Island Innovation Policy Brief:

# The climate crisis and sea level rise: Brazil-Tuvalu analysis and opportunities for Brazilian leadership in adaptation and international cooperation

by Lucca Gianni Figueiredo Stevenson[1], Fatima Pereira da Costa[2]

1 International Relation Student at (PUC-SP) Contact: lucca.gfs4@yahoo.com
2 International Relation Student at (PUC-SP) Contact: fatimcmartins27@gmail.com

## Abstract

The present article aims to initiate the search for possible engagement opportunities for Brazil regarding the challenges arising from rising sea levels, based on the consequences faced by the State of Tuvalu, stemming from the same process. It analyzes the effects of this event on Tuvalu's existence under international law, the material consequences suffered by this State, and the projects and initiatives it has undertaken to adapt to this reality. In this context, we seek to explore the lesser-reported effects of rising sea levels in Brazil and understand how the Brazilian government could leverage its greater reach and international influence in climate discussions to shed more light on the topic before the international community, assisting both Tuvalu and the Brazilian population in the process. The adopted methodology consists of bibliographic analysis, official document analysis, and interviews with relevant actors and scholars in the field, aiming to formulate real and effective opportunities regarding the role that Brazil can play in this current challenge. We conclude that several opportunities currently present themselves for Brazil, both to promote international engagement on this issue and to advance international cooperation strategies for adaptation.


**Keywords: Sea level rise, Tuvalu, global warming, International Law, Brazil, cooperation.**

## Theoretical Framework

The theoretical framework of this article is based on the intersection between International Law, climate change, and international cooperation strategies, highlighting the challenges that sea level rise poses to the sovereignty and existence of island states like Tuvalu. To develop this analysis, the research adopted a methodological approach based on three main axes: bibliographic review, analysis of official documents, and interviews with key academics and stakeholders, including representatives from the Brazilian Ministry of Environment and Climate Change, the United Nations Development Programme, and the Tuvalu Climate Action Network (TuCan). The bibliographic review, which includes Mazzuoli's (2020) theories on the concept of the state and Connell's (2003) studies on the impacts of sea level rise in Tuvalu, provides an initial framework for understanding how this phenomenon threatens the physical and legal existence of vulnerable states. The research is also enriched by works from Rayfuse (2011) and Wong (2013), which explore the dilemmas of recognition and sovereignty of states at risk of physical disappearance. Qualitative interviews complement this theoretical foundation by providing practical and strategic perspectives on Brazil's role, a country also facing challenges related to rising sea levels, promoting an important and necessary

proposition on how Brazil can leverage its international influence to lead cooperative adaptation efforts, fostering resilience and adaptation strategies for protecting vulnerable nations like Tuvalu and its own population.

## Introduction

We live in an era where the greatest threat to human security on earth is global warming. According to the 2023 report of the Intergovernmental Panel on Climate Change (IPCC), the world has already reached an increase of 1.1ºC in surface temperature above pre-industrial levels, mainly due to activities in the energy, industrial, and transportation sectors, causing severe changes in atmospheric, terrestrial, oceanic, and biosphere patterns. These changes result in more frequent extreme weather events and high temperatures, as observed in 2023, which is considered the hottest year on record (World Meteorological Organization, 2024). To illustrate this statement, consider some of the extreme weather events that occurred in 2023: Phoenix, Arizona, recorded 54 days with temperatures equal to or above 43ºC (The Guardian, 2023), the wildfire in Hawaii that claimed over 100 lives, Cyclone Freddy that began in Australia and affected Madagascar, Zimbabwe, Malawi, and Mozambique, killing 844 people in Africa alone (World Meteorological Organization, 2024), Typhoon Doksuri, which caused the worst flooding in recent Chinese history with $15.7 billion in damages, and the orange skies over New York due to over 18.4 million hectares of forest burned in Canada (O Globo, 2024), to name a few.

With climate change, we can directly observe increased devastation from the growing frequency of extreme weather events. Therefore, this work is dedicated to one of these consequences, sea level rise, which affects countries like Tuvalu and Brazil. Regarding sea level rise, this issue has concerned scientists for a long time, as explained by John Connell:

> In the late 1980s the global scientific community first began to suggest that global warming was a significant phenomenon and that accelerated global warming was likely to increase sea temperatures, with one outcome being sea-level rise (SLR). If SLR were to occur, the places most threatened would be low-lying islands and coasts, and specifically coral atolls, that are rarely more than a couple of meters above sea level. (Connell John, 2003, pg. 90)

Therefore, the countries most at risk from this process are small island nations, home to thousands of people, most of whom live less than three meters above sea level and thus, cannot relocate populations and economic activities to higher ground, as exemplified by the Maldives, Marshall Islands, Tuvalu, Kiribati, and Tokelau (Leatherman, 1997). Consequently, these geological formations suffer various negative processes, culminating in the possible ultimate loss of their territory and, therefore, the foundation of their existence as nation-states

in the international system.

According to Mazzuoli (2020), a state is described as a legal entity with international personality, formed by a community of individuals permanently established in a specific territory under the authority of an independent government, whose main function is to ensure the well-being of its population. International Law highlights four essential elements for the constitution of a state: people, territory, government, and purpose.

For this work, it is essential to focus on the concept of territory and the constitution of a state. Territory (comprising land, air, and maritime areas) represents the fundamental material element of the state concept, as it is over this land that the state entity exercises its sovereignty and competencies. International Law emphasizes the importance of a state possessing a clearly defined portion of land bordered by limits within which its population can live and develop. Within these territorial limits, the state exercises both internal and external sovereignty, consolidating its autonomy and governance capacity. It is worth noting that the size of the territory does not influence its legal characterization as a state. Therefore, partial loss of territory does not result in the loss of its legal personality in the international arena, provided the essential elements for its existence are preserved.

However, in current international law, one implication of rising sea levels is that countries that physically disappear will lose their legal capacity, which implies losing power to participate in treaties, claim territory, maintain their population, and engage in the international community. In her work "International Law and Disappearing States: Maritime Zones and the Criteria for Statehood," Rosemary Rayfuse points out that in the event of total inundation, the territory necessary for a state will cease to exist, compromising its claim to be considered a state. Additionally, she notes that the territory will become uninhabitable long before it completely disappears. In this context, the criteria for statehood ceases to be met as soon as the population is evacuated, leading to the state's end.

Conversely, Derek Wong, in "Sovereignty Sunk? The Position of 'Sinking States' in International Law," challenges this view, arguing that failing to meet the basic requirements for state formation does not necessarily imply the state's disappearance. He emphasizes that states are generally presumed to continue existing, even when facing extreme challenges.

Climate change and sea level rise thus pose new challenges for maintaining the traditionally conceived legal stability of International Law. The issues raised demonstrate the complexity of International Law's capacity to keep pace with problems arising from environmental phenomena. Therefore, international jurisprudence needs adjustments to address the reality of states facing the

loss of their physical territory due to sea level rise, including reconsidering how sovereignty and statehood principles apply in a world where physical borders are increasingly volatile.

## The Impact of Sea Level Rise in Tuvalu

To better understand the impact of these changes and potential engagement opportunities to mitigate their effects, we will first examine the consequences of sea level rise for Tuvalu and then for Brazil.

Tuvalu, a country in Oceania, northeast of Australia, comprises nine islands, including Funafuti, the capital. Tuvalu's current government is based on the constitution enacted in 2023. Its colonial past has influenced its current political system, which is a constitutional monarchy with the King of England as the monarch, represented in Tuvalu by the Governor-General. The Governor-General, in turn, is chosen by the English king with the assistance of Tuvalu's Prime Minister, who is elected by the country's parliament. Tuvalu's parliament is composed of 16 members elected by the population (Tuvalu Constitution, 2023).

Tuvalu's administration is divided into two spheres: a national sphere, focused on justice, national security, and foreign policy, and a more decentralized government composed of two main bodies, the Falekaupule, a more cultural and traditional council for each island, and the Kaupule, created as the executive arm of the former and the link between local governments of each district and the central government, located in the capital (Falekaupule Act, 1997). Under the 1997 Falekaupule Act, the Falekaupule is responsible for the formulation, administration, consultation, and mobilization of the population concerning island development plans, while the Kaupule is responsible for implementing these development plans through law formulation, public services, and maintaining order.

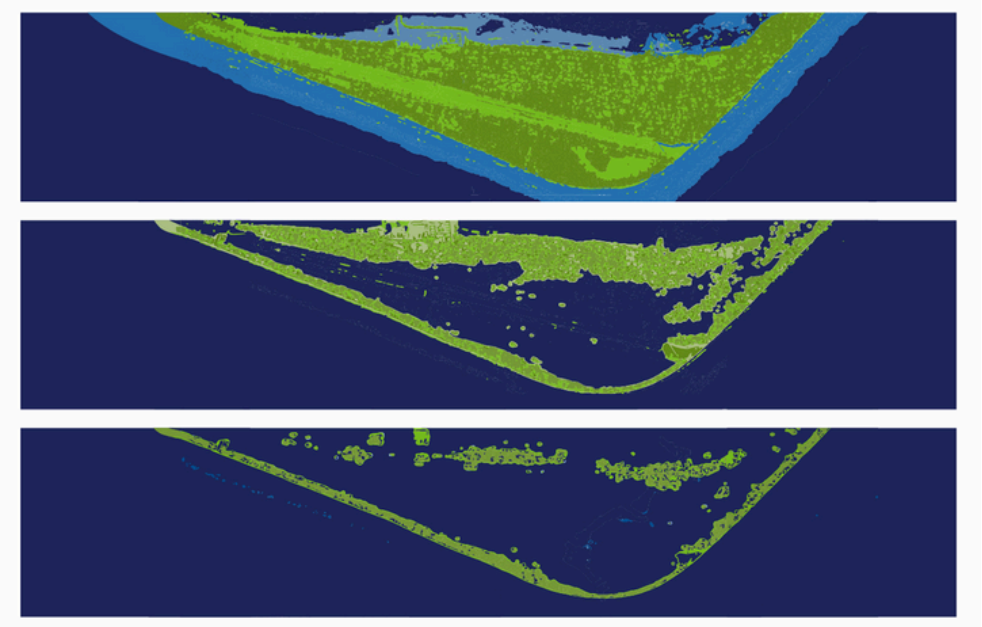
The islands, which have their total territory composed of 26 square kilometers, and are limited to 3 meters above sea level, are composed of mostly porus, unstructured and with low fertility soil, preventing subsistence farming and leaving the population dependent on the food production based on coconuts, bananas, breadfruit, padanus, and a native crop called pulaka, which grows in swamps, along with a heavy reliance on fishing, for food supply and economy. (Tuvalu National Adaptation Programme of Action, 2007).

Tuvalu also struggles with providing water to its inhabitants. The islands lack any freshwater bodies and depend mainly on rainwater. The country used to draw water from aquifer reservoirs but, due to saltwater intrusion, from sea

level rise, using this water has become difficult, often impossible (Tuvalu National Adaptation Programme of Action, 2007).

Due to these characteristics, global warming causes a series of consequences for the country, such as changing rainfall patterns, that hinder water collection and agricultural planning on the island, and sea level rise, that leads to saltwater intrusion into the few fertile lands, preventing the growth of the limited crops on the islands by flooding the swamps, where traditional pulaka grows (Islam et al., 2020) and also preventing the use of fresh water reservoirs. Additionally, this process also poses threats to the populations health, due to the development of diseases in flooded areas, which provide a proper environment for vector proliferation (Tuvalu National Adaptation Programme of Action, 2007).

Over the decades, these consequences are likely to worsen as the ocean encroaches on the land. The images below, based on United Nations Development Programme (UNDP) forecasts, show the future awaiting the country if global emissions continue at a high level. The first image shows the capital in 2023, the second shows it in 50 years, and the third in 100 years.



(**Source:** IMF,2023)

## Adaptation Mechanisms Implemented in Tuvalu

The nine islands that make up Tuvalu are sensitive to sea level rise due to their low elevation and morphology, causing various impacts on the island's life-support mechanisms, as discussed above. Thus, it is necessary to examine the

adaptation capabilities that these islands possess to protect themselves from these changes as well as the efforts that organizations and the government are making to aid the country.

In its different strategies for adapting to the climate crisis, Tuvalu has developed and identified opportunities to promote its continued existence. At the national level, a new constitution was written in 2023 that integrates the climate crisis into various parts of its self-determination, repeatedly declaring that its territory will not be disregarded due to climate change, and that, even with rising sea levels:

> "The State of Tuvalu within its historical, cultural, and legal framework shall remain in perpetuity in the future, notwithstanding the impacts of climate change or other causes resulting in loss to the physical territory of Tuvalu." (Constitution of Tuvalu, 2023, pg. 11,)

Furthermore, its constitution opens a loophole for parliament to proclaim Tuvalu's jurisdiction valid extra-territorially as explicitly stated in item 4 of division I of the constitution:

> "Nothing in this section prevents an Act of parliament from proclaiming the jurisdiction of Tuvalu, complete or partial, over any area of land or water or airspace above or prevents a law from having extra-territorial effect in accordance with section 86 (vesting the law-making power)" (Constitution of Tuvalu, 2023, p. 11)

In this context, it is also interesting to analyze the international treaties made by Tuvalu, and how they fit into its climate adaptation strategy. In 2023, the Falepili Union treaty was signed between Australia and Tuvalu. In this treaty, Australia grants Tuvalu citizens a special human mobility pathway to enter Australia, allowing them to study, work and access Australian government education, health and support services (Australia; Tuvalu, 2023). In addition to these benefits, Australia is obliged to assist Tuvalu in the event of natural disasters, health emergencies and military aggression against the country. In return, Tuvalu will have to agree to any partnership made by Australia with another state or entity on security, defense, protection, cyber security and critical infrastructure issues. This last condition was possibly accepted by Tuvalu due to its needs of a mobility plan for its population in the event that the islands are largely submerged.

Other adaptation mechanisms presented by Tuvalu were observed at COP 27, where Tuvalu once again used a video to draw the world's attention to its climate agenda. As was the case at COP 26, when Minister Simon Kofe gave a speech with seawater up to his knee, in 2022, the same Minister gave his speech announcing Tuvalu as the first country in the world to exist in digital format. In his speech, which mixed real videos of Tuvalu in a transition to a

digital world, the minister said that, due to the continued prediction of global temperature rise beyond 1.5 ºC, and the inaction of the states that were part of the conference, Tuvalu had made the decision to be the first digital state, so that its culture, ocean, and land could be saved, regardless of what happens in the physical world.

With regard to adaptive infrastructure projects, there are actions that can be taken, but the cost is beyond the capabilities of the Tuvaluan government (Barnett et al, 2009). Looking at the country's economy, the GDP in 2022, according to the World Bank, was 59 million dollars, and its GDP per capita was 5 thousand dollars. The plan presented by the country together with UNDP, entitled "L-TAP", is expected to cost 2 billion Australian dollars to implement all the adaptation pathways, which is equivalent to 2,000% of the country's GDP (IMF, 2023). Tuvalu is therefore highly dependent on international aid to have a chance of surviving and implementing adaptation plans.

Within the country's general adaptation objective, there are 3 major plans: the L-TAP (Long Term Adaptation Plan), which plans to formulate an elevation of 3. 6 square kilometers on the territory of Tuvalu, promoting a lasting solution to the forecast flooding of the territory by up to 95% by 2100; the TCAP (Tuvalu Coastal Adaptation Project), which aims to assist in measures to reduce exposure to coastal risks on the islands of Funafuti, Nanumea and Nanumaga, and which is being financed by the Green Climate Fund (US$36 million) and the Tuvalu government (US$2.9 million). As part of its activities, an infrastructure project was completed at the end of 2023, increasing the surface area of the capital by 78,000 square meters (TCAP, 2024). Finally, there is the NAP (Tuvalu's National Adaptation Plan), which is being led by the Secretariat of the Pacific Regional Environment Programme (SPREP) and seeks to create a sustainable platform for future investments related to climate adaptation, by focusing on the development of institutions, institutional governance, financing strategy and evidence produced for the development of maximum impact solutions (Secretariat of the Pacific Regional Environment Programme, 2024).

## Impacts in Brazil

From the effects of this serious crisis in Tuvalu, it is clear the great risk that this sea level rise can represent for a country, both for food security, health, residential security and for the very definition of borders and their impacts on international relations, inserting a country, especially a developing one, in a more vulnerable and dependent position before the international community. It is therefore extremely important to study how this crisis is affecting Brazil and what consequences this process is causing, and could cause to the country, especially with regard to the Brazilian government's need to be informed and

well prepared to deal with the various fronts of climate issues that affect all regions of the country.

Concerning all the problems that the Brazilian population currently faces, the issue of rising sea levels may seem like a distant problem, but the reality proves otherwise. The impacts of rising sea levels have already been causing damage in the last few decades. One city that has been dealing with this impact is Atafona, in the state of Rio de Janeiro, which has had a great portion of the city destroyed by the increasing sea erosion. As the article published by National Geographic in 2021 emphasizes, houses, schools, mansions and churches have already been completely destroyed by the impact of the Atlantic. This problem has also affected the economic activity of the region, which has seen 90% of its crab habitats destroyed, impacting the families that used to make a living from commercial activities related to the crustacean, creating 2,000 “climate refugees” since the 1960 (National Geographic, 2021).

Furthermore, this issue is proving to be a serious risk for the future of Brazil. According to the 2021 august report by the Intergovernmental Panel on Climate Change (IPCC) of the United Nations (UN), Recife is identified as the Brazilian capital most vulnerable to the effects of rising sea levels. This document places the city in sixteenth position in the ranking of global cities most exposed to this risk.

To better understand the seriousness of this issue, we conducted an interview with Professor Joseph Harari, from the Department of Physical, Chemical and Geological Oceanography at the University of São Paulo. The professor pointed out that, in Brazil, the problems related to rising sea levels are largely the result of two main factors: poorly planned construction work and the unregulated occupation of coastal areas. Due to the low stability of these constructions and occupations, these regions are especially vulnerable to intensified sea erosion and increased flooding. With sea levels expected to rise by 30 cm per century, the professor cited Brazilian areas that have already been, and will continue to be severely impacted, such as Massaguaçu beach in São Paulo, Macumba beach in Rio de Janeiro and coastal cities such as Recife, Ubatuba and Santos. The latter is home to the Port of Santos, the largest in Latin America, responsible for 28.8% of Brazil's trade flow in 2022 (G1, 2022), highlighting the potential economic impact that rising sea levels could cause if this important logistics hub were to be compromised.

## Engagement Opportunities for Brazil

In an attempt to understand more about the reality of those who live on these islands and the impact that Brazil could have on this problem, we interviewed

Richard Gokrun, Director of the Tuvalu Climate Action Network (TuCan), an NGO that is leading efforts against global warming in the country. Gokrun explained that the vast majority of the island's elderly population would rather die than leave the country, indicating that there will be no other place like Tuvalu. Tuvalu's unique characteristics such as unity, trust between community members, and safety on the island, where the majority of its population sleeps with their doors open, are found nowhere else according to Gokrun. Still, according to the institutional authority, there is significant concern for the younger population, who may witness the disappearance of the territory. A portion of this population is taking advantage of opportunities in countries like Australia and New Zealand to work and invest in a more certain future (Mortreux; Barnett, 2008). In this context, many families do not have the resources to finance their departure from the country, and are stuck on an island that is gradually disappearing. Another strategy used is to send only a few family members out of the country, young family members often being chosen to try a new life in another state. Thus creating another ramification of the impacts caused by rising sea levels, a social breakdown, by separating several Tuvaluan families.

In this way, we can see that rising sea levels cause a series of secondary impacts for the country, altering social relations, health conditions, nutritional supply, economic predictability and the continuation of the population. This demonstrates the intense crisis that rising sea levels cause for a nation, and therefore the urgent attention that the international community needs to pay to this problem.

When asked about Tuvalu's strategies at the international level, Gokrun mentions that the strategy when attending international conferences is to tell other countries what is happening to their population, pointing out the numerous problems faced, such as the lack of water and food in the country. In this context, the biggest issue faced by Tuvalu's representatives at these conferences is the lack of connection on the part of other countries, indicating that countries with large territorial extensions do not understand Tuvalu's suffering and therefore do not seek to help solve it.

We took the opportunity to ask how Brazil could assist Tuvalu at the international level, to encourage greater interest and attention to this issue. The director told us that Brazil could use its position in international forums such as the United Nations, G20 and BRICS to form alliances between countries suffering from the impacts of rising sea levels, increasing the collective bargaining power of small island countries in international climate negotiations. In addition, Gokrun also suggested an action already practiced by Brazil with other countries in the global South, cooperation for development, indicating that a mechanism for advancing the agenda would be

technological cooperation between the two countries related to renewable energies, sustainable agriculture, and drinking water management.

In an interview with a representative of the Ministry of the Environment and Climate Change of Brazil (MMA), they reported informations in an alignment with Gokrun's indication, that sea level rise, although a critical issue for some countries, has not yet been established as a priority challenge for the major powers, resulting in a lack of adequate attention to the problem, making it a difficult issue to gain prominence at major international conferences. This is mainly because it does not affect all countries in a significant way, and often the countries most affected, because they are less influential and have limited resources, such as Tuvalu, are unable to participate in these events to reinforce their agendas. This further reinforces the need for this article to demonstrate the importance of greater discussion of this issue for Brazil, and the great opportunity being presented to its leaders at the international level. Offering the chance to promote a possible solution for all the countries that suffer, and will suffer, the impacts of rising sea levels as well as expand its influence in the major international forums.

By connecting the points made by the MMA, and the analysis made by Professor Harari, the Brazilian scenario not only exposes Brazil's vulnerability, but also opens up an opportunity for the country to seek collaborative solutions on the international stage. The experience of Tuvalu, whose existence is threatened by rising sea levels can offer a model of cooperation in which Brazil can both contribute its resources and expertise, as proposed by the Director of TuCan, and learn from the adaptation strategies of other island nations. By proposing cooperation with other countries, Brazil can address domestic problems, such as structural and operational failures, while strengthening its diplomatic and climate position, expanding its influence in global discussions on climate change and helping to protect more vulnerable states, such as Tuvalu.

According to Arthur Webb, Chief Technical Advisor TCAP & Regional Coastal Adaptation Specialist of the United Nations Development Programme (UNDP), a good way in which Brazil could contribute even more to the Tuvalu issue would be to draw attention to the Brazilian cities themselves, which are at a low level of altitude in relation to sea level, recognizing that rising oceans represent a serious problem for them and consequently for the Brazilian state as a whole. In addition, Webb also focused on the great contribution that large countries like Brazil can make to Tuvalu by reducing their levels of greenhouse gas emissions.

These examples highlight an unprecedented opportunity for Brazil, which has the potential not only to help its own population but also the international

community to adapt to the consequences of global warming. With Brazil suffering from the same effects as smaller countries such as Tuvalu, and having a greater international platform and visibility, it could become a major player and spokesperson on this issue, expanding its influence and importance on the international stage, as well as promoting representativeness of the needs of developing countries in the face of these challenges.

Along with this greater visibility, Brazil and other countries could cooperate by building an information and technical network related to infrastructures and actions to adapt to the consequences of rising sea levels. This practice has already been carried out with other countries to achieve cooperation and development on issues of common concern, as seen in technical cooperation with African countries, through the Brazilian Cooperation Agency (ABC), such as Algeria, Benin, Botswana, Senegal and Togo, successfully addressing institutional, technological, technical and logistical improvements in the countries involved, including agricultural techniques and technologies (Brazilian Cooperation Agency, 2019).

Following the logic of international cooperation, and based on the idea explained by Professor Joseph Harari in our interview, there are already large networks of academic exchanges between the countries affected by major climate change. In such a scenario, another great opportunity presents itself for building effective adaptation actions in the face of this problem. The integration, encouragement, interaction and cooperation between public and international policymakers and academia. This interaction will enable access to and practical implementation of knowledge from various countries. It can be further enhanced by greater government investment in science and technology development, funding and encouraging projects that seek to solve the problems faced by Brazil and others around the world. This would certainly have a great effect in equipping the public structure to effectively solve this issue.

Therefore, in order to begin this process of cooperation and adaptation, and explore all the opportunities that present themselves in face of the great challenge that is sea level rise, it is first necessary for the Brazilian government to recognize, both in its external and internal agenda, that rising sea levels are a serious problem for Brazil and its inhabitants. This will enable greater international attention to be paid to the problems suffered by countries like Tuvalu, and the effective development of solutions that can preserve the structures and ways of life of millions threatened by rising sea levels.

## Conclusion

In short, this work sought to highlight an urgent issue for the countries that make up the international system and for humanity as a whole, but which, paradoxically, does not receive significant attention and political engagement. As we have seen, islands with a low elevation, such as Tuvalu, have a high risk of territorial disappearance, creating dilemmas in the area of international law, which is divided when it comes to recognizing the existence of countries without territories, which historically have in them a constituent element of their existence. In addition, they face a number of other problems, such as hunger, water shortages, the spread of diseases caused by vector proliferation and the growing separation of families.

In this respect, adaptation mechanisms designed to help Tuvalu are extremely dependent on aid from the international community due to the high costs required to finance such projects. Thus, Brazil, as a continental country with great weight in international climate negotiations, has a great potential to help states like Tuvalu. This cooperation is further facilitated by the country's previous experience in implementing and sharing international public policies, as well as the possibility of improving the lives of the Brazilian population itself, which is suffering from the increasing effects of rising sea levels. Brazil, as a major international player on the climate agenda, is therefore able to bring more attention to the issue by recognizing the risk and consequences of rising sea levels in its territory, consequently bringing this agenda to international negotiations and conferences.

Furthermore, by recognizing this problem as crucial for the Brazilian and global population, Brazil will be better able to adapt and overcome the challenges posed by rising oceans. Through technical cooperation with other countries, sharing and learning adaptation techniques, along with greater interaction between policymakers and academia, by sharing the scientific knowledge acquired by academics from various countries suffering from the consequences of rising sea levels, the state will be better prepared to act. In this way, reducing the problems arising from global warming and contributing to increased international attention to this challenge, helping the Brazilian population and countries like Tuvalu, which need external support to adapt and overcome this growing obstacle to their continued existence as a state, at least in what we currently delineate as such.

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