways of perceiving our historical epoch, its causes and possible solutions; nonetheless, as Shoshitaishvili suggests, there can be a benefit from trying to reconcile these two outlooks so as to provide a single, more comprehensive understanding of the challenges posed before us by the Great Acceleration.

I.III From the Great Acceleration to a “safe operating space”: environmental (in)security in the XXI century

After having discussed the present historical period through the illustration of the two major paradigms elucidating it, it is time to move to the analysis of the environmental challenges characterizing it.

Nowadays the concept of “Great Acceleration” - and its twenty four graphs, updated in 2015 - occupies a central spot in the wider academic debate, playing a key role in both the Anthropocene and the Noösphere paradigm (see the previous section) by illustrating the trends that characterized the last two centuries of some of the most important components of both the humankind and Earth system. Such trends are interconnected between them, as an increase or decrease in one of the socioeconomic components leads to an alteration of the one or more Earth system elements (or other socioeconomic ones) connected to it, and vice versa.

The Great Acceleration is a temporary event showing us a permanent future in which humanity and the Earth System are comprehensively interconnected to the point at which any action of the former leads to a reaction of the latter. This highlights the need for humankind to reach the level of awareness and responsibility towards the Earth System proportionate to its technological capacity to alter it - in fact, the way humankind will interpret this new reality brought by the Great Acceleration, and deal with the long-lasting effects produced by it, will within the next decades either determine whether we are moving towards a Great Disaster or we have found our “safe operating space” in which to thrive.

The rapid changes brought by the Great Acceleration and their negative effects on the Earth System made many within the scientific community begin to question the current global socioeconomic system, and look for alternative models of development that could ensure the wellbeing brought by the Great Acceleration while simultaneously avoiding its disruptive tendencies. To this purpose, a scientific group led by Johan Rockström proposed (inspired by the work of the Club of Rome) in 2009 a framework known as the “Planetary Boundaries”, which

rapidly became the most influential scientific approach to providing humanity a safe operating space. The framework uncovers the current major disruptive processes within the planet's biophysical subsystems, and assigns each of them a number of key control variables (particular elements that characterize the process, thus keeping track of it) and associated thresholds that if crossed could rapidly shift the control variable - therefore the process - into a new, unknown state with potentially disastrous consequences for the Earth System and humankind.

The nine planetary boundaries currently used, which in turn represent nine disruptive ecological processes, are: *climate change; ocean acidification; stratospheric ozone depletion; biogeochemical flows; changes in biosphere integrity; freshwater use; land-system change; atmospheric aerosol loading; introduction of novel entities*. Of the nine planetary boundaries, six of them have been transgressed: changes in biosphere integrity; climate change; land-system change; biogeochemical flows; introduction of novel entities; and freshwater use

I.IV Rethinking Environmental Security

The international community will need to abandon the current old-fashioned understandings of security aimed at ensuring the sole survival of the nation-state within a logic of rivalry between sovereign states; these approaches cause further harm to the planet and the international community itself, as they first do not allow for the cooperation needed to tackle environmental challenges - thus worsening the disruption of the Earth system - and then radicalize the competition between states when the worsening Earth system conditions inevitably lead to the deterioration of resources.

Instead, environmental security should increasingly be dealt with by international organizations, local governmental entities (city administrations, regional administrations, etc.) and citizens themselves - that is, supranational and local realities better equipped at dealing with the global and regional character of XXI century environmental threats. This will need a drastic revisiting of the concept of national sovereignty (tackling the intellectual and political oppositions that it might face), as well as the “restructuring” of international organizations and the promotion of forms of democratic participation so as to allow them to better carry out their new enhanced roles within environmental security (an example could be the creation of a “World Environmental Organization” and the new bottom-up approaches increasingly stemming from local non-profit organizations). Together with the change in its actors, environmental security should also shift its

focus: traditional environmentalist discourses of “doing no harm to planet Earth” that do not take into account the need to ensure the nation-state’s development would be as disruptive as those taking only the nation-state’s development into account, for the simple fact that they would largely be ignored by political actors, who would feel legitimized (by the utopian character of such discourses) to further reiterate the pre-existing security frameworks previously mentioned. To this purpose, it is fundamental (as mentioned in the third section of this chapter) to understand and study environmental security in relation to other branches of security - energy security in the first place.

II. Time and Temporality

II.I Linking Security and Time: the objective and the subjective

A large space was dedicated in the previous chapter to the scientific description of environmental security threats; while this might seem excessive for a soft sciences’ work, I believe it to be fundamental to capture the objectivity of environmental threats, which must be addressed by any work dealing with environmental security in order to create a solid base of knowledge from which to later move to the other side of security - subjective security. Having dealt with objective security, the work can now turn to subjective security. Shifting from objective to subjective security pushes us into the realm of perception - that is, how a person understands a given objective threat. The previous chapter has shown that the red thread connecting all aspects of environmental security is time; yet, the time with which this work has so far dealt with is what is often referred to as “objective time”. As we now move to the analysis of subjective security, so shall the kind of time analyzed change: in fact, subjective time measures subjective security to the extent that objective time measures objective security.

Temporality is the component of subjective time providing the comprehensive human understanding of past, present, and future; it is only a component of subjective time in that subjective time also consists of what could be called “short-run clock time perception” - subjective but immediate, not connected to a wider existential context like temporality, which is instead the understanding of the “time of our lives”. It is precisely this wider understanding given by temporality that enables the pursuit of security, which (as previously said) rests on the three components of time: past, present and future.

II.II A short history of temporality: the rise of standard (clock) time and Western linear temporality

Two distinctive and mutually exclusive categories of temporality have historically existed: cyclical temporality and linear temporality. Cyclical temporality perceives past, present and future events as a cycle endlessly repeating itself, whereas linear temporality perceives time as fundamentally moving unidirectionally from the past to the future, like an arrow. Several pre-industrial civilizations had a cyclical temporality, being heavily influenced by the cyclical rhythms of the agricultural year. In opposition to this cyclical temporality, the Christian tradition - based on both the cyclical teleological temporality of Judaism and the Aristotelian paradigm of time - developed a linear teleological temporality that perceived time as flowing from past to future, towards an ultimate telos. The spreading of Christianity in Europe during the Medieval period allowed this linear temporality to uniformly expand throughout the continent. Subsequently, this western linear temporality was - through colonization - exported into the other continents. Thus, as of today, Western clock time and its underlying linear temporality are what Hom calls “modernity’s most global hegemon”, constituting a fundamental pillar on which sovereignty rests, and shaping all aspects of national as well as international social, economic, and political relations.

Western linear temporality has however in recent years been the focus of feminist and postcolonialist studies, with a surge in academics claiming the need to abandon the idea of a single globally hegemonic temporality - rooted in colonial exploitation - and move towards the acceptance of the multiple temporalities that are in reality present (but obscured by the hegemonic western linear one) in the world and within individual societies themselves - what Hutchings identifies with the term “heterotemporality”.

II.III Uncovering temporality: identity formation in the new environmental age

The absence of an “absolute” temporality should then make us shift our focus to the very nature of temporality, analyzing the motivations and dynamics behind its formation and existence - that is, why do humans structure time into the wider framework of past, present and future? This section aims at addressing such a question.

A fundamental contribution to the analysis of time in social sciences was provided by Norbert Elias in several influential works throughout his career. Instead of focusing primarily on temporality, Elias draws our attention to the concept of timing, which he perceives to be analytically prior to both time and temporality. Timing can be understood as the practice based on “people’s capacity for connecting with each other two or more different sequences of continuous changes, one of which serves as a timing standard for the other”. What we perceive to be the “objective time” given by the calendar is in fact the product of a widely accepted - but nonetheless subjective - timing practice taking the calendar as the frame of reference to perceive change. Similarly, temporality has its origin in timing, because the human understanding of past, present and future depends on the frame of reference used to measure change (which is what differentiates past, present and future) and assign meaning to it. Both time and temporality are then simply the local result of a more meaningful underlying universal process through which humans seek to define themselves and what surrounds them.

Being a product of timing, temporality (and the time on which it rests) is consequently purely relative and positional, existing insofar as it is able to satisfy a specific purpose for a particular society or individual. Among such purposes is the vital process of identity formation, which plays a fundamental role in environmental security - the topic with which this work deals.

Increasing research points to the fact that identity continues to be formed throughout adulthood; identity formation can be understood as “the complex manner in which human beings establish a unique view of self (...) characterized by continuity and inner unity” : through social interaction with their surrounding environment, humans construct a mental representation of themselves (therefore subjective) which serves as a “fundamental organizing principle” able to synthesize their experiences in a way that provides them with a sense of continuity (perceiving the self as being the same over time) and inner unity (perceiving the self as coherent across life domains), as well as a feeling of uniqueness (a frame to differentiate between self and others). Continuity and inner unity are needed to provide the individual with a sense of stability, while uniqueness allows the individual to function autonomously from others.

A fundamental purpose for which temporality is created is that of forming identity: identity formation is a process that constantly unfolds in the present moment (as this is the only time inhabited by humans, therefore the only one in which psychological activities are carried out) whose central subjects of analysis and constitutive elements however include the dimensions of

past and future (that is: the subjective perception of them). By looking at both his past and future, the man constructs his identity in the present and consequently takes action. Temporality therefore plays a role in identity formation in that the continuous process through which identity is formed entails persons to look back at what they perceive their past to have been (through memory), and look forward to what they believe their future will be.

Given its purpose of forming identity, it is logical to assume that temporality will have to satisfy the three pillars on which identity rests - that is: continuity, inner unity and uniqueness. Therefore, this work argues that human understanding of past, present and future is constructed so as to give humans a sense of being the same over time, being coherent across all life domains, and being different from others. Thus, in order to understand how temporality comes into being, one should look at the pillars on which identity rests (continuity, inner unity and uniqueness) and the conditions satisfying them.

Having established that temporality is shaped so as to satisfy the pillars of identity, the work should (and will) now concretely illustrate what kind of temporality is able to satisfy such pillars. Although analyzing all three components of identity would surely yield interesting points of reflection for the social sciences, this work will only focus on continuity, because it believes it to be directly connected to the topic of environmental security with which this work ultimately deals.

What kind of temporality is needed to provide the self with such a sense of being the same over time? The temporal qualities of identity require a stable sense of time for there to be a stable sense of self. It can therefore be argued that humans construct stable temporalities with the (constant) aim of providing themselves with a stable sense of self. Such a stable temporality consists of perceiving the flow of time as stable, therefore of a future perceived as a continuation of the present. Since identity in turn determines action, humans act imagining the future as being characterized by the same kind of events characterizing the present.

How does this relate to environmental security? A large part of the previous chapter was dedicated to the changes in the Earth System leading to what many scientists believe to be a “new environmental era”. The bigger picture emerging from the previous chapter is that of having entered a new historical period marked by a different relation between humankind and the Earth system, and the necessity for humankind to acknowledge the future unprecedented ecological changes that this new environmental era will have if the current socioeconomic and

ecological trends are to continue, and effectively take action so as to prevent them from happening. This chapter has however proved that human perception of the future cannot accommodate changes that are unprecedented, because they would disrupt the sense of continuity needed by identity. As the ability to take action rests on identity, and identity rests on temporality, the inability of the current temporality to accommodate such changes translates into the inability of humankind to take effective action against the increasing deterioration of the Earth System; this conclusion can be proved by the preoccupying findings shown in the planetary boundary framework, thoroughly illustrated in the third section of the first chapter of this work. This in turn directly impacts the pursuit of environmental security. Therefore, it can be argued that *humans construct a kind of temporality unable to acknowledge the changes that the new environmental era entails - because such changes would deprive the human self of the sense of stability on which it rests - consequently preventing effective action against environmental disruption from being taken, and ultimately hindering the pursuit of environmental security in the XXI century.* We can try to provide a general rule on which to base the concept stated above by saying that *reality is a victim of temporality, which is in turn a victim of the self.*

II.IV Overcoming the temporal trap: provoking anxiety through creative dystopias

How to escape this temporal trap? The root underlying the problem contained in the temporal trap is the inherently unprecedented nature of the ecological events threatening planet Earth. Within this context, the only way to solve the temporal trap is to find a way for humans to imagine unprecedented events in a way that does not disrupt their identity's stability. In order to do this, it is important to focus on the human perception of the dimension from which these events stem - that is: the *future*.

Heidegger provides a useful addition to the framework illustrated in the previous section by uncovering the process through which the Self constantly envisages new possible kinds of futures, and how such *visions* of the future guide the Self and stimulate it to take action, leading it to eventually becoming the possibilities that it has envisaged. In the pursuit of a solution to the temporal trap previously illustrated, further analyzing the role of visions of the future - in the form of utopias and *dystopias* - as “instruments” capable of introducing to the present Self unprecedented futures without disrupting its sense of stability could provide interesting results.

Moving towards the analysis of how visions of the future motivate collective action and influence decision making is not a simple task, for the topic has historically been largely ignored within the academic world. Such a lack of deeper analysis becomes particularly evident when moving to the study of utopia (and consequently dystopia). Utopia in fact suffers to this day from a heavy stigmatization among scholars, mostly originating from the two world wars - which, on the one hand washed away with their horrors all positivist utopian claims of humanity's infinite progress, and on the other constructed through the authoritarian regimes rising in Europe new visions of the future (dystopic, one might say) that proved the powerful destructive force of utopia. The end of the XX century nonetheless witnessed a renewed interest towards it, with international relations academics reapproaching the concept, in line with the developments in cognitive science uncovering the importance of the perception of the future in identity formation processes.

This work sees *utopia as a vision of a better (not perfect) future in which the Self can be located, which generates dissatisfaction with the present situation and stimulates action towards the achievement of the envisioned future*. Utopia's "other side of the coin" - that is, *dystopia, consists of a vision of a worse future in which the Self can find itself stimulating action against that possible future from coming into being*. To summarize, utopias and dystopias rest on a comparison between the present and a hypothetical future, and have the aim of stimulating action so as to reduce (for utopia) or increase (for dystopia) the distance between the actual situation and the hypothetical one.

The obvious question arising from this statement is how can such visions of the future arise, and where from. In order to do this, we should move to the study of vision of the future within the field of political science; the study of visions of the future within political science has traditionally followed two approaches, based on the field's different academic branches; these are what Berenskoetter calls "robust visions" approach and "creative visions" approach. Unlike the robust visions approach judging visions as effective or not based on their embeddedness in historical dynamics, the creative visions approach focuses on the ahistorical ability of individuals to provide new visions of the future (however drawing on their experience) provoking an emotional response that inspires humans to take action.

What kind of vision of the future is relevant to the temporal trap introduced here? As the future scenarios to be imagined for humans to understand the seriousness of the current environmental

situation are purely negative, the vision of the future needed is that of a dystopia - that is: a vision of a worse future in which the Self can find itself stimulating action against that possible future from coming into being. A robust vision is insufficient to solve the temporal trap with which this work deals - if this was the case, the several negative future scenarios outlined by scientists in the last decades would have been able to invert many of the socioeconomic trends illustrated in the previous chapter, consequently providing a very different Planetary Boundary Framework scenario than the one here shown. This further legitimizes the need to focus on the creative aspect of visions: indeed, the unprecedented nature of the possible future disruptive ecological changes awaiting planet Earth demands a creative vision able to allow the envisioning of events believed to be impossible. How should such a vision be, in order to be able to overcome the temporal trap? As argued above, creative visions do not base themselves on compelling arguments illustrating the pre existing dynamics that justify their coming into being, but instead lay their success on their capacity to stir emotions. The emotional response generated by a dystopia is of course a negative one, provoked by envisioning a worse future. As it has been illustrated through both the account of identity formation processes and Heidegger's philosophy, humans constantly project themselves into the future; if they project themselves into the future, they also project the feelings characterizing them (the moods - by using Heidegger's terminology) - among which is the feeling of anxiety³⁴³. Thus, a vision of the future stirring the emotion of anxiety would be able to overcome the temporal trap, in that it would provide the Self with the confirmation of a feeling that it already experiences in the present. This work then argues that the Self can envision unfamiliar futures without disrupting its sense of stability through a creative dystopia provoking the familiar feeling of anxiety embedded in human beings.

Conclusion

This work has tried connecting a field of security studies still (unfortunately) quite under investigated - environmental security - with a topic almost completely ignored - temporality. At the heart of what might seem like an unusual connection between two uncommon subjects of analysis lies the firm belief in putting all of our best efforts in the pursuit of solutions to the undergoing environmental disruption characterizing planet Earth. This entails attempting to construct linkages between fields and subjects where no relations have been established before. The work presented here can be read in this perspective.