

# Sovereignty and Climate Dialogue Vance 1. 2024.

Climate adaptation, mitigation and resilience in the Americas: actors and perspectives

Anna Maria Franco Gantiva Fernando Portillo Romero Genners Arturo Barrios Garay Luis Bittencourt María Guadalupe Kerlakian Patrick Paterson Paulo Roberto da Silva Gomes Filho



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# **Preface**<sup>1</sup>

The year 2023 was marked by more frequent and intense weather events, as in the case of the "super El Niño", which directly affects the Americas. Once climate-related damage and risks are verified, it begins to be perceived as an "existential threat" to life on the planet (Sears, 2021). Thus, global climate change aggravates known challenges and brings new ones for geopolitics, such as the use of technological innovations, thus increasing the degree of uncertainty for the construction of future scenarios. These innovations include geoengineering, artificial intelligence, and new fuels such as sustainable aviation fuel, and green and blue hydrogens.

Historically, the quasi-monopoly of advanced technologies has allowed a tiny part of humanity to project power over the five domains (land, sea, air, space and cyber) and over the biosphere. With technological innovations, it is possible not only to monitor and explore, but also to colonize the Amazon, Antarctica and the seabed, accelerating an unprecedented process of greenhouse gas (GHG) release. Consequently, the concentration of power in the international order and the level of social inequalities tend to increase in this century. If climate insecurity can greatly affect human, food, water, health and energy security, how should sovereign states adapt now?

In this context, political inertia is one of the biggest challenges today. With the current failure of mitigation (ONU, 2023), adaptation to increase resilience has become an essential agenda. In the meantime, who is properly prepared? Who is thinking about global risks? If the Amazon Forest, the Cerrado and other ecosystems are also threatened by climate change, how can regional cooperation be thought of? In the case of the Americas, due to the presence of invaluable biological and mineral resources, institutional weaknesses, and a high rate of social inequality, the vulnerability is even more severe as it continues to increase. In this context, it is up to the Armed Forces to prepare for: conflicts related to climate insecurity; the internal displacement of people; migratory flows; threats to critical infrastructures; and national sovereignty.

This edition of the Journal Sovereignty and Climate Dialogue aims to enrich this debate, focusing on the Americas and institutional actors, notably the military, who will also be on the front lines whenever a crisis related to climate issues occurs. Authors from six countries offer insights for reflection on the main threats and relevant measures to respond to the evolving scenarios. In the article "Improving climate resilience: a suggestive approach for Argentina", Maria Guadalupe Kerlakian demonstrates the situation in Argentina and explains the necessary involvement of public and private sector actors. Then, Paulo Roberto da Silva Gomes Filho analyzes six different perspectives of impacts on the missions of the Brazilian Armed Forces", including multilateral humanitarian aid. In the article "Action and fight against the climate crisis in the midst of the Colombian conflict and post-conflict: efforts from the public and private sectors", Anna María Franco Gantiva highlights the national political scenario from the instrumentalization of nature during the armed conflict, with the concept of territorial peace. Patrick Paterson and Luis Bitencourt, in the article "Climate mitigation efforts of the U.S. Armed Forces", underline that the 2022 U.S. National Security

<sup>1.</sup> Translation: Vinícius Santiago.

Strategy recognized the climate as a "potentially existential" threat and analyze four intertwined challenges for the most powerful Armed Forces on the planet. In "Guatemala and its actions in the face of climate change", Genners Arturo Barrios Garay highlights the national vulnerability and responses to the climate problem, with emphasis on the National Energy Plan. Finally, Fernando Portillo Romero, in "The El Niño phenomenon and its implications in Peru" observes the need to understand the risks associated with El Niño to reduce the vulnerability of Peruvian communities and ecosystems.

Two major conclusions follow from this: first, the need to prepare in the short term for uncertain futures, on a local and national scale. Second, the interest in regional cooperation through strategies and policies for climate mitigation, adaptation, and resilience.

#### Ana Flávia Barros-Platiau

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# Improving climate resilience: a suggestive approach for Argentina

Maria Guadalupe Kerlakian<sup>1</sup>

### **Executive summary**

Argentina plays a significant global role in politics, economics, and diplomacy, impacting agriculture, energy resources, and international agreements. However, the nation faces substantial vulnerability to climate change, affecting its agricultural sector, energy resources, and socio-economic landscape. This paper provides an overview of Argentina's climate challenges and responses, suggesting approaches to enhance climate resilience and emphasizing the United Nations' potential support.

Argentina experiences diverse negative climate impacts, including temperature rise, extreme weather events, glacier melting, water scarcity, and increased wildfire risks, with floods and droughts causing economic losses and disrupting infrastructure. The agricultural sector, vital for food security and economic stability, faces vulnerabilities, while the energy sector confronts challenges due to changing water availability and rising temperatures. Argentina has made commendable climate efforts, such as renewable energy investments and participation in international agreements. Yet, experts consider its targets insufficient due to economic instability, fossil fuel dependence, and sustainable land-use issues. The country also grapples with challenges like economic priorities, policy consistency, and limited public awareness, hindering its climate resilience.

Strengthening climate resilience involves comprehensive approaches encompassing infrastructure, water management, agriculture, renewable energy, forestry, community engagement, and international collaboration. United Nations support plays a crucial role in providing technical expertise, climate finance access, capacity building, and fostering data collaboration. Effective climate action in Argentina necessitates synergy among government policies, international cooperation, private sector involvement, and public awareness to protect ecosystems and people in a changing climate.

#### POLICY RECOMMENDATIONS

#### 1. Economic and Development Challenges

Policy Focus: Ensure consistent funding for climate change mitigation despite economic and political instability.

<sup>1.</sup> Maria Guadalupe Kerlakian holds a prestigious bachelor's degree in International Relations from the esteemed Pontificia Universidad Catolica Argentina (UCA) and has completed her master's degree in International Relations, Diplomacy, Security, and Defense from the prestigious Universita e-Campus, Italy in 2023. She recently engaged in the '2023 United Nations Joint Mission Analysis Center Course', a remarkable initiative jointly organized by UNOCC and NODEFIC. Additionally, she has successfully completed the 'Climate Change and Implications for Defense and Security Course', an educational milestone offered by the renowned William J. Perry Center at NDU. Currently, Maria is contributing her expertise as an Information Analyst (UNV) at the United Nations Mission in South Sudan. Her career is more than a profession; it's a profound passion for international relations, underscored by an unwavering commitment to addressing the most critical global challenges towards peace, security and sustainable development. Beyond her professional pursuits, Maria is also deeply passionate about disaster relief and organizations like UNDRR, where she prepares to make a meaningful and positive impact. Email: guadakerlakian@gmail.com.

#### 2. Energy Transition and Fossil Fuels Dependence

Policy Action: Incentivize the transition to cleaner energy sources, emphasizing policies and investments in renewable energy infrastructure.

#### 3. Agricultural and Land-Use Practices

Policy Measure: Enforce regulations promoting sustainable land-use practices in agriculture, particularly addressing deforestation concerns.

#### 4. Political and Policy Challenges

Policy Approach: Establish and maintain consistent long-term climate policies, overcoming historical inconsistencies.

#### 5. Socioeconomic Inequities

Directive: Develop targeted policies addressing socioeconomic disparities, ensuring marginalized populations can adapt to climate change.

#### **6. International Climate Agreements**

Policy Strategy: Develop strategies to meet international commitments economically, advocating for global cooperation and support.

#### 7. Strengthening Argentina's Climate Resilience

Comprehensive Approach: Adopt a holistic strategy focusing on climate-resilient infrastructure, sustainable agriculture, and community engagement.

- a. Climate-Resilient Infrastructure:
  - i. Upgraded Buildings: Improve building codes for infrastructure resilience.
  - ii. Flood Management: Develop effective stormwater drainage systems.
  - iii. Transport Infrastructure: Upgrade roads and transportation networks for climate resilience.
- b. Water Management:
  - i. Storage and Conservation: Implement measures to address water scarcity.
  - ii. Watershed Management: Protect and restore watersheds for consistent water supply.

#### c. Agricultural Adaptation:

- i. Crop Diversification: Encourage diverse crops for climate resilience.
- ii. Improved Soil Management: Promote sustainable soil practices.
- d. Renewable Energy Transition:
  - i. Wind and Solar Power: Expand renewable energy production.
  - ii. Energy Efficiency: Enhance energy efficiency in industries and buildings.
- e. Forestry and Conservation:
  - i. Forest Protection: Preserve forests for carbon sequestration.
  - ii. Afforestation and Reforestation: Implement projects for increased forest cover.

#### f. Community Engagement:

- i. Public Awareness Campaigns: Conduct campaigns to educate citizens.
- ii. Local Adaptation Initiatives: Engage communities in climate adaptation.

#### 8. UN Support for Strengthening Climate Resilience

Strategic Engagement: Collaborate with the United Nations for technical expertise, climate finance access, capacity building, data collaboration, policy development, and community mobilization.

#### **KEYWORDS**

Climate Change; Environmental Implication; Resilience; Greenhouse Gas; Argentina; United Nations.

## 1. Introduction

Argentina, the second-largest South American nation, spans 2.8 million square kilometres and is home to around 45.8 million people. As one of Latin America's leading economies, Argentina holds a prominent position in global politics and economics, influencing diverse sectors and international relations. The country's significance lies in its abundant natural resources, engagement in international politics, and its role in South American diplomacy. It is among the world's leading food exporters, with large-scale agricultural and livestock industries (IFAD, 2023), that wields a substantial influence on food prices and contributes significantly to the imperative goal of ensuring global food security. Its energy resources<sup>2</sup>, including oil, natural gas, and renewables, shape the global energy landscape as the world shifts towards cleaner sources.

Politically, Argentina actively engages in international diplomacy through organizations like the United Nations, G20, and the World Trade Organization, contributing to discussions on climate change, trade, human rights, and peacekeeping missions, thus shaping international policies and agreements. Argentina's multifaceted influence is undeniable, as it plays a pivotal role in various global affairs<sup>3</sup>, including ensuring food security, shaping the energy landscape, and participating in critical international discussions.

Climate change poses a growing threat to nations across the globe, with Argentina being no exception. The World Bank Group's Country Climate and Development Report (CCDRs) of 2022 explicitly highlights the impact of the climate crisis on poverty and the Argentine macroeconomy. The report analyses the climate change impacts Argentina already faces, mainly through losses caused by droughts and floods. It evaluates that drought losses could account for 4 percent of Argentina's GDP by 2050. Furthermore, floods may cause up to \$1.4 billion in average annual asset losses and \$4 billion in welfare losses. The report also noted that climate events have widened inequality (The World Bank, 2022a).

The changing climate patterns have brought about extreme weather events, shifting rainfall patterns, and rising temperatures, all of which have significant implications for Argentina's agriculture, economy, and overall well-being. The Argentine economy relies heavily on natural capital (agriculture and natural resources), contributing to the country's vulnerability to climate change. Argentina is one of the world's largest agriculture producers, and agroindustry represents about 54 percent of its 2021 exports (The World Bank, 2022b), making the economy particularly vulnerable to climate variability. The country also has vast renewable and nonrenewable energy resources, with world-class and largely untapped wind and solar power sources and the world's second-highest shale gas and fourth highest shale oil reserves (The World Bank, 2018).

This essay commences by examining the impacts of climate change on Argentina and the country's response to this existential threat. It subsequently delves into the contemporary challenges the nation encounters while combating climate change. In its final section, the essay aims to propose a suggestive multifaceted approach to enhance Argentina's climate resilience, exploring potential avenues for United Nations support in bolstering these efforts.

"The World Bank Group's **Country Climate and Development Report** (CCDRs) of 2022 explicitly highlights the impact of the climate crisis on poverty and the Argentine macroeconomy. The report analyses the climate change impacts Argentina already faces, mainly through losses caused by droughts and floods. It evaluates that drought losses could account for 4 percent of Argentina's GDP by 2050. Furthermore, floods may cause up to \$1.4 billion in average annual asset losses and \$4 billion in welfare losses."

<sup>2.</sup> Regarding Argentina's energy resources, even though shale gas is a fossil fuel, it's important to note that the country has the second largest reserve of shale gas, and the fourth largest reserve of shale oil worldwide (IEA, 2020).

<sup>3.</sup> Argentina is a G20 member, third largest economy in Latin America, and it has also now been invited to become a member of BRICS.

# 2. Argentina's climate challenges: understanding the impact of climate change

Climate change is a global crisis with far-reaching implications, and Argentina, a nation known for its diverse landscapes and rich cultural heritage, is not immune to its effects. This section delves into the profound impact of climate change on Argentina, encompassing environmental, economic, and social consequences. By examining the impacts of climate change on Argentina, we aim to gain insight into the multifaceted nature of this critical issue.

Argentina's vulnerability to a diverse array of climate change impacts is intricately tied to the country's vast geographical and climatic variations. The northern regions are confronted with escalating temperatures and heightened susceptibility to extreme weather events, such as droughts and floods, contributing to water scarcity challenges. In the central Pampas region, alterations in precipitation patterns pose risks to vital sectors like agriculture, influencing the overall economic landscape. The Andean and southern regions grapple with issues such as glacial melt and shifts in biodiversity, impacting ecosystems and local economies. Climate change has repercussions on temperature and precipitation patterns. With the intensification and increased frequency of floods and droughts, the severity of overflows and coastal inundations escalates, while glacier melting contributes to heightened water scarcity and a potential increase in wildfire risk<sup>4</sup>.

According to EM-DAT (2022), a global database on natural and technological disasters, in Argentina, floods<sup>5</sup> have been the most severe weather-related disaster in terms of number of events, affected people, health impacts, and their associated asset losses. From 1900 to 2021, 92 percent of the 115 recorded natural disasters were climate-related, mostly floods (58 percent) and storms (20 percent) (Figure 1). Argentina loses up to \$1.4 billion (2015 purchasing power parity PPP) in annual expected asset losses from floods (The World Bank, 2022a, p. 6), which translates into up to \$4 billion in welfare losses (The World Bank, 2021).

Floods also severely affect Argentina's transport systems, causing major economic disruptions. Infrastructure disruptions could cost Argentine firms \$4 billion a year, or 0.8 percent of the 2017 gross domestic product (GDP), mostly due to transport interruptions (Hallegatte, Rentschler and Rozenberg, 2019, cited in The World Bank, 2022a, p. 7).

Further, droughts and excessive precipitation have significant ramifications for Argentina's agricultural sector, leading to notable macroeconomic and social implications. Climate-related events result in reduced crop yields, impacting the majority of agricultural regions and harvests, causing economic setbacks in various provinces, and undermining food security. The volatility of agricultural production means this variable's average impact is high. Nationally, annual losses in rainfed agriculture from water deficits or excesses are estimated at about \$2.1 billion, or 0.61 percent of GDP (The World Bank, 2022a). The composition of exports, where agriculture constitutes approximately 60% of the total, combined with the taxation framework, renders droughts a pivotal factor in maintaining macroeconomic equilibrium. The immediate consequences of the 2018 drought alone accounted for more than half of the decline in economic activity during that year, further compounding the preexisting economic and financial crisis<sup>6</sup>.

<sup>4.</sup> At first, as the glacier melts, more water runs downhill away from the glacier. However, as the glacier shrinks, the water supply will diminish, and farms, villages and cities might lose a valuable water source (IPCC, 2022b, p. 2300). Moreover, Chapter 12 of IPCC (2022a) shows overall increases in temperature and humidity for Argentina, positive rainfall trend in the southern part of La Plata Basin (northeastern Argentina), increased precipitation and climate extremes in the east, and the association of El Niño events with increased precipitation in the north.

<sup>5.</sup> World Bank staff calculations, based on data from EM-DAT (https://public.emdat.be/).

<sup>6.</sup> The Argentine Central Bank attributes the 4% GDP growth rate decline in the second quarter of 2018 largely to agricultural production contraction due to the drought (Banco Central de la República Argentina, 2018).



#### Figure 1. Effects of natural disasters in Argentina (1900-2021)

Source: The World Bank, 2022, p. 7.

In the absence of adaptation measures (like drought-resistant crops), climate change could result in up to 10 percent yield losses for sunflowers, 30 percent for corn and wheat, and 50 percent for soybeans by 2050 (The World Bank, 2021, p. 21). Under the existing infrastructure and prevailing water use efficiency, rising temperatures and increased evapotranspiration rates would render the preservation of the current 2.1 million irrigated hectares unfeasible. In the absence of mitigation measures, climate change is poised to imperil approximately a quarter (25%) of the nation's irrigated land, resulting in annual losses of around \$837 million, primarily concentrated within the Cuyo region.

Furthermore, increased water scarcity and drought frequency threaten waterway transport, hydropower production, and the delivery of agricultural products to urban consumption centres and exports. About 84 percent of agriculture and byproduct exports come through the ports on the Paraguay-Paraná-de la Plata waterway, or Hidrovía<sup>7</sup>, where navigability is maintained by dredging critical passages and therefore, with increased water scarcity, the cost of maintaining navigability on waterways will increase. Hydroelectric production also depends on the available volume of water, which is likely to decrease under climate change. In 2021, a profound drought had a substantial impact on Argentina's hydropower generation, causing it to drop in total electricity production (WMO, 2022, p. 18). To compensate for this shortfall, thermal power generation assumed a pivotal role, resulting in escalated utilization of fossil fuels and elevated generation expenses. The drought's effects extended into 2022, affecting electricity generation costs, which were subsequently amplified by the conflict in Ukraine and ultimately leading to significant price hikes. Moreover, the agricultural supply chain within the country is significantly affected, as water scarcity directly influences crop yields and productivity. Reduced water availability hampers irrigation capabilities, leading to decreased agricultural output and potentially compromising food security at the domestic level. The consequences extend to Argentina's capacity to meet international export demands, with potential disruptions in the timely and reliable delivery of agricultural products to global markets.

Scientific evidence unequivocally indicates that Argentina is poised to confront catastrophic climate repercussions should it persist on a high-emission trajectory. In the absence of immediate and resolute measures, Argentina's future portends a distressing surge, with agricultural drought occurrences projected to spike by a staggering 65% by 2050, while heatwaves are anticipated to persist for over 6247% longer periods. The confluence of rising sea levels aggravated coastal erosion, and increasingly severe weather patterns are anticipated to wreak hav-

7. Around 84% of exported grains and by products, and 92 percent of containers moved (for both export and import) are transported by river (MAGYP, 2023; Estado Argentino, 2023).

oc on Argentina's economic landscape. This grim outlook projects potential losses amounting to approximately 8% of the nation's GDP by the turn of the century (CMCC, 2021, p. 20).



Figure 2. Argentina's GHG emissions, by sector and energy subsector (1990-2018)

A number of discernible manifestations of climate change in Argentina can be summarised under the following heads:

#### a. Environmental Implications

- (i) Rising Temperatures and Extreme Weather Events: Increasing global temperatures and the escalation of extreme weather events in Argentina, including droughts, floods, and heatwaves, have consequences for ecosystems, including glacier melting in the Andes and disruptions to wildlife habitats.
- (ii) Biodiversity Loss: The threat climate change poses to Argentina's unique biodiversity, resulting in endangered species and ecosystem, impacts on ecosystem services like pollination and water purification.
- (iii) Water Scarcity and Glacial Retreat: The implications of climate change on water resources, including potential water scarcity and glacial retreat, lead to challenges in water management, agriculture, and hydropower generation.

#### **b.** Economic Implications

- (i) Agriculture and Food Security: Argentina's agricultural sector vulnerability to changing climate patterns impacts on crop yields, livestock production, and global food prices. Agriculture is a core element of Argentina's economy, contributing approximately 4.4% of the country's annual GDP.
- (ii) Energy Supply: Rising temperatures and more severe heatwaves will affect Argentina's energy system and change the profile of its energy demand. It bears consequences for the energy sector, particularly the reliance on hydropower generation and fossil fuels. Therefore, it brings around a need for diversifying the energy matrix through renewable sources.
- (iii) Economic Costs: The economic costs associated with climate-related damages, such as infrastructure repairs and disaster management, underscore the importance of climate resilience for ensuring long-term economic stability.

Source: The World Bank, 2022, p. 9.

c. Social Implications

"Argentina has made

significant strides in

change. The country is

committed to reducing

addressing climate

its greenhouse gas

emissions (GHG) and

for the future. It has

economy, including

investing in renewable energy, improving energy

its natural resources."

efficiency, and protecting

has set ambitious targets

implemented policies and

initiatives to transition to a more sustainable and environmentally friendly

- (i) Health Risks: The public health risks linked to climate change, including heat-related illnesses and the spread of vector-borne diseases, will have a disproportionate impact on vulnerable populations without access to adequate healthcare.
- (ii) Displacement and Migration: The potential for climate-induced displacement and migration, particularly in vulnerable coastal regions, highlights the need for policies and strategies to address the challenges of climate migrants.
- (iii) Social Inequality: The exacerbation of existing social inequalities as marginalized communities bear the brunt of climate impacts highlights the importance of ensuring equitable access to resources and opportunities.

# 3. Argentina's response to impact of climate change

Argentina has made significant strides in addressing climate change. The country is committed to reducing its greenhouse gas emissions (GHG) and has set ambitious targets for the future. It has implemented policies and initiatives to transition to a more sustainable and environmentally friendly economy, including investing in renewable energy, improving energy efficiency, and protecting its natural resources (PAGE Argentina, 2021). Argentina is also actively participating in international efforts to combat climate change, such as the Paris Agreement (Republic of Argentina, 2016), and is working to enhance its resilience to the impacts of a changing climate. Through a combination of domestic actions and international cooperation, Argentina is taking meaningful steps to mitigate the effects of climate change and build a more sustainable future (The World Bank, 2017).

Argentina has implemented significant measures to curb emissions across various sectors. In the transportation sector, plans involve the development of cycling infrastructure, the introduction of electric rail systems, and the establishment of targets for electric vehicles (EVs) in both public and private fleets, as well as public transport (Climate Action Tracker, 2023). In the building sector, strategies encompass incentives for rooftop solar installations and solar heating, as well as measures to promote more energy-efficient lighting and appliances (Climate Action Tracker, 2023). Additionally, homes are now subject to energy efficiency labelling (Climate Action Tracker, 2023). In the waste sector, Argentina has committed to eliminating open-air landfills and has set goals to reduce food loss and waste by the year 2030 (Climate Action Tracker, 2023). Some of the key initiatives (thou h most of these are in a nascent stage of implementation) by the nation are summarised below:

"Through a combination of domestic actions and international cooperation, Argentina is taking meaningful steps to mitigate the effects of climate change and build a more sustainable future."

**a. Renewable Energy Investments:** Argentina has been investing in renewable energy sources, particularly wind and solar power. The country aims to increase the share of renewables in its energy mix to reduce GHG emissions. Argentina is aiming to generate 57% of its energy from renewable sources by the end of the decade, according to an official energy transition plan (República Argentina, 2023) launched in late June 2023.

**b. Afforestation and Reforestation:** To combat deforestation and mitigate climate change impacts, Argentina has implemented afforestation and reforestation programs to restore and conserve its forests. The Green Climate Fund (GCF) approved a US \$82 million project to combat deforestation and promote sustainable forest management in Argentina (FAO, 2020). The funds destined for Argentina were granted under the REDD + Results-Based Payments Pilot Program.

**c. Climate Adaptation Strategies**: Argentina has developed strategies to adapt to the changing climate, including efforts to improve water management, protect against flooding, and enhance agricultural practices (The World Bank; CIAT and CATIE, 2015).

**d. Participation in International Agreements:** Argentina is a signatory to international agreements<sup>8</sup>. It has committed to reducing its emissions and contributing to global efforts to limit global warming. Argentina submitted its revised second Nationally Determined Contribution (NDC) in November 2021, its NDC includes a more ambitious goal of not exceeding the net emission of 359 MtCO2e in 2030 (absolute, economy-wide, and unconditional), equivalent to a total decrease in emissions of 19% by 2030, compared to the historical peak reached in 2007, and a reduction of 25.7% compared to the previous NDC (UNDP, 2023).

e. Climate Research and Data Collection: Argentina has been investing in climate research and data collection to better understand climate change impacts on its territory and plan accordingly. The National Meteorological Service operates a network of weather stations, contributing to the collection of crucial meteorological data<sup>9</sup>. The country collaborates with international organizations and participates in global initiatives, fostering a broader exchange of climate-related information. Argentina's commitment is evident through its regular submissions to the United Nations, detailing GHG emissions, vulnerabilities, and mitigation strategies. The establishment of the National Climate Change Observatory (OECD, 2020) further centralizes efforts, coordinating research and monitoring activities. Argentine scientists actively contribute to academic publications, reflecting the nation's dedication to advancing climate knowledge through data-driven approaches.

**f. Sustainable Agriculture Practices:** Argentina is promoting sustainable agriculture practices to reduce the environmental impact of its agricultural sector, which is a significant contributor to the nation's economy (Agroberichten Buitenland, 2023). The adoption of sustainable practices involves precision farming techniques, agroecology, and conservation agriculture. Precision farming utilizes technology to optimize inputs such as water, fertilizers, and pesticides, thereby enhancing resource efficiency (OECD, 2019).

**g. Resilience Building:** The country is working to improve its resilience to climate-related disasters, such as floods and droughts, through infrastructure development and risk reduction strategies. The Argentinian government's National Climate Change Office developed an interactive website (known as Argentina's Climate Risks Map System (SIMARCC)) that provides risk maps covering different scenarios of threats and vulnerabilities related to climate change (OECD, 2018, p. 25). This platform combines georeferenced data on the potential hazards from climate change with data on social vulnerabilities. This tool was designed to be useful for decision makers in the public and private sectors.

As previously argued, Argentina submitted its revised second NDC<sup>10</sup> in November 2021. It includes a more ambitious goal of not exceeding the net emission of 359 MtCO2e in 2030 (absolute, economy-wide, and unconditional), equivalent to a total decrease in emissions of 19% by 2030, compared to the historical peak reached in 2007, and a reduction of 25.7% compared to the previous NDC (UNDP, 2023). This pledge aligns with the nation's comprehensive strategy known as the 'Climate Change Adaptation and Mitigation Plan' (Ministry for the Environment and Sustainable Development of the Argentine Republic, 2022). This plan encompasses a total of 250 public policy initiatives scheduled for implementation by 2030, with a primary focus on transitioning to natural gas as a bridging fuel. Additionally, it emphasizes emissions reduction in the agricultural and livestock sectors and places significant emphasis on enhancing water resource management. The estimated cost of the plan exceeds \$185 billion, equivalent to approximately 40% of Argentina's 2021 GDP, prompting the government to explore international financing options to facilitate its realization.

Other initiatives to enhance climate resilience include the "Plan Belgrano" (The World Bank, 2023), which focuses on improving infrastructure and water management in the northern

<sup>8.</sup>As a Non-Annex 1 (non-industrialized) party to the National United Nations Framework Convention on Climate Change (UNFCCC), Argentina also ratified the Kyoto Protocol in 2001 and the Paris Agreement in 2016. Argentina accepted the Doha Amendment in 2015.

<sup>9.</sup> More information: https://halo-db.pa.op.dlr.de/institute/62.

<sup>10.</sup> The Nationally Determined Contribution (NDC) is each country's national plan to address climate change. Countries submit an NDC as part of Paris Agreement obligations.

provinces, mitigating vulnerability to droughts and floods. Simultaneously, forest conservation efforts in the Yungas and Patagonia regions bolster carbon sequestration and biodiversity conservation. In Buenos Aires, flood management initiatives, including enhanced stormwater drainage, address the mounting risk of flooding, collectively contributing to the nation's climate resilience.

"As outlined in the Green Climate **Fund's "Readiness** Proposal 2020" (Green Climate Fund, 2020), **Argentina possesses** a robust institutional framework for climate change mitigation and adaptation. However, to fulfil its ambitious NDCs and transition towards a resilient, lowemissions economy, Argentina requires access to financial mechanisms that align with the United **Nations Framework Convention on Climate** Change (UNFCCC) and the Paris Agreement."

Argentina is gradually advancing in the formulation of climate policies, but it falls short of demonstrating strong commitment in pivotal sectors like energy, agriculture, and livestock. In November 2022, Argentina fulfilled a long-standing promise by submitting its Long-Term Strategy (LTS), reaffirming its goal to achieve GHG neutrality by 2050. Subsequently, the nation unveiled its National Plan for Climate Change Mitigation and Adaptation (Ministry for the Environment and Sustainable Development of the Argentine Republic, 2022), outlining a variety of measures and sector-specific objectives in support of its GHG emission targets, although the level of ambition remained modest. In the collective assessment of climate experts, Argentina's climate targets and policy measures are deemed 'Critically insufficient' by the Climate Action Tracker (2023)<sup>11</sup>. As outlined in the Green Climate Fund's "Readiness Proposal 2020" (Green Climate Fund, 2020), Argentina possesses a robust institutional framework for climate change mitigation and adaptation. However, to fulfil its ambitious NDCs and transition towards a resilient, low-emissions economy, Argentina requires access to financial mechanisms that align with the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement.

# 4. Argentina's climate change challenges: an analysis

Argentina, like many countries, faces challenges in tackling climate change due to a variety of factors. It's important to note that addressing climate change is a complex and multifaceted issue, and no single factor can explain why a country may struggle to make significant progress. Here are some of the evident challenges that Argentina faces today as it endeavours to address climate change:

**a. Economic and Development Challenges:** Argentina has faced economic and political instability over the years, which has, at times, diverted resources and attention away from climate change mitigation efforts. Focusing on economic development and poverty reduction has, on occasion, taken precedence over environmental concerns in the short term.

**b.** Energy Mix and Dependence on Fossil Fuels: Argentina's energy sector is heavily dependent on fossil fuels, making it a significant contributor to greenhouse gas emissions. One challenge is to transition towards cleaner and more sustainable energy sources. The country has taken steps to invest in renewable energy, particularly wind and solar power. However, the transition is complex, and it requires substantial investments in infrastructure and policy changes. Therefore, transitioning to cleaner and more sustainable energy sources can be costly and challenging, both technically and politically.

**c. Agricultural and Land-Use Practices:** Argentina is a major agricultural producer, and the expansion of agriculture, particularly soy farming, has led to deforestation and other environmental issues. Sustainable land-use practices can be difficult to implement in the face of powerful agricultural interests.

<sup>11.</sup> The CAT utilizes the "Fair Share" model as its basis for evaluation. This model assesses a country's contributions to climate action in alignment with the global effort required to limit global warming. In this context, the term "Fair Share" implies that each nation is expected to contribute a fair and equitable share to global climate goals based on its capacity and responsibility. The "Critically Insufficient" rating underscores that Argentina's current efforts fall significantly short of what is considered a fair and equitable share to global climate goals. The CAT thus serves as a tool for assessing the adequacy of a country's climate policies in the broader context of global climate goals.

**d. Political and Policy Challenges:** Consistency in climate policies and political support for climate action at times has been inconsistent, making it difficult to enact long-term strategies and measures to reduce GHG emissions.

**e. Socioeconomic Inequities:** Historically, disparities in both social and economic spheres have consistently impeded the effective response to climate change. Marginalized populations, in particular, face resource and infrastructure deficiencies that hinder their capacity to adapt to the repercussions of climate change.

**f. International Climate Agreements:** Being a signatory to International Climate Agreements like the Paris Agreement poses a challenge to Argentina due to the inherent commitments and obligations associated with these agreements. Meeting emission reduction targets often necessitates substantial financial investments and policy adjustments, which can strain the nation's resources and economy. Additionally, international agreements are subject to geopolitical dynamics and the cooperation of multiple countries, making the attainment of climate goals contingent on global consensus and collaboration.

**g. Limited Public Awareness and Education:** The level of public awareness and comprehension regarding climate change issues significantly influences the endorsement of climate action (Mercado-Sáez and Galarza, 2017). In certain instances, there is a noticeable absence of broad-reaching awareness and education on this subject in Argentina.

Argentina, like many countries, grapples with substantial challenges in its endeavour to combat climate change. While the nation has taken commendable steps to address this issue, such as setting GHG reduction targets and promoting the use of renewable energy, the intricate nature of these challenges, alongside other contributing factors, makes expeditious progress in the fight against climate change a daunting task. These challenges have far-reaching impacts on critical sectors like agriculture and energy, emphasizing the need for comprehensive, coordinated efforts.

"The imperative of enhancing climate resilience cannot be overstated, as it is integral to safeguarding the nation's economy, environment, and public health. To this end, Argentina can realize substantial advancements by adopting a comprehensive approach that encompasses climate-resilient infrastructure, sustainable agricultural practices, a shift towards renewable energy sources, and active community engagement."

# 5. Strengthening Argentina's climate resilience

As per the World Bank (2022a), Argentina has the potential to achieve more robust economic growth through a transition to a low-carbon economy, with particular emphasis on reshaping its energy and agricultural sectors. The imperative of enhancing climate resilience cannot be overstated, as it is integral to safeguarding the nation's economy, environment, and public health. To this end, Argentina can realize substantial advancements by adopting a comprehensive approach that encompasses climate-resilient infrastructure, sustainable agricultural practices, a shift towards renewable energy sources, and active community engagement. Highlighted below are some key strategies that can facilitate Argentina in fortifying its climate resilience:

- a. Climate-Resilient Infrastructure Strategies
  - (i) **Upgraded and Resilient Buildings:** Improve building codes and standards to make infrastructure more resilient to extreme weather events such as floods and storms.
  - (ii) Flood and Stormwater Management: Develop and maintain effective stormwater drainage systems and flood protection measures in urban and rural areas.
  - (iii) Transport Infrastructure: Upgrade roads, bridges, and transportation networks to withstand the impacts of climate change.

#### b. Water Management Strategies

(i) Water Storage and Conservation: Implement water storage and conservation measures to address water scarcity during droughts and manage excess water during heavy rainfall.

(ii) Watershed Management: Protect and restore watersheds to maintain water quality and ensure a consistent water supply.

#### c. Agricultural Adaptation Strategies

- (i) **Crop Diversification:** Encourage diversification of crops to reduce dependence on a single crop and increase resilience to changing climate conditions.
- (ii) **Improved Soil Management:** Promote sustainable soil management practices to prevent soil degradation and erosion.

#### d. Renewable Energy Transition Strategies

- (i) Wind and Solar Power: Expand renewable energy production, particularly wind and solar power, to reduce the energy sector's vulnerability to changing water availability and lower greenhouse gas emissions.
- (ii) **Energy Efficiency:** Enhance energy efficiency in industries and buildings to reduce energy demand.

#### e. Forestry and Conservation Strategies

- (i) **Forest Protection:** Protect and preserve forests to sequester carbon and maintain biodiversity, contributing to climate resilience.
- (ii) **Afforestation and Reforestation:** Implement afforestation and reforestation projects to increase forest cover and carbon storage.

#### f. Community Engagement Strategies

- (i) Public Awareness Campaigns: Conduct public awareness campaigns to educate citizens about climate change and its impacts, encouraging support for resilience initiatives.
- (ii) Local Adaptation Initiatives: Engage local communities in the development and implementation of climate adaptation strategies.

#### g. Coastal Protection Strategies

- (i) Seawalls and Beach Nourishment: Implement coastal protection measures, such as seawalls and beach nourishment, to mitigate the impacts of sea-level rise and storm surges on coastal areas.
- (ii) Erosion Control: Develop erosion control measures to protect coastal infrastructure and ecosystems.

#### h. National and Regional Coordination Strategies

- (i) **Policy Consistency:** Ensure consistent policies and regulations for climate resilience at both the national and regional levels.
- (ii) Funding Mechanisms: Establish funding mechanisms to support adaptation projects and promote regional coordination.

#### i. Research and Data Strategies

- (i) Climate Research: Invest in climate research and data collection to better understand local climate impacts and make informed decisions regarding resilience strategies.
- (ii) **Early Warning Systems:** Develop and enhance early warning systems to provide timely information on extreme weather events and other climate-related risks.

#### j. International Collaboration Strategies

 (i) Regional Partnerships: Strengthen collaboration with neighbouring countries to address shared climate challenges.  (ii) International Support: Collaborate with international organizations to access knowledge, resources, and technology to enhance climate resilience.

#### k. Additional Measures

- (i) Ensuring Social Protection: Establishing social protection systems, including cash transfers, efficiently reduces welfare impacts of climate-related events like droughts and floods. These systems help the most vulnerable adapt to climate change's gradual effects.
- (ii) Exploiting Green Competitiveness: Argentina can tap into green competitiveness by investing in renewable energy, prioritizing energy efficiency, promoting sustainable agriculture, fostering eco-friendly innovation, introducing green certifications, developing green infrastructure, creating green finance mechanisms, and raising environmental awareness through education. These strategies can boost economic growth, reduce environmental impact, and position Argentina as a competitive player in the global green economy. Lithium, vital for lithium-ion batteries used in electric vehicles and energy storage, can help Argentina combat climate change. As a leading global lithium producer<sup>12</sup>, Argentina can expand lithium production and EV infrastructure to reduce transport emissions, promote cleaner energy, and enhance sustainability. Economic gains from the lithium industry can fund climate initiatives, bolstering resilience to climate change.

# 6. Leveraging United Nations support in strengthening climate resilience

"By leveraging the support and resources provided by the United Nations, Argentina has the potential to make significant strides in enhancing its climate resilience. That, in turn, will fortify its natural environment, bolster economic stability, and enhance community resilience in the face of the multifaceted challenges presented by climate change."

By leveraging the support and resources provided by the United Nations, Argentina has the potential to make significant strides in enhancing its climate resilience. That, in turn, will fortify its natural environment, bolster economic stability, and enhance community resilience in the face of the multifaceted challenges presented by climate change. Highlighted below are several key areas in which the United Nations can assist Argentina in strengthening its climate resilience:

a. Technical Expertise and Knowledge Sharing: The United Nations can provide Argentina with access to a network of climate experts and researchers who can offer guidance on climate resilience strategies tailored to the country's specific vulnerabilities. These strategies include technical assistance in areas such as water management, infrastructure development, and sustainable agriculture practices.

**b. Climate Finance Access:** The UN can facilitate Argentina's access to climate finance mechanisms, helping the country secure grants, loans, and funding from international sources like the Green Climate Fund. These financial resources can be directed towards critical climate resilience projects and initiatives.

**c. Capacity Building:** The UN can support capacity-building efforts within Argentina by offering training programs, workshops, and knowledge-sharing platforms for government agencies, local institutions, and community organizations. Capacity building helps enhance the country's ability to develop and implement effective climate resilience policies and programs.

**d. Data and Research Collaboration:** The UN can collaborate with Argentine institutions to improve climate data collection, analysis, and dissemination. This partnership can result in the development of localized climate models, risk assessments, and early warning systems, enabling more accurate predictions of extreme weather events.

e. Policy Development and Guidance: The UN can work closely with Argentina's government to formulate comprehensive and consistent climate policies and regulations. This co-

<sup>12.</sup> The country accounts for 21% of the world's reserves (Nugent, 2022).

operation includes guidance on legal frameworks, incentives for sustainable practices, and measures to ensure policy continuity, regardless of changes in government.

**f. Community Mobilization and Education:** The UN can assist Argentina in designing and implementing public awareness campaigns and community engagement initiatives. These programs can educate citizens on the impacts of climate change and empower them to participate in resilience-building efforts at the local level.

**g. International Collaboration:** The UN can facilitate regional and global collaborations, connecting Argentina with neighbouring countries facing similar climate challenges. International organizations can also offer resources and expertise for large-scale climate resilience projects.

**h. Early Warning Systems:** The UN can help Argentina develop and enhance its early warning systems to provide timely information and alerts about extreme weather events, enabling better preparedness and response.

**i. Promotion of Sustainable Practices:** The UN can promote and support sustainable agricultural practices, afforestation, and reforestation initiatives, as well as the transition to renewable energy sources. These measures not only enhance resilience but also contribute to greenhouse gas emission reduction.

**j. Disaster Risk Reduction:** Collaborating with the UN can enable Argentina to develop comprehensive disaster risk reduction strategies, which include infrastructure improvements, contingency planning, and community-based disaster risk management.

The above strategies can collectively form a comprehensive blueprint for Argentina to boost its climate resilience. Successful execution necessitates a synergy of government policies, active private sector participation, community engagement, and international collaboration. Through the adoption of a proactive and multifaceted approach, Argentina can more effectively equip itself to confront the challenges of climate change, safeguard its ecosystems, and ensure the welfare of its populace and economy amidst a shifting climate landscape.

### 7. Conclusion

Argentina's heavy reliance on natural capital contributes to its vulnerability to climate change through agriculture and hydropower and to low-carbon transitions through the oil and gas industries. But it also presents opportunities for growth. Argentina, like numerous countries, is taking steps to combat climate change, including setting targets to reduce GHG emissions and promoting the use of renewable energy. Despite these efforts, the country faces significant challenges, particularly in sectors like agriculture and energy, necessitating coordinated action. While existing policies represent a positive start, they must be reinforced to match the urgency of the climate crisis. Effective climate action demands a blend of government policies, international collaboration, private sector involvement, and public awareness. Overcoming these hurdles will require sustained commitment from all segments of society. Argentina's dedication to emissions reduction, climate adaptation, and the transition to cleaner energy sources is pivotal in securing a sustainable future for the nation and its diverse ecosystems. International cooperation and ongoing assessment of these endeavours are vital to ensuring their effectiveness and meaningful impact.

"Effective climate action demands a blend of government policies, international collaboration, private sector involvement, and public awareness. **Overcoming these** hurdles will require sustained commitment from all segments of society. Argentina's dedication to emissions reduction, climate adaptation, and the transition to cleaner energy sources is pivotal in securing a sustainable future for the nation and its diverse ecosystems. International cooperation and ongoing assessment of these endeavours are vital to ensuring their effectiveness and meaningful impact."

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# Impacts of climate change on the preparation and use of the Armed Forces

Paulo Roberto da Silva Gomes Filho<sup>1</sup>

### **Executive summary**

Ongoing climate change impacts the planet globally, significantly affecting the security of nation-states. These changes result from human actions, particularly those leading to greenhouse gas emissions. This reality reverberates through the strategic and operational planning of the armed forces and is reflected in high-level security and defense documents of several countries.

Concerning Brazil, the effects of climate change are related to the following factors: increased temperature, decreased rainfall, intensification of the dry season, sea level rise and coastal flooding, alteration of the rainfall regime, and intensification of extreme weather phenomena.

Such changes and their consequences impact in a complex and diverse way the missions of the armed forces around the world, causing effects of multiple orders. Six different perspectives affect the missions of the armed forces: (1) the debate around the role of the forces as a relevant actor in the emission of greenhouse gases; (2) the budget dispute, since the public resources necessary for measures to mitigate the effects of climate change are large; (3) the direct effects of climate change on areas, facilities and equipment of the armed forces; (4) the increased use of the armed forces in civil defense missions; (5) the possibility of engagement in humanitarian missions under the aegis of multilateral organizations, in areas affected by natural disasters; and (6) the possibility of engagement in high-intensity conflicts, due to geopolitical disputes against the background of environmental issues.

From the analysis of these perspectives of impact on the armed forces, the present work makes the following recommendations to the Brazilian Defense Sector.

- Expand studies so that, ahead of time, operationally appropriate solutions can be put forward for the Forces to adopt. These could include the adoption of alternative forms of energy production and the adoption of solutions in Military Engagement Systems and Materials that contribute to the country's effort to achieve its goals of reducing greenhouse gas emissions;
- Prepare for a budget dispute increasingly impacted by government investments committed to mitigating the effects of climate change;
- Adopt measures that increase the resilience of areas and facilities under military administration, as well as Military Engagement Systems and Materials, in the face of extreme weather events;

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<sup>\*\*</sup> Translation: Vinícius Santiago.

- Maintain the preparation and readiness of troops to act in humanitarian aid operations in a joint and interagency environment, in the context of operations in support of Civil Defense, in national territory;
- Maintain the preparation and readiness of troops to act in humanitarian operations under the aegis of multilateral organizations in a joint and combined engagement environment abroad;
- Maintain the preparation and readiness of troops to act in defense of the homeland, in high-intensity operations, and in the maintenance of sovereignty and national interests within a framework of instrumentalization of the climate issue.

#### **KEYWORDS**

Climate Change; Armed Forces, Security; Defense.

# 1. Introduction

Ongoing climate change impacts the planet globally, with significant repercussions on the security of nation-states. Such changes are the result of human action, especially those that result in greenhouse gas emissions. This is a reality that reverberates in the strategic and operational planning of the armed forces and is also reflected in the highest-level security and defense documents of several countries.

The effects of climate change are already being felt. Extreme phenomena such as severe droughts, increasingly intense and frequent heat waves, desertification, or floods impact human groups with social, political, economic, and humanitarian consequences, putting pressure on and destabilizing governments, with evident consequences for the security and defense of states.

For Guimarães (2023), the effects of climate change concerning Brazil are related to the following factors: increased temperature, decreased rainfall, intensification of the dry season, sea level rise and coastal flooding, alteration of the rainfall regime, and intensification of extreme weather phenomena.

The first goal of this study was to examine how climate change will affect the military's missions. In other words, it was a matter of researching the effects of climate change and always taking care to analyze the phenomenon through the lens of fulfilling the missions of the armed forces. Once this objective was achieved, the next step was to investigate how such effects could influence the preparation and use of the Brazilian military instrument. The last step was to suggest options and paths for the implementation of policies in the Defense sector. To this end, a review of the existing literature was carried out in the search for consecrated approaches to address the issues raised.

# 2. Climate change and the mission of the Armed Forces

The mission of the Armed Forces is defined in Article 142 of the Constitution.

The Armed Forces, constituted by the Navy, the Army and the Air Force, are permanent and regular national institutions, organized on the basis of hierarchy and discipline, under the supreme authority of the President of the Republic, and are intended for the defense of the Homeland, the guarantee of constitutional powers and, on the initiative of any of these, of law and order (Brasil, 1988, Art. 142).

"Climate change impacts the missions of armed forces around the world in a complex and diverse way, causing effects of multiple orders." Complementary Law No. 97, of 1999, provided for the organization, preparation, and use of the Armed Forces. This law provides that the Armed Forces have subsidiary attributions, such as cooperation with national development, support for civil defense, and action to combat transboundary and environmental illicit acts in the border strip.

Climate change impacts the missions of armed forces around the world in a complex and diverse way, causing effects of multiple orders. According to Brzoska (2015, p. 172), the missions of the armed forces are affected by six different perspectives: (1) the debate around

"Parkinson and Cottrell (2022) state that, together, the world's armed forces are responsible for 5.5% of total greenhouse gas emissions. This means that, if they were a country, the armed forces as a whole would have the fourth largest carbon footprint, behind only China, the United States of America (USA), and India."

the role of the forces as a relevant actor in the emission of greenhouse gases; (2) the budget dispute, since the public resources necessary for measures to mitigate the effects of climate change are large; (3) the direct effects of climate change on areas, facilities, and equipment of the armed forces; (4) the increased use of the armed forces in civil defense missions; (5) the possibility of engagement in humanitarian missions under the aegis of multilateral organizations in areas affected by natural disasters; and (6) the possibility of engagement in high-intensity conflicts due to geopolitical disputes against the background of environmental issues. Let's look at each of these dimensions below.

#### Figure 1. Perspectives on which Forces are impacted by climate change



Source: Prepared by the author based on Brzoska (2015, p. 172).

As it follows, I analyze each of these perspectives, bringing them to the Brazilian context, always intending to unveil the impacts of climate change on the Brazilian Armed Forces.

# 2.1. The armed forces and greenhouse gases

The international discussion on the production of greenhouse gases by the armed forces has been gaining prominence in specialized forums. Parkinson and Cottrell (2022) state that, together, the world's armed forces are responsible for 5.5% of total greenhouse gas emissions. This means that, if they were a country, the armed forces as a whole would have the fourth largest carbon footprint, behind only China, the United States of America (USA), and India.

The researchers' methodology aims to determine the carbon footprint (F) of the armed forces. For this, they developed a formula — F = ep(1+r)s — that takes into account the following factors: (1) the "per capita" emissions of the military (e); (2) total military personnel (p); (3) proportion between emissions generated by stationary activities and mobile activities, those that employ aircraft, spacecraft, ships, or land vehicles (1+r); and (4) a multiplier related to the carbon footprint of supply chain activities related to the military activities of each country (ies).

The study presented by the authors did not particularize Brazil, which, however, was cited as one of the ten countries in the world that contribute 60% of total carbon emissions, in addition to being one of the twenty largest in investments in the Defense sector (Parkison and Cotrel, 2022).

The concern of the aforementioned authors in seeking to measure the carbon footprint of the military segment of society highlights the importance of the topic, suggesting that it will gain increasing visibility and significance, which will lead to greater social pressure for all activities carried out by the armed forces to have a smaller carbon footprint.

Thus, it also seems clear that the trend will be greater social pressure for the acquisition and development of new Military Engagement Systems and Materials (SMEM, for its acronym in Portuguese) that use renewable energy sources, as well as for military installations of all types, which should seek new solutions and adapt to work with renewable energy sources or, at least, less polluting ones. It is clear that the equipment to be acquired by the armed forces must primarily meet the necessary requirements for their intended use in building the military capabilities needed to fulfill the mission. Once these conditions are met and the necessary operational levels are maintained, there is

"...it also seems clear that the trend will be greater social pressure for the acquisition and development of new **Military Engagement Systems and Materials** (SMEM, for its acronym in Portuguese) that use renewable energy sources, as well as for military installations of all types, which should seek new solutions and adapt to work with renewable energy sources or, at least, less polluting ones."

"It is clear that the equipment to be acquired by the armed forces must primarily meet the necessary requirements for their intended use in building the military capabilities needed to fulfill the mission. Once these conditions are met and the necessary operational levels are maintained, there is nothing to prevent the acquisition of SMEM with a lower carbon footprint, especially in the support activities of the armed forces."

"The aforementioned **Complementary Law No.** 97 of 1999 provides in its article 16 that it is up to the Brazilian Armed Forces, as a general subsidiary attribution, to cooperate with the Civil Defense. An increase in the number, amplitude, and frequency of natural or anthropogenic disasters in Brazil will certainly lead to an even more frequent performance of its Armed Forces in this type of activity." nothing to prevent the acquisition of SMEM with a lower carbon footprint, especially in the support activities of the armed forces.

# 2.2. Budget disputes

Measures for climate change mitigation and energy transition require substantial investments from national governments, which may impact the budget availability of the Defense sector.

Bachner, Bednar-Friedl, and Knittel (2019) found that adaptation to climate change affects government budgets directly, with regard to expenditure, but also indirectly, through changes in the tax base and consumption patterns of governments.

Another aspect to be considered is that the pressure to acquire SMEMs that use renewable energy sources, as seen in the previous section, and the adaptation of areas and facilities, as will be explored in the next section, will also impact the budget available to the Defense Sector.

Thus, the budget dispute tends to become more intense as the climate emergency presents itself more incisively, resulting in a possible decrease in the budget available to the armed forces.

# 2.3. Direct effects of climate change on areas, facilities, and equipment of the armed forces

The military itself can also suffer directly from the effects of climate change: seaside military installations, as well as ports and shipyards, for example, can be rendered unusable by rising sea levels. A report prepared by the US Department of Defense in 2018 concluded that about half of the approximately 3,500 US military installations reported adverse effects of climate change, such as floods, forest fires, droughts, or episodes of strong winds (EUA, 2018).

In the same vein, less navigable rivers can greatly affect the waterway logistics supply, which is especially important for the Brazilian Army in maintaining the logistics flow to the Force Units in the Brazilian Amazon. The literature review carried out for this study did not find scientific studies done specifically for the Brazilian Amazon; however, the extraordinary drought that occurred in that region in 2023 seems to be illustrative of the case. Concerning other regions, there are several studies relating climate change to the decrease in navigability in other important river basins. Guerrero *et al.* (2013) state that climate change can affect the navigability of waterways, both by changing the rainfall regime and by changes in the morphology of rivers, which can be affected by erosion and sedimentation.

# 2.4. Increasing the use of the armed forces in Civil Defense missions

The aforementioned Complementary Law No. 97 of 1999 provides in its article 16 that it is up to the Brazilian Armed Forces, as a general subsidiary attribution, to cooperate with the Civil Defense. An increase in the number, amplitude, and frequency of natural or anthropogenic disasters in Brazil will certainly lead to an even more frequent performance of its Armed Forces in this type of activity. This is due both to the capabilities of the Forces, which have the means, personnel, and material to be deployed in emergencies, and to the territorial distribution of the armed forces in the national territory, a characteristic that gives them a capillarity that allows prompt response in crises.

This is not an engagement peculiarity specific to Brazil. According to Boeno (2018), the US Department of Defense has concluded, in several studies and reports, that climate change will make natural disasters more frequent and intense, impairing the ability of the US and allied Armed Forces to provide humanitarian assistance and disaster relief.

In the case of the Brazilian Army, the engineering system is what concentrates the capabilities that have historically been and are used in cases of support of Civil Defense. The use of these and other capacities must follow the provisions of the doctrine of the Force itself, contained in the Ministry's instructions contained in MD 33-I-01 — Use of the Armed Forces in Support of Civil Defense and the recently published campaign manual EB 70-MC-10.236 — Humanitarian Aid Operations.

The occurrence, increasingly frequent, of the so-called extreme weather events, which affect areas with large concentrations of population, gives rise to the need to prepare the armed forces (AF) to be able to help civilian institutions preserve safety conditions and well-being for the inhabitants of the affected region (Brasil, 2023).

For Grenteski (2020), there is no doubt that, in the face of the climate change scenario, with increasingly frequent catastrophic events with unpredictable amplitude and results, there is an increasing need for the involvement of the Armed Forces, especially the Brazilian Army.

# 2.5. Engagement in humanitarian missions under the aegis of multilateral organizations in areas affected by natural disasters

Severe climatic phenomena, combined with political, economic, or demographic factors, may act as catalysts for internal conflicts in vulnerable countries. This could lead to the engagement of Brazilian forces in stabilization missions, typically occurring with Brazilian troops in a multinational effort under the aegis of multilateral organizations such as the United Nations (UN) and the Organization of American States (OAS).

Climate change will have a greater impact on the nations least prepared to address it. According to Mayer (2007), the negative consequences for human security in these areas will aggravate the already existing destabilizing trends. While climate change will undoubtedly have serious consequences for the richest and most developed nations, these countries are likely to be among the least affected by the direct impacts of the altered environment. Possessing substantial financial reserves in addition to efficient government structures, they will also be reasonably well equipped to deal with most negative effects. Unfortunately, this is not the case for poor and developing countries.

An international response to the natural disaster caused by climate change that occurs in an already impoverished state in the presence of an armed conflict makes the humanitarian assistance operation much more complex, requiring the presence of military forces to stabilize the situation before or even during the provision of aid to the affected populations. The cases of Sudan, Somalia, and Mali are some examples of this reality (McGrady, Kingsley, and Stewart, 2010).

Thus, it is very likely to anticipate the use of the armed forces, under the aegis of the UN or even the OAS, in stabilization operations in the context of natural disasters aggravating pre-existing political and economic crises in vulnerable countries.

# 2.6. Engagement in high-intensity conflicts due to geopolitical disputes against the background of environmental issues

In the previous two sections, some possibilities for the use of the armed forces directly related to climate change were presented. But there is also the possibility of climate change being instrumentalized by states as a justification for military action that serves other interests.

Medeiros Filho (2023) already warns that the theme can gain an instrumental dimension as an element of competition between sovereign nations, with a tendency to increase conflict between countries, in an environment of international pressure and protection-

"An international response to the natural disaster caused by climate change that occurs in an already impoverished state in the presence of an armed conflict makes the humanitarian assistance operation much more complex, requiring the presence of military forces to stabilize the situation before or even during the provision of aid to the affected populations." ist narratives. In this sense, the author warns that political rationality must be sought, avoiding the extremes of socio-environmental insensitivity — after all, the issue of climate change is real — or geopolitical naivety, which does not recognize the instrumentalization of the issue.

It is in this context that, in the Brazilian case, the defense of sovereignty over the Amazon is manifested, a biome whose preservation is considered fundamental for the achievement of the global goals of reducing the emission of greenhouse gases. These are undoubtedly legitimate and pertinent concerns of the international community. However, they can, to the detriment of Brazilian sovereignty, serve as a shelter for other interests. It is in this sense that the Brazilian Armed Forces should be prepared to act in defense of Brazilian sovereignty in dealing with issues that concern only Brazilians.

# 3. Influence of selected aspects on the preparation and use of the armed forces

Article 14 of Complementary Law No. 97 defines three basic parameters for the preparation of the Armed Forces: permanent operational efficiency, search for national autonomy, and correct use through the carefully planned mobilization of national potential (Brasil, 1999).

The operational efficiency of the Armed Forces may be affected in several ways related to the previously highlighted consequences of climate change. The pressures on the Forces to reduce their "carbon footprint" may imply the acquisition of new SMEMs, which of course should be done without prejudice to the troop's operability. However, these new SMEMs may give rise to new techniques, tactics, or procedures for their use, with a direct impact on the preparation and use of troops. Another aspect to be highlighted is energy availability. A possible restriction on energy consumption, related, for example, to the reduction of the supply of a certain source by replacing it with another that may be less efficient, may also have repercussions on the preparation and use of forces.

The budget dispute, especially in the context of a developing country and with so many aspects still requiring heavy investments from the federal government, may worsen due to climate change, resulting in restrictions that can severely affect the preparation and use of the Armed Forces.

The effects of climate change on areas, facilities, and equipment directly impact the preparation and use of the Armed Forces. For example, make it impossible to use fields of instruction, eventually affected by forest fires and fires; seaside facilities, like ports, naval bases, docks, and shipyards; and facilities of all kinds, subject to inclement weather of a varied and increasingly frequent nature, such as unroofing and flooding, with multiple damages.

The action of the Armed Forces in support of Civil Defense requires the military to apply specific competencies, which must be obtained in advance of the emergence of the crisis. In addition, in this type of operation, there is broad and deep inter-agency action. Operating in coordination with police, fire departments, civil defenses, environmental agencies, and health surveillance, in addition to a myriad of federal, state, and municipal agencies requires specific preparation from the military involved so that the action is efficient and effective.

If climate change creates or aggravates existing crises in fragile national states<sup>2</sup>, resulting in the engagement of Brazilian troops under the aegis of a multilateral body, the need for specific preparation is quite clear, which will have to be adjusted to the specific case. However, there are commonalities in this type of engagement, which can be the object of the preparation of

<sup>2.</sup> For this work, fragile national states are those that cannot, due to their scarce means, deal on their own with the effects of climate disasters, imperatively needing international aid.

the Armed Forces staff, especially the troops already previously selected as being those available for prompt action in this type of operation.

Finally, operating in a high-intensity conflict is the raison d'être and the main mission of the Armed Forces. Therefore, even if it has as a background an issue related to climate change, it will require the same preparation already normally carried out by the Forces, requiring only that the highest-level planners be fully aware of the political, geopolitical, economic, scientific, and social issues surrounding the issue in order to build the most appropriate operational design for the solution of the imposed military problem.

#### **Recommendations for the Defense Sector**

Thus, as a conclusion of this work, some recommendations will be presented to better adapt the preparation and use of the Armed Forces in the context of climate change:

- Expand studies so that, ahead of time, operationally appropriate solutions can be put forward for the Forces to adopt. These could include the adoption of alternative forms of energy production and the adoption of solutions in Military Engagement Systems and Materials that contribute to the country's effort to achieve its goals of reducing greenhouse gas emissions;
- Prepare for a budget dispute increasingly impacted by government investments committed to mitigating the effects of climate change;
- Adopt measures that increase the resilience of areas and facilities under military administration, as well as Military Engagement Systems and Materials, in the face of extreme weather events;
- Maintain the preparation and readiness of troops to act in humanitarian aid operations in a joint and interagency environment, in the context of operations in support of Civil Defense, in national territory;
- Maintain the preparation and readiness of troops to act in humanitarian operations under the aegis of multilateral organizations in a joint and combined engagement environment abroad;
- Maintain the preparation and readiness of troops to act in defense of the homeland, in high-intensity operations, and in the maintenance of sovereignty and national interests, within a framework of instrumentalization of the climate issue.

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# Action and fight against the climate crisis in the midst of the Colombian conflict and post-conflict: efforts from the public and private sectors

#### Anna María Franco Gantiva<sup>1</sup>

### **Executive summary**

In 2015, under the leadership of Colombia, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development and established 17 goals. Its goal number 13 is 'Action for Climate' while number 16 is 'Peace, Justice and Strong Institutions'. A year later, Colombia is reportedly signing the Final Agreement for the Termination of the Conflict and the Construction of a Stable and Lasting Peace (Final Agreement) with the Revolutionary Armed Forces of Colombia — People's Army (FARC-EP). Both years were significant for the country's political history and marked a milestone in the degradation of the nation's strategic ecosystems.

At this time, eight years from fulfilling the time imposed by the 2030 Agenda and the implementation phase of the Final Agreement, in the midst of a violent post-conflict and a selective degradation of the tropical forest, Gustavo Petro came to the presidency with his promises of total peace and the fight against climate change.

The self-proclaimed 'Government of Change' took office amid the proliferation of resilient armed oligopolies throughout the territory and the massive destruction of natural capital. Conflict, violence, and the environmental crisis continue to reveal that every territory in Colombia is an expression of the illegal economy — or war — and the legal one, where the juxtaposition of the former on the latter has prevented sustainable development and puts at risk the carrying capacity and resilience of strategic ecosystems to fight against climate change.

Under the aforementioned scenario, this policy paper is organized into five parts. The first and second parts explain how nature was instrumentalized during the armed conflict, and how it was later recognized as a victim of the conflict. The third part presents the challenges of adaptation to climate change within the framework of a violent post-conflict. The fourth part presents initiatives developed by the Colombian Military Forces, the National Army and the private sector that help offset the environmental liabilities of the armed conflict and post-conflict. Finally, the conclusions highlight the most relevant aspects of this analysis and present a series of public policy recommendations.

This policy paper has three objectives. The first one is to explain the role of nature during armed conflict and its subsequent recognition as a subject of rights and victim, and the impact this has on climate action. The second one is to highlight the nexus between climate adaptation and territorial peacebuilding, in the midst of a violent post-conflict. The third one is to present initiatives from the public and private sectors that have a two-way impact in the fight against climate change and the construction of territorial peace.

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Now, after analyzing the three objectives, the following far-reaching recommendations can be proposed:

#### For the executive sector:

- Priority implementation of the environmental provisions of the Final Agreement and the Environmental Zoning Plan (PZA, for its acronym in Spanish).
- Address the final initiatives of the Regional Transformation Action Plans (PATR, for its acronym in Spanish) as adaptation and risk strategies based on Ecosystems (EbA, ecosystems-based adaptation) and Communities (CbA, community-based adaptation).
- Comply with Judgment STC-4360 of 2018.
- Adopt a state Defense and Security Policy (PDS, for its acronym in Spanish) that gives continuity over time to the actions implemented by the Army and Military Forces.

#### For the legislative sector:

• Support the creation of the National Forest Extension and Bioeconomy Service presented by the National Government. This service should promote a change in the regional model in terms of policy and productive chains and create a forest inventory. From this, strengthen the forest economy nuclei.

#### For the executive and judicial sector:

 It is taken for granted that every action of reparation on nature is aimed at recovering its initial state. However, this action must also implicitly have a component that prevents the deepening of socio-environmental conflicts associated with the use of territory and the quality of natural resources.

#### **KEYWORDS**

Crimes Against Nature; Deforestation; Natural Security; Colombia.

# **1. Instrumentalization of nature during armed conflict** and environmental liabilities

Throughout the expansion and consolidation of the armed conflict in Colombia, the FARC-EP were characterized as the strongest illegal armed actor and the one that had the greatest presence in the country's municipalities. Its strategy was to create 'para-states' based on the establishment of 'liberated zones' and the generation of safe mobility spaces (Ávila, 2019). They did this by taking out the institutions and isolating society. As a result, in different areas of the country — especially in the southeast — and as a military strategy, they managed to build very strong social relationships with the communities. In environmentally strategic areas, such as the Amazon region, they acted as an 'environmental authority' and created co-existence manuals where, among other things, they regulated forest clearing and prohibited hunting (Franco, 2021).

This way of militarily instrumentalizing nature responded to an umbrella strategy under which the standing forest as an enclave helped the guerrillas hide kidnapped people, trafficking routes for arms, fauna and flora, and drug trafficking. In addition to launching attacks and hiding from government forces. However, while in the Amazon region biota was used as a shield, and indirectly protected by a purely military interest, in other areas of the country it was becoming a passive victim of the armed conflict.

One of the triggers that contributed considerably to the environmental deterioration was the uncontrolled oil spill, following the attack on oil infrastructures. For example, over a thousand pipeline blasts were recorded during 1986 and 1991 (MinAmbiente, 2012). This practice, which was part of the *modus operandi* of the FARC-EP and the National Liberation Army (ELN, for its acronym in Spanish), generated immeasurable environmental liabilities.

In fact, between 1976 and 2015, there were eight major oil spills; however, the one that left the greatest socio-environmental liabilities was the blasting of the Trans-Andean pipeline in June 2015. On June 21, the FARC-EP spilled more than 410,000 gallons of crude into the Pinauló and Guisa streams, which reached the Mira River and then the sea. These water sources that supply the main agreement of the municipality of Tumaco left 160 thousand people without water (Calle, 2020; Franco, 2021). The impact was of such magnitude that the Special Justice for Peace (JEP, for its acronym in Spanish) took it into consideration in macro case 002<sup>2</sup>.

Another emblematic event occurred in 2015 in the department of Putumayo, which is part of the Amazon region. On that occasion, 19 drivers were forced by the Front 49 of the FARC-EP to open the tanks' valves that contained five thousand barrels of crude oil (FIP, 2015; Semana, 2015). More than 450 families were affected by the contamination of water sources.

Two more triggers that contributed to and continue to accelerate the deterioration of the environment, through deforestation and pollution, are criminal gold mining and the planting of illicit crops. All illegal armed actors (FARC-EP, ELN, paramilitaries, dissidents, and other Organized Armed Groups - GAO, for its acronym in Spanish) have benefited from these illegal economies. Regarding the first illegal economy, the environmental liabilities it has left - the soil, subsoil, and water contamination by mercury and cyanide — have not been quantified.

"This way of militarily instrumentalizing nature responded to an umbrella strategy under which the standing forest as an enclave helped the guerrillas hide kidnapped people, trafficking routes for arms, fauna and flora, and drug trafficking."

<sup>2.</sup> The macro cases are the large legal investigations carried out by the JEP in order to clarify the most serious events that took place during the armed conflict and punish those most responsible for violations of human rights and international humanitarian law. Those appearing are members of the extinct FARC-EP, paramilitaries, members of the public force, civilians and officials or public servants who voluntarily submit to the jurisdiction.

However, in 2016, as a result of criminal mining, the Sambingo River disappeared, which was located in the department of Cauca. However, with regard to the planting of illicit crops, their illegal status usually means that they are located in geographical areas that are difficult to access, thus affecting primary or virgin forest regions.

"By 2017, the 170 PDET municipalities accounted for 84% of the total national deforestation rate and 25.6% of land use conflicts."

Since the signing of the Final Agreement for the termination of the armed conflict between the Colombian state and the FARC-EP in November 2016, 170 municipalities have been prioritized for immediate state intervention. These territories, also called 'PDET municipalities' (Development Plans with a Territorial Approach - PDET, for its acronym in Spanish), concentrated 94.2% of coca crops for that year (Decreto 893, 2017). At the level of environmental land use planning, 23% of protected environmental areas are located there. By 2017, the 170 PDET municipalities accounted for 84% of the total national deforestation rate and 25.6% of land use conflicts (Franco, 2021).

In this order of ideas, it is valid to affirm that the expectation of territorial peace and the signing of the Final Agreement marked a historical point to understand the complex paradox between the conservation and destruction of natural capital, depending on the illegal actor and the type of war economy that developed in that territory. Therefore, and considering the heterogeneity of the armed conflict in the regions and its consequences, the degradation of ecosystems is more visible in some territories than in others. That is why it is essential to bring up the recognition of nature as a victim of armed conflict, and more so in a context of climate change where the context and availability of natural resources can deepen or generate new spirals of violence.

# 2. Nature as a victim of armed conflict and as a restorative subject of law

Three facts are relevant to understand the legal importance of recognizing nature as a victim of the armed conflict and some natural ecosystems as subjects of rights in the midst of the climate crisis.

The first is the issuance of Decree<sup>3</sup> Law 4633 of 2011, "Through which measures of assistance, attention, integral reparation and restitution of territorial rights are issued to victims belonging to indigenous peoples and communities." Its articles 3 'Victims' and 45 'Damage to the territory' stipulate the recognition of the territory as a victim and the attention, integral reparation, and restitution of territorial rights of the victims who belong to indigenous peoples. In this sense, there is a recognition of the territories and nature as subjects and victims of the armed conflict, which served as a prelude to the JEP so that it recognized them, legally, in the investigations it carries out.

The second fact is related to the recognition of some ecosystems as subjects of rights from ordinary justice. The Atrato River, located in the department of Chocó and the Urabá Antioqueño, was the first to be recognized through judgment T-622 of 2016 by the Constitutional Court. The second was the Amazon, by the Supreme Court of Justice in its Judgment STC-4360 of 2018.

In particular, Judgment STC-4360 (Map 1) has been historic and pioneering once it is framed in the territorial consequences of climate change. The guardianship, which was filed by 25 Colombians who were between 7 and 25 years old, demanded the legal protection of their rights based on the protection of the Amazon. They argued that their rights were threatened by the

"In this sense, there is a recognition of the territories and nature as subjects and victims of the armed conflict, which served as a prelude to the JEP so that it recognized them, legally, in the investigations it carries out. The second fact is related to the recognition of some ecosystems as subjects of rights from ordinary justice."

<sup>3.</sup> This extraordinary Decree was issued by the National Government in exercise of the extraordinary powers conferred by article 205 of Law 1448 of 2011 "By which measures are issued for the attention, assistance and integral reparation to the victims of the internal armed conflict and other provisions are issued." This article recognizes that victims belonging to indigenous, Romani and black, Afro-Colombian, Raizal and Palenquera peoples and communities must have comprehensive reparation and their lands must be restored. Now, this law and Decree Law 4633 were in force until 2021. However, both regulations were extended for 10 years with Law 2078 of 2021.

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impacts of climate change, which accelerated and deepened with deforestation. They also pointed out that this activity could cause a temperature increase between 1.6°C and 2.14°C between 2041 and 2071, precisely when they would become adults and older adults.

"In 2023, Colombia had 28 judgments where nature or a particular natural ecosystem was recognized as a subject of law."

Given this, the High Court argued that the legal protection they demanded was under the environmental principles of precaution, solidarity, and intergenerational equity. In addition, it recognized future generations and the Amazon as subjects of rights. Therefore, the municipalities that are part of their jurisdiction should update their land use plans and direct them towards adaptation to climate change. In 2023, Colombia had 28 judgments where nature or a particular natural ecosystem was recognized as a subject of law (JEP, 2023).

The third fact is the investigation of environmental crimes that the JEP has developed from positive law and common law; and the dialogical process that has taken place within it. These investigations are followed by the international community and the International Criminal Court, in particular.

In this order of ideas, the JEP advances the investigation of three macro cases (002<sup>4</sup>, 004<sup>5</sup> and 005<sup>6</sup>) (Map 1) that focus on recognizing the violence that occurred in the framework of the armed conflict against living beings: human and non-human, where the latter involves territory and nature. In this sense, there are three macro cases in which socio-environmental and territorial damages in the prioritized municipalities are considered. "This fact recognizes the vulnerability of human-nature relationships that were systematically destroyed" (JEP, n.d. [a]). From this, the JEP determined two macrocriminal patterns in the three cases: (i) destruction of the Territory and Nature from hydrocarbon pollution and criminal gold mining; and (ii) illicit use and affectation by anti-personnel mines and explosive remnants of war.

Map 1. Areas of study and jurisprudential decision



Source: Prepared by the author.

However, case 002 was a pioneer in recognizing nature and territory as victims from the perspective of ethnic peoples. And cases 004 and 005 follow the same direction. In this regard, the JEP determined that the FARC-EP affected the environment in a widespread and lasting manner through: (i) installation of mines, attacks with explosives and unconventional weap-

4. Investigate the events that occurred in the ethnic territories of Tumaco, Barbacoas and Ricaurte in Nariño.

5. Urabá region (Turbo, Apartado, Carepa, Chigorodo, Mutata and Dabeida in Antioquia and Carmen del Darien, Riosucio, Unguia and Acandi in Chocó. This region is one of the areas with the greatest loss of biodiversity in the country.

6. Nasa Territory of the Cxhab Wala Kiwe and the municipalities of Caldono and Morales in Northern Cauca and Southern Valle del Cauca.
ons; (ii) invasion of ancestral ethnic territories (particularly cases 002 and 005); (iii) impact on moorlands (especially case 005); (iv) drug trafficking and criminal gold mining (JEP, n.d. [b]).

The impact on the environment results in the degradation of the quality of natural resources and the fulfillment of their ecosystem functions. This in turn has an impact on the levels of risk, consequences, and adaptation to climate change that territories and their communities have. Therefore, within the domain of public power, these three facts can be considered as a way for the state to take action in two completely interconnected directions from the principle of progressivity of rights. Basically because, when nature and territory are recognized as subjects of rights, they are implicitly considered and treated as victims with the effects and scope inherent to this condition.

Therefore, this leads to a repair and restoration process, which goes through the recognition of a climate crisis and the compensation of environmental liabilities. An example of this is the reforestation in places near the sacred sites of indigenous peoples, which coincide with points of hot biodiversity, and the recovery of rivers that became cemeteries in the worst years of the conflict.

In this order of ideas, it is possible to conclude at this point that the recognition of nature as a subject of rights, victim, and restorative subject of rights is a significant advance in the conception of how that ecosystem is seen and how it is treated. That is, it leaves aside the anthropocentric view that nature is merely an object and moves towards a national view and a long-term view of how we have to relate to that ecosystem. This means that a new pact or code of relationships is established where the interdependence between human beings and nature to survive is recognized. And this is essential to establish territorial climate mitigation and adaptation responses.

# "...the link between climate change and peacebuilding during the post-conflict lies in the identification of risks and their management."

# 3. Adapting to climate change in the midst of a violent post-conflict

Dan Smith and Janani Vivekananda (2007) assert that the link between climate change and peacebuilding during the post-conflict lies in the identification of risks and their management. Such identification allows strengthening the adaptive capacity to reduce climate risk and the risk of a new violent conflict emerging over access to finite natural resources, such as water and land. As the authors say, the consequences of climate change will combine with other factors, putting additional pressure on post-conflict societies that tend to have a fragile system.

In a special way, and without being the objective of the Final Agreement, it is possible to direct, on the one hand, the construction of territorial peace (SDG 16) and environmental peace; and, on the other, climate action and fight (SDG 13), as part of the same sustainable strategy over time. Of the 578 total provisions of the Final Agreement, 84 can be considered environmental commitments (Sáez *et al.*, 2023). In fact, Point 1 of the Agreement, which deals with Comprehensive Rural Reform and has 104 provisions, could be considered an instrument for resolving socio-environmental conflicts associated with land use.

However, within the framework of the Final Agreement, there are three management and planning instruments that have a significant scope in territorial climate action: (i) the Participatory Environmental Zoning Plan (PZA); (ii) the Development Plans with a Territorial Approach (PDET); and, (iii) the Regional Transformation Action Plans (PATR) that enshrine the final initiatives proposed in the PDET. The PZA contains the expansion of the agricultural frontier and indicates that everything that has been deforested after 2010 is considered as forest land and, therefore, must have a restoration and reforestation process. Therefore, it can be considered as an instrument to mitigate the territorial consequences of climate change (Franco, 2021). In January 2023, it was in the subregional implementation phase (Sáez *et al.*, 2023).

"In other words, the expectation and delay in the construction of territorial peace became a threat to the survival of Colombia's strategic natural ecosystems. The deeprooted fear of the FARC-EP and the structural social coercion they imposed meant that the processes of landscape transformation took place slowly."

For its part, it is imperative to address the initiatives that enshrine the PATR as Adaptation Strategies and risk management based on Ecosystems (EbA) and Communities (CbA). Its implementation would facilitate adapting territories to the effects of climate change through on-site prevention while improving the level of climate resilience of the population through equitable access to goods and services. For example, of the 142 initiatives from the PATR sub-regions<sup>7</sup> of Antioquia, 29 of them are considered EbA and CbA strategies. For its part, of the 84 initiatives in the Macarena-Guaviare PATR subregion<sup>8</sup>, 40 are EbA and CbA strategies (Franco, 2021). Many of these strategies are aimed at reforestation, environmental land use planning, silvopastoral reconversion, and the recovery of water sources<sup>9</sup>.

However, seven years after the signing of the Final Agreement, its implementation has been slow, with Point 1 being one of the furthest behind (Graph 1). The juxtaposition of illicit economies over licit ones in territories remains a threat to biodiversity and its ecosystem function. Deforestation continues to be the greatest manifestation of the social conflict associated with land use, the convergence of two different economies, and the lack of identity and appropriation of the territory. In other words, the expectation and delay in the construction of territorial peace became a threat to the survival of Colombia's strategic natural ecosystems. The deep-rooted fear of the FARC-EP and the structural social coercion they imposed meant that the processes of landscape transformation took place slowly. In other words, 'obedience out of fear' or 'social submission' to this organization 'favored' the conservation of certain ecosystems, including the Amazonian biota.

#### Graph 1. Implementation level of Point 1 of the Final Agreement



Source: Own elaboration according to Echavarría et al. (2023) and Sáez et al. (2023).

"Amid the territorial consequences of climate change, a structural solution involves the creation of a state Defense and Security Policy (PDSe, for its acronym in Spanish) based on natural security."

What the last few years have revealed is that one of the most recurrent and recycled problems in the country continues to be the uneven presence of the state in the territory and the existence of resilient illegal armed oligopolies (López, 2016). Therefore, accelerated, and full implementation of the Final Agreement is only part of the solution. Amid the territorial consequences of climate change, a structural solution involves the creation of a state Defense and Security Policy (PDSe, for its acronym in Spanish) based on natural security. Why? Because nature is the most silent victim of armed conflict and post-conflict. This encompasses not only the loss of biodiversity but also the ecosystem's resilience and the availability, in both quantity and quality, of natural resources.

So, starting from the idea that nature is the basis that sustains all life, human and non-human, the actions taken to protect and conserve it, or to end and destroy it, directly affect human well-being in the midst, for example, of projected scenarios of increased temperature<sup>10</sup>

<sup>7.</sup> The two subregions are Bajo Cauca and Nordeste Antioqueño, and Urabá Antioqueño. El Urabá is part of case 004.

<sup>8.</sup> This PATR subregion is part of the Amazon region.

<sup>9.60%</sup> of water sources were potentially affected by oil spills and criminal mining.

<sup>10.</sup> Projected scenarios: 0.5°C to 1.5°C to 2040; 2.5°C to 4.5°C between 2041 and 2070; and between 3.5°C to 4.5°C in some areas

and decreased rainfall<sup>11</sup>. Of the 81 continental ecosystems that Colombia has, 36 are at high risk, 22 are in a critical state and 14 are in a state of danger. In addition, it is projected that by 2050 the regions with the greatest loss or degradation of ecosystems will be the Andes, the north of the Amazon and the south of the Orinoquia (Humboldt Institute, 2020). In 2018, 30% of the country's biodiversity was in great danger as a result of external tensions and threats, one of them being the presence of GAO (MinAmbiente, 2018).

"From these approaches, the bases are generated that guarantee, for example, the continuity of the sustainable actions of climate mitigation and adaptation advanced by the Army, which allow the stabilization of the territory through integral action, the preservation of the multifunctional landscape and the disruption of the conflict."

In this order of ideas, natural security is oriented towards a (i) selective approach, based on ecological task forces (ETF); and (ii) systemic, which addresses the environmental principle of interconnection (Keucheyan, 2016; Parthemore and Rogers, 2010). From these approaches, the bases are generated that guarantee, for example, the continuity of the sustainable actions of climate mitigation and adaptation advanced by the Army, which allow the stabilization of the territory through integral action, the preservation of the multifunctional landscape and the disruption of the conflict.

Landscape preservation involves the protection of tropical dry and wet forest, and water resources, two vital ecosystems for the preservation of life as we know it. Colombia has 52 million hectares of forest, and a large part of these hectares is home to the most vulnerable population. The forest is the ecosystem on which more pressure is exerted and on which the alarms are set. Therefore, a PDSe must be accompanied by a 'country bet' in which there is an incorporation of forests into the national economy, as natural capital. An example of this is Asoprocegua, in the department of Guaviare, which is located in the Colombian Amazon region (Franco, 2021).

However, by 2023 standing forest is seen as an obstacle to development by many local communities and by some departmental and local governments (Franco, 2022). This has made it easier for landowners (illegal and legal) to promote the 'investor-forester' model, causing ecosystem fragmentation in different parts of the country (Map 2). In particular, the balance and connection of ecosystems at the continental level is at risk in the Amazon. Facts that increase climate vulnerability while decreasing adaptive capacity (Franco, 2022).

Map 2. National deforestation by June 2023



Source: BISIGOI - COGFM (2023).

and between 4.5°C to 5.5°C in others, between 2070 and 2100. (BID-CEPAL-DNP, 2014)

11.1t is expected that by 2040 there will be a decrease between 10% and 15%, and a decrease between 15% and 36%, over the course of the century.

The causes of deforestation remained the same as more than a decade ago. The most recurrent before November 2016 were: illicit/criminal extraction of minerals, planting of illicit crops, and illegal logging. Now, during the first quarter of March 2023, 12 active deforestation nuclei were registered (IDEAM, 2023). Those that have intensified since then include: agricultural expansion at different scales, land grabbing through prarification, unsustainable extensive livestock farming practices, and unplanned transportation infrastructure.

According to several experts (Beevers, 2012; Lujala and Rustad, 2012), post-conflict is the stage where we should most seek to invest in the reconstruction of human capital and institutions, particularly those that are in charge of the management of natural resources and their recovery, especially when the environment has been a victim of armed conflict. At the same time, this investment involves a technology and innovation component that strengthens the forest system. It is therefore necessary to know the ecosystem, understand it and protect it. This will have an impact on improving or decreasing their level of climate resilience capacity.

# 4. Public and private sector initiatives

As the analysis is carried out within the framework of the Colombian post-conflict, the public sector initiatives that are brought up are those carried out by the National Army (Table 1) and the Military Forces (Table 2).

	COMMENTS	IMPACT LEVEL	
INITIATIVES		IN THE PZA	ECHOSYSTEM RESTORATION
Environmental bubbles of the Sixth Division: early warning monitoring system that sought to prevent, control and monitor critical points of indiscriminate logging.	One of its objectives is to mitigate the effects of deforestation and illegal mining, through the involvement of civil authorities, actors and promoters of this problem, and environmentalists and protectors of water and the territory.	•	•
Plano Artemis: components: i. Reforestation.	Its area of operation is the country's PNN and its three objectives are: i. Stop deforestation;	_	
<li>ii. Prevention and state control of deforestation and trafficking of species.</li>	ii. Recover humid tropical forests; iii. Prosecute the perpetrators who are behind this ecocide.		
Macro forest nurseries dedicated to the germination and hardening of plant material from native species of trees, "frailejones" (a native species) and wax palms. In July 2023, there were 143 forest nurseries.	Es pionero en la germinación de semillas espeletia (frailejón) para resembrar el bosque de páramo. Entre 2016 y 2022 se plantaron 20 mil especies.	•	•
Support for the "El Balso" project led by the ACSOBALSO association. The project is supported by the Artillery Battalion N. 27 in Putumayo.	This agroforestry project aims to be a legal alternative for farmers dedicated to planting illicit crops.		•

#### Table 1. Initiatives advanced by the Army

Source: Own elaboration according to Franco (2021) and Gutiérrez (2019).

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Pa	TRIA, HON	OR, LEALT	D

High
 Medium
 Low



#### Table 2. Initiatives advanced by the Military Forces

			IMPACT LEVEL	
	INITIATIVES	COMMENTS	IN THE PZA	ECOSYSTEM RESTORATION
	Ayacucho Plan 2023 - 2026 brings together the objectives and actions aimed at fulfilling the constitutional mission, including facilitating national reconciliation, supporting the construction of total peace and allowing the development of a sustainable economy.	The Amazon Plan was set out in order to protect this ecosystem.	•	•
High	Comprehensive Climate Change Management Plan for the Security and Defense Sector.	Objectives: i. Reduce insecurity risks and deforestation rates; ii. Support the conservation and restoration of food security; iii. Seek solutions and GHG protection, reduction and mitigation; and, iv. Promote lines of action that are almost at advantation and strengtheoring	•	•
<ul> <li>Medium</li> <li>Low</li> </ul>		resilience in the face of changing climate conditions.		

Source: Own elaboration according to the General Command of Military Forces (2023) and the Ministry of National Defense (2022).

Thus, with regard to the private sector, three national examples can be brought up that impact on the mitigation of socio-environmental conflict associated with land use, and that also go hand in hand with the containment of the agricultural frontier. Not to mention that they are projects that work with communities and seek to reduce territorial climate impacts.

#### Table 3. Main private sector initiatives

			IMPACT LEVEL	
	INICIATIVES	COMMENTS	IN THE PZA	ECOSYSTEM CONSERVATION/ RESTORATION
Terrasos	Habitat bank models whose purpose is the conservation of biodiversity and the recovery of ecosystems. The two types of clients are the mining energy sector and infrastructure sector.	Pioneers in Colombia and Latin America. This business model allows financing conservation initiatives with private sector resources for 30 years under the principle of payment by results, so that compensation resources are not lost. Other economies are enabled from this environmental market. In 2023, eight projects covering more than three thousand hectares were underway.	•	•
ISA	The Jaguar Corridor Initiative.	In this initiative the jaguar is presented as a wide- range umbrella species. Likewise, through the conservation of this species and its habitat, other species are protected. This project does not generate environmental liabilities but welfare assistance, it is based on co-responsibility and its pillar or guiding principle is the social return on investment (SROI). In November 2023, three projects were underway.	•	•
BancO2	BancO2 Bio is a partnership between companies, governments and rural, peasant and ethnic communities around the conservation of natural ecosystems.	Economic initiative of payments for environmental services to benefit peasant families who are dedicated to the protection and conservation of forests. In November 2023, 107 companies were participating.	•	•

🔴 High

😑 Medium

Low

Source: Own elaboration according to BancO2 (2023), ISA (2023) and Terrasos (2023).

As can be seen in Tables 1, 2, and 3, the initiatives have in common the restoration, sustainable use, and conservation of the impacted ecosystem, and in this sense they are complementary. However, it is possible to affirm that those of the Army and Military Forces respond to a primary and fundamental need to stabilize the territory, while creating the necessary conditions for a transition to licit economies, such as agroforestry. On the other hand, private sector initiatives promote economic activities that align with the land's vocation and use; have the potential to promote long-term sources of employment; and can be replicated faster than those of the Military Forces in other territories.

## 5. Final considerations and recommendations

The recognition of nature as a victim and restorative subject of rights as a result of the environmental liabilities left by the armed conflict, and in particular the declaration of some ecosystems, such as the Colombian Amazon and the Atrato River, as subjects of rights obliges the state, at all levels, to mobilize to comply with High Courts orders. In parallel, the implementation of the Final Agreement, particularly Point 1, obliges the state to build territorial peace in the PDET municipalities. However, the great problem that the country has is the lack of state presence in the most conflictive territories and with greater natural wealth, in addition to institutional weakness and the lack of capacity and technical, administrative, and economic management to fulfill its commitments. Therefore, Colombia's historical opportunity to adapt to climate change while building territorial peace seems to be dilating.

It is then at this point that the initiatives of the Army, the Military Forces, and the private sector play a crucial role. First, because the military has the technical capacity and strength to reach anywhere in the country. Therefore, once the territory is stabilized, they can implement EbA and CbA actions and strategies through comprehensive action, which a civilian — whether an individual or a company — could not be due to the public order situation. If there were a state PDS based on natural security, these actions could be sustainable over time. Meanwhile, private sector initiatives and projects that are committed to economic reconversion and agroforestry are being consolidated in those territories that have a high ecological and ecosystem value, and low levels of violence. This duo could not only help the social, economic, and environmental reconstruction of the country.

Therefore, considering the *status quo* presented, it is valid to say that three groups of actors directly impact climate action and struggle. On the one hand, there is the public sector that shelters the Constitutional Court, the Supreme Court of Justice, JEP, the Army, and the Military Forces. On the other hand, the private sector is promoting different initiatives, including the three that were indicated in Table 3. Finally, we have the socio-environmental actor represented by indigenous peoples and nature as a subject *per se*. The actions presented here have a legal and political nature, with socio-environmental repercussions. However, they are not enough amid a scenario as complex as the Colombian one.

Finally, the recommendations raised here are not a panacea, but specific actions that reduce the intensity of the problems that were related in this policy paper. They are:

#### For the executive sector:

- Priority implementation of the environmental provisions of the Final Agreement and the PZA.
- Address the final initiatives of the PATR, such as EbA and CbA strategies.
- Comply with Judgment STC-4360 of 2018.
- Adopt a state PDS that gives continuity over time to the actions implemented by the Army and the Military Forces.

#### For the legislative sector:

• Support the creation of the National Forest Extension and Bioeconomy Service presented by the National Government. This service should promote a change of regional model in terms of policy and productive chains and create a forest inventory. From this, strengthen the forestry economy nuclei.



#### For the executive and judicial sector:

• It is taken for granted that every action of reparation on nature is aimed at the recovery of its initial state. However, this action must also implicitly have a component that prevents the deepening of socio-environmental conflicts associated with the use of territory and the quality of natural resources.

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# Climate mitigation efforts of the U.S. Armed Forces

Patrick Paterson<sup>1</sup> and Luis Bitencourt<sup>2</sup>

#### **Executive summary**

For the U.S. military, climate change is an extremely grave challenge that manifests in multiple ways. These interconnected climate threats represent the most serious security challenge to the United States and the international community since the threat of a nuclear confrontation during the Cold War. For example, the 2022 National Security Strategy states that "of all the shared problems we face, climate change is the greatest and potentially existential for all nations." In particular, the U.S. military sees climate change and global warming as fitting into four interrelated security challenges: (1) as a risk to military installations and infrastructure; (2) as a requirement for heightened humanitarian responses; (3) as a catalyst for civil unrest and disorder; and (4) as a principal cause for migration and internal displacement. The transformation of the U.S. armed forces represents a significant operational restructuring of the world's largest military.

To address these multifaceted challenges, this paper discusses and proposes a comprehensive set of recommendations designed to enhance resilience and adaptability of military installations and operations in the face of climate change. These recommendations, detailed subsequently, encompass a range of strategies from infrastructure adaptation to collaborative efforts with civil society, aiming to fortify the U.S. military's capability to respond effectively to the dynamic threats posed by a changing climate.

- Conduct vulnerability assessments of military installations, particularly seeking to identify risks from drought, flooding, excessive heat, sea level rise, energy demand, land degradation, wildfires, and extreme weather.
- Plan and budget for energy and utility autonomy for installations to include electricity, fresh water, water treatment facilities, and food.
- Budget and construct water desalination systems using renewable energy systems.
- Construct cooling centers with renewable energy systems.

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- Budget for basic human needs for refugee camps using the minimum humanitarian standards identified by The Sphere Project and The Humanitarian Charter and Minimum Standards (The Humanitarian Charter and Minimum Standards).
- Conduct exercises and rehearsals to establish refugee camps to include shelters (tents), solar lighting, adequate bathrooms, and food supplies.
- Work with civil defense forces, local organizations, non-government organizations, and other civil society groups to synchronize efforts and avoid redundancy of services.
- Identify other climate mitigation and adaptation efforts.

#### **KEYWORDS**

Department of Defense; Military; Climate Change; Threat.

# 1. Introduction

The U.S. Department of Defense considers climate change an extremely grave national security threat that manifests in multiple ways. Without rapid and substantial action, the consequences could be catastrophic on a global scale. The interconnected climatological threats represent an existential threat to humanity, the most serious security challenge to the United States and the international community since the threat of a nuclear confrontation during the Cold War. For example, the 2022 National Security Strategy states that "of all the shared problems we face, climate change is the greatest and potentially existential for all nations" (U.S. National Security Strategy, 2022, p. 9).

This report examines the development of U.S. government (USG) policy on climate change. This introduction will be followed by an explanation of how the U.S. Department of Defense (DOD) assesses the topic. In particular, the U.S. military sees climate change and global warming as fitting into four interrelated security challenges: (1) as a threat against military installations and infrastructure; (2) as a requirement for heightened humanitarian responses; (3) as a catalyst for civil unrest and disorder; (4) and as a principal cause for migration and internal displacement. To put these challenges into context, examples are drawn from the United States and Latin America.

# 2. The U.S. government position on climate change

Climate change mitigation efforts are a major focus of U.S. national security documents. In the National Security Strategy, published in October 2022, President Biden calls climate change "the greatest and potentially existential for all nations" (U.S. National Security Strategy, 2022, p. 9). The president has mobilized the entire U.S. government and all its branches to fight climate change and do everything within the government's ability to avoid crossing the critical warming threshold of 1.5 degrees Celsius, after which scientists have warned some of the most catastrophic climate impacts will be irreversible (The White House, 2021). On January 27th, 2021, during his first week in the White House, Biden issued Executive Order 14008, laying out an extensive and ambitious plan to slow global warming, effectively directing the U.S. government in a coherent and aggressive unified effort. In April of that year, he organized a climate change summit in Washington D.C. with leaders from more than 40 countries, including heads of state from Antigua and Barbuda, Brazil, Chile, Colombia, Jamaica, and Mexico.

Biden has also increased the pledge the country made to the international community. The U.S., the second largest emitter of greenhouse gas emissions, and the pollution it generates from its energy, industry, defense, and transportation sectors, has an impact on every other nation on the planet, regardless of their level of development. Under President Biden, the U.S. recognizes its moral imperative to reduce this transnational and global threat to humanity. In 2021, the U.S. presented a new Nationally Determined Contribution to the United Nations Framework for Climate Change (UNFCCC). Emissions reduction goals were increased: a 50-52 percent reduction of U.S. emissions by 2030 (below 2005 levels). That was a big jump over the pledges of the previous Democratic president, Barack Obama, who promised to reduce emissions by 25% by 2050 (Obama White House, 2015).

"The U.S., the second largest emitter of greenhouse gas emissions, and the pollution it generates from its energy, industry, defense, and transportation sectors, has an impact on every other nation on the planet, regardless of their level of development."

# 3. The Department of Defense (DOD) and the Office of the Secretary of Defense (OSD)

The U.S. Secretary of Defense, retired General Lloyd Austin, leads the largest U.S. government department. The Department of Defense is also the largest greenhouse gas emissions-producing organization globally, producing more pollutants from its operations and infrastructure than most countries<sup>3</sup> (Crawford, 2019). The DOD produces 56 percent of the federal government's emissions and 52 percent of its electricity use (Birnbaum, 2023). As directed by the president, Secretary Austin is tasked with reducing the department's carbon footprint.

It is a monumental task: reduce the emissions of the U.S. Department of Defense, transform military installations away from fossil fuels toward renewable energy, find ways to shift to alternate sources of jet, ship, and vehicle fuel, and, all the while, don't lose an inch on warfighting readiness. The latter part has been a particularly challenging idea considering Russia's aggression toward Ukraine, the Israel-Hamas conflict, and tensions with China.

But Secretary Austin knows what is at stake. "We face all kinds of threats in our line of work, but few of them truly deserve to be called existential. But climate crisis does deserve to be called existential", he said in April 2021 (Austin, 2021, 0:33). The need for climate resilience and adaptation is urgent. The department has suffered billions of dollars of damage from climate disasters and the country's warfighting capabilities have been weakened as a result.

On September 1st, 2021, the Department of Defense published an updated DOD Climate Adaptation Plan - CAP (U.S. Department of Defense, 2021a) partly because of President Biden's mandate to prioritize climate change security implications in all government activities, including key strategy, planning, and programming documents (The White House, 2021). The CAP focuses on two broad efforts: (1) adaptation initiatives to enhance climate change resilience and (2) mitigation actions to reduce greenhouse gas emissions. The plan includes five lines of effort: (1) climate-informed decision-making; (2) train and equip a climate-ready force; (3) resilient built and natural installation infrastructure; (4) supply chain resilience and innovation; and (5) enhance adaptation and resilience through collaboration. For example, the new military budget requires the U.S. armed forces to electrify all non-combat military vehicles by 2035 (Birnbaum, 2023). Each branch of the armed forces has also been directed to take climate mitigation efforts. The U.S. Army, Navy, Air Force, and Marines have developed their own climate action plans in 2022.

# 3.1. Protecting threat against military installations and infrastructure

One of the top priorities of the U.S.DOD is to protect its installations and bases from climate change threats. Without fully functioning installations, military personnel are unable to conduct training, maintain their readiness, and achieve their missions. For example, if a military base relies on energy from a public utility company and that system crashes because of a climate catastrophe, the military base may lose perishable foods, water, heating, air conditioning, lighting, communications, computers, fuel distribution systems, and wastewater disposal systems.

Additionally, the U.S. has a global footprint. According to the 2022 Base Structure Report, the U.S. has almost 650,000 facilities in the U.S. and in foreign countries with a value of \$1,6 trillion (U.S. Department of Defense, 2022). To put that in perspective, those DOD properties' value is twice the entire department's annual operating budget<sup>4</sup>.

"The need for climate resilience and adaptation is urgent. The department has suffered billions of dollars of damage from climate disasters and the country's warfighting capabilities have been weakened as a result."

<sup>3.</sup> Jet fuel consumption accounts for approximately 70 percent of operational energy (2014 data).

<sup>4.</sup> The 2023 National Defense Authorization Act into law allotted \$816.7 billion to the Defense Department.

According to department authorities, billions of dollars of equipment and facilities are at risk from climate effects, including drought, floods, fires, and extreme weather. A recent DOD study found that recurrent flooding, drought, and wildfires are the most common climate threats. Under Secretary of Defense for Acquisition and Sustainment, 2019). In the past few years, dozens of U.S. military bases have been struck by climate-induced disasters. Marine Corps bases in North Carolina suffered billions of dollars in damage from hurricanes in 2018. Offutt Air Force base in Nebraska, home to the U.S. Strategic Command and its squadrons of strategic nuclear bombers, had its runways closed by excessive flooding when the Missouri River overflowed its banks in 2019. Norfolk Naval Station, the largest military base in the world, sees frequent "sunny day flooding" because of rising sea levels that threaten base infrastructure that support nuclear aircraft carriers and dozens of other warships. Military exercises and operations at Naval Air Weapons Station (NAWS) at China Lake, California had to be canceled in 2020 because of wildfires. Military headquarters in Tampa, Florida, to include the Special Operations Command and the U.S. Central Command, were evacuated in September 2023 because of Hurricane Idalia<sup>5</sup>.

#### Image 1. U.S. 2023 Billion-Dollar Weather and Climate Disasters



Source: U.S. 2023 Billion-Dollar Weather and Climate Disasters from NOAA National Centers for Environmental Information (2023).

U.S. military officials consider vulnerability risk assessments as a critical first step in determining the level of exposure and adaptive capacity of a base or installation (Pinson et al., 2021). The DOD uses two systems to determine the potential physical damage to its installations. First, the DOD Climate Assessment Tool (DCAT) considers eight climate hazards: coastal flooding, riverine flooding, heat, drought, energy demand, land degradation, wildfire, and historical extreme weather events. (Gade et al. 2020). The most dominant climate hazard for all DOD installations is drought (Pinson et al. 2021). In April 2021, it used this methodology to assess the climate risks of almost 1,400 DOD installations (Gade et al. 2020). Facilities were graded on three factors: (1) the exposure of the base to climate hazards; (2) the sensitivity of the base to the hazards; and (3) and the adaptive capacity to reduce exposure and sensitivity. The cumulative vulnerability of the base is referred to as the exposure-sensitivity-adaptive capacity (ESAC) framing. Obviously, the least vulnerable bases would have low exposure and sensitivity and high adaptive capacity. The process also considers the importance of the installation and uses a weighted value of the importance of the factor, thereby providing a mixed methods assessment with both quantitative and qualitative scores.

As part of a separate vulnerability assessment, the DOD also conducted energy resilience tests. These events, called black start exercises, involved disconnecting base power from

5. According to one independent report, \$378 billion of U.S. military bases and installations are at risk because of climate change and extreme weather. See, for example, Lee *et al.*, 2023) and (Eversden, 2021).

"U.S. military officials consider vulnerability risk assessments as a critical first step in determining the level of exposure and adaptive capacity of a base or installation." the normal energy grid to determine if the base had sustained access to on-site power generation. It's a scenario that DOD authorities expect to occur frequently as climate shocks impact a region (e.g., blackouts caused by heat waves or overtaxed public power grids).

## 3.2. Heightened humanitarian responses

The second DOD priority for climate resilience are its missions of Humanitarian Assistance and Disaster Relief (HADR) and Foreign Disaster Relief (FDR). The 2022 National Security Strategy states, "the United States is the largest bilateral donor of humanitarian assistance and [...] we will sustain our leadership on humanitarian assistance and manage long-term refugee and displacement crises" (The White House, 2021). Domestic disasters — those within the 50 U.S. states or territories — are the responsibility of the Federal Emergency Management Agency (FEMA) and the states' National Guard. The latter has seen the operational tempo skyrocket because of climate catastrophes. According to Deputy Secretary of Defense, Kathleen Hicks, "the number of personnel days the National Guard spent on firefighting [within the United States] increased from 14,000 in 2016 to 176,000 in 2021, a twelve-fold increase in just five years and a major redirection of time, attention, and resources"(Garamone, 2023). In contrast to the National Guard, the U.S. active-duty military works almost exclusively overseas for foreign disaster relief but can be used for internal disasters and disturbances in exceptional cases.

The lead government agency for HADR efforts is the U.S. Agency for International Development (USAID). On average over the past five years, the US devoted about \$50 billion to foreign assistance and USAID received the lion's share of those funds, about \$20-\$25 billion each year. Portions go to global health and education initiatives, but about half of the annual budget (\$10 billion annually) is dedicated to humanitarian assistance, US-AID's largest program<sup>6</sup>. USAID's Bureau of Humanitarian Assistance (BHA) manages those funds and HADR operations when the need arises<sup>7</sup>. Within the U.S. system, the military is a "supporting" government agency, not the lead on foreign disaster relief. The DOD is only activated when BHA determines their assistance is required.

The U.S. government responds to dozens of natural disasters in other countries each year. For example, in 2021, the BHA responded to 82 crises in 69 countries and distributed more than eight billion dollars to disaster zones (U.S. Agency for International Development, 2021a; U.S. Agency for International Development, 2021b). Every geographic combatant command (called COCOMs), from the U.S. Southern Command to the U.S. Indo-Pacific Command, practices HADR responses through exercises and simulations each year. The U.S. military — as is true in most countries — brings important assets to an emergency zone. The DOD can provide the airlift, sealift, logistics, manpower, distribution of relief supplies, field hospitals, search and rescue teams, communications, evacuation of injured victims, tent encampments for displaced persons, debris removal, and provision of basic human needs for large groups. Thousands of U.S. service members, dozens of US naval vessels, hundreds of aircraft, and millions of dollars can be devoted to HADR response.

Here's an example. In 2013, Super Typhoon Haiyan struck the Philippine Islands as the most powerful typhoon ever to strike land in the Pacific with 195 mph winds. More than 6,293 victims perished, and another 27,000 were injured. Approximately 1.1 million homes were damaged or destroyed, and four million inhabitants were left homeless. A storm surge of 15-20 swept across many low-lying areas. The U.S. DOD launched Op. Damayan under Joint Task Force (JTF) 505 with a nuclear aircraft carrier, 80 aircraft, two guided missile cruisers, two guided missile destroyers, and several auxiliary and supply vessels. In total, JTF 505 included 14,000 U.S. military personnel who delivered 2,500 tons of relief supplies and evacuated 21,000 people (Klare, 2019, 40).

<sup>6.</sup> The U.S. maintains public records on the humanitarian assistance it provides to other countries. See the helpful Foreign Assistance Dashboard on the USAID and DOS homepage. Link: <a href="https://foreignassistance.gov/">https://foreignassistance.gov/</a>.

<sup>7.</sup> Formerly known as the Office of Foreign Disaster Assistance (OFDA), the name was changed to the Bureau of Humanitarian Assistance (BHA) in 2020.

"The most vulnerable nations are those with fragile government institutions or inadequate resources to react promptly to their citizens' needs. Ineffective responses by authorities contribute to the political populism, economic inequality, criminal activity, and migration crises that already bedevil many countries."

Catastrophic disasters — whether natural or man-made — can have devastating impacts on governments and communities and can create severe economic, political, and security consequences that may take years to restore. The most vulnerable nations are those with fragile government institutions or inadequate resources to react promptly to their citizens' needs. Ineffective responses by authorities contribute to the political populism, economic inequality, criminal activity, and migration crises that already bedevil many countries (Rettberg, 2015; Collier, 2003).

## 3.3. Civil unrest and disorder

The Office of the U.S. National Director for Intelligence (DNI), head of 18 federal agencies within the intelligence community, places climate threat as a national security threat on par with China, Russia, Iran, and North Korea. In a special 2021 National Intelligence Estimate (NIE), the DNI warns of geopolitical confrontations over resources, within the Arctic, or with Chinese fishing fleets that are sweeping the oceans of food, depleting the traditional food sources of millions of other people (U.S. National Director for Intelligence, 2021, 8).

Latin American nations face even more risk of civil unrest than the U.S. In opinion surveys conducted at the William J. Perry Center for Hemispheric Defense Studies, the DOD regional academic center that studies security and defense matters in Latin America and the Caribbean, almost one in every three respondents (31 percent) considered climate change one of the top security threats in the region. Global average temperatures have already surged more than 1.1 degrees Celsius since the pre-Industrial Revolution period in the 19th century. Worsening conditions seem to have accelerated in the past 50 years the world population surges toward 11 billion by 2100. The most recent year (as of this writing in December 2023) was the hottest in human history. The World Meteorological Organization predicts the next five years will be even hotter, partly because of the return of El Niño in the Pacific Ocean (U.S. National Director for Intelligence, 2021, 11). In an extremely dire assessment, scientists warned humanity that it was also on track to hit 3.2 degrees Celsius by 2100, conditions that would probably lead to an extinction-level event for humanity. (United Nations Intergovernmental Panel on Climate Change (IPCC), 2022, section C.1).

In testimony before the U.S. Congress in January 2019, the former Director of National Intelligence, Dan Coats, referred to climate change as a "threat multiplier" and stated that climate change is "likely to fuel competition for resources, economic distress, and social discontent" (U.S. Director of National Intelligence, 2019, p. 23). One author described it this way:

(...) many governments in Asia, Africa, and the Middle East are already on edge in terms of their ability to provide basic needs: food, water, shelter, stability. Climate change will exacerbate those problems and challenge the ability of governments to provide effective governance. Climate change acts as a threat multiplier for instability in some of the most volatile regions of the world" (Klare, 2019, p. 21).

In Latin America as an example again, all this is, of course, bad news for communities which suffer from rampant crime, weak government institutions, a reliance on the informal economy, and corruption. Poverty, for example, averages about 40 percent among Central American nations and 30 percent in South America, according to the World Bank (Paterson, 2023). Members of vulnerable groups — the elderly, infants, farmers, displaced persons and immigrants, and the poor — are fifteen times more likely to die from climate disasters, according to the United Nations' Intergovernmental Panel on Climate Change (IPCC, 2023).

The public in most countries in Latin America is already suffering from a crisis of confidence in political parties and leaders. Subsequently, the region has seen a deterioration

"Members of vulnerable groups — the elderly, infants, farmers, displaced persons and immigrants, and the poor — are fifteen times more likely to die from climate disasters, according to the United Nations' Intergovernmental Panel on Climate Change."

of democratic standards for seventeen consecutive years, according to the think tank Freedom House<sup>8</sup> (Freedom House, 2023).

As climate conditions worsen, more frequent climate catastrophes will delay the recovery efforts and strain limited resources of governments. Displaced persons will resort to looting and illicit activities to find food and goods. Food and water crises will lead to public protests which may be met with shows of force by security forces as has been seen in Colombia, Chile, Honduras, and Nicaragua recently. The number of migrant and displaced persons will swell. Refugee camps will spring up wherever it is feasible. State security forces will be overstretched because of the heightened tempo of operations. Declarations of prolonged states of emergency, constitutionally permissible in every Latin American country, will anger citizens, contributing to additional unrest. Excessive force incidents by security force members will generate more public anger and protests, a vicious cycle that results in more violence. Under the worst-case scenario, countries face a collapse of the government or perhaps even a societal collapse.

Image 2. How climate change causes insecurity and instability



Source: How climate change causes insecurity and instability, own work (2023).

# 3.4. Migration and internal displacement

The last of the four focus areas for the U.S. is for climate-induced migration and displaced persons. Climate disasters have been increasing in frequency and intensity in the U.S. The number of billion-dollar disasters, for example, have risen every decade since the events were tracked. These immensely costly disasters come in the form of droughts, hurricanes, forest fires, and flooding. In the 1980s, for example, there were 33 natural disasters in which damages exceeded one billion dollars. That increased to 57 in the 1990s, 67 in the 2000s, and 131 in the 2010s. In the first three years of the most recent decade (2020-2023), there have already been 60 megaevents. The country is on track to break the previous annual record (National Centers for Environmental Information (NCEI), 2023).

Every one of these events leaves inhabitants homeless and often with the destruction of all their possessions and property. California, for example, has suffered from severe drought and consequently severe fire seasons. Global warming in the U.S. have created hot, dry conditions in many western states permitting wildfires to spread faster and burn more intensely. The 2018 Camp Fire, for example, was the deadliest and most destructive in Californian history. Because of extremely dry conditions and strong winds, the fire raged out of control for more than two weeks, took 85 lives, and destroyed 18,000 homes

<sup>8.</sup> Populist leaders will ride the sentiment of frustrated constituents into office and begin to roll back the systems of checks and balances so important in healthy democracies, leading to a weakening of the rule of law.

and buildings. Climate events have become so severe in the United States that personal property and homeowners' insurance companies have refused to offer protection policies in parts of Florida and California, heightening the risk for many Americans.

The U.S. is also witnessing a worsening humanitarian crisis along its southwestern border. For the second year in a row, illegal crossings at the U.S.-Mexico border have surpassed more than two million, far exceeding previous years' totals (Wu, 2023). This year, 2023, will probably mark a record in the number of people trying to enter the U.S. Climate change is driving the forced exodus from parts of Latin America.

In the DNI's National Intelligence Estimate (NIE), mentioned previously in this report, the five most vulnerable countries in Latin America and the Caribbean are Colombia, Guatemala, Haiti, Honduras, and Nicaragua. These countries "lack the financial resources or governance capacity" and have "heightened risk of instability induced migration and displacement flows" (U.S. National Director for Intelligence, 2021, 8). In Honduras, for example, climate change is the most widely cited reason to migrate, beating out employment opportunities or parents' fear for their children's safety from gangs and violence. In fact, 85 percent of those surveyed for their reasons to migrate from Central America stated that they had experienced at least three times climate disasters such as drought, hurricanes, flooding, crop failure, or food shortages.

Conditions are likely to worsen. According to the World Bank, 17 million people could be forced to abandon their homes because of climate change problems such as hurricanes, droughts, and floods. Nearly 5.8 million Latin Americans and Caribbean citizens could fall into extreme poverty by 2030, as climate change reduces access to safe drinking water and increases vulnerability to excessive heat and flooding (World Bank, 2023).

#### Image 3. Annual southwestern border apprehensions

By fiscal year, from October to September



Source: Annual southwestern border apprehensions from Wu (2023).

"Climate change represents the greatest threat that humanity has ever faced. Unless rapid and sustained reduction in greenhouse gas emissions occurs quickly, global warming conditions may reach a point of irreversibility as "tipping points" provoke positive feedback cycles and a runaway greenhouse gas effect, conditions that would probably lead to an extinction level event for the human race."

# 4. Conclusion

Climate change represents the greatest threat that humanity has ever faced. Unless rapid and sustained reduction in greenhouse gas emissions occurs quickly, global warming conditions may reach a point of irreversibility as "tipping points" provoke positive feedback cycles and a runaway greenhouse gas effect, conditions that would probably lead to an extinction level

"Nearly 5.8 million Latin Americans and Caribbean citizens could fall into extreme poverty by 2030, as climate change reduces access to safe drinking water and increases vulnerability to excessive heat and flooding."

event for the human race. (McKay, D.I.A. *et al.*, 2022; Ripple, W.J. *et al.*, 2023a; Kemp, L. *et al.*, 2022; Ripple, W. *et al.*, 2023b)

The United States is the second largest emitter of dangerous greenhouse gases, and the U.S. Department of Defense is the largest polluting organization in the world. This article examines four urgent actions that the U.S. Department of Defense is pursuing to prepare for the worst consequences of climate change: the threat against military installations and infrastructure; the requirement for heightened humanitarian responses; civil unrest and disorder; and increased migration and internal displacement. Word limits on this report prevent an examination of two other important topics, ones that are worthy of their own lengthy analysis: (1) how to reduce the greenhouse gas emissions from DOD infrastructure, such as heating and cooling for buildings, and (2) how to maintain a warfighting primacy as the world's most powerful military while transforming equipment of the armed forces to renewable energy systems.

Given the urgent challenges identified, we propose a comprehensive suite of eight essential and pragmatic recommendations:

#### Recommendations

• Conduct vulnerability assessments of military installations, particularly seeking to identify risks from drought, flooding, excessive heat, sea level rise, energy demand, land degradation, wildfires, and extreme weather.

- Plan and budget for energy and utility autonomy for installations to include electricity, fresh water, water treatment facilities, and food.
- Budget and construct water desalination systems using renewable energy systems.
- Construct cooling centers with renewable energy systems.
- Budget for basic human needs for refugee camps using the minimum humanitarian standards identified by The Sphere Project and The Humanitarian Charter and Minimum Standards (The Humanitarian Charter and Minimum Standards).
- Conduct exercises and rehearsals to establish refugee camps to include shelters (tents), solar lighting, adequate bathrooms, and food supplies.
- Work with civil defense forces, local organizations, non-government organizations, and other civil society groups to synchronize efforts and avoid redundancy of services.
- Identify other climate mitigation and adaptation efforts.

These measures are not only crucial for reducing the DoD's environmental footprint but also for maintaining operational readiness in a rapidly changing world. This strategic approach reflects an understanding of the intricate relationship between environmental stewardship and national security, marking a pivotal shift towards a more sustainable and resilient defense posture.

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# Guatemala and its actions in the face of climate change

#### Genners Arturo Barrios Garay<sup>1</sup>

## **Executive summary**

Due to its geographical position, Guatemala is one of the countries in the Central American region most affected by the impact of natural phenomena, both of geological and hydrome-teorological origin — the latter associated with climate change and variability, which are increasingly frequent and intense, generating loss of human lives, property and livelihoods.

Anthropogenic activities such as industrialization, means of transport, forest and non-forest fires, changes in land use, deforestation and occupation of areas susceptible to droughts are among the immediate causes of climate change. The increase in greenhouse gases raises the average temperature in an accelerated manner and limits the living conditions of families and their food security.

Guatemala seeks to minimize the impact of climate change and variability through its policies, laws and international commitments. Coordination and overcoming political barriers — such as the lack of interest of governments in power to provide continuity to commitments and agreements — and economic barriers are challenges for the conservation, protection and sustainable use of the country's natural resources. The support of national public and private entities, academia, research institutes and international cooperation are also tools for the fulfillment of internal and international goals and commitments.

Although Guatemala does not generate high greenhouse gas emissions, it is very vulnerable to climate change. Climate action could adapt the country to change and, at the same time, support the reduction of poverty and inequality gaps in the most vulnerable populations.

For adaptation and mitigation measures to be more effective, in order to reduce vulnerability to the impact of climate change and variability, the development, monitoring, evaluation and reporting of actions must be based on inclusive national policies and international commitments. And for this to happen, Guatemala's ancestral knowledge and practices, worldview and cultural diversity must be prioritized — a change in relation to the current model.

#### **Policy recommendations**

• Guatemala has a strong legal basis on the issue of Climate Change, which is why it is necessary for the governments in power to give support so that these policies are complied with

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#### 1. Geographical and cultural context of Guatemala

The name of Guatemala originates from the Mexican language Nahuatl, which means place of many trees. It has an area of 108,889 km<sup>2</sup>, and the territory is divided into 22 departments and 340 municipalities. Altitudes range from zero to 4,272 meters above sea level. Furthermore, its location in the tropical strip and the influence of the Pacific and Atlantic oceans have been decisive for the country's climatic conditions, with several regions, each with its own climatic characteristics due to the effect of regional topography, vegetation, geology and soil types. Volcanic activity is associated with the geological conformation due to the interaction of three tectonic plates: North America, the Caribbean and Cocos, as well as biological diversity under the category of megadiverse countries. It is a tourist destination of great natural interest, and its cultural diversity is made up of different ethnic groups, multilingual and distributed throughout the country.

This has allowed the country to be considered as megadiverse, also generating the ideal conditions for agricultural production, both for local consumption and export, different species of forests, among other activities that are an important part of the country's economy, which are based on the use of natural resources (Guatemala, n.d.; MARN, SGCCC and PNUD, 2021).

## 1.1. Climatic regions of the country

Guatemala possibly has more than 1,171 endemic plant species, about 15% of endemism with respect to the total number of reported species. At least 8 regions have been identified as particularly important and priority for conservation due to the endemism of the species they represent (United Nations Decade on Biodiversity, 2020).



Figure 1. Map of climatic regions

Source: INSIVUMEH, 2017.

#### **Caribbean Region**

Altitudes range from 0 to 900 meters above sea level. The altitude rises as long as one enters the territory where there are warm climates, varying between very humid, humid and semi-dry, and without a well-defined dry season.

#### **Eastern Valleys Region**

The main feature is the rainfall deficiency. The factor that defines the conditions of the region is the Sierra de las Minas, which leaves it without humidity, filtering only warm air. In this region, there are warm climates, varying in character from semi-dry without a well-defined dry season.

#### Western Region

It is the most mountainous region of the national territory. The mountains have altitudes ranging from 1600 to 4200 meters above sea level. These geographical features allow the generation of a great diversity of microclimates. There are climates that vary from temperate and semi-cold, to humid and semi-dry.

#### **Boca Costa Region**

It is the decline from the plateau towards the Pacific coastal plain. Together with the northern section, it has the highest precipitation rates in the country. Temperature levels increase as it descends towards the coast. They reach a certain stability in the regions near the sea. There is a generalized climate of semi-warm and without a well-defined cold season, with a very humid character without a well-defined dry season.

#### **Pacific Coast Region**

It descends from 600 to 0 meters above sea level. With less intense rainfall than the Boca Costa, which tends to decrease nearby the sea coast. Temperature records are high. And there are warm climates without a well-defined cold season, with a humid character varying to semi-dry.

#### **Central Plateau Region**

It is considered a mountainous region, which favors the development of microclimates, its elevations range between 1000 and 2500 meters above sea level. There are climates that vary from temperate and semi-cold, to humid and semi-dry.

#### **Northern Traversal Strip Region**

Altitudes range from 900 to 2000 meters above sea level. It is very rainy, and the highest records are obtained from June to October. Temperature levels drop as altitude increases, with the highest temperatures between May and September. There are very humid warm climates with no well-defined cold season.

#### **Northern Region**

Altitudes range from 0 to 900 meters above sea level. It is a very rainy area, it rains throughout the year, although the heaviest rainfall is recorded from June to October. The average temperature records range from 20 to 30°C. In this region there are very humid, humid, semi-dry warm climates with no well-defined dry season.

# 2. Legal framework and international commitments related to climate change

Due to political conditions, violence and crime, the Guatemalan population is affected in the exercise of (or excluded from) their rights. Other factors such as low access to health, education, employment, decent housing, food security, water, discrimination, among others, also influence and do not allow adequate development, being more noticeable in indigenous peoples and women communities in the rural area of the country.

"Although Guatemala has a legal framework based on laws, plans and strategies for climate action (...) social conditions and the vulnerability of the territory create even more complex conditions for climate action and for the availability of natural resources."

Although Guatemala has a legal framework based on laws, plans and strategies for climate action — such as the Political Constitution of the Republic, Framework Law on Climate Change (Decree 7-2013 of the Congress of the Republic), National Policy for Climate Change, National Action Plan for Climate Change (PANCC, for its acronym in Spanish), National Strategy for the Reduction of Deforestation and Degradation of Forests in Guatemala, among others —, social conditions and the vulnerability of the territory create even more complex conditions for climate action and for the availability of natural resources.

The Political Constitution of the Republic indicates, in Article 19, that the obligations of the state are, in paragraph: "c) To adopt the necessary measures for the conservation, development and efficient use of natural resources"<sup>2</sup>.

The general objective of the National Policy for Climate Change (Governmental Agreement 329-2009) is:

(...) That the state of Guatemala, through the Central Government, municipalities, organized civil society and citizens in general, adopt risk prevention practices, reduce vulnerability and improve adaptation to climate change, and contribute to the reduction of greenhouse gas emissions in its territory and to the improvement of the quality of life of its inhabitants and strengthen its advocacy capacity in international climate change negotiations (...) (MARN, 2009, p. 10)<sup>3</sup>.

However, data presented in the Third Communication on Climate Change indicate that 14 of the 38 major basins of Guatemala have high levels of physical and biological contamination and toxic pollutants, and that the estimated annual deforestation rate is 38,356 hectares, due to unsustainable forest products activities, expansion of territories for livestock, agriculture, expansion of urban and industrial infrastructure. Another important fact is that only 49% of the population has a sewerage system for wastewater (MARN, SGCCC and PNUD, 2021).

Guatemala, through Decree 15-95 of the Congress of the Republic, is part of the United Nations Framework Convention on Climate Change (UNFCCC), in order to stabilize the levels of Greenhouse Gases (GHG) generated by human activity.

The Paris Agreement (2015) seeks to carry out joint actions to reduce GHGs, through emission reduction commitments submitted by each country — the Nationally Determined Contributions (NDCs), which include mitigation and adaptation measures to the effects of climate change. On October 27, 2016, Guatemala was added to the countries that ratified the Paris Agreement, through Decree Number 48-2016 of the Congress of the Republic.

In its NDC, Guatemala has presented two proposals for the reduction of GHG emissions. The first is a "Non-conditional Proposal", in which the country plans, with its own capabilities, a reduction of 11.2% of its total GHG emissions from the base year 2005 projected to 2030. The second is a "Conditional Proposal", which submits a reduction of up to 22.6% of its total GHG emissions from the base year 2005 projected to 2030, whose achievement is conditional on having the technical and financial support of new and additional public and private international resources (MEM, 2013). Guatemalan climate action also incorporates the National Development Plan — KATUN 2032 —, in an articulated, coherent and systematic effort of the Sustainable Development Goals (SDGs) to 2030, with a low emissions focus.

"In its NDC, Guatemala has presented two proposals for the reduction of GHG emissions. The first is a 'Non-conditional Proposal', in which the country plans, with its own capabilities, a reduction of 11.2% of its total GHG emissions from the base year 2005 projected to 2030. The second is a 'Conditional Proposal', which submits a reduction of up to 22.6% of its total GHG emissions from the base year 2005 projected to 2030, whose achievement is conditional on having the technical and financial support of new and additional public and private international resources."

<sup>2.</sup> Original source: "c) Adoptar las medidas que sean necesarias para la conservación, desarrollo y aprovechamiento de los recursos naturales en forma eficiente."

<sup>3.</sup> Original source: "(...) Que el Estado de Guatemala, a través del Gobierno Central, las municipalidades, la sociedad civil organizada y la ciudadanía en general, adopte prácticas de prevención de riesgo, reducción de la vulnerabilidad y mejora de la adaptación al cambio climático, y contribuya a la reducción de emisiones de gases de efecto invernadero en su territorio, coadyuve a la mejora de la calidad de vida de sus habitantes y fortalezca su capacidad de incidencia en las negociaciones internacionales de cambio climático (...)".

# 3. Adaptation and mitigation actions in Guatemala in the face of climate change

As a guide for this document, the Framework Law on Climate Change, Decree 7-2013, is taken as a basis to identify the different actions that have been achieved since its creation for the benefit and better use of the country's natural resources. It is worth considering the priorities or plans of the governments in charge on the issue of climate change and variability to give it the necessary impetus so that these actions have the expected results. Not only is the government responsible for the best use of natural resources, but also the inhabitants, organized civil society, business organizations, among others. We must all contribute with actions from our daily activities, such as the best use of water resources, proper management of solid waste, rational use of electrical energy and fossil fuels, among others.

#### **3.1 Development of national capacity**

From the institutional point of view, the Framework Law on Climate Change, Decree 7-2013, specifically in Chapter III, Development of National Capacities, points to the creation of entities such as:

**National Council on Climate Change** chaired by the Presidency of the Republic, with public and private participation from different sectors of the country. The functions of this Council include the regulation, supervision of the implementation of actions, conflict resolution, and tracking of the actions derived from this law, including the national climate change policy, the climate change fund, strategies and action plans and programs on mitigation (emission reduction) and adaptation to the impacts of climate change (Gobierno de Guatemala, 2013).

**National Climate Change Information System** (SNICC, for its acronym in Spanish), so that all public and private entities provide information related to GHG emissions and reduction, vulnerability and adaptation to climate change required by the Ministry of Environment and Natural Resources, necessary to carry out the country's mandatory national communications (Gobierno de Guatemala, 2013).

Land Use Regulation for Climate Change Adaptation and Mitigation, the Secretariat of Planning and Programming of the Presidency (SEGEPLAN, for its acronym in Spanish) prepared, in 2018, the Methodological Guide for the Preparation of the Municipal Development Plan and Land Use Regulation in Guatemala (Government of Guatemala, 2013).

This methodological guide seeks to manage planning and land use regulation at the municipal level in the processes of coordination and organization, political decisions by local authorities, in order to go beyond government periods, carry out technical activities, have the budget for strategic planning and capacity building, and make decisions about development. All of this is based on knowledge of the territory, social, economic, cultural, environmental, and political-institutional dynamics, in other words, recognising the problems and potentialities that limit or promote progress (SEGEPLAN, 2018).

In 2022, only 06 of 340 municipalities had implemented a land use regulation plan: Guatemala, Antigua Guatemala, Quetzaltenango, Salcajá, Poptún, and Villa Nueva; although 91 municipalities have this document, in compliance with the K'atun 2032 National Development Plan and the 2030 Agenda of the SDGs (Martínez, 2022).

Although article 142 of the Municipal Code establishes the Land Use Regulation Plans as mandatory, there has been little progress, mainly due to changes in municipal authorities every four years, and lack of economic resources and support from the central government for their implementation. Other factors that delay the implementation of land use regulation

"Although article 142 of the Municipal Code establishes the Land Use Regulation Plans as mandatory, there has been little progress, mainly due to changes in municipal authorities every four years, and lack of economic resources and support from the central government for their implementation." plans are the lack of participation and consensus of the population, pressure on natural resources, due to the accelerated change in land use, opposition from some landowners due to the uses and regulations that such plans could apply to their properties, among others.

**Guidelines for the reduction of vulnerability,** these were developed based on article 14 of the Framework Law on Climate Change, Decree 7-2013, on the issue of adaptation, and with the support of the Alliance for Resilience in 2018. These consist of actions for the reduction of vulnerability, the improvement of adaptive capacity. In addition, they are technical tools that describe the steps to be followed in the processes of planning and implementing adaptation measures to the risk of extreme hydrometeorological events, in the following sectors: Infrastructure, Biodiversity, Agriculture, Coastal Marine Zone, and Health.

The Alliance of Biodiversity International and the International Center for Tropical Agriculture (CIAT, for its acronym in Spanish) with research-based solutions to the global crises of malnutrition, climate change, biodiversity loss and environmental degradation, have supported since 2018 the implementation of climate services that integrate information adapted to users' needs in order support decision making in the field, and avoid losses at the local level, in particular, the Agroclimatic Technical Committees (MTA, for its acronym in Spanish). The Alliance of Biodiversity International and CIAT have the support of several entities, mainly the Ministry of Agriculture, Livestock and Food (MAGA, for its acronym in Spanish) and the National Institute of Seismology, Volcanology, Meteorology, and Hydrology (IN-SIVUMEH, for its acronym in Spanish) as strategic partners for the development of the MTAs.

(...) The MTAs in Guatemala are open spaces for dialogue between actors representing different public and private institutions, associations, academies, cooperatives, Non-Governmental Organizations, and international cooperation, among others, together with local agricultural producers in each region, in order to try to understand the possible behavior of the climate in a locality. Based on seasonal climate information and meteorological information issued by INSIVUMEH, agroclimatic recommendations are analyzed, discussed and issued to help reduce risks related to climate variability (...) (Hernández-Quevedo, 2022, p. 13)<sup>4</sup>.

In 2023, there were 19 active MTAs, whose area of influence covers 100% of the national territory, as shown in the following picture.

**Figure 2.** Agroclimatic Technical Committees in Guatemala and areas of influence of the different initiatives



Source: Hernández-Quevedo, 2022, p. 14.

<sup>4.</sup> Original source: "(...) Las MTA en Guatemala son espacios abiertos de diálogo entre actores representantes de diferentes instituciones públicas, privadas, asociaciones, academias, cooperativas, Organizaciones No Gubernamentales y de cooperación internacional, entre otras, unidas a los productores agropecuarios locales de cada región, con el propósito de procurar comprender el posible comportamiento del clima en una localidad. Basados en la información climática estacional y la información meteorológica que emite el INSIVUMEH, se analizan, discuten y emiten recomendaciones agroclimáticas que ayuden a disminuir los riesgos relacionados con la variabilidad climática (...)."

"These forecasts designed to suit users are making it possible to offer products for the implementation of better climate services in Guatemala in relation to the management of agriculture and food security, water, disaster risk reduction, health and energy, better performance of crops, vegetation indices, among others."

The climate forecasts used and presented in the MTAs are developed with the New Generation of Forecasts "NextGen". These seasonal probabilistic forecasts generated by IN-SIVUMEH with the support of the International Research Institute for Climate and Society (IRI) provide useful information for making climate-smart decisions. These forecasts designed to suit users are making it possible to offer products for the implementation of better climate services in Guatemala in relation to the management of agriculture and food security, water, disaster risk reduction, health and energy, better performance of crops, vegetation indices, among others.

In the Monitoring and Evaluation Report of the Agroclimatic Technical Committees (MTA) in Guatemala 2022, it is identified that:

(...) 84% said that the forecast of the amount of rain was accurate, showing the degree of confidence of users of the weather information generated by the meteorological service. There are some variations in confidence among some MTAs, particularly in committees such as Quiché, Huehuetenango, and Totonicapán, where between 35-40% say they have average confidence in the information. Only in two cases, the committees of El Progreso and Izabal, the information was not correct (...) (Hernández-Quevedo, 2022, p. 39)<sup>5</sup>.

The agroclimatic bulletins are considered to be the tangible products of the MTAs. These have information on the conditions of the last months or years of climatic variables of interest, local climate prediction, probability of occurrence of rainfall above normal, normal or below normal, the implications of climate prediction in different phenological phases of crops, and a set of recommendations to reduce negative impacts or take advantage of opportunities in relation to the given forecast.

Figure 3. PETÉN Agroclimatic Technical Committee



Source: CGIAR, 2022.

The bulletins highlight good practices and general information on agriculture and are written in a simple, easy-to-understand way. They are designed to be used as a guide for agricultural technicians, who in turn can pass them on to farmers. There are bulletins that are translated into the main Mayan languages that are used in the MTA, where farmers speak these languages (Hernández-Quevedo, 2022).

<sup>5.</sup> Original source: "(...) el 84% manifestó que el pronóstico de cantidad de lluvia fue acertado, mostrando el grado de confianza de los usuarios de la información climática que genera el servicio meteorológico. Existen algunas variaciones de la confianza entre algunas MTA, particularmente en mesas como Quiché, Huehuetenango y Totonicapán, donde entre el 35-40% manifiesta tener confianza media en la información. Únicamente en dos casos se computó nada acertada la información, siendo estas las mesas de El Progreso e Izabal (...).



Figure 4. Quetzaltenango Agroclimatic Technical Committee in Mam language - CDRO

Source: CGIAR, 2022.

**The National Action Plan for Climate Change** (PANCC, for its acronym in Spanish) arises in compliance with Article 11 of Decree 7-2013. It has two versions: the first was in October 2016, and the following version was updated in 2018. The General Purpose of this is:

(...) to define, in a clear and orderly manner, the main actions and guidelines that government institutions and other sectors of the state must follow in order to effectively contribute to reducing the vulnerability of the majority of the national population, to expand the country's adaptive capacity and to reduce greenhouse gas emissions, in the face of the threat of the effects of the phenomenon of climate change and climate variability (Guatemala, 2018, p. 17)<sup>6</sup>.

Moreover:

The PANCC Specific Objectives (OE, for its acronym in Spanish) refer to what is expected from the Plan as an instrument for better government management and decision making in general terms. This is an area that is located above thematic management and rather concerns the highest levels — those with the capacity for planning and inter-institutional coordination — because they are transversal in nature.

OE1: Operationalize the Framework Law on Climate Change, the PNCC, and the other national and international instruments related to the subject.

OE2: Guide public institutions and other sectors of the state linked to the issue, regarding the actions to be implemented in the short, medium and long term.

OE3: Guide the preparation of institutional strategic plans, defining priorities in sectoral, territorial and institutional planning.

OE4: Define criteria for prioritizing public investment linked to the implementation of actions to reduce vulnerability and promote adaptation to the effects of climate change.

<sup>6.</sup> Original source: "definir, de forma clara y ordenada, las principales acciones y lineamientos que las instituciones de gobierno y demás sectores del Estado deberán seguir a efectos de contribuir de manera efectiva a la reducción de la vulnerabilidad en que se encuentra la mayoría de la población nacional, a ampliar la capacidad de adaptación del país y a reducir las emisiones de gases efecto invernadero, ante la amenaza de los efectos del fenómeno del cambio climático y la variabilidad del clima."

"The National Energy Plan 2017-2032 was prepared in 2016, to comply with Article 18 of the Framework Law on Climate Change, to improve the consumption and use of renewable natural resources, implement technologies to improve efficiency and energy savings, and reduce greenhouse gas emissions."

OE5: Define priorities for international cooperation (Guatemala, 2018, p. 17)<sup>7</sup>.

**The National Energy Plan 2017-2032** was prepared in 2016, to comply with Article 18 of the Framework Law on Climate Change, to improve the consumption and use of renewable natural resources, implement technologies to improve efficiency and energy savings, and reduce greenhouse gas emissions. It has three strategic axes:

1) Use of renewable resources

2) Energy efficiency and saving

3) Greenhouse gas emissions reductions

Each of these axes indicates actions for all the subsectors and actors that make up the energy sector.

In national energy consumption, own consumption refers to the energy that is generated and used for the transformation of a primary energy into a secondary one, for example, the energy that is needed for the operation of auxiliary services in a power generation plant. In turn, losses represent all energy that is not used. The transport sector corresponds to the transfer of cargo or passengers. Finally, the industrial, residential, commercial, and service sectors refer to the economic activity in which energy is used and needed.





Source: MEM, 2013, p. 45.

In addition, Guatemala uses different types of energy for different end uses, and its consumption depends on this. For example, oil derivatives such as gasoline and diesel are used in the transportation sector, while firewood and LPG are used in the residential sector for cooking and heating purposes.

7. Original source: Los Objetivos Específicos del PANCC (OE) se refieren a lo que se espera del Plan como instrumento que sirva para la mejor conducción del gobierno y la toma de decisiones en términos generales. Se trata de un ámbito que se ubica por encima de la gestión temática y más bien atañe a las más altas esferas - aquellas con capacidad dispositiva para la planificación y la coordinación interinstitucional - porque son de carácter transversal.

OE1: Hacer operativos la Ley Marco de Cambio Climático, la PNCC y los demás instrumentos nacionales e internacionales vinculados a la temática.

OE2: Orientar la institucionalidad pública y demás sectores del Estado vinculados a la temática, respecto a las acciones a ser implementadas en el corto, mediano y largo plazo.

OE3: Orientar la elaboración de los planes estratégicos institucionales, definiendo las prioridades en la planificación sectorial, territorial e institucional.

OE4: Definir criterios de priorización de la inversión pública vinculada a la implementación de acciones para reducir la vulnerabilidad y promover la adaptación ante los efectos del cambio climático.

OE5: Definir prioridades para la cooperación internacional.

The most used energy in Guatemala in 2016 was firewood, and this corresponds to an economy where there are few energy-intensive industries, such as steel or mining; the Trade and Services is the sector with the highest share in the national GDP, which has a very low energy intensity. This leads to an energy matrix dominated by energy use in both the residential and transportation sectors. The transportation sector is represented through the consumption of gasoline and diesel, and although the industrial sector also consumes diesel, its participation is very low when compared to cargo and passenger transportation (MEM, 2013).

#### Figure 6. Participation of the different energy resources at the national level



Source: MEM, 2013, p. 46.

For 2016, national electricity generation was predominantly from hydroelectric generation, with an energy contribution of 3,951 GWh, followed by coal generation, with a contribution of 3,533 GWh.

Additionally, it is important to mention the participation of renewable energies in the electric energy matrix, since during 2016, 58% of the national electric generation was obtained from renewable energy sources, while the other 42% was obtained from non-renewable sources.

In 2016, it was estimated that 18.44 million tons of carbon dioxide were emitted, of which approximately 50% correspond to land transportation and then 32% correspond to electricity generation activities.

In order to comply with the objectives of the National Energy Plan, three strategic areas of intervention have been proposed to guide and provide guidelines for the growth of the country's energy sector. These actions are aimed at fulfilling the objectives of the different instruments of the country's various policies:

#### Sustainable use of renewable resources

It aims to prioritize the use of renewable natural resources for the generation and consumption of electricity. Renewable resources must be used sustainably over time so as not to compromise the resources of future generations, achieving environmental and climate benefits through the reduction of greenhouse gas emissions.

#### **Energy efficiency and saving**

The second axis of this plan strengthens the objectives and actions of the fourth axis of the Energy Policy 2013-2027, to promote the efficient use of energy consumption in the country's residential, commercial, institutional, and commercial sectors. The plan also

"...it is important to mention the participation of renewable energies in the electric energy matrix, since during 2016, 58% of the national electric generation was obtained from renewable energy sources, while the other 42% was obtained from non-renewable sources." emphasizes existing implementation mechanisms and new methodologies for energy saving and efficiency.

#### **Reduction of greenhouse gas emissions**

The third axis frames the importance of carrying out the actions proposed in this Plan, in its two previous axes, demonstrating the amounts of greenhouse gas emissions that can be reduced by sector, contributing to the mitigation of the effects of climate change.

The GHG emission reduction target proposed by this National Energy Plan (PNE, for its acronym in Spanish) is 29.2% by 2032. This 29.2% reduction implies that emissions, in a BAU scenario of 16.82 million tons of CO2 equivalent by 2032, will be reduced to a value of 11.91 million tons of CO2 equivalent in that year. It is important to mention that compliance with the actions proposed in this plan promotes a reduction in emissions beyond the 11.2% established as a contribution to emissions reduction described in the NDC for the energy sector.

## 4. Final considerations

The purpose of this article is to show that Guatemala has a legal framework on Climate Change, such as the Framework Law on Climate Change, from which several actions are derived, such as the National Climate Change Action Plan, the National Energy Plan, the Methodological Guides for the Reduction of Vulnerability, among others, which involve the actions of both public and private entities to reduce the effects of climate change and variability. However, the degradation that Guatemala has suffered in recent years due to anthropogenic activities, misuse of natural resources, deforestation, forest fires, extensive episodes of drought, extreme hydrometeorological phenomena are exacerbated due to low resilience, affecting vital infrastructure, assets and livelihoods. These events, which have been recurrent, have generated a stagnation in development, due to the lack of correct application of laws and regulations related to climate change. In a country in which its economy is based especially on agriculture, the availability of water resources and maintaining the diversity of ecosystems is important.

Other factors that influence are that, although there are adaptation programs and projects to reduce vulnerability to climate change and variability, these are slow or discarded because they are not considered a priority by the governments, in addition to the replacements of personnel with knowledge of the subject in the institutions. The lack of projects aimed at the integral management of basins and land use regulation, which is responsibility of each of the municipalities, has led to inadequate land use, causing accelerated soil degradation, land-slides, flooding due to surface runoff, and consequently, recurrently affecting the inhabitants with the least economic resources.

All of the above reflects a non-encouraging scenario for the coming years, as the loss of the quality of natural resources will affect the Guatemalan population the most, who, faced with a poor health system, could experience chronic respiratory diseases, gastrointestinal problems, malnutrition, among others. Without drastic action in a short time, studies, diagnoses, projections, informative documents and others will be of no use in the face of increasing environmental degradation.

The good news is that the issue of Climate Change has gradually begun to attract the attention of actors linked to the governance of the country, who are influencing this problem, due to the high economic losses that this basically socially constructed phenomenon has caused in recent years. Both governability and governance must be supported by all research tools, developed by experts on the subject to make decisions for immediate solutions. Everything points to the need to prioritize the stability of the global climate, so it is necessary to radically dismantle CO2 emissions, logging, generate renewable energy and implement Land Use Regulation Plans in accordance with the Law in all the country's municipalities.

Reiterating the existing treaties and policies, the challenge is to enforce them, to strengthen education at the departmental, municipal and especially local levels, so that the whole society becomes aware of the danger of extinction facing the country`s ecosystems and humanity itself. We need to stop the illicit enrichment of the exploitation of natural resources, we need to protect our home called earth before an extreme climatic event makes us understand that we are not prepared to respond and even less to recover. In conclusion, we need common sense.

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# The El Niño phenomenon and its implications in Peru

#### Fernando Portillo Romero<sup>1</sup>

### **Executive summary**

Climate change is probably one of the main causes of the warming of the surface waters in the Pacific Ocean (Naciones Unidas, 2017), which generates the climate event known as the El Niño phenomenon, in addition to accentuating its recurrence and consequences on the coastal countries of the eastern Pacific. Among the impacts of the phenomenon, the significant impacts on agriculture, fisheries, health and the economy of various regions stand out, both in South America and in other parts of the world. In Peru, El Niño occurred in 1982-1983, 1997-1998, 2017, and 2023 off its northern coast, causing intense rainfall and also affecting the central coast and the northwestern region (Instituto Nacional de Defensa Civil [INDECI], 2023b).

Understanding these impacts and implementing preparedness and mitigation measures, and effective response to El Niño events are critical to reducing vulnerability and associated risks in vulnerable communities and ecosystems.

#### **KEYWORDS**

El Niño Phenomenon; Coastal El Niño; Southern Oscillation (ENSO); Climate Change; Climate Change in Peru.

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## 1. Introduction

The El Niño phenomenon (FEN, for its acronym in Spanish) is a climate event that occurs periodically in the equatorial Pacific region, with significant effects on global climate. It is characterized by an anomalous warming of the surface waters of the tropical Pacific Ocean, which generates changes in weather patterns in various regions of the world (Picture 1).

Picture 1. Sea Surface Temperature Anomalies in the Pacific



Source: Servicio Nacional de Meteorología e Hidrología del Perú [SENAMHI] (2023a).

"During an El Niño event, anomalous weather conditions are observed, such as heavy rainfall, droughts, and changes in temperature distribution, which can have significant impacts on agriculture, fisheries, health, and the economy of various regions, both in South America and in other parts of the world."

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The FEN originates from the complex interaction between the atmosphere and the ocean in the equatorial Pacific region. Its causes are related to changes in atmospheric and oceanic circulation patterns (SENAMHI, 2014). These changes occur more frequently as a result of climate change. Some of the key causes of El Niño are:

- **1. Decreased trade winds:** the trade winds, which generally move east-west along the equator, weaken or even reverse during an El Niño event. This decrease in the trade winds' intensity allows the western Pacific's warm waters to move eastward.
- 2. Warm water accumulation in the Central and Eastern Pacific: decreased trade winds allow warm waters to accumulate in the Central and Eastern Pacific, resulting in anomalous sea surface warming in these regions.
- **3. Southern oscillation changes:** El Niño is associated with changes in the Southern Oscillation (ENSO<sup>2</sup>), which is a complex weather pattern involving interactions between the atmosphere and the ocean in the equatorial Pacific.

These atmospheric and oceanic conditions interact with each other to create a cycle that may

<sup>2.</sup> The El Niño-Southern Oscillation (ENSO) is a climate pattern that consists of the oscillation of the meteorological parameters in the equatorial Pacific every certain number of years. It presents two opposite phases, one of warming and rainfall in the eastern Pacific known as the El Niño phenomenon and the other phase of cooling called La Niña. This temperature oscillation is oceanic and atmospheric and is in turn related to the atmospheric phenomenon called the Southern Oscillation, which consists of an oscillation of atmospheric pressure in the Western Pacific. The relationship or coupling between these phenomena brings great climatic consequences in much of the world (Reyes, 2001, translated).

cause the FEN. Although scientists have better understood the factors that contribute to its emergence, research is still being carried out to understand its dynamics and causes.

The El Niño phenomenon can have a number of significant consequences in different regions of the world, which can vary depending on the intensity and duration of the event. Some of the common consequences of FEN are (SENAMHI, 2014; Morales Casco and Zúñiga González, 2016):

- Extreme weather conditions: El Niño can trigger extreme weather events, such as torrential rains, floods, droughts, storms, and hurricanes, depending on the geographic location. These extreme events can cause material damage, loss of life, and displacement of entire populations.
- 2. Impacts on agriculture and food security: adverse weather conditions associated with El Niño, such as droughts or floods, can reduce agricultural productivity, which in turn can lead to food shortages, rising commodity prices, and food insecurity in affected regions.
- **3. Biodiversity loss:** changing weather patterns can affect natural ecosystems, resulting in habitat loss, declining biodiversity, and changes in the natural cycles of animal and plant species.
- 4. Impacts on the economy: the FEN can have negative repercussions on the economy, especially in sectors such as agriculture, fishery, tourism, and infrastructure. The costs of recovery and reconstruction after El Niño-related natural disasters can be significant and put pressure on national budgets.
- 5. Public health risks: extreme weather conditions and disasters associated with El Niño can increase health risks, including waterborne diseases, respiratory illnesses, and mental health problems due to loss of housing and livelihoods.

"These consequences highlight the importance of preparedness, risk mitigation, and effective response to El Niño events to reduce their negative impact on vulnerable communities and ecosystems."

These consequences highlight the importance of preparedness, risk mitigation, and effective response to El Niño events to reduce their negative impact on vulnerable communities and ecosystems. Understanding these impacts and implementing preparedness and mitigation measures are critical to reducing vulnerability and risks associated with El Niño in Peruvian territory.

## 2. The El Niño phenomenon in Peru

In Peru, the FEN was produced in 1982-1983, 1997-1998, and 2017 (Niño Costero, third most intense FEN in recent years). In March 2023, the FEN was produced again due to the warm conditions of the Sea Surface Temperature (SST) off the northern coasts of Peru, causing intense rains and also affecting the central coast and the northwestern region (INDECI, 2023b).

The FEN has several significant impacts on Peru, specifically, ranging from heavy rain conditions to prolonged droughts, depending on the region and the intensity of the event. Some of the harmful effects include the following:

- Heavy rainfall and landslides: the FEN can bring torrential rains and heavy flooding, often resulting in landslides and damage to infrastructure, crops, and homes.
- **2. Impacts on agriculture:** floods and droughts associated with El Niño can harm agricultural production. Excessive rainfall can flood fields, while droughts can reduce the availability of water for irrigation and for human and animal consumption.
- **3. Disturbances in fishing**: warming marine waters can change fish migration patterns and negatively affect the fishing industry, which can have a significant economic impact on coastal communities that rely on fishing for their livelihoods.

- 4. Health risks: floods and the resulting overcrowded conditions can increase the risk of waterborne diseases, such as dengue, malaria, and diarrhea, as well as respiratory diseases associated with humidity and cold.
- **5. Infrastructure and economic impacts:** natural disasters associated with El Niño can cause significant damage to infrastructure, including roads, bridges, and housing, which in turn can have adverse effects on the local and national economy. For example, the El Niño phenomena of 1982-1983 and 1997-1998 caused a decrease in Peru's Gross Domestic Product (GDP) of 11.6% and 6.2%, respectively. The Northern regions were the most affected by floods and mass movements. But also, as part of the effects of El Niño, droughts were recorded, mainly in the southern area.

In Peru, the Multisectoral Commission in charge of the National Study of the "El Niño" Phenomenon (ENFEN, for its acronym in Spanish) has been formed and composed of Peruvian scientific technical entities such as the Peruvian Institute of the Sea (IMARPE, for its acronym in Spanish), the National Meteorology and Hydrology Service (SENAMHI, for its acronym in Spanish), the Geophysical Institute of Peru (IGP, for its acronym in Spanish), the Directorate of Hydrography and Navigation of the Peruvian Navy (DIHIDRONAV, for its acronym in Spanish), the National Institute of Civil Defense (INDECI, for its acronym in Spanish), the National Water Authority (ANA, for its acronym in Spanish) and the National Center for Disaster Risk Estimation, Prevention and Reduction (CENEPRED, for its acronym in Spanish).

This commission maintains constant monitoring and predictions of the development of El Niño-Southern Oscillation (ENSO), periodically reporting the monitoring analysis of ocean-atmospheric parameters in the equatorial, southeastern Pacific, with emphasis on the coast of Peru. It also performs the monitoring analysis of marine ecosystem impacts, reporting the fertility and productivity indicators of some hydrobiological resources of the Peruvian sea, the response of the main resources and fishing activity. Moreover, the ENFEN constantly monitors the hydrological impact associated with rainfall and sudden increases in the flow of the main rivers of the Peruvian territory. Finally, this commission formulates the forecast of the main indicators associated with ENSO, with emphasis on the El Niño phenomenon, in the short, medium and long term.

In this regard, the ENFEN Technical Report is prepared based on the collegiate analysis of the Multisectoral Commission scientific technical group, considering the monthly reports of each entity that is a member of this commission and that monitors and forecasts ocean-at-mospheric conditions, as well as their manifestations and impacts in the Peruvian sea and in the national territory.

According to the latest official ENFEN statement (2023), coastal El Niño (Niño 1+2 region) is expected to continue at least until early autumn 2024, as a result of the evolution of El Niño in the central Pacific. Likewise, the aforementioned document communicates that strong warm conditions are more likely to remain until February. By next summer 2024, on average, the most likely magnitudes of coastal El Niño are strong (49%) and moderate (47%).

It is also reported that in the central Pacific (Niño 3.4 region) El Niño is expected to continue for the time being until mid-autumn 2024, reaching its maximum intensity at the end of the year. The most likely magnitudes of El Niño in the central Pacific for the summer are strong (49%) and moderate (48%), as described in Picture 2.



Picture 2. Most Likely El Niño Magnitudes for Summer 2024

Source: ENFEN (2023).

Likewise, it is estimated that between November 2023 and January 2024, there will be the persistence of warm air temperature conditions along the coast. Rainfall is more likely to exceed its normal accumulated values mainly on the north coast, central coast and northern highlands. By the summer of 2024, considering the rainfall scenario, in the context of coastal El Niño (Niño 1+2 Region), it is likely that above-normal rainfall will occur in the northern and central coast of Peru, as well as the northern highlands, without ruling out intense rainfall in these sectors (Picture 3). Considering the El Niño scenario in the central Pacific (Niño 3.4 Region), below-normal rainfall is expected in the Andean region, particularly in the south-eastern highlands (Picture 4).

**Picture 3.** Probabilistic Forecast for the Magnitude of the Coastal El Niño Event: Dec 2023 – Mar 2024 (Niño 1+2 Region)



Source: ENFEN (2023).

**Picture 4.** Probabilistic Forecast for the Magnitude of El Niño Event: Dec 2023 – Mar 2024 Central Equatorial Pacific (Niño 3.4 Region)



## 3. Consequences of the FEN in Peru

Given this communication, the National Center for Disaster Risk Estimation, Prevention and Reduction (CENEPRED) prepared the risk scenario for mass movements in the face of rainfall associated with FEN based on the following territorial conditioning factors: slope, geomorphology, lithology, hydrogeology, and vegetation cover. Areas of very high and high susceptibility are mainly characterized by mountainous reliefs, steep slopes, and little or no vegetation cover (Picture 5). CENEPRED also developed the flood risk scenario for rainfall associated with the FEN (Centro de Estimación, Prevención y Reducción de Riesgos de Desastres [CENEPRED], 2023a). Both scenarios were prepared based on the technical information generated by the Geological, Mining, and Metallurgical Institute (INGEMMET, for its acronym in Spanish), the National Meteorological and Hydrometeorological Service (SENAMHI, 2023), and the National Water Authority (ANA, 2023).

**Picture 5.** Map of areas of very high-risk susceptibility to dangers associated with heavy rains, floods, and mass movements



Source: INDECI (2023a).

The National Institute of Civil Defense (INDECI, for its acronym in Spanish), based on the risk scenario information prepared by the CENEPRED regarding susceptibility to floods and mass movements, as well as the statistical analysis of damage caused by the El Niño phenomenon at the national level in previous years, has systematized the information on risk scenarios considered at "very high risk due to exposure to dangers associated with intense rains" levels. Thus, they have identified 18 departments, 139 provinces, and 856 districts at very high risk due to exposure to dangers caused by the FEN, identifying those elements that are exposed within the scenario of dangers caused by rainfall greater than normal, determining that the population exposed to very high danger due to dangers associated with rainfall is 14,326,109 inhabitants and 4,376,208 homes (Pictures 6 and 7).

**Picture 6.** Districts at very high risk due to exposure to heavy rainfall and associated dangers due to the expected FEN 2023-2024

Departament	N° of Provinces	N° of Districts	Population	Homes
AMAZONAS	7	66	110,198	34,067
ANCASH	20	62	638,422	213,389
AREQUIPA	7	61	410,412	164,420
AYACUCHO	11	77	288,957	145,511
CAJAMARCA	11	62	611,792	194,876
HUANCAVELICA	7	87	306,334	152,164
HUÁNUCO	8	21	136,088	40,223
ICA	5	24	401,508	145,304
JUNÍN	9	48	334,245	138,302
LA LIBERTAD	12	76	1,625,453	428,063
LAMBAYEQUE	3	38	1,197,260	354,617
LIMA	10	73	5,833,925	1,583,495
MOQUEGUA	2	15	90,870	48,151
PASCO	3	21	160,098	59,237
PIURA	8	65	1,856,809	559,592
SAN MARTÍN	10	38	90,689	26,940
TACNA	3	9	8,186	7,115
TUMBES	3	13	224,863	80,742
TOTAL	139	856	14,326,109	4,376,208

Source: INDECI (2023a).

**Picture 7.** Districts at very high risk due to exposure to heavy rainfall and dangers associated with the expected FEN 2023-2024



Source: INDECI (2023a).

The CENEPRED also developed the water deficit risk scenario, including the analysis of susceptibility to meteorological droughts according to their intensity and frequency, and also based on characteristics of the social, economic, and environmental dimensions. The integration of both products results in risk scenarios for the occurrence of meteorological droughts, categorized as moderate, severe, and extreme. According to SENAMHI (2023b, p. 38), the hydrological perspective will prolong the deficient water conditions in the Titicaca Hydrographic Region for the coming months, with categories "far below normal" to "below normal", being the most critical levels of deficiency in the characterization of flows. In the rivers of the South Pacific Hydrographic Region and the Central and Southern Amazon Hydrographic Region, there was variation with categories between "below normal" to "far above normal".

Likewise, based on the risk scenario information prepared by the CENEPRED in the face of the imminent danger due to water deficit, INDECI determined the areas of exposure, identifying 9 departments, 42 provinces, and 130 districts at very high risk, with a total population of 1,008,028 inhabitants at very high risk due to water deficit (Pictures 8 and 9).

Departament	N° of Provinces	N° of Districts	Population	Homes
APURIMAC	3	9	38,508	12,300
AREQUIPA	1	1	3,697	777
AYACUCHO	4	4	16,272	3,128
CUSCO	10	22	160,539	46,106
HUANCAVELICA	4	7	33,037	10,238
JUNÍN	6	16	57,387	16,824
PASCO	1	1	3,877	1,151
PUNO	11	68	689,089	243,780
TACNA	2	2	5,622	1,482
Total	42	130	1,008,028	335,786

Picture 8. Districts at very high risk due to exposure to water deficit by FEN 2023-2024

Source: INDECI (2023a).





Source: INDECI (2023a).

## 4. Actions in the face of the FEN

Facing these risk scenarios, the Peruvian Government has made State of Emergency Declarations in several districts of provinces of the departments of Amazonas, Ancash, Arequipa, Ayacucho, Cajamarca, Huancavelica, Huánuco, Ica, Junín, La Libertad, Lambayeque, Lima, Moquegua, Pasco, Piura, San Martín, Tacna and Tumbes, for "imminent danger before the rainy period 2023-2024 and the expected El Niño Phenomenon" (Gobierno de Perú, 2023b, 2023c, 2023e and 2023f). The Government has also made Declarations of State of Emergency in districts of provinces of the departments of Ancash, Apurímac, Arequipa, Ayacucho, Cusco, Huancavelica, Huánuco, Ica, Junín, La Libertad, Lima, Pasco, Puno and Tacna, due to "imminent danger of water deficit as a result of the expected El Niño Phenomenon 2023-2024" (Gobierno de Perú, 2023a and 2023d). Based on these declarations, the regional governments, ministries, and other involved public and private institutions will execute the immediate and necessary emergency measures and actions to reduce the very high existing risk, as well as actions of response and rehabilitation, if required.

"Moreover, based on the State of Emergency Declarations, the Peruvian Government prepared the Multisectoral Plan 2023 – 2024 as a mechanism for coordination and articulation of interventions between the Ministries, its public agencies, and public universities..."

Moreover, based on the State of Emergency Declarations, the Peruvian Government prepared the Multisectoral Plan 2023 – 2024 as a mechanism for coordination and articulation of interventions between the Ministries, its public agencies, and public universities, in the districts identified as being at very high risk in the face of intense rains and associated dangers, as well as of a water deficit due to the expected FEN 2023-2024, with the aim of carrying out a series of actions and interventions in the territory in order to reduce and mitigate the risks of the determined vulnerabilities (Presidencia del Consejo de Ministros, 2023).

This typical multisectoral approach plan allowed the allocation of financial resources for the acquisition of machinery of the yellow line and the white line, the development of emergency projects and activities such as dredging of the riverbeds and streams (Picture 10), defense of structural riverbanks and dynamic barriers, acquisition of 3,765 tons of food aid and 1,610 tons of non-food aid (roof, shelter, tools, toilet kits, cleaning kits, household items, pots, kitchens, among others). The resource was also used for the replenishment of the National Warehouses of the National Institute of Civil Defense; training and technical assistance in Disaster Risk Management to local and regional authorities; contracting technical assistance for the formulation of Preparedness Plans, Emergency Operations, Rehabilitation, Heavy Rain Contingency, and Operational Continuity; the training of brigade members in reactive management; as well as monitoring the corresponding actions.

Picture 10. Dredging of the riverbed in the northern part of Peru



Source: Diario Oficial EL Peruano (2023).

"Among the guidelines of the National Disaster **Risk Management Policy**, they consider that the country must have an adequate capacity to respond to disasters, with criteria of effectiveness, efficiency, learning, and permanent updating. **Communities and public** entities' resilience and response capacities must be permanently strengthened, fostered, and improved."

## 5. Final considerations

The Peruvian state has the legal framework to deal with imminent dangers and disasters caused by natural phenomena through Law Number 29664 "Law that creates the National System for Disaster Risk Management (SINAGERD)" (Gobierno del Perú, 2011), which aims to identify and reduce the risks associated with dangers or minimize their effects. This law also seeks to avoid the cause of new risks and to be prepared and attentive to disaster situations through the establishment of principles, policy guidelines, components, processes, and instruments of Disaster Risk Management, of mandatory application and compliance for all public entities and companies at all levels of government, as well as for the private sector and citizens in general.

Among the guidelines of the National Disaster Risk Management Policy, they consider that the country must have an adequate capacity to respond to disasters, with criteria of effectiveness, efficiency, learning, and permanent updating. Communities and public entities' resilience and response capacities must be permanently strengthened, fostered, and improved. Also, the public entities of the Executive Branch must establish and maintain the strategic and operational mechanisms that allow an adequate response to emergency situations and large-scale disasters. Regional and local governments are responsible for developing Disaster Risk Management actions.

To comply with this law, the Ministry of Economy and Finance is in charge of evaluating and identifying the appropriate and cost-efficient mechanisms that allow the Peruvian state to have the financial capacity to manage large-scale disasters and their respective reconstruction, as well as the relevant disaster risk financial management mechanisms (Gobierno del Perú, 2011). In this sense, the Budgetary Program 0068 "Reducción de la Vulnerabilidad y Atención de Emergencias por Desastres" ("Vulnerability Reduction and Disaster Emergency Response") is provided of a multisectoral nature in the Public Sector Budget, under the guidance of the Presidency of the Council of Ministers (PCM), as the main financial mechanism and contingency fund of the State Disaster Risk Management.

Likewise, in accordance with article 17 of the SINAGERD Law, the Peruvian state has the Armed Forces and the National Police of Peru that participate ex officio in the attention of emergency situations that require immediate response actions, carrying out the tasks that fall to them even when a state of emergency has not been declared, which is why they always act as first response entities. Moreover, the Armed Forces and the National Police of Peru participate in Disaster Risk Management in terms of preparedness and response to disaster situations, in accordance with their competencies and in coordination and support to the appropriate authorities.

Therefore, the Peruvian state is in a position to guarantee its primary duty to protect the population from threats to their security and promote their general welfare in accordance with Article 44 of the Political Constitution of Peru (Congreso de la República, 1993).

"...the Armed Forces and the National Police of Peru participate in Disaster Risk Management in terms of preparedness and response to disaster situations, in accordance with their competencies and in coordination and support to the appropriate authorities."

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