WILLIAM J. PERRY CENTER



FOR HEMISPHERIC DEFENSE STUDIES

Climate Change in Latin America and the Caribbean

Capstone Spouses Course

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Problems in Latin America today

- Societal collapse in Venezuela
- Cartel violence in Mexico
- Constitutional crises in Peru and Ecuador
- Climate change
- Dramatic increase in cocaine production
- Crime wave in Brazil
- Violent gangs in Central America
- Hurricanes in Caribbean and Central America
- Inequality and poverty
- Corruption
- Weak govenrment institutions



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Part 1 - What is Climate Change?

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A coal factory in China in 2019.



París Climate Accord, 2015

Greenhouse Gases in the atmosphere continue to increase

Global net anthropogenic emissions have continued to rise across all major groups of greenhouse gases.



a. Global net anthropogenic GHG emissions 1990–2019⁽⁵⁾

Source: Climate Change 2022 Mitigation of Climate Change Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 2022. Link: <u>https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf</u>



Greenhouse Gases (GHG)

Pollution caused by humans generates greenhouse gases (CO_2 , CH_4 , N_2O) that trap solar radiation within the atmosphere.

The reaction of the molecules with the sun's rays creates GHG that cannot escape from the atmosphere.

Some greenhouse gas effect is natural and keeps the planet's temps normal.

Trapped radiation is slowly raising temperatures across the planet.



Sources of Greenhouse Gases



World Resources Institute lists top emission sources by country.

GHG Emissions are Driving Temperature Increases

Planetary temperatures are increasing rapidly. The eight hottest years in human history have occurred since 2014. 2023 will be the hottest.

In May 2023, World Meteorological Organization (WMO) predicted the next five years will be hottest in human history. (WMO, 17 May 2023)

We are currently at around **1.1° C** of warming above pre-industrial temperatures in the 19th century. The IPCC predicts planetary temperatures will reach **1.5° C** in **2030**.



Source: 2023 IPCC AR6 Synthesis Report, section A.4.4 (March 20, 2023); International Energy Agency (IEA), "CO2 Emissions in 2022," March 2023; WMO, 17 May 2023. Source:

https://public.wmo.int/en/media/press-release/global-temperatures-set-reach-new-records-next-five-years

GHG Emissions are Driving Temperature Increases

How high does the IPCC predict temperatures will rise by 2100?



What do we need to do to stop or slow global warming?

Electrify energy sectors with clean energy

Decarbonize the atmosphere

We don't need to stop all GHG, but we need to reach "net zero" emissions or be carbon neutral.





What is causing climate change?

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What is causing climate change?

"It is unequivocal that human influence has warmed the atmosphere, ocean and land," IPCC, August 9, 2021.

List of 200 worldwide scientific organizations supporting the fact that climate change is caused by humans. http://www.opr.ca.gov/facts/list-of-scientific-organizations.html

"Of all the shared problems we face, climate change is the greatest and potentially existential for all nations." U.S. National Security Strategy, October 2022.

Part 2 - Climate change threats in Latin America



Effects of Extreme Heat

More destructive hurricanes Heat waves Droughts and crop loss Loss of potable water **Forest fires** Sea level rise Glacier and ice cap melt





Scientists predict that there will be an increase in Category 4 and 5 hurricanes. The storms will contain on average 10-15% more rain.

Source: IPCC 6th Assessment Report (AR6), 2021, link: <u>https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf</u>; see also U.S. National Oceanic and Atmospheric Agency (NOAA), <u>https://www.gfdl.noaa.gov/global-warming-and-hurricanes/#global-warming-and-atlantic-hurricanes</u>

Heat Waves

Extreme heat could make parts of Asia and Africa **uninhabitable** in decades. – UN and ICRC, 11 Oct 2022.

Parts of Central America and southern U.S. will be affected.

600 million will be affected.

Mass migration surges predicted by the World Bank (<u>2021 Groundswell</u> <u>report</u>) and International Organization for Migration (IOM)



Heat and Humidity Waves

2023 saw simultaneous heat waves (extreme above average temperatures) on multiple continents.

- Europe had its hottest summer ever (3,000 heat-related deaths)
- Antarctica saw temperatures 70 deg F above normal.
- Pakistan, India, and China experienced extreme heat
- 129 deg F in Kuwait.
- Longest fire season in Canadian history

World Sees Record Heat Waves

Selection of heat records by country (or continent) recorded during the last six years, in °C



As of July 10, 2023.

* European record still being validated by the WMO.

Sources: World Meteorological Organization, media reports, Statista research





Heat stroke vs heat exhaustion



Vulnerable groups at risk of heat stroke and exhaustion



Vulnerable persons are **15x more likely to die** from climate disasters. Source: IPCC Sixth Assessment Report (AR6), March 2023, Link: <u>https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_LongerReport.pdf</u>





El Niño returns!

El Niño generally means warmer temperatures in the Pacific waters west of Central and South America. But it also has a global effect.

Technical term: El Niño-Southern Oscillation (ENSO).

La Niña (cooler ocean waters in Eastern Pacific) has prevailed from 2020-2022.

El Niño returned in July 2023 and will cause a surge in higher global temperatures.



Sources: National meteorological agencies; International Research Institute for Climate and Society; United Nations Environment Programme/GRID-Arendal; World Metereological Organisation; Oceana; Infobae; La Nación (Argentina); 2000 Agro (Argentina); Meteored (Chile); Bio Bio Chile; Ministerio de Agricultura (Colombia); EIU.

Droughts

Parts of Caribbean, South and Central America in the midst of lengthy droughts ("megadroughts")

The two most populated cities in the Americas – São Paulo and Mexico City with 25M populations – have both had recent water crises.

July 2023, Montevideo, UR (pop: 1.4M) reservoirs at 2% capacity.

August 2023, Panama Canal restricted navigability for deep draft vessels.

How do we provide drinking water for millions of people when the taps run dry?



The U.S. Colorado River crisis

- Potable water and irrigation source for nearly 40M people in 7 states.
- Feeds agriculture sources for 90% of winter vegetables in U.S.
- Diverting and overuse combined with a lengthy drought in the U.S. West – have reduced the flow of the river.
- A collective action challenge and "tragedy of the commons"
- Also major source of hydroelectricity for American West



Glacier retreat

Two-thirds of tropical glaciers will disappear by 2100



Qori Kalis Glacier, Peru

References: Buytaert, Wouter; et al, 2017: Glacial melt content of water use in the tropical Andes. *Environmental Research Letters* 12:11. Link: <u>https://iopscience.iop.org/article/10.1088/1748-9326/aa926c</u>.; David Rounce, et al., "Global glacier change in the 21st century: Every increase in temperature matters," *Science*, Vol 379, Issue 6627, pp. 78-83, 05 Jan 2023

Sea level rise (SLR)



Slow motion but dangerous sea level rise conditions will continue for centuries because of the amount of heat absorbed the world's oceans. Source: NOAA Climate.gov graph, adapted from Sweet et al., 2022. **Migrant Flows** REDUCTOR DE VELOCIONO

Fuentes: The World Bank 2018 Groundswell report; Bassetti, Francesco 2019: Environmental Migrants: Up to 1 billion by 2050. <u>https://www.climateforesight.eu/migrations/environmental-migrants-up-to-1-billion-by-2050/</u>

Part 3 – Future scenarios

How high does the IPCC predict temperatures will rise by 2100?



Temperatures rising to lethal levels

Under current conditions, IPCC climate forecasts indicate temps will increase to 3.2° C by 2100.

To keep within the 1.5° C limit, emissions need to be reduced by at least 43% by 2030 compared to 2019 levels, and at least 60% by 2035.

The decisions we make in the next decade will determine the fate of the human race.

The seven warmest years on record were the past seven

Increase above 1850-1900 reference level (C)



© FT

Source: IPCC AR6 synthesis report, March 2023, section A.4.4; IPCC AR6 WG3, section C.1, 2022. Question: if scientists have been warning about climate change for decades, why has there been so little action to prevent these catastrophic conditions?

Question: if scientists have been warning about climate change for decades, why has there been so little action to prevent it?

Cost. Cost of action to transform energy and industry systems too high.

- **Infrastructure investment.** Our societies are constructed and operated through trillions of dollars of fossil fuel–powered sectors.
- **Technology**. Renewable energy technology not adequately developed.
- **Science**. Uncertainty about accuracy and precision of climate science.
- **Education**. Not enough people understand the dangers we face.
- **Poverty**. Widespread poverty in many countries limits the actions many people can take.
- **Special interests**. Lobbying groups working for energy and chemical industry spend hundreds of millions to sow doubt about climate change.

Today, the obstacles to climate change mitigation are more political than economic or technological.

When will emissions peak?



Carbon dioxide emissions by sector and region - current pathway

*Other includes buildings, energy, waste and carbon net capture impact **Rest of World includes CO₂ emissions from international civil aviation and international navigation

Source: Rystad Energy's Energy Transition Solution. February 2023. A Rystad Energy Graphic.

G20 industrialized nations produce about 80% of GHG emissions. China with 28% is the world's largest emitter. The U.S. is second with 13%.

Future scenarios?

Emissions pathways

IPCC AR5 pathways: Baseline range



GtCO2, gigatonnes of carbon dioxide; IPCC AR5, IPCC Fifth Assessment Report scenario; IPCC SR1.5, IPCC Special Report on 1.5°C scenario; NDCs, nationally determined contributions.

Emissions overshoot



Year

Climate change tipping points



Reference: David I. Armstrong McKay, et al. "Exceeding 1.5°C global warming could trigger multiple climate tipping points," *Science*, Volume 377, Issue 6611, 9 September 2022



Sixth Assessment Report of IPCC

https://www.ipcc.ch/ar6-syr/

INTERGOVERNMENTAL PANEL ON CLIMATE CHARGE

Climate Change 2021 The Physical Science Basis



Working Group I contribution to the

Sixth Assessment Report of the

Intergovernmental Panel on Climate Change

INTERGOVERNMENTAL PANEL ON CI

Climate Change 2022 Impacts, Adaptation and Vulnerability

Summary for Policymakers





Working Group II contribution to the Sixth Assessment Report of the ergovernmental Panel on Climate Change



WGIII

AR6 Synthesis Report

Climate Change 2023

Working Group III contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change



Climate Change 2022 Mitigation of Climate Change Summary for Policymakers



Recommended Reading: Chapters 12 and 15 of IPCC AR6 WGII



CHAPTER 12

Central and South America

Chapter 12 assesses climate change impacts and risks, vulnerability as well as barriers and options for adaptation and climate resilient development in Central and South America.





CHAPTER 15

Small Islands

Chapter 15 assesses climate change impacts and risks, vulnerability as well as barriers and options for adaptation and climate resilient development in Small Islands.

EXPLORE

15

DOWNLOADS .

FIGURES

Small Islands

Link: https://www.ipcc.ch/report/ar6/wg2/

FIGURES

Recommended Reading: U.S. National Climate Assessment (NCA)



Executive Summary Fourth National Climate Assessment | Volume I

Fourth National Climate Assessment

U.S. Global Change Research Program



Volume II Impacts, Risks, and Adaptation in the United States Report-in-Brief **4th National Climate Assessment** (NCA) published in 2017 and 2018. Link:

https://nca2018.globalchange.gov/

5th National Climate Assessment (NCA) **to be published in 2023**. Link: <u>https://www.globalchange.gov/nca5</u>

State Climate Assessments: https://statesummaries.ncics.org/

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Department of the Army (2022), "Army Climate Strategy Implementation Plan: Fiscal Year 2023-2027," October 2022. Link: <u>https://www.army.mil/e2/downloads/rv7/about/2022_Army_Climate_Strategy_Implementation_Plan_FY23-FY27.pdf</u>

Department of the Navy, "Climate Action 2030," October 2022. Link: https://www.navy.mil/Portals/1/Documents/Department%20of%20the%20Navy%20Climate%20Action%202030.pdf

Thanks for your attention! Dr. Patrick Paterson spatrick.paterson@ndu.edu