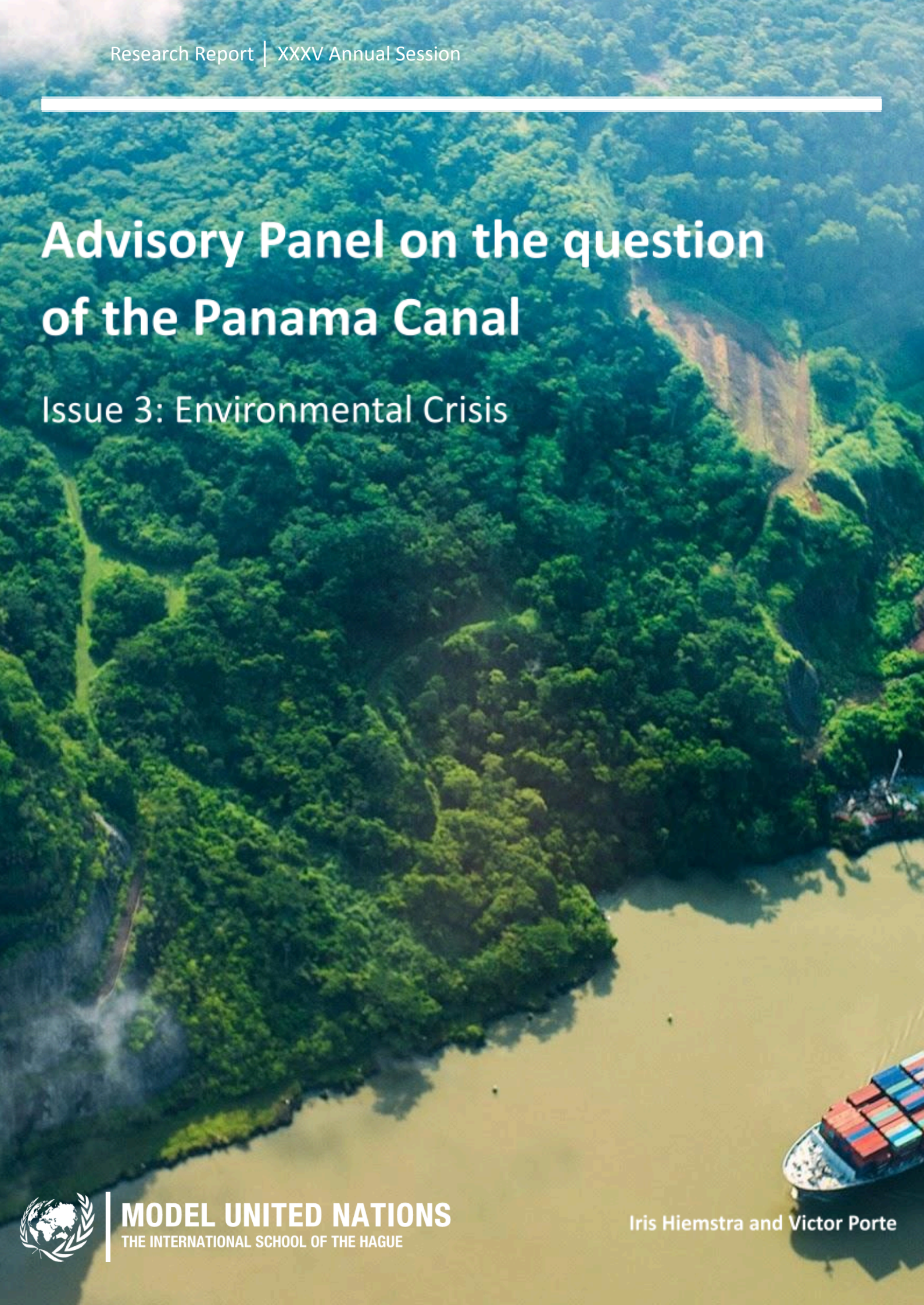
Advisory Panel on the question of the Panama Canal

Issue 3: Environmental Crisis



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Forum	APQ Panama Canal
Issue:	Environmental Crisis
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Introduction

As mentioned in the previous research reports on the question of the Panama Canal, the topic is split into three issues; economic, political and lastly, the environmental crisis. This report will discuss the latter one. Due to the low water levels of Lake Gatun, the canal's main water source, the Panama Canal is also experiencing extremely low water levels. This is the result of ongoing drought and the occurrence of El Niño events (see definitions). It is also due to the higher water demand in the area for agriculture and increased usage of drinking water.

These historically low water levels in the Panama Canal have resulted in the ACP (Autoridad del Canal de Panamá or the Panama Canal Authority) to lessen the daily vessels going through from 36 to only 18 in a span of only months at the end of 2023 and beginning of 2024. The size of the vessel itself has also gotten restricted.

Definition of Key Terms

Panama Canal Authority (APC)

The APC (Panama Canal Authority), or locally known as the Autoridad del Canal de Panamá is the organisation founded after the changeover of canal control, at the end of 1999. This organisation is to this day in charge of the Panama Canal's administration.

Trade winds

Trade winds is a term used when sailing and it refers to persistent winds blowing from east to west along the equator.

El Niño

A naturally occurring climate phenomenon where waters in the Pacific Ocean become warmer, causing changes in weather patterns in Central America such as the observed droughts in Panama

Freshwater scarcity

A condition in which the available freshwater supply is insufficient to meet demand. In Panama, it affects both the operation of the Canal and access to water for over two million residents, creating a conflict between economic and social needs.

General Overview

Climate change

Climate change has shown its effects all over the globe. Coming in a variety of different forms, this has resulted in water levels rising, but also in increased instances of drought, and conversely, more rainfall than usual. In Panama, it has mostly resulted in longer and drier dry seasons and less rain. Because of this, the water levels in Lake Gatún have been quite low, thus affecting the ability for water to flow into the canal itself. Whereas other canals frequently get their water from the ocean, the Panama Canal gets its water from Lake Gatún and Alajuela Lake. Both water reservoirs rely solely on rainfall. This makes the canal solely dependent on rain, meaning that, with less frequent and less intense rainfall, less water can flow into the canal. This then directly impacts the trade routes along the Panama Canal as fewer ships can pass through. Furthermore, ships passing through use approximately 200 liters of water, once again burdening water supply in Panama.

Climate change also makes the weather wetter in some periods, but overall rainfall becomes less consistent. South and Central America used to have wet seasons between the months of May and December, but in recent years, these periods have become shorter and more intense, making the dry periods longer. This overall makes it a highly unsustainable climate for ensuring the consistent operation of the Panama Canal.

Global warming also plays a large part in the lessening of water in the canal. Higher temperature means that water evaporates at a much faster rate. As such, even if there is enough rain, it quickly turns back into water vapour, evaporating back into the Earth's atmosphere.

The Canal is not only a victim of climate change, but also a contributor to environmental pollution and degradation. The ACP is aiming to get the canal's CO2 emissions to zero and have already made steps towards this goal, yet these remain difficult in implementation. The Canal's operations remain heavily dependent on fossil fuels, shipping traffic, and freshwater consumption, all of which generate significant environmental strain. The shipping industry as a whole is a massive pollutant, falling underneath the category of transportation which makes up for around one-quarter to one-third of global greenhouse gas (GHG) emissions. Despite this, measures have been taken to reduce the carbon footprint. In 2016, they reduced carbon emission by 16 tons in comparison to the year before, roughly equating to 3.2 million passenger vehicles, however global action is required to determine sustainable solutions for Panama's shipping industry.

El Niño

El Niño is a natural occurrence. During normal conditions, the so-called trade winds blow towards the western direction, along the equator. Because of this, warm water moves from South America to Asia. In reaction to this, a process called upwelling then starts, which refers to the cold water rising up from lower in the oceans. During El Niño, the trade winds weaken and the warm water is pushed eastward toward the coast of South America. As a result of this, the Pacific Jet Stream shifts south of its normal position. Due to this shift, the large areas of the northern parts of North America become dryer than usual. El Niño also has an effect on ecosystems. In Panama, the phenomenon El Niño brings hotter and drier weather which worsens the dry seasons.

Opposite of this is La Niña. During these periods, the trade winds are stronger than usual, pushing warm water further west towards Asia and enhancing cold-water upwelling off South America. This instead causes the Southern US to become drier while the Northern U.S. and Canada experience cooler, wetter conditions with increased flooding risk.

These alternating climate patterns directly affect rainfall in Panama, making the country vulnerable to fluctuations in weather, going from prolonged droughts to periods of heavy rainfall. Due to a longer period of El Niño from June 2023 to May 2024, rainfall was substantially less, contributing directly to the historically low levels of water in the canal. It has been shown that in the last decades,

the severity and the altering between the two events have become worse and more frequent. This has been linked back to climate change and experts predict further instability in the future.

Major Parties Involved

Panama Canal Authority (ACP)

The ACP stands in the centre of the crisis as it manages operations surrounding the canal which are heavily reliant on freshwater from sources such as Lake Gatun. The governmental organisation is in charge of maintaining the balance between not depleting its own resources and preserving the local environment, but still providing freshwater to foster greater revenue from the canal as economic pressure grows.

Panamanian Government

Similar to the ACP, the Panamanian government oversees national water policies, environmental protection laws, and infrastructure development, and is responsible for responding to both the economic and environmental fallout of the crisis. It must weigh the canal's economic importance against the need to provide drinking water for over two million people and protect the country's natural resources. The government has sought international aid and partnerships to improve climate resilience. Its actions directly influence how sustainable the response to the crisis will be.

Civil Societies and Environmental NGOs

Environmental organizations in Panama and abroad have raised awareness about deforestation, water pollution, and the loss of biodiversity in the canal region. Groups such as Centro de Incidencia Ambiental (CIAM) and international NGOs like WWF have criticized large infrastructure projects for their ecological impact and called for alternative solutions like watershed restoration, reforestation, and better water governance. Their advocacy has pressured authorities to consider more sustainable and socially responsible responses to the crisis.

World Bank

The World Bank is involved by funding and advising on climate adaptation projects, including watershed protection and infrastructure upgrades. It plays a key role in shaping how Panama finances and implements environmental solutions. The world bank promotes sustainability standards and often requires environmental assessments before approving major projects, influencing the sustainability of those initiatives.

Timeline of Key Events

1881	The first move to make a Panama Canal was made.
November 3th 1903	Panama became independent from Colombia.
February 23th 1904	The United States of America got ownership of the canal from the French.
August 14th 1914	The first transit through the canal was made, it was now open to traffic.
October 3th 2023	The APC observed a daily inflow of less than half the expected amount of water in an average year in the Gatun reservoir.
October 31th 2023	The record shows October was the driest month in 2023 with a drop of 41% compared to usual and the APC made the decision to lower the amount of daily vessels allowed through the canal. First from 32 to 24 in the month of November, in December it was lowered to 22. In January the plan was to lower that number to 20 and lastly 18 in February of 2024.
2023	This year had a historically big drop in rainfall, with the drop being 30% compared to average.
December 15th 2023	Due to a small improvement in rainfall in the area and the measures taken by the APC, the amount of daily vessels was raised back to 24.
2050	The ACP strives to make the Panama Canal's net carbon emission zero by the year 2050.

UN involvement, Relevant Resolutions, Treaties and Events

- Treaty concerning the Permanent Neutrality and Operation of the Panama Canal, September 1977 (UNTS, Vol. 1161, No. 18342)
- Panama Canal Treaty, 7 September 1977 (UNTS, Vol. 1280, No. 21086)

  These treaties, also called the Torrijos–Carter Treaties, did not only talk about the neutrality of the Panama Canal but included protocols on environmental and operational responsibilities as well.

- Agreement Between the United States of America and Panama Regarding Assistance with Respect to Certain Environmental Pollution Incidents in the Panama Canal Area, 1 April 2002 (Panama City) (TIAS 02-401)

  Panama and the United States of America came to an agreement regarding the environmental pollution in the Panama Canal's area. The agreement makes it possible for joint action to happen in response to environmental incidents that could impact the local ecosystem or navigation.

- Cooperation Agreement between the United Nations Environment Programme and the Panama Canal Authority (2019) (No formal United Nations document code, since this is a bilateral administrative agreement)
- State of Environmental Emergency Declared by the Government of Panama, May 2023 (Official Resolution of the Republic of Panama)
- Universal Congress on the Panama Canal Resolution on Integrated Approach to Environmental, Trade, and Development Issues, 2024 (UNGA resolution; specific number is unlisted as of July 2025)

Previous Attempts to solve the Issue

The ACP completed a major expansion of the Panama Canal in 2016, adding a third lane and new locks that could accommodate larger ships (Neopanamax vessels). While this increased capacity and revenue, the new locks still relied on freshwater and added pressure to already limited water resources. This emphasis on economic growth led to the implementation of regulations such as freshwater surcharge.

In January 2020, the Panama Canal Authority (ACP) implemented a freshwater surcharge on vessels using the canal. This fee was designed to offset reduced water availability and fund water-saving measures. It also served as a short-term tool to manage declining revenues and discourage inefficient water use during periods of drought.

The Rio Indio reservoir was proposed as a major infrastructure project located West of the Gatun lake system whose objective is to provide a new, dedicated water source for the canal. Although it could significantly ease the strain on Gatún Lake, the project has faced delays due to funding issues, environmental impact concerns, and strong opposition from local and Indigenous communities who risked displacement. Following pressure from the USA, in February 2025, the project was accepted by the Panama Canal Board of Directors.

Possible Solutions

Infrastructure

One of the most direct solutions to Panama's water scarcity is the proposed construction of the Rio Indio Reservoir. This project would provide a new freshwater source independent of the overstressed Gatún Lake system. The reservoir is designed to store enough water to sustain both canal operations and public consumption during prolonged droughts. However, the project faces major challenges, including the displacement of local communities and environmental degradation. If implemented responsibly—with fair compensation, transparent environmental assessments, and international support—it could significantly improve Panama's long-term water security.

Modernising the canal's lock systems with water-saving technology, such as recycling basins, offers a less invasive and highly effective solution. These systems reduce the amount of freshwater

needed for each ship transit by reusing water between lock chambers. Though expensive to install, such infrastructure upgrades could lower operational water consumption and make the canal more resilient during dry periods. This would allow higher traffic through the canal even when lake levels are low, reducing the economic impact of droughts.

Environmental adaptation

Large-scale reforestation within the Panama Canal watershed could help restore the natural water cycle. Forests play a vital role in water retention, reducing soil erosion, and promoting groundwater recharge. Deforested and degraded areas could be restored with native tree species through government programs, community efforts, and international funding. These projects may take years to yield results but offer long-term environmental benefits. They can also provide local employment and protect biodiversity, making them a sustainable component of Panama's climate adaptation strategy.

Strengthening environmental regulations within the canal watershed is crucial to preventing further degradation. Illegal logging, unregulated development, and unsustainable agricultural practices have all contributed to water stress and declining water quality. Enforcing land-use restrictions, creating buffer zones, and promoting conservation-friendly farming methods can protect key water sources. Better regulation ensures that rainfall is absorbed into healthy ecosystems instead of lost through runoff and contamination.

Economic diversification

Finally, the current crisis highlights Panama's economic vulnerability due to its dependence on canal tolls. Diversifying into other sectors such as tourism, agriculture, green energy, and logistics can reduce pressure on the canal and strengthen national resilience. With better infrastructure, policy incentives, and investment in emerging industries, Panama can create jobs and reduce reliance on a single water sensitive revenue stream.

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