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CLIMATE CHANGE, ARCTIC AND SECURITY IN THE 21ST CENTURY

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Abstract

Climate studies have been evolving since the 19th century allowing to present possible future changes that are being felt around the world and specifically in the Arctic region, which is profoundly impacted by climate change. The Arctic has become a critical area of concern in the context of global security in the 21st century. Extensive climate studies highlight the rapid loss of sea ice, which has significantly altered both the physical environment and geopolitical dynamics. This dramatic ice loss is accelerating the opening of new maritime routes, making changes in the ecosystem on earth and below water, current waters included. Climate change, acting as a threat multiplier, exacerbates existing security risks. The Copenhagen School's concept of securitization is particularly relevant in this context, as the Arctic's environmental changes are increasingly framed as security issues, with potential for militarization and conflict over sovereignty and resources. The intersection of climate change and security in the Arctic emphasizes the urgency of managing the region's growing geopolitical significance while mitigating the risks posed by its changing climate. Thus, challenges have a global impact. An inter- and multi-interdisciplinary qualitative analysis shows the interconnectedness of the elements and topics.

Keywords

Anthropocene, Arctic, Climate Change, Copenhagen School, Threat Multiplier, Security.

Resumo

Os estudos do clima têm evoluído desde o século XIX, o que permite apresentar possíveis mudanças futuras. Mudancas que já se fazem sentir em várias regiões do planeta e mais especificamente na região do Ártico. O Ártico é uma área de preocupação crescente no contexto da segurança global no século XXI. Através Estudos dos estudos e registos sobre a evolução e do clima, é possivel destacar a rápida perda da calora polar, do gelo no oceano, o que tem consequências no ambiente físico e por conseguinte a nível geopolítico. Deste modo, um oceano sem gelo abre novas rotas marítimas, provoca mudanças nos ecossistemas terrestres e marinhos. As alterações climáticas são uma ameaça. Assim, o conceito de securitização da Escola de Copenhaga é particularmente relevante neste contexto, tendo em conta que as alterações sentidas na região do Ártico são cada vez mais enquadradas nos temas relacionados com segurança, militarização e conflito sobre soberania e recursos. O nexo alterações climáticas e segurança no Ártico enfatiza a necessidade de entender a crescente importância geopolítica da região, ao mesmo tempo que se mitigam os riscos. Significa que os desafios têm um impacto global. Uma análise qualitativa inter e multi-interdisciplinar demonstra a interconexão dos elementos e tópicos.

Palavras-chave

Antropoceno, Ártico, Alterações Climáticas, Escola de Copenhaga, Multiplicador de Ameaças, Segurança.

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CÉLINE RODRIGUES

Climate change acts as a threat multiplier
for instability in some of the most volatile regions of the world.
CNA, 2007, p. 6

Introduction

The year 1610 is seen as an important year for some scholars when trying to identify the beginning of the Anthropocene as an event or epoch. For the French philosopher Bruno Latour, that year is related to a massive reforestation after the Age of Discovery that changed the landscape and Indigenous communities of the Amazon. An idea sustained by Lewis and Maslin in their article entitled *Defining the Anthropocene* (2015). 1610 is also the year Galileo published *Siderus Nuncius*, "the Messenger from the Stars", as it can be read in *Facing Gaia* (Latour, 2017). A year that also coincides with the death of Henry IV. From Latour' s perspective, this specific year brings together the following themes: 1)- Earth (massive reforestation), 2)- science (Galileo) and 3) religion (death of Henri IV) in 1610 (Latour, 2017). The authors Lewis and Maslin (2018; 2015), who identify this year as the *Orbis spike*, sustain that in 1610 there was a decrease in atmospheric CO2 as a consequence of the arrival of colonizers leading to a decline in human numbers in the American continent between the period 1492 - 1650, the first global trade networks between Europe, China, Africa and the Americas, named Globalisation 1.0 by Lewis and Maslin (2018). A fact that for both authors is to be considered the beginning of the Anthropocene. In the face of Will Steffen et al (2011) considering that "it is difficult to put a precise date on a transition that occurred at different times and rates in different places" (2011, p. 849).

The term Anthropocene, coined by Paul Crutzen and Eugene Stoermer in 2000, does not seem to find consensus amid geologists. However, for some scholars there is no doubt that it is human activity that has been affecting the Earth system. An observation made in 1873 by the Italian geologist Antonio Stoppani and in 1926 by V. I. Vernadsky who "acknowledged the increasing impact of mankind" (Crutzen, 2002, p. 23).

For the 2018 Nobel Prize Laureate, the epoch of the Anthropocene started in the final part of the 18th century "when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane" (*idem*). This coincides

with the Industrial Revolution. The second moment, that is also often branded as the beginning of the Anthropocene, is the Great Acceleration (named Globalisation 2.0 by Lewis and Maslin, 2018) in the 1950s and the atomic bomb.

Nonetheless, the authors of *Defining the Anthropocene* (Lewis and Maslin, 2015) consider that two dates are of choice according to the perception one has of human actions on the environment: a)- 1610 (Orbis spike): for the authors this date is "the geological and historical importance of the event" (Lewis and Maslin, 2015, p. 177) that is linked to a transoceanic movement of species "through colonialism, global trade and coal" (idem); b)- 1964 (bomb spike or golden spike (Rockström et al, 2016) is instead the expansion of technology that can destroy the planet.

In March 2024, the Subcommission on Quaternary Stratigraphy of International Commission on Stratigraphy (ICS) did not accept the proposal of the Anthropocene Working Group (AWG). The AWG is an interdisciplinary research group created in 2009 to the investigate the Anthropocene. From AWG' s perspective, the working group decided, by majority, in 2016 that the beginning of the Anthropocene epoch is in the mid-20th century with the "Great Acceleration". This vision collides with the Subcommission on Quaternary Stratigraphy' s opinion (2024) whose members rejected the proposal of Anthropocene Working Group presented in 2016 to consider the Anthropocene an epoch. For now, the discussion mentioned above about whether it is an event or epoch is considered closed by the voters. The Anthropocene is an event, matching Gibbard´s above mentioned point of view. So, Holocene (which epoch began 11,700 years ago) is still the epoch humankind lives in.

The environmental disruption has directed the way to Johan Rockström and Will Steffen to create a framework, assessing critical environmental thresholds, by studying the resilience of ecosystems (Attenborough, 2020; Lewis and Maslin, 2018) and present planetary boundaries in a total of 9: 1) Climate change, 2) Change in biosphere integrity (biodiversity loss and species extinction), 3) Stratospheric ozone depletion, 4) Ocean acidification, 5) Biogeochemical flows (phosphorus and nitrogen cycles), 6) Land-system change (for example deforestation), 7) Freshwater use, 8) Atmospheric aerosol loading (microscopic particles in the atmosphere that affect climate and living organisms), 9) Introduction of novel entities (Richardson, *et al*. 2023). For the authors of the article entitled *The planetary commons: A new paradigm for safeguarding Earth-regulating systems in the Anthropocene* (2024), global commons have been constructed in a way that is, at the present time, inadequate and not prepared to tackle challenges in this era. The same is observed in what concerns the legal status, created separately for each global common: it is no longer in coherence and adapted to the reality the world is facing (Rockström et al, 2024). That is why, the authors propose an alternative with a new term: *planetary commons* which are:

> *"defined by the functions they provide to Earth system stability and resilience and include all critical Earth-regulating bio-physical systems and their functions, irrespective of where they are located, because they are essential to sustain all life across the planet"* (*idem*, 2024, p. 4).

What are the elements that are considered in the Earth System? The aforementioned perspectives aid to look at the following interdependent systems: atmosphere (air), hydrosphere (water), cryosphere (frozen portion or earth), geosphere (interior and surface of the earth, or lithosphere – the rocks of the earth) and biosphere (living things). There is an interaction of physical, chemical, and biological processes and, nowadays, it comprises human society, meaning that social and economic systems are the key drivers of change in the Earth system.

This paper seeks to answer the question: *how to connect climate change, Arctic, and security?* Three sections will allow us to answer and explain the linkage.

The first section presents the evolution and history of climate studies. The birth of historical climatology is considered to be in the 18th century (Favier, 2019). The Earth System has been going through different processes and changes since its formation "some 5 billion years ago", as pointed out by Shakhashiri and Bell (2013, p. 5) and Notz (2020, p. 4). Scientists have agreed, over time, in a wide scientific consensus, that human action is strongly affecting natural processes (Cook et al, 2013, 2016). A brief history of climate studies is based on the *Historical Overview of climate change science* (IPCC, AR4, WGI, 2007) elaborated by the Working Group I and placed in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in 2007, AR6 WGII and WGIII IPCC (2022d; 2022e) World Wild Fund (WWF, 2022) and World Meteorological Organization (WMO, 2022), completed by Svante Arrhenius, Francis Molena (1912) and René Favier (2019).

In the second section, hopefully showcases how and why it will be possible to acknowledge the importance of the Arctic at a regional, which direct and indirect impacts are global. Literature of relevance such as *The Arctic a very short introduction* by Klaus Dodds and Jamie Woodward (2021) and the report *Overview of EU actions in the Arctic and their impact* by Koivurova, et al (2021), *Arctic Report Card: Update for 2023* (NOAA, 2023) will support the information presented.

The third section connects the dots of what was presented in the previous sections: climate change, bringing together the Arctic and its security impact. The Arctic is not only about Arctic countries anymore, it is about the entire planet. Digging into the evolution of the concept of security will show us that it was initially connected to inner peace and nature. A vision of security that changed over time and created a path towards non-traditional security that the Copenhagen School and securitization theory connect to environment issues, challenging the traditional thinking. It will recover Ms. Sherri Goodman's sentence: *climate change as a threat multiplier* and cognizance of the acceptance and assimilation of such expression regionally and globally. The literature for this subsection is based on Buzan, Waever and de Wilde (1998), CAN (2007), and WBGU report (2007). Tuchman Matthews and Ms Sherri Goodman (2022, 2023) support the transversality of the topics, as they both mostly allude to natural sciences, by supporting action in a preventive way in security issues. The Copenhagen School is the conceptual and theoretical framework for this paper.

The methodology used is qualitative based on many reports emanating from the natural sciences delivered by WWF, WMO and IPCC as mentioned above, as well as from social sciences, mostly within the Copenhagen School theoretical and methodological scope.

In conclusion, it will then be possible to claim that climate change is definitely assimilated as a threat multiplier and a matter of security. A discussion that is moving onto ice by enhancing our knowledge of the various components that sustain life, we can cultivate a sense of both internal and external security for human existence on this planet. Science is key to decision-making and both parties shall come to understand each other and work in a cooperative way with other actors (non-state actors included) to find a common path towards a common future.

To conclude, inter- and multi- disciplinary thinking in this context is mandatory. In a globalised manner and within International Relations field of study to look beyond and beyond the Atlantic basin. This interconnected approach is vital for creating a stable and sustainable global order that can address both the immediate and long-term risks posed by climate change and environmental degradation. With this paper it is expected to contribute to climate and ocean literacies

1. Climate change studies evolution

Climate change has been a subject of inquiry since the time of the Inca, who utilized solar and lunar calendars to manage their agricultural practices, as recalled by René Favier in his article *Thinking about climate change, 16th - 21st centuries* (2019). The development of the thermometer in the 17th century marked a significant advancement in the measurement, recording, and reporting of temperature. In 1765, the French physician and botanist Duhamel du Monceau identified substantial alterations to the Earth, including phenomena such as fires, floods, and geological upheavals. Natural energy flows on Earth have been influenced by three primary processes over time: variations in incoming solar radiation, changes in planetary albedo, and shifts in atmospheric conditions. The physicist Joseph Fourier in 1824 posited that the effects of solar heat on the Earth are modified by the atmosphere and the oceans. The greenhouse effect, which maintains the planet's warmth through the absorption and reradiation of radiation, is intensifying due to both natural processes and human activities, leading to global warming and the accelerated melting of snow and ice. Fourier affirmed that "all the earth's effects of the sun's heat were modified by the interposition of the atmosphere and the presence of the ocean" (Favier, 2019, p. 6). This assertion is further corroborated by the authors of the IPCC, AR4 Working Group I (2007) and Dirk Notz (2020) in his article *A Short History of Climate Change*. They emphasize that all forms of life on Earth emit radiation, which is subsequently reflected by clouds and absorbed by atmospheric aerosols, while the remaining light is reflected by surfaces such as snow, ice, and deserts. Additionally, volcanic eruptions contribute to the Earth's energy dynamics, influencing temperature and necessitating the emission of radiation to achieve thermal equilibrium. The phenomenon known as the "greenhouse effect," which arises from the natural absorption and reradiation of energy back to the Earth, plays a crucial role in maintaining the planet's warmth; without it, the Earth's surface would succumb to freezing

temperatures. However, this greenhouse effect is intensifying due to both natural processes and anthropogenic activities, leading to global warming and the consequent melting of snow and ice. The resultant melting increases the surface's capacity to absorb radiation, thereby exacerbating warming through a feedback mechanism known as the albedo effect, as detailed in the IPCC AR4 WGI (2007) and discussed by Dodds and Woodward (2021).

The albedo effect is a process that reflects solar energy, but without ice, open water absorbs more solar energy. As we will see, in the case of the Arctic, this fact leads to a hotter ocean that melts sea-ice, because, in the words of Dodds and Woodward, "open water, means to have a poor reflector where only 10% is reflected while sea ice can reflect up to 90% of incoming solar radiation" (2021, p. 24). Consequently, the perennial sea ice disappears resulting in Arctic amplification.

Arrhenius (1896) and Molena (1912) recognized the ocean as regulator because it can absorb a huge amount of carbon dioxide (or "carbon acid" as the term was used at that time by the 1903 Nobel Prize laureate) (Hendricks, 2018), providing the balance of life, as affirmed in the Brundtland report, *Our common Future*, "by playing a critical role in maintaining its life support-systems, in moderating its climate, and in sustaining animals and plants" (1987, p. 217), while in the 21st century, the authors of the *Historical Overview of Climate Change Science* state that "the oceans' role in climate are still hotly debated" (2007, AR4, WGI, p. 111).

Understanding how the Earth absorbs carbon dioxide naturally—a gas produced by volcanoes, wildfires, and ruminating animals—we can add human activity to this process at this point due to the burning of coal during the Industrial Revolution.

A lot of research was done on the topic of burning coal during the 19th century. H.A. Phillips, the author of the article *Pollution of the Atmosphere* that published in the magazine Nature, states that 10,000 million tons of coal were burned in 1854, which means that "100 million tons of hydrogen and hydrocarbons are floating in the atmosphere" (1882, p. 127). On this respect, Svante Arrhenius, the author of the 1896 paper *On the influence of carbonic Acid in the air upon the temperature of the ground* (1896) provides further details by citing the research of Prof. Hogbom, who describes the various ways in which carbon acid enters the atmosphere and affects the warming effect (1896).

Both Favier (2019) and Hendricks (2018) refer to Arrhenius as the first to have understood that global warming by means of changing the composition of the atmosphere is possible and is the one who situates the greenhouse effect in the carbon cycle, having his ideas accepted amid the scientific community, by matching global warming and use of fossil fuels in 1903. However, studies and observations from the mid-1850s lead Francis Molena to question whether there is a correlation between fossil fuel and climate, given that 1911 has been regarded as an unusually hot year. This was addressed in his March 1912 article *Remarkable Weather of 1911: The Effect of the Combustion of Coal on the Climate – What Scientists Predict for the Future*, which was published in the Popular Mechanics Magazine:

> *Since burning coal produces carbon dioxide it may be inquired whether the enormous use of that fuel in modern times may not be an important factor in filling the atmosphere with this substance, and consequently in indirectly raising the temperature of the earth* (1912, p. 342).

Guy Stewart Callendar, an English engineer and amateur meteorologist, noted in 1938 that during the 52-year period of the industrial revolution (from 1890 to 1938), there was a 10% increase in CO2 in the atmosphere (Favier, 2019). He suggested that coal combustion was one of the reasons for the warming effects that were observed. Stewart Callendar has confirmed that Arrhenius studies and Molena's concerns are supported, indicating that "the principal result of increasing atmospheric carbon dioxide would be a gradual increase in the mean temperature of the colder regions of the Earth" (IPCC, 2007, p. 105) and make the planet warmed unnaturally (Mathews, 1989). The increasing of warming has been observed for the past 40 years, and it is happening quickly, especially in the Arctic.

David Keeling (1958) was able to obtain accurate data on Mauna Loa in Hawaii regarding the "true measure of the global carbon cycle" (*idem*, p. 100) thanks to advancements in digital systems for observation and measurement in the second half of the 20th century. However, René Favier believes that the discussion of global warming is viewed as anecdotal. The notion that the earth is cooling and "that the cyclical return of major glaciation periods as a function of (known) variations in the orbit and Earth's rotation" (2019, p. 8) is attributed to the Serbian scientist, Milutin Milankovitch, did not permit taking it seriously as other threats at that time as the Cold War atomic bomb. The concept of cooling was introduced in articles published in the 1960s and 1970s (idem; IPCC, 2007, p. 98). Despite this, the number of articles tripled in 30 years, from 1965 to 1995, thanks to the advancement of scientific instruments and methodologies. Scientists believe that caution is needed, despite Francis Molena's statement that it "would be improbable that the mean temperature will change sensibly in a thousand years" (1912, p. 340).

The 1972 Meadows report, *The limits to growth,* and the 1979 Geneva World Climate Conference, a meeting of World Meteorological Organization (WMO) experts on climate change and humanity were ignored by politicians and the media, from Favier´s perspective (2019). It won't be until 1983 that the problem begins to surface for discussion. According to René Favier, the hot summer of 1983 is what attracted more attention to this subject.

With the WMO and the United Nations Environment Programme (UNEP) defining the Intergovernmental Panel on Climate Change[1] (IPCC) in 1988 with the "role of assessing the scientific, technical, and socioeconomic information relevant for understanding the

[1] It is constituted by three Working Groups and a Task Force: Working Group I: assess scientific aspects of the climate system and climate change; Working Groups II and III assess the vulnerability and adaptation or socioeconomic and natural systems to climate change, and the mitigation options for limiting greenhouse gas emissions, respectively. the Task Force is responsible for the IPCC National Greenhouse Gas Inventories Programme (IPCC, AR4, WGI, 2007**,** https://www.ipcc.ch/site/assets/uploads/2018/03/ar4-wg1-chapter1.pdf, p. 118).

risk of human-induced climate change", it is becoming a more significant issue on the political agenda with regard to climate vision (IPCC, 2007, p. 118).

The second report was presented at the Rio Conference in 1992 by the development of Agenda 21, which included 2500 recommendations to be implemented in the 21st century and two Conventions on Biological Diversity (CBD) (CBD, 1992 and 1995).

It was then expected that the Kyoto Protocol (1997) would bind states to cut greenhouse gas emissions. The Paris Agreement, approved at COP 21 in 2015, which shall reflect a consensus regarding anthropogenic influence in global warming, has proven to be difficult to implement. *Global warming* named as such in 1975 by Wallace Broecker in his article *Climate Change: Are We on the Brink of a Pronounced Global Warming?* where the geologist predicted that global temperature would get warmer by "the first decade of next century than any in the last 1000 years" (1975, p. 461).

Understanding the nature of the Earth System requires an appreciation of one feature, which is the capacity for sudden change. The palaeo-evidence that has been gathered over the last ten years substantially supports the existence of these changes. Enhancing comprehension of the *planetary machiner* is hampered by the most urgent challenge of figuring out what causes these changes and the internal dynamics of the Earth System that link the cause to the result (Steffen et al, 2005). The changes can happen in a rapid way and lead to an abrupt climate change that shall be understood as:

> *a change that is substantially faster than the rate of change in the recent history of the affected components of a system. Abrupt climate change refers to a large-scale change in the climate system that takes place over a few decades or less, persists (or is anticipated to persist) for at least a few decades, and causes substantial disruptions in human and natural systems* (IPCC, 2019, p. 678).

As stated in the 4th report of the IPCC in 2007, there is a clear consensus in scientific society in the 21st century (Cook et al, 2013; 2016) that 90% of the probability of climate change is caused by human activity. This consensus is further supported and expanded upon in the 5th report of 2014, which reveals that "methane has a greater warming potential than CO2" (Favier, 2019, p. 9; Koivurova et al, 2021, p. 49). The reports have satisfactorily addressed the scepticism and inquiry of the 18th century philosophers and have precisely verified the research, data sets, and conclusions of the 19th and 20th centuries. Despite the declaration of a climate emergency by 38 countries (until now) and promises made during the COPs meetings, UN Secretary-General, António Guterres, has criticized the "failure to tackle climate disruption" and suggested five critical actions (UN, Secretary General Guterres, 2022) to jump-start the energy transition, which he called the "peace project of the 21st century" (UN, Secretary General Guterres, 2022), quoting the World Meteorological Organization (WMO) report released on May 18, 2022.

Planetary systems are fundamentally changing as a result of humanity's inability to fit its activities into that pattern. There are numerous potentially fatal risks that go along with

these changes. Recognizing and managing this new reality, from which there is no escape, is necessary (Club of Rome, 1972; Brundtland, 1987).

Tuchman Mathews wrote in 1989 that:

> *"The lesson is this: current knowledge of planetary mechanisms is so scanty that the possibility of surprise, perhaps quite nasty surprise, must be rated rather high. The greatest risk may well come from a completely unanticipated direction. We lack both crucial knowledge and early warning systems" (Mathews, 1989, p. 171).*

Apparently, warnings have been ignored.

2. The Arctic and global impact

The Arctic is ground zero for climate change.

Dodds and Nuttal, 2019, p. 19

When using the term **impact,** we mean it in accordance with what the IPCC *Special Report on the Ocean and Cryosphere in a Changing Climate* defines as:

> *"how something affects people's lives, means of subsistence, health and happiness, ecosystems and species, assets related to the economy, society, and culture, services (including ecosystem services), and infrastructure. Impacts can be positive or negative, also known as consequences or outcomes" (IPCC, 2019, p. 689).*

The rising of maximum and minimum temperatures has impact on ice, being an instability in the Arctic, the world's refrigerator (Hancock, n.d.) Extreme events like heat waves in various parts of the world, wildfires, precipitation, floods, droughts, tropical cyclones, and powerful storms are caused by this destabilization (WMO, 2022). However, when the ocean's ice cover is reduced, heat from the ocean is released into the atmosphere, raising the temperature of the Arctic's surface air. The area can no longer establish the required equilibrium because it is no longer the air conditioner. Those factors have direct and indirect impacts on the Ocean and the Arctic. The relevant impacts (direct and indirect) on the ocean and the Arctic are): a)- direct impacts: rising maximum and minimum temperatures; declining Arctic Sea ice and snow cover; glacier recession and retreat; thawing permafrost; seabed permafrost; and b)- indirect impacts: loss of biodiversity; threat to livelihoods.

> *The components of the Earth System at and below the land and ocean surface that are frozen, including snow cover, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost and seasonally frozen ground (IPCC, 2019, p. 682).*

With temperature rising four times faster (Rantanen et al, 2022) than in the rest of the world, the Arctic region is the sentinel of the word, the bell ringing alerting for the changes affecting not only the region but whole regions on the planet.

The Arctic can be looked at as the intersection of elements, territories and processes such as: land (high arctic and low arctic according to the distribution of tundra and boreal forest), sea (central Arctic ocean and its adjacent seas: Barents, Beaufort, Chukchi, Kara, Laptev and Hudson Bay and the marine environment) and ice (sea ice thickness and snow) according to Klaus Dodds and Mark Nuttal description in their book The Arctic everyone needs to know (2019). The region is the air conditioning of the Northern Hemisphere and has a role in stabilising and cooling the planet. Gradually, cryosphere is entering the field of humanities as Klaus Dodds and Sverker Sörlin in Ice humanities (2022).

The Arctic region is also designated and considered a hotspot in this century. Hotspot understood as the place that is receiving more interest and where changes in cooperation and peace might alter, having climate change as main feature of those changes as the region is warming four times faster than the rest of the world. For Professor Lassi Heininen, climate change is being the "biggest global threat or challenge in the Arctic" (2011, p. 37), but the topic is ambiguous when framed in the context of the Arctic, what the professor explains according to the setting of the year 2011.

Facing those facts, dynamics and cascading effects, Nakicenovic et al (2016) place the Arctic as a key tipping element in the Earth system which tipping elements are: Arctic summer sea-ice, Greenland ice sheet (GIS) and Permafrost (Lenton et al, 2008).

How to understand the global connection of the region? First, the region plays an important role in the Earth System and secondly, the changes occurring in the region have impacts worldwide and consequently, and thirdly, changes have implications in geopolitics that are not confined to the Artic states but are a concern for other regions.

The discussion regarding the Arctic being a global common shall be carefully addressed as it usually blends the Central Arctic Ocean with the whole Arctic region (Burke, 2018; Gautam, 2011). Nevertheless, and as the organisation Global Choices promotes: "We cannot plant ice". It matters to know that ice is a component of the Earth system as well.

For the authors of the IPCC report (2019) there are several ways in which the polar regions affect the world climate. More heat is absorbed at the surface when the amount of spring snow and summer sea ice cover decreases. There is mounting evidence that the Arctic's ongoing changes—most notably the loss of sea ice—may have an impact on weather patterns in the mid-latitudes. The recent article published in Nature Reviews, Projections of an ice-free Arctic Ocean (Jahn, Holland and Kay, 2024) reaffirms that the Arctic Sea ice (that includes sea ice area (SIA), sea ice extent (SIE) and sea ice thickness) has been declining since satellite observations started in 1978. Jhan, Holland and Kay (2024) confirm that the losses occurring during summer are the greatest.

Permafrost soils in northern regions store less carbon as Arctic temperatures rise. Global warming is exacerbated by the land's release of methane and carbon dioxide into the atmosphere. Sea levels rise as a result of melting glaciers and ice sheets in the polar

regions, which has an impact on coastal areas with significant populations and economies.

According to the authors of the report *Overview of EU actions in the Arctic and their impact* (2021), black carbon appears to have a greater impact on Arctic warming than methane (causing string regional warming), which is released by permafrost and contributes to current global warming. Black carbon absorbs solar radiation, which warms the atmosphere and reaches "the cryospheric surfaces of the Arctic" (Koivurova et al, 2021, p. 49; IPCC, 2019). Cryosphere, from Greek Krios, meaning cold, includes ice and snow. The term coined by Antoni Boleslaw Dobrowlski in 1923, a Polish geophysicist and meteorologist, explains that it is composed by an envelope entering into "a close, definite and peculiar relationship with hydrosphere, lithosphere and atmosphere" (Dodds and Sörlin, 2022, p. 14).

In the Arctic region, the impacts, divided in direct and indirect, are: a)- *direct impacts*: (i) melting of sea ice; (ii) ice sheet; (iii) thawing permafrost; (iv)- subsea permafrost (not well-known, even among scientists according to the authors Overduin, Portnov, Ruppel, NOAA, 2023) and b)- *indirect impacts*: (i) loss of biodiversity; (ii) threat to livelihoods (see **APPENDIX 1**).

The extent of Arctic Sea ice has shown a persistent decline over the past several decades. In September 2024, the recorded sea ice extent was the sixth lowest in the 45-year history of satellite observations. Since 1982, areas of the Arctic Ocean that are devoid of ice in August have experienced a warming trend of about 0.3°C per decade. The decline in sea ice has facilitated the development of new maritime pathways, notably the Northern Sea Route and the Northwest Passage. Research indicates that utilizing these Arctic shipping lanes could shorten travel distances between Europe and Asia by approximately 40%, leading to significant fuel savings. Nevertheless, the rise in shipping activity brings forth environmental issues, particularly regarding the potential effects on Arctic ecosystems (Aksenov, et al, 2017).

The Arctic is losing its geophysical exceptionality (Jacobsen, Pram Gad and Wæver, 2024) facing opportunities and challenges. The latter at local, national and regional scales but also at a global scale.

The sequence of direct impacts provokes indirect impacts in peoples´ livelihoods and ecosystems. For Arctic Indigenous Peoples, living in the Arctic has provided a "rich livelihood for their ancestors over uncounted generations" (McGhee, 2007, p. 35).

The changes are not confined to this specific region. The influence of the Arctic on mid-latitude weather is a topic of discussion among the climate community (Cohen, Pfeiffer and Francis, 2018). This has impact on millions of people worldwide. Understanding the link that scientists are finding in the Potential for the Polar Cryosphere to Influence Mid-latitude Weather report (see box 3.2, IPCC, 2019, p. 216) is made easier by identifying the impacts in the Arctic region. This information supports the claim that the Arctic and climate change are global, as well as the sentence: "what happens in the Arctic does not stay in the Arctic" (2017). The author of the sentence is Vidar Helgesen, former Norwegian Minister of Climate and Environment, who proclaimed it during a seminar organised by the NATO Parliamentary Assembly and the Norwegian Parliament in

Svalbard in 2017. The butterfly effect, a term coined by meteorologist Edward Lorenz in the 1960's, means that the impacts felt in the Arctic will have stronger impacts elsewhere in the world.

3. Climate change as a threat multiplier: a security issue

Svante Arrhenius projected that the temperature in Arctic regions would increase by approximately 8 to 9 degrees Celsius if the concentration of carbon dioxide were to rise to 2.5 or 3 times its current level (1896) is somehow confirmed by the Arctic Monitoring and Assessment Programme (AMAP, 2019) report when the authors of the article The Arctic has warmed nearly four times faster than the globe since 1979 are in condition to confirm that the temperature is raising four times faster than in the rest of the world (Rantanen, M., et al, 2022). As a cascade effect, amplification is verified (Cohen, Pfeiffer, & Francis, 2018; Dodds and Woodward, 2021; WWF, 2022; WMO, 2022).

Climate change, ocean, Arctic and security are global, transnational hot topics with relevance at the different levels: global, regional and national in the 21st century with impacts on people's lives. Consequently, populations are at risk due to different factors and with different impacts according to their geography, location. Since the themes in this research are global in nature, the security topic will naturally relate to them by creating a configuration that links the security to the ocean and ice (even if melting).

Security, a concept that has been tried to be redefined. In this section, the intention is to understand and present how and when was climate change considered a security issue, more precisely considered a threat. A term that is now included in the speech act, in Copenhagen school' s words, perspective and vision.

The word and concept of security has been evolving and has reached what can be identified as a pluralistic meaning, multiplicity of understandings in different historical moments (Rothschild, 1995) and a complex historical epistemology with a subjective (absence of fear about those threats), objective (the actual absence of threat) (Herington, 2012, p. 61) and discursive (speech act) (Buzan, 2009, p. 32) discussion as it will be possible to check in this section. Additionally, security studies are in International Relations field a subcategory or subtheme that, in the words of Paul Williams, "should not live in IR shadow" (2008, p. 4) which for most scholars, security definition includes the mitigation of dangers to precious values.

States and populations are facing risks, challenges, and threats related to environmental degradation, which could jeopardize their security. What is understood as security? In order to answer this question, I will go back in time with the help of authors such as Buzan and Rothschild as well as Herington who in his doctoral thesis goes back to Ancient Greek, affirming that the word is "ataraxia", previous to the Latin word "securitas" (freedom form care) (Herington, 2012). At that time, there was a connection with the state of mind, serenity (idem), reflection about life that is separated from politics, business and society. It is an "inner peace, calmness", as Liddell and Scott write (cited by Herington, 2012, p. 12) that both Greek and Roman care about. Then, slowly, the meaning of *securitas* changes, being associated to Pax Romana. Here, physical safety

and political liberty of Roman citizens are added to meaning of security (idem, p. 13). Though, Christianity gives a negative connotation when external factors such as "a sinful certitude in the face of God" (idem) takes the lead until the Pre-Enlightenment. The latter tries to recapture the meaning of internal calmness and freedom from fear but seem to have been unsuccessful. Entering the Enlightenment period, Herington, considers that it can be associated to the Greek word "asphaleia" which was "implying steadfastness or the physical stability of an individual or object" (Arends cited by Herington, 2012, p. 14).

Hobbes, in 1668, with the translation of Leviathan, considered that security shall be guaranteed by a political authority. This means that Enlightenment philosophers, authors, political thinkers would accept it as such in the meaning of security. An acceptance followed by Locke, Condorcet ("security consists of the protection which society accords to each citizen, for the conservation of his person, his property and his rights", Rothschild, 1995, p. 62) and Rousseau who develop the social contract. In that sense it is the internal state that needs to be secured and the individual, both individual and collective good (idem p. 63). Also, is considered the idea that the state depends on the ability to protect its citizens from external threats (understood as foreigners' invasion) and/or injuries. Nonetheless, it can be observed from Condorcet s words that security is now interchangeable with land, property, money and is attached to the means, that is to say the means needed to secure: armies and weapons (McSweeney, 1999).

The American and French revolutions confirm the shift of having the state as necessary to keep security, stepping away from Securitas and ataraxia meanings, what is edified by the Napoleonic wars as the political importance of the state with practices of security (Herington, 2012; Rothschild, 1995) as the "concept of security itself" (Herington, 2012, p.17).

Entering in the 20th century, the timeline presented so far, shows that the words: state, military power and security are close to each other's meaning. The second half of last century, marked by the Cold War, is perceived as a condition of the international community of states, deriving from interstate cooperation and the essential interdependence of IR (McSweeney, 1999, p. 19). People are no longer referent but instrument, alike armed forces, seen as potential enemies (idem). The person is now a thing. It is a rational thinking in a hostile moment with national security as focus.

The end of the cold War seems to be a moment for scholars, interested in security studies, to try to redefine security (Tuchman Mathews, 1989; Ullman, 1983; Rothschild, 1995), a neglected (Baldwin, 1997), contested and underdeveloped (Buzan, 1983) concept in an attempt of broadening and deepening the concept of security, that has become a "watchword" (idem, p.8). Though, Barry Buzan is to be the one to defy in the early 1980s, more precisely in 1983 in his book People, States and Fear, where he affirms and argues that security is about all human aggregations and cannot be restricted to military forces. Somehow, Buzan and Hansen pioneer securities studies, by acknowledging that after World War II the debate was about how to protect the state against external and internal threats (2009, p. 8) and outlines four concerns for International Security Studies (ISS): 1)- privilege the state as the referent object; 2)- include internal as well as external

threats; 3)- expand security beyond the military sector and the use of force; 4)- see security as inextricably tied to a dynamic of threats, dangers and urgency.

Critiques consider that at least three changes were suggested to the traditional concept of security: "a)- shift the focus from the security of the State to another entity; b)- broaden the set of goods which constitute security; c)- emphasise the subjective realisation of security" (Herington, 2012, p. 22). The 1980s and 1990s saw a change in perspective, recognising persons/people as subject of security (Buzan, Wæver, and de Wilde, 1998). The last decades of the 20th century, extended the concept of security according to forms in a total of 4 and principles also in a total of 4 (see **APPENDIX 2**) that are described and examined by theorists and analysts. But the last word and decision is from officials, policy makers, as they are the ones who can decide what is to be securitized.

The 1990s demand a redefinition of what constitutes security, more specifically national security from Tuchman Mathews´ perspective in a moment "that environmental strains transcend national borders beginning to break down the sacred boundaries of national sovereignty" (1989, p. 162).

Within the different intellectual development in the academia after the Cold war period, the school of thought that best represents this intellectual development is the Copenhagen School, by the hand of Buzan, Wæver and de Wilde, who developed the securitization concept. First, it is not too much to remember the early development of this school as part the Copenhagen School of Security Studies within the Copenhagen Conflict and Peace Research Institute, founded in 1985. The authors above mentioned, more specifically Wæver, develop the securitization within this school, showing that it is possible to expand concepts (as referred to by Rothschild, 1995) and develop a multidisciplinary approach that leads to security problem so solutions can be found. This new way of thinking and connecting dots does not exclude the persons and nature. It tries to exclude the military side, but in the 21st century it does not seem possible. For Buzan it is clear that humanity depends on the planetary biosphere as the essential support system, that is why it necessary, if not mandatory, to maintain it, so that environmental insecurity can be avoided (Buzan, 1991).

As mentioned by the authors of the Copenhagen School, the five sectors to be considered as source of threats by this school are: military, political, economic, societal and environmental.

The idea of securitization developed by Ole Wæver is defined as "a more extreme version of politization" with 3 meanings:

1)- nonpoliticized: state does not deal with it as it is not in any other way made an issue of public debate and decision;

2)- politicized: the issue is part of public policy, requiring government decision and resource allocations or, more rarely, some other form of communal governance;

3)- securitized: the issue is presented as an existential threat, requiring emergency measures and justifying actions outside the normal bounds of political procedure (1998, pp. 23-24).

For the authors, the best way to define securitization is understanding it as intersubjective regarding the establishment of an existential threat with a sufficient salience to provoke political effects and socially constructed where other social entities can raise an issue to the level of general consideration or even to the status of sanctioned urgency among themselves.

How and what, according to the Copenhagen School, can something be identified as an existential threat? First, an existential threat is something that "overflows the normal political logic of weighing issues against each other, this must be the case because it can upset the entire process of weighing as such" (1998, p. 24) that is part of the discourse as a referent object (understood as the thing that is threatened and needs protection) that is argued, legitimizing emergency measures. By discourse it shall be understood as speech-act, which might not contain the word security and is done by an actor that decides whether something is to be handled as an existential threat and be accepted by the audience (citizen) (Buzan, Wæver and de Wilde, 1998; Jacobsen, Pram Gad and Wæver, 2024).

Focusing on the environmental sector identified by the Copenhagen School, it can be said that a different kind of "environmental concern has arisen from mankind' s new ability to alter the environment on a planetary scale" (Tuchman Mathews, 1989, p. 168) summarising what has been presented so far:

> *A different kind of environmental concern has arisen from mankind's new ability to alter the environment on a planetary scale. The earth's physiology is shaped by the characteristics four elements (carbon, nitrogen, phosphorous and sulfur); its living inhabitants (the biosphere); and by the interactions the atmosphere and the oceans, which produce our climate. Mankind is altering both the carbon and nitrogen cycles, having increased the natural carbon dioxide concentration the atmosphere by 25 percent. This has occurred last three decades through fossil-fuel use and deforestation (idem, p. 169).*

The Club of Rome (1972) acknowledged that environmental security would be a concern in the coming decades and has been part of international policy via the United Nations since that year with the growing awareness and consciousness transformed in a conference. Though, the Brundtland report 1987 would emphasize the importance of this sector. So, somehow, even if not in a proper scale, the discourse and speech act were gaining some foundation after the end of the Cold War, sustained by schools of thinking such as the Copenhagen School. From what has been exposed so far in this chapter, it can be stated that environmental security is the interaction between security and environmental degradation (Goodman and Baudu, 2022), it is a cause-effect which web of causality can be catalytic (Brundtland report, 1987).

Interestingly, this school of thought has been evolving and I am personally glad to see that it is being applied in the Arctic context as the recent book explores: Greenland in Arctic Security, (De)securitization Dynamics under Climatic Thaw and Geopolitical Freeze by Marc Jacobsen, Ulrik Pram Gad, and Ole Wæver (2024). With those new insights, it is possible to add that, and in accordance with the topics of this research, "some referent

objects of securitization can be (or be in) the sea per se" (2024, p. 338). In regards to the ice, Kristian Soby Kristeensen and Lin Alexandra Mortensgaard welcome the debate over whether the Greenlandic Ice Sheet should be viewed as a threat from a macro securitization standpoint. Why would ice be considered a threat? Because, and as the authors explain, it is a threat to the ocean, the atmosphere and the rest of the world: "becoming water allows the ice to reach spaces across the globe" (2024, p. 49) and implying that ice is no longer merely an object of science (Dodds and Sörlin, 2022). This perception confirms that environmental issues go beyond national states borders. In what concerns the ocean, it is seen as a "space of insecurity and threats" (Bueger, 2015, p. 162).

When discussing climate change, how prevalent is the word threat?

Since 1972, environmental concerns are in global political agenda, namely with the Limits to Growth report and the first UN conference on Environment that year in Stockholm. I would like to note that the Brundtland report identified in 1987 environmental issues as threats being aware of the scale of such topic(s): "Environmental threats to security are now beginning to emerge on a global scale" (chapter 11, number 15, 1987). Analysing the discourse, the word threat has been included in official documents, namely in the Brundtland report 1987 whether as a noun or verb, with a global scale perception and concerning all human beings on earth. It was also used by the former UN Secretary General, Kofi Annan, in 2006, showing and expressing its perception of the damage climate change can cause by affirming that it was a threat to peace and security, it is an all-encompassing threat (UN Secretary-General Kofi Annan, 2006). Still, it seems it did not catch enough attention. and it will be in the following year that the term threat multiplier will receive more attention worldwide. Let' s see how.

So far, the contextualization of the nexus climate change-ocean-security allows to present the evolution of the above expression and how it has been accepted and entered the speech act as mentioned by the Copenhagen School so climate change and environmental issues are considered a security concern. This inclusion and acceptance have been happening since 2007 with the report released by the Center for Naval Analysis (CNA) with Ms. Sherri Goodman as Executive Director, at that time Military Advisory Board. The Center for Naval Analyses Military Board on Climate and National Security was founded by Sherri Goodman who was appointed as the first Deputy Undersecretary of Defense for Environmental Security from 1993 to 2001 as it can be read in the Briefer nº 38, 2023, Climate Change as a "Threat Multiplier:" History, Uses and Future of the Concept (Goodman and Baudu, 2023).

The 2007 National Security and the Threat Climate Change report considers "global climate change as a new and very different type of national security challenge" (2007, p. 3). The cognizance of this fact allows developing such report, elaborated by military and civilian scholars, divided in different chapters/sections where impacts and implications of climate change are explained, as well as findings and recommendations presented. In this report, not only the vision of a national threat to the US security is explained but also at a global scale recognising it will highlight and enhance instability and tensions "even in stable regions of the world" (idem, p.7). The report enumerates the impacts of

temperature increasing on natural systems and previously mentioned: "habitats, precipitation patterns, extreme weather events, ice cover and sea level" (idem, p.11).

In what concerns the Arctic region on this specific report, there is only one brief reference included in the Section entitled Direct Impacts on Military Systems, Infrastructure and Operations on page 38 with a subsection identified as The Arctic: A Region of particular Concern. A concern that will broaden its scope in the 2014 National Security and the Accelerating Risks of Climate Change CNA report, with the title The Arctic: An Era of Special International and Domestic Emphasis focusing on the opening ice. This report recognises that climate change impacts transcend international borders and geographic areas of responsibility, using the word risks instead of threat. In 202,1 Sherri Goodman participated in the Climate Change and Security in the Arctic report, a partnership between The Center for Climate and Security (institute of the Council on Strategic Risks) and the Norwegian Institute of international Affairs. In this report, the analysis is based upon two distinct scenarios that the authors identify as "Curbed Warming Scenario and Uncurbed Warming Scenario acknowledging five key takeaways" (2021, p. 5) in the Summary of Climate Scenarios. Also, it shall be noted that a transversal and repeated idea is expressed in both CNA reports (2007 and 2014) which is that it is not possible to wait until we have 100 percent certainty to act in order to mitigate and adapt to new circumstances.

Though, in 1989 Tuchman Mathews already stated that environmental decline occasionally leads directly to conflict (p. 166). There is an inevitable linkage between the decline of conditions and conflict caused by less resources access, floods, droughts, fires and other extreme events that we have ben witnessing. The 2006 Climate Change as a Security Risk report, Germany, is recovered here "climate change is a catalyst: for cooperation or conflict! (2006; 2014, p. 8).

Ms. Sherri Goodman helps us to better understand the 3 ways climate security risks were perceived:

1)- by framing risks as emanating from climate change per se but form how it interacts with and aggravates other environmental, economic, social and political stressors that can threaten national stability, the term helped explain the systemic nature of climate risks and move away from siloed-thinking. In doing so, it allowed for the rise of a broader and more comprehensive security approach to climate risks, with responses integrating defence, development and diplomacy;

2)- by highlighting the role of and implications on the military, it emphasised the necessity to incorporate climate change in every aspect of military planning. it consequently brought together the climate and defence communities and got multiple actors engaged in efforts toward increased climate resilience of communities and basis;

3)- by recognising climate change is not only an environmental issue, but also a national security concern, it helped broaden the bipartisan coalition of policymakers and practitioners in the U.S interested in addressing climate change around military bases and infrastructure and highlighted the transnational security aspects of climate risks requiring collective action. (Goodman and Baudu, 2022, p. 5 and 6).

How has the phrase "climate change as a threat multiplier" been incorporated into the discourse of international organizations since 2007?

Sherri Goodman and Pauline Baudu's Briefer publication 2023 will aid in creating this timeline, which will concentrate on the security communities - European Union (EU) and North Atlantic Treaty Organisation (NATO) -that seem to be moving at different speed on this issue and the United Nations (UN) to analyse the progressive adoption and perspective worldwide of the threat multiplier term, also recognised by scientist and academic circles. Below, I will outline the first occasion in which the EU (i) and UN (ii) used the term "threat multiplier" and provide additional details regarding NATO (iii): (i) European Union: Climate Change and International Security - Paper from the High Representative and the European Commission to the European Council in 2008. The Arctic region is listed as geographical example of climate change, referring to a need of debate about the access to new trade routes; (ii) United Nations General Assembly: considered climate change as a threat multiplier in the UN A/64/350; (iii) NATO: The Alliance took some time to include the expression and perceive it as relevant for the future of the organisation. There was a smooth mention of climate change in 2010 Strategic Concept. It was only in 2021 in the document named NATO Climate Change and Security Action Plan that the expression threat multiplier can be read and the Secretary General used the expression in his speech at COP26 the same year. The Regional Perspectives on The Arctic - Strategic Foresights Analysis 2021 report uses the term several times. The New Strategic Concept 2022 and Climate Change Security Impact Assessment both fully assume the meaning of the term referring that it is a crisis connecting it to the Arctic region in the strategic concept. It shall also be highlighted that a Centre of Excellent on Climate Change was created in 2023 and is located in Canada. A roundtable about climate change and security was held on January 2024 in Brussels.

Nonetheless, it does not mean that the expression "climate change as a threat multiplier" is free of critics. It led to discourse about climate security and the securitization of climate change, debating whether it is not also absorbed in the traditional security perspective. According to Goodman and Baudu (2022) the term has been described as "limiting" (p.14) but had allowed the rise of the ecological security, being concerned about the loss of biodiversity.

In the light of the above, Tuchman Mathews' doubt "whether the planet can accommodate all of the demands" (1989, p. 163) is no longer an open question.

If weapons cannot fight climate change, what may be done and how to act in cooperative and preventive way with scientists' groups, with no doubts about their role, so that policy and decision-making can be done in an informative and conscious way? Global change and action are needed when facing common dangers that is synonym of common security (Palme, 1982), in the sense of universal, for a common prosperity.

> *(…) the driving force of the coming decades may well be environmental change. Man is still utterly dependent on natural world but now has for the first time the ability to it, rapidly and on a global scale. Because of that difference, Einstein's verdict that "we shall require a substantially manner of*

thinking if mankind is to survive" still seems apt (Tuchman Mathews, 1989, p. 177).

Conclusion

Understanding the science of climate change is essential for developing effective solutions to protect marine ecosystems, such as reducing greenhouse gas emissions, implementing marine protected areas, and fostering sustainable fisheries. The impact of climate change on the Arctic requires a collaborative approach that combines scientific research, policy development, and cultural understanding. The Arctic, cryosphere/ice (water in solid state) is increasingly important in the context of climate change, ocean systems, and global security. Its unique geography and environmental characteristics make it a focal point for understanding the intersection of climate shifts, marine ecosystems, and geopolitical dynamics.

Nations are increasingly viewing the Arctic not only as an environmental or economic zone but as a critical theatre for security concerns. This requires a delicate balance of cooperation, conflict management, and sustainable resource management to prevent escalation while addressing the pressing global challenges posed by climate change.

It can be considered that from the Copenhagen School's perspective, climate change, and the Arctic are all issues that have been securitized through discourse. Climate change is framed as an existential threat that has tangible security consequences. The Arctic, in particular, is increasingly viewed not just as a vulnerable ecosystem but as a space where national and international security interests collide, and where traditional and non-traditional eventually will go side by side. This focus on security could also hinder international cooperation and sustainable governance, making it a delicate balance between collaboration and conflict in addressing the complex challenges of the Arctic and climate change. The series of direct effects leads to indirect consequences for both the livelihoods of individuals and the surrounding ecosystems. For Indigenous Peoples of the Arctic, their existence in this region has provided a rich source of sustenance for their ancestors over numerous generations.

Finally, inter- and multi- disciplinary thinking in this context is mandatory. In order to understand the geopolitical changes in the Arctic that will affect the rest of the world, it is necessary to look beyond International Relations and Social Sciences but also beyond the Atlantic basin.

Shall this paper lead to other types of multidisciplinary research contributing to climate and ocean literacies but also to further research on blue humanities and ice humanities.

References

Aksenov, Yevgeny, *et al.* (2017). On the future navigability of Arctic Sea routes: High-resolution projections of the Arctic Ocean and sea ice. Marine Policy, Volume 75, pp. 300-317. https://doi.org/10.1016/j.marpol.2015.12.027

AMAP. (2019). AMAP Climate Change Update 2019. https://www.amap.no/documents/doc/amap-climate-change-update-2019/1761

Andreeva, S., Dodds, K., Douglas, N., Humrich, C. and Nawrath, T. (2024). New Arctic Realities —Between Conflicting Interests and Avenues for Cooperation. ZOiS Report 1. *Centre for East European and International Studies (ZOis).* https://www.zois-berlin.de/fileadmin/media/Dateien/3-Publikationen/ZOiS_Reports/2024/ZOiS_Report_1_2024.pdf

Arrhenius, S. (1896). On the influence of carbonic Acid in the air upon the temperature of the ground. *Philosophical Magazine and Journal of Science*, April 1896, series 5, volume 41, pp. 237-276. https://www.rsc.org/images/Arrhenius1896_tcm18-173546.pdf

Baldwin, D. A. (1997). The concept of security. *Review of International Studies*, nº 23, pp. 5-26. https://dbaldwin.scholar.princeton.edu/sites/g/files/toruqf4596/files/dbaldwin/files/baldwin_1997_the_concept_of_security.pdf

Broecker, W. (2010). *The Great Ocean Conveyor*. *Discovering the Trigger for Abrupt Climate Change.* Princeton University Press.

Brundtland Report. (1987). Report of the World Commission on Environment and Development: Our Common Future. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

Bueger, C. (2015). What is maritime security? Marine Policy, Volume 53, 2015,pp.159-164, https://doi.org/10.1016/j.marpol.2014.12.005.

Burke, D. C., (2018, April 8). Why the Arctic isn't a 'global commons'. *The Conversation*. https://theconversation.com/why-the-arctic-isnt-a-global-commons-93976

Buzan, B., Wæver, O, and de Wilde, J. (1998). Security, A New Framework for Analysis. Lynne Rienner Publishers, Inc.

Buzan, B and Hansen, L. (2009). Human Security *In* The Evolution of International Security Studies. Cambridge University. pp. 202 – 205. https://ir101.co.uk/wp-content/uploads/2018/10/buzan-the-evolution-of-international-security-studies-compressed.pdf

Club of Rome. (1972). The limits to growth. Meadows Report. Potomac Associates

CNA. (2007). *National security and threat of climate change*. https://www.cna.org/reports/2007/national%20security%20and%20the%20threat%20of%20climate%20change%20%281%29.pdf

Cohen, J., Pfeiffer, K., Francis, J. A. (2018). Warm Arctic episodes linked with increased frequency of extreme winter weather in the United States. DOI: 10.1038/s41467-018-02992-9

Cook, J., et al. (2013). Quantifying the consensus on anthropogenic global warming in the scientific literature. Environmental Research Letters 8. DOI:10.1088/1748-9326/8/2/024024

Cook, J., et al. (2016). Consensus on consensus: a synthesis of consensus estimates on

human-caused global warming. Environmental Research Letters 11. http://dx.doi.org/10.1088/1748-9326/11/4/048002

Crutzen, P. J. (2002, January 3). Geology of mankind. *Nature*, Vol 415. https://www.nature.com/articles/415023a

Dodds, K. and Sörlin, S. (2022). *Ice humanities Living, working, and thinking in a melting world*. Edited by: Klaus Dodds and Sverker Sörlin. Manchester University Press.

Dodds, K and Nuttal, M. (2019). *The Arctic: What Everyone Needs to Know.* Oxford University Press

Dodds, K. and Woodward, J. (2021). The Arctic, A Very Short Introduction. Oxford University Press

Earle, S. (2021, August 30). A letter from Dr. Sylvia Earle. https://missionblue.org/2021/08/a-letter-from-dr-sylvia-earle/

Favier, R. (2019). Thinking about climate change (16th-21st centuries). Encyclopédie de l'Environnement. http://www.encyclopedie-environnement.org/?p=9687

Gautam, P. K. (2011). The Arctic as a Global Common. IDSA Issue Brief. https://www.files.ethz.ch/isn/135416/IB_TheArcticasaGlobalCommon.pdf

Gibbard, P. et al. (2022). The Anthropocene as an Event, not an Epoch. Journal of Quaternary Science. pp. 1–5. DOI: 10.1002/jqs.3416

Goodman, S, Kaufman, H., and Baudu, P. (2022). Climate Change a "Top Tier Threat" in the 2022 U.S. National Security Strategy. Briefer, n. 36. Center for Climate and Security. https://councilonstrategicrisks.org/wp-content/uploads/2022/11/36-ClimateChangeNSS.pdf

Goodman, S. and Baudu, P. (2023). Climate Change as a "Threat Multiplier": History, Uses and Future of the Concept. Briefer n. 38. *Center for Climate and Security.* https://climateandsecurity.org/2023/01/briefer-climate-change-as-a-threat-multiplier-history-uses-and-future-of-the-concept/

Hancock. L. (N.D). Six ways loss of Arctic ice impacts everyone. WWF. https://www.worldwildlife.org/pages/six-ways-loss-of-arctic-ice-impacts-everyone

Hendricks, S. (2018, October 5). Article from 1912 warns the world about climate change. *Big Think*. https://bigthink.com/the-present/1912-climate-change-prediction/.

Heininen, L. (2011). The end of the post-Cold War in the Arctic. Nordia Geographical Publications 40: 4, pp. 31–42. https://nordia.journal.fi/article/download/75947/37322/104986

Herington, J. (2012). The Concept of Security. https://jherington.com/docs/Herington_Ashgate-2012.pdf

IPCC. (2023). Summary for Policymakers. *In:* Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001

IPCC. (2022a). AR6. The Working Group II contribution, Climate Change 2022: Impacts, Adaptation and Vulnerability. https://www.ipcc.ch/assessment-report/ar6/

IPCC. (2022b). AR6. The Working Group III contribution, Climate Change 2022: Mitigation of Climate Change. https://www.ipcc.ch/assessment-report/ar6/

IPCC. (2021). Ocean, Cryosphere and Sea Level Change. *In* Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1211–1362, https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter09.pdf

IPCC. (2019). Annex I: Glossary [Weyer, N.M. (ed.)]. *In* IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 677–702. https://doi.org/10.1017/9781009157964.010.

IPCC. AR4. (2007). Climate Change 2007, The Physical Science Basis.

https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf

IPCC. (1990). Sea Level Rise, chapter 9. https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_I_chapter_09.pdf

Jahn, A., Holland, M.M. & Kay, J.E. (2024). Projections of an ice-free Arctic Ocean. *Nat Rev Earth Environ*. https://doi.org/10.1038/s43017-023-00515-9

Jacobsen, M., Pram Gad, U., and Wæver, O. (2024). *Greenland in Arctic Security, (De)securitization Dynamics under Climatic Thaw and Geopolitical Freeze*. University of Michigan Press. https://doi.org/10.3998/mpub.12676130

Koivurova, T., et al. (2021). Overview of EU actions in the Arctic and their impact, Final report, European Commission https://eprd.pl/wp-content/uploads/2021/06/EU-Policy-Arctic-Impact-Overview-Final-Report.pdf

Latour, B. (2017). *Facing Gaia - Eight Lectures on the New Climatic Regime*. Polity Press. https://grattoncourses.files.wordpress.com/2019/06/bruno-latour-facing-gaia-eight-lectures-on-the-new-climatic-regime.pdf

Lenton, T.M., et al (2008). Tipping elements in the Earth's climate system. https://doi.org/10.1073/pnas.0705414105

Lewis, S. L., & Maslin, M. A. (2018). The Human Planet: How We Created the Anthropocene. London: Pelican

Lewis, S. L., & Maslin, M. A. (2015). Defining the Anthropocene. Nature. https://doi.org/10.1038/nature14258

McGhee, R. (2007). The Last Imaginary Place. University Of Chicago Press

McSweeney, B. (1999). Security, Identity and Interests: A Sociology of International Relations. Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511491559

Molena, F. (1912). "Remarkable Weather of 1911, the effect of combustion of coal on the climate – What scientists for the future". Popular Mechanics. https://books.google.pt/books?id=Tt4DAAAAMBAJ&pg=PA341&lpg=PA341&dq=this+tends+to+make+the+air+a+more+effective+blanket+for+the+earth&source=bl&ots=QvdH-SgFLl&sig=WiPUNOIzM6udOSTBm2VXzRQB9K8&hl=en&sa=X&redir_esc=y#v=onepage&q&f=false

Nakicenovic N, et al. (2016). Global Commons in the Anthropocene: World Development on a Stable and Resilient Planet. Working Paper WP-16-019. *International Institute for Applied Systems Analysis*. https://pure.iiasa.ac.at/id/eprint/14003/1/WP-16-019.pdf

NASA. (2023). Tides. https://science.nasa.gov/moon/tides/

NOOA. (2024). Report Card 2024. https://arctic.noaa.gov/report-card/report-card-2024/

Notz, D. (2020). A short history of climate change. EPJ Web of Conferences 246, 00002. https://doi.org/10.1051/epjconf/202024600002

Overduin, P. P., Portnov, A., Ruppel, C. D. (2023) Permafrost Beneath Arctic Ocean Margins *in* NOAA. Arctic Report Card 2023. pp. 76-83. https://arctic.noaa.gov/wp-content/uploads/2023/12/ArcticReportCard_full_report2023.pdf

Palme, O. (1982). *Common Security. A blueprint for survival*, Report. https://s3.amazonaws.com/unoda-web/documents/library/A-CN10-38.pdf

Rantanen, M., et al. (2022). The Arctic has warmed nearly four times faster than the globe since 1979. Commun Earth Environ 3, 168. https://doi.org/10.1038/s43247-022-00498-3

Rockström, J., et al. (2024). The planetary commons: A new paradigm for safeguarding Earth-regulating systems in the Anthropocene. PNAS, Vol. 121, No. 5. https://doi.org/10.1073/pnas.2301531121

Rothschild, E. (1995). What Is Security? Daedalus, Summer, 1995, Vol. 124, No. 3, The Quest for World Order (Summer, 1995), pp. 53-98. The MIT Press on behalf of American Academy of Arts & Sciences. https://www.jstor.org/stable/pdf/20027310.pdf

Shakhashiri, B.Z., Bell. J. L. (2013). Climate change and our responsibilities as chemists. Arabian Journal of Chemistry, Volume 7, Issue 1, January 2014, pp. 5-9. http://dx.doi.org/10.1016/j.arabjc.2013.10.004

Steffen, W., et al. (2011). The Anthropocene: conceptual and historical perspectives. *Phil. Trans. R. Soc. A* nº 369, pp. 842–867. doi:10.1098/rsta.2010.0327

Tuchman Mathews, J. (1989). Redefining Security. Foreign Affairs, Vol. 68, No. 2 (Spring, 1989), pp. 162-177. Council on Foreign Relations. http://www.jstor.org/stable/20043906

United Nations. Convention on Biological Diversity (CBD). (1992). Rio de Janeiro. https://treaties.un.org/doc/Treaties/1992/06/19920605%2008-44%20PM/Ch_XXVII_08p.pdf

United Nations, General Assembly. (2009). Climate change and its possible security implications. Report of the Secretary-General. UN A/64/350. https://documents.un.org/doc/undoc/gen/n09/509/46/pdf/n0950946.pdf?token=Bm06asW33OvrYd6toW&fe=true

WBGU (2006). German Advisory Council on Global Change (WBGU). The Future Oceans, Warming Up, Rising High, Turning Sour. Special Report. https://www.wbgu.de/fileadmin/user_upload/wbgu/publikationen/sondergutachten/sg2006/pdf/wbgu_sn2006_en.pdf

Williams, P. (2008). Security Studies, An introduction. https://www.accord.edu.so/course/material/security-studies-328/pdf_content

WMO. (2022). State of the Global Climate 2021. WMO, Nº. 1290. https://library.wmo.int/doc_num.php?explnum_id=11178

WWF. (2022). Arctic Climate Impact Science. An update since ACIA. https://wwfeu.awsassets.panda.org/downloads/final_climateimpact_22apr08.pdf

APPENDIX 1: Direct and indirect impacts on the Arctic

DIRECT IMPACTS	
Melting of sea ice	According to Dodds and Woodward (2021), sea ice begins to form during the boreal winter and reaches its maximum coverage in early March. It then steadily melts during the summer to reach its yearly minimum extent in September and is significant to the Arctic environment because it follows a seasonal cycle. With a 75% reduction in September Sea ice since 1979, the Arctic Ocean is navigable during the summer (AMAP, 2019; Dodds and Woodward, 2021). Moreover, the *Atlantification* process has its influence in the melting ice. This process consists of warm Atlantic water being advected into the high-latitude ocean in increasing amounts. The melting of sea ice reveals a much darker ocean surface, which absorbs more radiation and causes the temperature to rise. According to energy-balance models, there are a number of stable states of sea ice (and land snow) cover that can result from this ice-albedo positive feedback, including ice-free and finite ice cap states, with ice caps smaller than a particular size being unstable. Certain atmospheric general circulation models (AGCMs) also contain this tiny ice-cap instability, but noise from natural variability can mainly remove it. A significant portion of the ice cover has thinned and the area of the Arctic Sea ice, both summer and winter, is currently losing (summer sea ice losing more significantly), a conclusion from NASA observations that happen since 1978. the observations and data confirm that between March and September 2023, the ice cover in the Arctic contracted from a top area of 14.62 million square kilometres to 4.23 million square kilometres. this size could cover the United States, according to NASA scientists. In 2023, scientists verified remarkably low levels of ice in the Northwest Passage. in the words of Walt Meier, scientist at NSIDC, "It is more open there than it used to be" (NASA, 2023). Since 1988, external forcing in the thinning and shrinkage has been largely subordinated to positive ice-albedo feedback, as indicated by strong nonlinearity. This has led to argue that the system may have already passed a tipping point. According to Lenton et al (2008) only two IPCC models show a total loss of yearly sea ice cover. When the polar temperature rises above 5°C (13°C above the current value), one exhibits a nonlinear transition to a new stable state in 10 years, while the other exhibits a more linear transition. The authors also conclude that a critical threshold for summer Arctic sea-ice loss may occur, whereas a further threshold for year-round ice loss is more uncertain this century. The world's least salinity ocean is the Arctic Ocean, which has a surface area of roughly 14 million km2 (Dodds and Woodward, 2021) is essential for controlling and regulating the global climate. Despite the IPCC (2021) having excluded the Arctic Ocean on the sea level studies, as mentioned above, for the working group AMAP Sea levels are rising globally as a logical consequence of the ice melting, and in the Arctic, this is having an impact on coastal ecosystems and communities through coastal erosion and an increase in floods brought on by salt intrusion in groundwater (AMAP, 2019). A consequence will be obtaining clean water.
Ice sheet	The world's second-largest freshwater reserve, the Greenland Ice Sheet, and the Arctic Sea ice are melting at alarming rates. It's possible that both glaciers have already passed the tipping point, at which point faster melting is being caused by accelerating positive feedbacks (WWF, 2022). The Greenland ice sheet, one of the Arctic glaciers, will continue to lose mass this century even if the 2015 Paris Agreement's mitigation measures are implemented (Koivurova et al., 2021). The albedo effect, which was discussed in the first section of this chapter, is the cause for the melting of the Arctic ice and for the increase of the global temperature. The interpretation of recent observations is still unclear because natural Greenland Ice Sheet (GIS) variability is unknown and Greenland temperature variations have deviated from the global trend. The IPCC provides a 1,000-year timescale for GIS collapse if a threshold is crossed. Nonetheless, a lower limit of 300 years is plausible given the acknowledged lack of processes in current models that could accelerate

	collapse and their incapacity to replicate the quick disappearance of continental ice at the end of the last ice age (Lenton, et al. 2008).
Thawing Permafrost	Permafrost, which is found underground and is frozen at or below zero Celsius for at least two years (Dodds and Woodward, 2021, p. 27) is another feature of the Arctic landscape. It stores enormous amounts of methane, which also contributes to climate change (see section 1 of this chapter). It exacerbates the risks by reinforcing them. Yedoma, "a type of carbon-rich permafrost" (WWF, 2022, p. 13) primarily found in Siberia, is to be considered also a source of carbon emissions that thaw permafrost. Permafrost is a reservoir of carbon that is as large as the atmosphere.
Subsea permafrost	The frozen nature of the sediment beneath many of the continental shelves surrounding the Arctic Ocean is not well known, even among scientists. Permafrost was created by prolonged subaerial exposure, which frozen the ground hundreds of meters below the surface in areas that were exposed and not glaciated during the Last Glacial Maximum (LGM; roughly 21,000 years ago). There are currently 2.5 million km2 of ice-bearing subsea permafrost, according to model estimates, because of rising sea levels and ocean water inundating coastal permafrost at low elevations during deglaciation (Overduin et al. 2019). Terrestrial permafrost now stretches from the coast of the Arctic Ocean in the north to the boreal forests in the south. Subsea permafrost begins at the coast and extends northward beneath the seabed on some Arctic Ocean margins, occasionally even reaching the edge of the continental shelf. Seawater near or above freezing (-2 to 0°C) for the majority of the year replaced the extremely low average yearly air temperatures (-10 to -20°C) above the tundra due to sea level rise, which submerged terrestrial permafrost and created subsea permafrost. The authors of NOAA' s article refer that both the top and bottom of the subsea permafrost have begun to thaw as a result of this notable increase in surrounding temperatures. Within the subsea permafrost region, saline water infiltration has an impact on gas migration, fluid flow, and thaw patterns. As frozen sediments thaw, organic carbon stored there is released for microbial breakdown, generating greenhouse gases like methane that could move toward the seafloor and eventually enter the ocean or even the atmosphere. These gases have the potential to worsen global warming if they are released into the atmosphere. Additionally, thawing lessens the ability of submerged permafrost to capture gases rising from deep layers that may contain deposits of oil and gas. According to the authors Overduin, Portnov, Ruppel, (NOAA, 2023) subsurface permafrost conditions have only been currently documented for a limited number of sites around the Arctic Ocean. More than 80 percent of the subsurface permafrost in the Arctic is probably beneath the largest shelves in the world, which are found in the Laptev and East Siberian Seas. The Earth's widest shallow continental shelf is located 800 km poleward. About 21,000 years ago, at the time of the greatest ice caps and lowest sea levels, it was almost completely subaerial and unglaciated. The ensuing deep freeze at the shore produced thicknesses of permafrost exceeding 700 meters. The authors note that very little data is available to constrain the distribution and properties of subsurface permafrost on this margin. based on data available, Overduin, Portnov, Ruppel (2023) affirm that the subsea permafrost longevity is influenced by geothermal heat flow at the permafrost's base, bottom water temperatures, and salinity in the surrounding waters. Over an extended period of inundation, the top of ice-bearing permafrost thaws more slowly and deeply. In the Beaufort and Laptev Seas, boreholes have revealed thaw depths that are less than 100 meters below the seafloor, following thousands of years of flooding (Overduin, Portnov, Ruppel, 2023). The melting sea ice will allow a navigable Central Arctic Ocean, getting closer and linked to the North Atlantic, where the Federation of Russia intends to have access whereas projecting power (Andreeva, Dodds, Douglas, Humrich, and Nawrath, 2024).

INDIRECT IMPACTS	
Loss of biodiversity	The various terrestrial and marine[2],[3], ecosystems are strained, disturbed, and diminished by all of the aforementioned effects and changes. Research will enable them to provide more details about their options for climate change adaptation (WWF, 2022). When it comes to the marine ecosystem, factors like water temperature, sea ice loss, and ocean acidification affect the marine biota, which includes algae. Furthermore, the connection between the Atlantic and Arctic basins affects marine ecosystems, especially in the Barents Sea. Because plants and animals cannot quickly or readily adapt to new environments, there is a noticeable loss of biodiversity that could result in the introduction of invasive species into the Arctic (Koivurova et al., 2021). With less ice in the Arctic, the tundra is growing greener and will soon no longer be called a désert de glace.
Threat to livelihoods	The changes have been affecting livelihoods in the Arctic region. Arctic indigenous peoples have been adapting to a new reality which is affecting their traditional way of life based on fishing and harvesting. A way of life that has been able to prepare generations to live in hostile and harsh conditions. The changes in the environment, landscape and ecosystem are all turning indigenous communities into vulnerable communities while, at the same time, they are facing poverty and unemployment problems (Koivurova, Tervo, and Stepien, 2008). Indigenous traditional knowledge, which is linked to knowledge and comprehension of ecosystems and the environment[4], and their means of subsistence are at risk (IPCC, 2022b) so it is important to keep its preservation by oral transmission to the next generation through songs, stories, and legends[5]. Although some opposition, this kind of traditional knowledge has been equated with scientific knowledge (IPCC, AR6, WGII, 2007) on a global scale[6] for the reason that it can provide guidance on how to mitigate the effects of human activity on climate change currently faced by those communities. On June 5th 2022[7], the UN Secretary-General, Antonio Guterres stated that indigenous and traditional knowledge must also be respected and harnessed to help protect our fragile ecosystems, underscoring the significance of this knowledge even further. According to Koivurova, Tervo, and Stepien (2008), it is not possible to separate the significant shifts from the region's economic effects, which are shaped by commercial fishing, the extraction of raw materials, and the sale of harvested goods. Indigenous Peoples recognize the importance of treating resources with sustainability. According to them, their ancestors' rich livelihood throughout innumerable generations was made possible by living in the Arctic (McGhee, 2007). The threat to livelihoods is not only towards indigenous communities. It affects each and every one of us independently of the place each human beings is located on Earth.

Source: Own elaboration

[2] Marine ecosystems are also affected by plastic pollution which in turn affects indigenous people's health. See: Lusher, A. L., Tirelli, V., O'Connor, I. & Officer, R. (2015). Microplastics in Arctic polar waters: the first reported values of particles in surface and sub-surface samples *Scientific Reports*. 5. DOI: 10.1038/srep14947.
[3] Nuttall, M. (1998). *Protecting the Arctic, Indigenous Peoples and Cultural Survival*, Routledge.
[4]See: Arctic Council. (N.D). *Ottawa Traditional Knowledge Principles*. https://static1.squarespace.com/static/58b6de9e414fb54d6c50134e/t/5dd4097576d4226b2a894337/1574177142813/Ottawa_TK_Principles.pdf
[5] See: Arctic Center. (N.D). https://www.arcticcentre.org/EN/arcticregion/Arctic-Indigenous-Peoples/Traditional-knowledge
[6] United Nations. Economic and Social Council. Permanent Forum on Indigenous Issues. (2021). *Indigenous peoples and climate change, Note by the Secretariat*. E/C.19/2021/5. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N21/009/43/PDF/N2100943.pdf?OpenElement
[7] United Nations. Economic and Social Council. Permanent Forum on Indigenous Issues. (2021). *Indigenous peoples and climate change, Note by the Secretariat*. E/C.19/2021/5. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N21/009/43/PDF/N2100943.pdf?OpenElement

APPENDIX 2

4 forms of security extension

1	the concept of security is extended from the security of nations to the security of groups and individuals: it is extended downwards from nations to individuals.
2	it is extended from the security of nations to the security of the international system, or of a supranational physical environment: it is extended upwards, from the nation to the biosphere. The extension, in both cases, is in the sorts of entities whose security is to be ensured.
3	the concept of security is extended horizontally, or to the sorts of security that are in question. Different entities (such as individuals, nations, and "systems") cannot be expected to be secure or insecure in the same way; the concept of security is extended, therefore, from military to political, economic, social, environmental, or "human" security.
4	the political responsibility for ensuring security (or for invigilating all these "concepts of security") is itself extended: it is diffused in all directions from national states, including upwards to international institutions, downwards to regional or local government, and sideways to nongovernmental organizations, to public opinion and the press, and to the abstract forces of nature or of the market

Source: Rothschild, 1995, p. 55

4 principles of security

1	to provide some sort of guidance to the policies made by governments. Principles of security may be derived or described by theorists, but they are followed or held by officials. This is what could be described as the "naive" view of the debate over principles of security, in that it assumes that principles are indeed important in the organization of policy.
2	to guide public opinion about policy, to suggest a way of thinking about security, or principles to be held by the people on behalf of whom policy is to be made. (...) But public opinion is itself influenced by principles or concepts.
3 NATO	to contest existing policies. To dispute the foundations of policy is one way? an often effective way in a strongly popular system of government? to subvert public support for policies to which one is opposed. The interest in new concepts of security was thus encouraged, in the late 1970s and 1980s, by quite disparate groups. The politics of extended security is substantially different in the 1990s, in that it has engaged the theorists as well as the critics of military establishments. If security is the objective of military and intelligence organizations, and if the sources of insecurity have changed in character (with the end of the Cold War), then a condition for redefining the role of the "security forces" is redefining security: to contest old policies and to promote new ones.
4 UN	to influence directly the distribution of money and power. A public interest organization concerned with environmental programs, for example, might hope that by promoting ideas of environmental security, it would bring about a change in government policy such that less money was spent on military deployments, and more on environmental programs. A change in the objectives of policy from military to economic security would bring a change in government expenditure from ministries of defense to ministries of commerce or of foreign relations. A change in the definition of military security to include the prevention of conflicts by the deployment of peacekeeping forces would bring an increase, or prevent a decrease, in expenditure on military forces.

Source: Rothschild, 1995, pp. 57-59