CLIMATE CHANGE AS A MAJOR CONTEMPORARY TOPIC: A CATASTROPHE THAT DEMANDS NORMATIVE RESPONSES

AS MUDANÇAS CLIMÁTICAS COMO GRANDE TEMA DA ATUALIDADE: UMA CATÁSTROFE QUE EXIGE RESPOSTAS NORMATIVAS À SUA ALTURA

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ABSTRACT: 2024 once again surpassed previous levels of global warming, going over the Paris Agreement target of 1.5°C. At a time of international discouragement regarding multilateral climate agreements, this article seeks to reintroduce the phenomenon of climate change as a central theme of international debate. To this end, this event is considered as a major topic that should be located at a central position on the international agenda. It describes the negative effects of climate change as catastrophes and seeks to highlight flaws and gaps in the regulation carried out by international law in this area. The article concludes that despite being humanity's greatest concern today, the issue has not been effectively regulated by international law. Therefore, it suggests a new approach: the International Law of Catastrophes.
Keywords: climate change; International Law of Catastrophes; Paris Agreement; United Nations Framework Convention on Climate Change; Kyoto Protocol.

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RESUMO: O ano de 2024 mais uma vez superou os níveis anteriores de aquecimento global, ultrapassando a meta do Acordo de Paris de 1,5°C. Em uma época de desmotivação internacional em relação a acordos climáticos multilaterais, o presente artigo busca reintroduzir o fenômeno das mudanças climáticas como um tema central. Para isso, trabalha esse evento como o grande tema da atualidade que deve ser debatido na agenda internacional. Descreve os efeitos negativos das mudanças climáticas como catástrofes e procura evidenciar falhas e lacunas na regulamentação realizada pelo direito internacional nessa área. O artigo conclui que apesar de ser a maior preocupação da humanidade hodiernamente, o assunto não vem sendo regulamentado de forma efetiva pelo direito internacional. Dessa forma, sugere uma nova abordagem: o Direito Internacional das Catástrofes.
Palavras-chave: mudanças climáticas; Direito Internacional das Catástrofes; Acordo de Paris; Convenção-Quadro das Nações Unidas sobre a Mudança do Clima; Protocolo de Quioto.

1. **INTRODUCTION**

Climate change affects every aspect of human life. In a year when COP 30 will be held in Brazil, reflecting on this phenomenon is a must. The COP's host city, Belém, already reveals the eternal conflict between environmental preservation and economic development, given its location in the Amazon and recent pressure to allow oil exploration in the region. With the United States, one of the largest emitters of greenhouse gases, outside the Paris Agreement, the future of climate negotiations looks bleak. Furthermore, the year 2024 once again surpassed previous warming records, surpassing, for the first time, the Paris Agreement's target of maintaining 1.5°C of warming. It seems to be no wonder that in one of its latest issues, The Economist magazine featured the phrase: "The Age of Chaos" as its cover story.

Given this climate of insecurity and low expectations for climate negotiations, this article seeks to rekindle the importance of the climate change debate and reaffirm the issue's centrality in today's international society. The objective of this research is to confirm that climate change is a major concern for humanity's future and to understand how international law has regulated this area. In this sense, the article begins with an analysis of climate change, providing a brief history of how the issue gradually entered the international agenda and gained prominence. The work then demonstrates that international action has been insufficient, and the phenomenon of climate change has now become a matter of addressing catastrophes. Finally, the study analyzes the role that

international law has achieved in this area, highlighting gaps and obstacles. The article concludes that a new normative approach is needed that can place climate change at the center, in its rightful place in the current legal system.

2. CLIMATE CHANGE AS A MAJOR GLOBAL THEME

In 2009, a select group of scientists, led by the Swedish Johan Rocksoström, linked to the Stockholm Resilience Centre (SRC), published the study entitled Planetary Boundaries: Exploring the Safe Operating Space for Humanity na prestigiada Ecology e Society.[3]

At the time, the researchers stated that anthropogenic pressures on the Earth system had already reached a scale where abrupt global environmental changes could no longer be excluded and proposed a new approach to global sustainability in which they defined some planetary boundaries within which there was an expectation that humanity could operate with a certain margin of safety.

At that time, they warned that transgressing one or more planetary boundaries[4]—understood as safe limits for humanity on the nine critical processes that, together, maintain a stable and resilient Earth—could be harmful or even catastrophic due to the risk of exceeding thresholds that could trigger significant, nonlinear environmental changes in systems at continental and planetary scales. Nine planetary boundaries were identified (climate change; biodiversity loss; ozone layer depletion; atmospheric aerosol load; ocean acidification; modification of biogeochemical flows; freshwater change; land-use abuses; chemical pollution) and, based on scientific knowledge, proposed quantifications for seven of them, as they had not been able to determine the limits for chemical pollution and atmospheric aerosol load.[5]

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[3] ROCKSOTRÖM, Johan et all. *Planetary Boundaries: Exploring the Safe Operating Space for Humanity.* Ecology e Society. Vol. 14, No. 2 Art. 32. Disponível em https://www.ecologyandsociety.org /vol14/iss2/art32/. Acesso em 21/03/2024.

[4] "As fronteiras planetárias definem, por assim dizer, as fronteiras do "campo de jogo planetário" para a humanidade, se quisermos ter a certeza de evitar grandes mudanças ambientais induzidas pelo homem à escala global." ROCKSOTRÖM, Johan et all. Planetary Boundaries: *Exploring the Safe Operating Space for Humanity.* Ecology e Society. Vol. 14, No. 2 Art. 32. Disponível em https://www.ecologyandsociety.org /vol14/iss2/art32/ Acesso em 21/03/2024.

[5] "These seven are climate change (CO2 concentration in the atmosphere 350 ppm and/or a maximum change of +1 W m-2 in radiative forcing); ocean acidification (mean surface seawater saturation state with respect to aragonite ≥ 80% of pre-industrial levels); stratospheric ozone (5% reduction in O3 concentration from pre-industrial level of 290 Dobson Units); biogeochemical nitrogen (N) cycle (limit industrial and agricultural fixation of N2 to 35 Tg N yr-1) and phosphorus (P) cycle (annual P inflow to oceans not to exceed 10 times the natural background weathering of P); global freshwater use (4000 km3 yr-1 of

It is important to note that the Planetary Boundaries are interdependent, meaning that if one of the boundaries is exceeded, the others will eventually be surpassed as well, or at the very least, will not remain within an adequate operational space.

The study also observed that planetary boundaries are interconnected within the planet's biophysical system; therefore, all nine boundaries must be maintained at levels considered safe to prevent harm to humanity. Any change in this scenario could push the planet out of the stable state it has experienced over the past nearly 12,000 years (a period known as the Holocene).[6]

With a warmer and more stable climate, the Holocene period created favorable conditions for the development of human societies, fostering the rise of agriculture as well as cultural and technological advances. However, many scientists[7] point out that the turn of the 20th century marked the closing moments of the Holocene, and that the changes produced in the global system after World War II were equally significant, marking the emergence of a new period: the Anthropocene. This scientific hypothesis is based on the assumption that, just as with the climate, biodiversity, the seas, the oceans, and the Earth itself have undergone profound changes and people have come to occupy a predominant place in the global system, as explained in the study "The Anthropogenic Incursion in the Global South," published in the journal "Desacatos" in 2017. However, it is still under debate whether the Anthropocene should be introduced as a geological epoch (like the Holocene), within the Quaternary period, or if it would be on a lower hierarchical level, that is, a subdivision within the Holocene, as argued by Manuel Tironi.[8]

The fact is that, more recently, in 2023, it became possible to quantify all nine processes that regulate the stability and resilience of the Earth system. Furthermore, scientists also reached the understanding that six out of the nine boundaries had been

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consumptive use of runoff resources); land system change (15% of the ice-free land surface under cropland); and the rate at which biological diversity is lost (annual rate of <0 extinctions per million species). The two additional planetary boundaries for which we have not yet been able to determine a boundary level are chemical pollution and atmospheric aerosol loading." ROCKSOTRÖM, Johan et all. Planetary Boundaries: Exploring the Safe Operating Space for Humanity. Ecology e Society. Vol. 14, No. 2 Art. 32. Disponível em https://www.ecologyandsociety.org /vol14/iss2/art32/

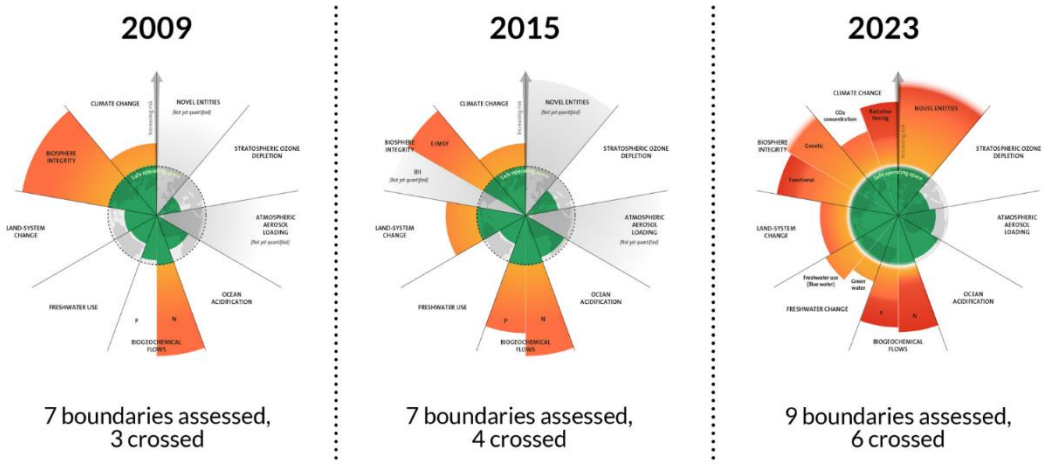
[6] "Foi no Holoceno que a espécie humana, que surgiu há cerca de 200 mil anos, evoluiu a ponto de formar a civilização que existe hoje. O clima relativamente estável do período atual também permite a existência de outras formas de vida tão importantes quanto a nossa para o equilíbrio ambiental." VICK, Mariana. O que são limites planetários. E quais já foram cruzados. Disponível em https://www.nexojornal.com.br/expresso/2024/05/25/limites-planetarios-o-que-sao

[7] WALSH, Alistair. O que é o Antropoceno. Disponível em https://www.ihu.unisinos.br/637352. Acesso em 10/12/2024.

[8] O que é o Antropoceno e por que esta teoria científica responsabiliza a humanidade? Disponível em https://www.nationalgeographicbrasil.com/historia/2023/01/o-que-e-o-antropoceno-e-por-que-esta-teoria-cienti-fica -responsabiliza-a-humanidade.

crossed, thus posing a great risk of significant and irreversible large-scale changes that could cause severe harm to the environment and all planetary life. This latest study (from 2023), by indicating the transgression of six planetary boundaries—alongside the findings from 2009 and 2015, as illustrated below[9]—emphasizes the serious risk faced by the planet and, consequently, all of humanity.[10]

Figure – Transgression of the six planetary limits



Another important research center that addresses this matter, the Potsdam Institute for Climate Impact Research[11], has also produced an interesting approach to planetary boundaries and emphasized that the path humanity has taken may lead to irreversible catastrophes, with global warming considered as the main villain in this issue.

Unlike the Stockholm Resilience Centre, the Potsdam Institute identified seven processes that have already exceeded safe levels or are close to doing so. They are:

[9] Atualização de 2023 para os limites planetários. Licenciado sob CC BY-NC-ND 3.0 . Crédito: "Azote para o Stockholm Resilience Centre, com base na análise em Richardson et al 2023. Disponível em https://www.stockholmresilience.org/research/planetary-boundaries.html. Acesso em 02/12/2024.

[10] "This planetary boundaries framework update finds that six of the nine boundaries are transgressed, suggesting that Earth is now well outside of the safe operating space for humanity. Ocean acidification is close to being breached, while aerosol loading regionally exceeds the boundary. Stratospheric ozone levels have slightly recovered. The transgression level has increased for all boundaries earlier identified as overstepped. As primary production drives Earth system biosphere functions, human appropriation of net primary production is proposed as a control variable for functional biosphere integrity. This boundary is also transgressed. Earth system modeling of different levels of the transgression of the climate and land system change boundaries illustrates that these anthropogenic impacts on Earth system must be considered in a systemic context." RICHARDSON, Katherine et all. Earth beyond six of nine planetary boundaries. Science AdvancesVol. 9, No. 37, 2023. Disponível em https://www.science.org/doi/10.1126/sciadv.adh2458

[11] POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH. Disponível em https://www.pik-potsdam.de/en/topics/planetary-boundaries-tipping-elements-global-commons. Acesso em 02/12/20124.

> a) “mudanças no uso da terra do planeta: corresponde ao desmatamento e a conversão de ecossistemas naturais em áreas agrícolas ou urbanas, que estão destruindo habitats e afetando a regulação climática cujos níveis seguros já foram ultrapassados e atingiram uma zona de alto risco;
> b) mudanças climáticas: diretamente ligado ao aumento da temperatura devido à poluição por gases do efeito estufa, que têm consequências graves para o planeta, em que seus níveis considerados seguros já foram ultrapassados e atingiram uma zona de alto risco;
> c) biodiversidade: possuí relação com a extinção de várias espécies, causada pela degradação dos habitats naturais e pela exploração excessiva dos recursos, ocasião em que seus níveis seguros já foram ultrapassados e atingiram uma zona de alto risco;
> d) ciclo do nitrogênio e fósforo: está relacionado ao uso excessivo de fertilizantes, que prejudica a qualidade da água e afeta os ecossistemas aquáticos, cujos níveis seguros já foram ultrapassados e atingiram uma zona de alto risco;
> e) uso de água doce: voltado para a demanda crescente por água em várias regiões, que está se aproximando de níveis críticos e indica que os níveis seguros já foram ultrapassados;
> f) poluição química por compostos como microplásticos: corresponde ao acúmulo de produtos químicos tóxicos no ambiente, que representa uma ameaça crescente à saúde humana e à biodiversidade. seus níveis seguros já foram ultrapassados;
> g) acidificação dos oceanos: voltado ao aumento de CO_2 na atmosfera, que torna os oceanos mais ácidos, prejudicando a vida marinha e os recifes de corais, em que seus níveis seguros ainda não foram ultrapassados, mas estão muito próximos.”[12]

As for the other two processes identified, which have not yet come close to being trespassed, they are as follows: a) aerosols in the atmosphere: that is, the increase of suspended particles in the air (such as soot and dust), which is altering regional climate patterns and affecting human health; and b) the ozone layer: the degradation of this region of the stratosphere was already underway, but international actions have helped protect it. The illustration below shows the indication of the seven processes:

Figure – Visual representation of planetary limits

[12] POTSDAM Institute for Climate Impact Research. Disponível em https://www.pik-potsdam.de/en/topics/planetary-boundaries-tipping-elements-global-commons. Acesso em 02/12/20124.

Indeed, the situation described above is worrisome and calls for urgent behavioral changes at all levels of society, as planetary boundaries, in a way, indicate how far human behavior can go without compromising the planet's regenerative capacity. Although these boundaries have been presented separately by the renowned Swedish research center, it is possible to identify a close relationship between the issues, whose central element lies in the challenge humanity faces regarding climate matters.

Nevertheless, the transformations brought about in the world by the Industrial Revolution have produced (and continue to produce) significant harm to the environment—whether due to the predatory use of natural resources, the unrestrained consumption by civil society, or the excessive production of greenhouse gases (GHGs). These factors have directly impacted significant climate changes, characterizing what is now termed a "new era," the Anthropocene.

In fact, nature—regarded as a source of wealth to be exploited by society and as an instrument for economic growth—and its subsequent degradation, became yet another side effect of this conception of development. Ideas of progress and well-being in modernity are based on utilitarianism that is uneven and lacking in ecological rationality.[13]

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[13] PERALTA, Carlos E. *El antropoceno en la sociedad de riesgo: entendiendo el contexto del problema ecológico*. Universidad de Costa Rica, Facultad de Derecho, 2022.

It is no coincidence that, in 2024, the amount of CO2 in the atmosphere surpassed the staggering number of 422 ppm—above the 350 ppm limit considered by the Paris Agreement targets, as indicated by the Potsdam Institute for Climate Impact Research. [14] Also noteworthy is the fact that the so-called warming force caused by human activity in the atmosphere exceeds 2.79 W/m², while planetary boundaries for this force have been set at +1.0 W/m² (in relation to pre-industrial levels). As a result of these negative milestones, there is an increase in global temperatures and, consequently, the outbreak of extreme events.

Modernization has brought consequences that put at risk the very basic living conditions achieved through this process. It corresponds to a reality that threatens society itself, in which it becomes evident that the growing production of wealth is accompanied by an equally relentless social production of globalized risks, affecting all nations equally, without distinction.

Human actions have caused severe damage to the environment, and one of the most significant signs is closely related to climate change, which today presents itself as a catastrophe of global magnitude. The behavior adopted by multiple social actors is, in some way, based on risk[15], and with each passing day, new risks are generated and intensified.

3. **CLIMATE CHANGE: A FORETOLD CATASTROPHE?**

In recent years, the planet has been struck by various extreme events. By way of illustration, in 2024, episodes were identified in almost every region of the world, such as the floods that occurred in the state of Rio Grande do Sul, Brazil; the high temperatures,

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[14] POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH. Disponível em https://www.pik-potsdam.de/en/topics /planetary-boundaries-tipping-elements-global-commons. Acesso em 02/12/20124.

[15] **“**Temos pesquisado sobre os problemas ambientais porque consideramos que apontam para os processos de degradação que vêm atingindo os sistemas de suporte à vida, como os ciclos das águas, do clima e dos solos, o fornecimento de alimentos e de água, a disponibilidade de recursos naturais fundamentais a nossa vida. Assim, podemos falar que há melhoria da qualidade de vida (acoplada à ideia de que quanto mais consumo, melhor a qualidade de vida) tendo ao mesmo tempo a piora dos indicadores ambientais (quanto mais consumo, mais recursos naturais são utilizados ou degradados, de modo que não há uma fórmula mágica que permita aumentar o consumo sem aumentar os danos ambientais). E isto também se acopla ao crescimento, tanto da população como ao consumo per capita, que também cresceu ao longo do século XX, ao mesmo tempo acompanhado de grandes desigualdades, já que o consumo médio de um cidadão de um país rico pode ser até 40 vezes maior do que outro cidadão vivendo em um país pobre. Assim, consideramos que não podemos tratar de melhoria da qualidade de vida, sem tratar dos sistemas de suporte à vida, sendo que, na inter-relação entre um e outro, temos a questão do crescimento e das desigualdades.” MACHADO, Carlos. Degradação ambiental na sociedade do risco. Até onde podemos ir? Disponível em https://www.plurale.com.br/site/noticias-detalhes.php?cod=8438&codSecao=3. Acesso em 12/05/2021.

reaching approximately 50 degrees Celsius, in several parts of India; the remarkable number of tornadoes that touched down on the North American coast; earthquakes in Japan, among others. What these occurrences seem to have in common—such as the intense heat waves, floods, and droughts—is the central element of global warming and its ramifications in climate change.

According to the report titled "Learning Interrupted: Global Snapshot of Climate-Related School Disruptions in 2024," heatwaves were the main events responsible for school closures or interruptions of classes in primary and secondary education.[16] The report states that more than 242 million students, in 85 countries, missed school because of heatwaves, floods, cyclones, and other weather events. The information in this report coincides with the fact that 2024 was the hottest year in history, with global temperatures exceeding 1.5°C above pre-industrial levels for the first time. UNICEF Executive Director Catherine Russell warned that:

> children are more vulnerable to the impacts of climate crises, such as stronger and more frequent heatwaves, storms, droughts, and floods. Children's bodies are especially susceptible. They heat up faster, sweat less efficiently, and cool down more slowly than adults. They cannot concentrate in stiflingly hot classrooms and cannot get to school if the way is flooded or if the schools are washed away by the water. All of this affects long-term education.[17]

Global warming is altering the entire environmental balance on a planetary scale and, in this context, increases the likelihood of climate-related catastrophes. It is a subject that concerns everyone indiscriminately since it involves intergenerational rights. The

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[16] "The snapshot highlights 10 key findings: globally, at least 242 million students – from pre-primary to upper secondary education – have experienced school disruptions due to climate events in 2024; At least 1 in 7 students had their schooling disrupted due to climate hazards in 2024; in 2024, 85 countries or territories saw their schools affected by climate-related hazards, with 23 countries experiencing multiple rounds of school disruptions; at least 20 countries had nationwide school disruptions in 2024 due to climate-induced disasters. Heatwaves, tropical cyclones, storms, and floods– all exacerbated by climate change – were causing nationwide school closures in 2024; 74 per cent of the 242 million affected students are in low- and lower-middle-income countries, with an average Children's Climate Risk Index (CCRI) score of 7 out of 10; South Asia was the most affected region in 2024 with 128 million students affected by climate-related school disruptions. East Asia and the Pacific region followed, impacting 50 million students; in 2024, heatwaves were the most significant climate hazard worldwide to disrupt schooling, affecting an estimated 171 million students; april saw the highest global climate-related school disruptions, with heatwave as the leading hazard affecting at least 118 million children in Bangladesh, Cambodia, India, the Philippines, and Thailand; september recorded the most frequent climate-related school disruptions. At a time of year when schools reopen in many parts of the world, at least 18 countries suspended classes. Typhoon Yagi affected 16 million children in East Asia and the Pacific, making it the top hazard in September; in Africa, while over 107 million children are already out of school, climate-related disruptions in 2024 have put an additional 20 million children at risk of dropping out." LEARNING interrupted: *Global snapshot of climate-related school disruptions in 2024*. Disponível em https://www.unicef.org/reports/learning-interrupted-global-snapshot-2024. Acesso em 02/02/2025

[17] LEARNING INTERRUPTED: *Global snapshot of climate-related school disruptions in 2024*. Disponível em https://www.unicef.org/reports/learning-interrupted-global-snapshot-2024. Acesso em 02/02/2025.

harmful effects produced since the Industrial Revolution in the 18th century have reached catastrophic levels in the 21st century, especially due to human actions.

In a recent article published in the renowned journal BioScience, which featured the report "State of the Climate 2024"[18], the scientists responsible for the studies expressed shock at the numerous extreme climate events, stating that humanity is living through "dangerous times," with the possibility of an irreversible climate episode, and they warn:

> A realidade, vivida de Norte a Sul, nos quatro cantos do planeta. E mesmo com um progresso aqui outro ali, continuamos alimentando as causas da tragédia climática, enquanto suas consequências se tornam mais letais para todos, mas principalmente para países e populações mais pobres. Ainda estamos caminhando na direção errada; as emissões de combustíveis fósseis aumentaram para o nível mais alto de todos os tempos, os três dias mais quentes de todos os tempos ocorreram em julho de 2024 e as políticas atuais nos colocam no caminho certo para um pico de aquecimento de aproximadamente 2,7°C até 2100. (...) Estamos testemunhando a realidade sombria das previsões à medida que os impactos climáticos aumentam, trazendo à tona cenas de desastres sem precedentes em todo o mundo e sofrimento humano e não humano. Encontramo-nos em meio a uma abrupta reviravolta climática, uma situação terrível nunca antes encontrada nos anais da existência humana. [19]

Undoubtedly, issues related to climate change[20] present themselves as a global concern, given that humanity is at high risk; it can be said that we are facing a true "climate catastrophe."[21]

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[18] RIPPLE, William J. et all. *The 2024 state of the climate report: Perilous times on planet Earth*. BioScience, Volume 74, Issue 12, December 2024, Pages 812–824. Disponível em https://academic.oup.com/ bioscience/article/74/12/812/7808595?login=false. Acesso em 20/12/2024.

[19] RIPPLE, William J. et all. *The 2024 state of the climate report: Perilous times on planet Earth*. BioScience, Volume 74, Issue 12, December 2024, Pages 812–824. Disponível em https://academic.oup.com/ bioscience/article/74/12/812/7808595?login=false

[20] "Muito embora o tema das mudanças climáticas tenha sido pautado desde a década de 1980, nos últimos anos ele tomou uma proporção ainda maior, sendo hoje o tema ecológico com maior ressonância na agenda política, tanto em um plano nacional quanto internacional. O mundo chegou em uma "situação limite" em termos de mudanças climáticas, sendo que, se medidas disruptivas não forem tomadas, estar-se-á entrando em um problema que poderá comprometer as presentes e futuras gerações. Em outros termos, é possível afirmar que a janela de oportunidades para reversão dos efeitos trazidos pela emergência climática está cada vez mais próxima de ser fechada." ROCHA, Mário; NASCIMENTO, Anna; ÁVILA, Laura. Direito internacional do mar e do clima: a necessidade de mitigação dos efeitos causados pelas causados pelas mudanças climáticas nos mares e oceanos. In TOLEDO, André; SUBTIL, Leonardo; ZANELLA, Tiago. *Direito do mar (v.7): navegação, novas tecnologias e meio ambiente marinho.* Belo Horizonte: D'Plácido, 2024

[21] O Secretário Geral da Organização das Nações Unidas, Antonio Guterres, tem utilizado em suas manifestações frequentes a expressão de catástrofe climática, como por exemplo, na abertura do fórum sobre sustentabilidade promovido pela revista The Economist, em março de 2022: "Na contramão das discussões durante a Conferência das Nações Unidas sobre Mudança Climática e contrariando as estimativas do último relatório do IPCC, as emissões globais devem aumentar quase 14% na década de 2020. O mundo caminha para uma "catástrofe climática". ONU. *Mundo caminha para "catástrofe climática", afirma chefe da ONU*. Disponível em https://news.un.org/pt/story/2022/03/1783532. Acesso em 03/03/2023.

4. **INTERNATIONAL LAW AND CLIMATE CHANGE**

In international law, the regulation of issues related to climate change is concentrated in the United Nations Framework Convention on Climate Change[22], the Kyoto Protocol,[23] and the Paris Agreement.[24] The Framework Convention was adopted at the 1992 Rio Conference and remains the main international regulation on the subject, generating great expectations for COP 30, which will be held in Brazil in 2025. The major challenges facing the international climate regime are threefold: ensuring the participation of the entire international society, achieving a reduction in global emissions, and guaranteeing compliance with the established norms.

As analyzed, climate change represents a catastrophic threat to humanity. Therefore, any effective change requires the commitment of all major emitters, which demands that States completely transform their production and energy systems. To complicate matters, scientific knowledge about the process of climate change is still developing with the reports issued by the IPCC.

The main shortcoming in the climate change regime lies in the fact that it consists, for the most part, of mitigation rules, whether through the reduction of CO2 emissions or the decrease in greenhouse gas concentrations. A robust normative framework will be needed to overcome catastrophes and repair damages. Adapting international law to this new reality is the task that must be faced by this generation.

In this sense, Polizzi reflects on the need for a new legal regime capable of adopting specific measures for regional realities and imperative rules based on the interests of humanity:

> It is time to change the focus from exclusively global to include local-specific measures. What we need is a new legal framework that allows the utilization of many different techniques to adapt to local impacts, while maintaining global mitigation goals. The new framework will have to allow regulatory schemes to adapt to a new reality as conditions worsen. Most importantly, enforcement provisions will have to be strong enough to support the concept that implementation and compliance will not be voluntary. The means of

[22] CONVENÇÃO-QUADRO das Nações Unidas sobre mudança do clima. 9 de maio de 1992. Disponível em: https://www.planalto.gov.br/ccivil_03/decreto/d2652.htm Acesso em: 15 jul. 2025.
[23] PROTOCOLO de Quioto. 16 de março de 1998. Disponível em: http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/Protocolo_Quioto.pdf Acesso em: 15 jul. 2025.
[24] ACORDO de Paris. 12 de dezembro de 2015. Disponível em: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/publicacoes/acordo-de-paris-e-ndc/arquivos/pdf/acordo_paris.pdf Acesso em: 15 jul. 2025.

> adaptation can be written to reflect local circumstances and needs but the goals of adaptation law cannot be subject to local veto or avoidance.[25]

This regulatory framework must reduce vulnerabilities and increase resilience, especially to address permanent changes such as rising sea levels, temperature increases, and glacier melt. In order to reduce vulnerabilities, it is essential to invest in infrastructure, which makes environments safer in the event of catastrophes. Making States more resilient is a somewhat more complex task, requiring a robust emergency response structure and investments in environmental restoration. Since climate change remains a phenomenon with few scientific certainties regarding the future, the structure to be built needs to be flexible in order to adapt to possible changes in terms of catastrophes.

The Paris Agreement represented a significant breakthrough in international regulations concerning losses and damages suffered as a result of climate change. The adoption of this reparatory measure, however, was the subject of much debate between developing and developed countries, which is evident in the somewhat ambiguous wording of its article:

> Artigo 8º
> 1. As Partes reconhecem a importância de evitar, minimizar e enfrentar perdas e danos associados aos efeitos negativos da mudança do clima, incluindo eventos climáticos extremos e eventos de evolução lenta, e o papel do desenvolvimento sustentável na redução do risco de perdas e danos.
> 2. O Mecanismo Internacional de Varsóvia sobre Perdas e Danos associados aos Impactos da Mudança do Clima deve estar sujeito à autoridade e à orientação da Conferência das Partes na qualidade de reunião das Partes deste Acordo, e poderá ser aprimorado e fortalecido, conforme determinado pela Conferência das Partes na qualidade de reunião das Partes deste Acordo.
> 3. As Partes deverão reforçar o entendimento, a ação e o apoio, inclusive por meio do Mecanismo Internacional de Varsóvia, conforme o caso, de maneira cooperativa e facilitadora, em relação a perdas e danos associados aos efeitos negativos da mudança do clima.
> 4. Por conseguinte, a atuação cooperativa e facilitadora para reforçar o entendimento, a ação e o apoio podem incluir as seguintes áreas:
> (a) Sistemas de alerta antecipado;
> (b) Preparação para situações de emergência;
> (c) Eventos de evolução lenta;
> d) Eventos que possam envolver perdas e danos irreversíveis e permanentes;
> (e) Avaliação e gestão abrangente de riscos;
> (f) Mecanismos de seguro contra riscos, compartilhamento de riscos climáticos e outras soluções relativas a seguro;
> (g) Perdas não econômicas; e
> (h) Resiliência de comunidades, meios de subsistência e ecossistemas.
> 5. O Mecanismo Internacional de Varsóvia deve colaborar com os órgãos e grupos de especialistas existentes no âmbito do Acordo, bem como com organizações e órgãos especializados pertinentes externos ao Acordo.[26]

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[25] POLIZZI, Norma. Can International Law Adapt to Climate Change? **Environmental Claims Journal**, p.1-15, jan. 2020. Disponível em: https://doi.org/10.1080/10406026.2020.1718849 Acesso em: 15 jul. 2025. P.5

[26] ACORDO de Paris. 12 de dezembro de 2015. Disponível em: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/publicacoes/acordo-de-paris-e-ndc/arquivos/pdf/acordo_paris.pdf Acesso em: 15 jul. 2025.

Discussions about the need to develop rules on responsibility and compensation in situations of loss and damage date back to the early days of the climate change system, during the debates at the 1992 Rio Conference and the adoption of the United Nations Framework Convention, when the Alliance of Small Island States group was already advocating for its implementation through the creation of an international fund. This was the argument put forward by Vanuatu:

> The financial burden of loss and damage suffered by the most vulnerable small island and low-lying developing countries (Group 1 countries) as a result of sea level rise shall be distributed in an equitable manner amongst the industrialized developed countries (Group 2 countries) by means of an Insurance Pool.[27]

After this initial proposal, the idea of introducing reparations for loss and damage due to climate change was persistently put forward, yet with little success, in all the most important discussions on the topic. The Bali Action Plan, adopted in 2007, included a specific item dedicated to this subject.[28] In 2008, the Secretariat of the Framework Convention prepared an extensive technical report on financial mechanisms for cases of loss and damage directly related to climate change.[29]

It was only in 2010, at COP16 in Cancun, that the idea began to take shape, creating a work program to consider how to address loss and damage directly associated with climate change in developing countries that are especially vulnerable to the negative effects of this phenomenon.[30] With advances in this work program, in 2012, at COP18 in Doha, States agreed to establish institutional arrangements for cases of loss and damage at the next COP. [31] During COP19 in Warsaw, the Warsaw International Mechanism for

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[27] COMITÊ Intergovernamental negociador para a estrutura da Convenção sobre Mudanças Climáticas. 17 de dezembro de 1991. Disponível em: https://unfccc.int/sites/default/files/resource/docs/a/wg2crp08.pdf Acesso em: 15 jul. 2025.

[28] "Disaster reduction strategies and means to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change;" PLANO de Ação de Bali. 15 de dezembro de 2007. Disponível em: https://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf Acesso em: 15 jul. 2025. p.4

[29] RELATÓRIO técnico sobre mecanismos para administrar riscos financeiros decorrentes diretamente de mudanças climáticas em países em desenvolvimento. 21 de novembro de 2008. Disponível em: https://unfccc.int/resource/docs/2008/tp/09.pdf Acesso em: 15 jul. 2025.

[30] "establish a work programme in order to consider, including through workshops and expert meetings, as appropriate, approaches to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change." RELATÓRIO da Conferência das Partes em sua 16ª sessão, realizada em Cancun de 29 de novembro a 10 de dezembro de 2010. Disponível em: https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf Acesso em: 15 jul. 2025.

[31] APPROACHES to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change to enhance adaptive capacity. Draft conclusions proposed by the Chair. 1 de dezembro de 2012. Disponível em: https://unfccc.int/documents/7559 Acesso em: 15 jul. 2025.

Loss and Damage was established, and Article 8 of the Paris Agreement refers to this mechanism:

> Establishes the Warsaw international mechanism for loss and damage, under the Cancun Adaptation Framework, subject to review at the twenty-second session of the Conference of the Parties (November–December 2016) pursuant to paragraph 15 below, to address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change (hereinafter referred to as the Warsaw international mechanism), and in line with the provisions contained in paragraphs 2−15 below;[32]

The distinction usually drawn by scholars is that losses are negative climate impacts that are impossible to repair, while damages refer to those negative impacts that can still be remedied. However, this distinction seems to be mainly of academic interest, since in the context of climate change, restoration is almost always technically possible, although it requires significant resources and a return to original conditions is unlikely. [33]

According to Article 8 of the Paris Agreement, the term "loss and damage" appears to encompass both reparable and irreparable negative impacts, including economic and non-economic issues. Nevertheless, the article does not define what constitutes loss and damage, nor does it specify what would be included under negative climate change impacts with non-economic losses and damages. A particularly interesting issue raised in the literature is the difficulty of distinguishing cases of state non-adaptation from cases of loss and damage. Whenever it is possible to take measures to avoid a negative impact, it is considered a matter of adaptation. If such a measure is not adopted, it becomes challenging to differentiate whether it is a case of loss and damage:

> Consider the case of a small-island state threatened by sea-level rise. The state decides to build protective dikes—a form of adaptation. Because it can only build dikes around some of its islands, it is forced to abandon some of them to the rising sea. This we will consider to fall into the L&D category. Note, however, that the question of whether or not to build a dike on a given island may not be merely a question of technical feasibility. It may be a political question about how to use the state's limited resources. In other words, it may be that the state must choose between either building dikes around the main is lands and abandoning the rest, or building dikes around all of the islands and, because of the cost involved, cutting back on basic health services and school ing. In this situation, where it is a political decision not to (fully) adapt, it is not clear whether the abandonment of certain islands ('unavoided loss') should be categorized as (non) adaptation or L&D. Whereas the limits to adaptation in this example are economic, in practice they may be much more complex and involve socio-cultural and institutional (in addition to biophysical and technical) aspects, as illustrated by the case study of Otoara Ha'apio et al. of

[32] MECANISMO Internacional de Varsóvia. 23 de novembro de 2013. Disponível em: https://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf Acesso em: 15 jul. 2025.
[33] BROBERG, Morten. The Third Pillar of International Climate Change Law: explaining 'loss and damage' after the Paris Agreement. **Climate Law**, 10, p.211-223, 2020. P.216

> the Solomon Islands. The case illustrates how the distinction between adaptation and L&D can be blurred.[34]

The reading of Article 8 of the Paris Agreement suggests that it should be applied whenever there are cases of loss and damage. Therefore, there should not be a distinction regarding whether these losses and damages could have been prevented by adaptation measures. The main issue with this article is that it is not considered a legal basis for establishing liability and reparations. Thus, international law still lacks a clear pathway for States to utilize Article 8, relying on general rules, customary law, and domestic law to seek effective reparations and accountability.

5. **FINAL REMARKS**

The phenomenon of climate change emerges as one of humanity's greatest contemporary concerns, bringing with it unprecedented challenges. The negative consequences, such as extreme weather events, rising sea levels, and changes in weather patterns, have caused large-scale disasters, affecting communities around the globe and putting the sustainability of numerous regions at risk. Despite the severity of these impacts, international law still presents a climate regime considered incipient and, often, insufficient to respond to such complexity.

The international normative framework on climate change is formed mainly by the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement. However, these norms and principles focus primarily on mitigation issues, often sidelining equally urgent needs such as the repair and overcoming of catastrophic events. When it comes to loss and damage, Article 8 of the Paris Agreement is often cited, but it is a provision that does not create direct obligations for liability or compensation, thus limiting the effectiveness of legal responses to the adverse consequences of climate change. For these reasons, current international law proves incapable of comprehensively regulating the numerous relationships that arise in the context of international society, especially those involving legal consequences stemming from extreme climate events.

It is precisely to address these gaps and provide a more effective response that the so-called International Law of Catastrophes is emerging—a new field under development,

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[34] BROBERG, Morten. The Third Pillar of International Climate Change Law: explaining 'loss and damage' after the Paris Agreement. **Climate Law**, 10, p.211-223, 2020. P.218 e 219

as proposed by Sidney Guerra. This area seeks to develop a set of rules and principles aimed at the prevention, minimization, and reparation of catastrophes associated with climate events. International Law of Catastrophes is based on the understanding that global-scale problems, such as climate change, require equally global and coordinated responses, grounded in key pillars like solidarity, cooperation, and non-indifference.

While humanity has yet to consolidate clear rights and responsibilities regarding the consequences of climate change, finding truly effective solutions for the greatest challenge of our time will remain a major — perhaps even insurmountable — obstacle. This further reinforces the need for normative and institutional advances that ensure effective protection for those affected, promote climate justice, and secure international cooperation, solidarity and non-indifference in the face of environmental catastrophes that are becoming increasingly frequent and severe.

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