“Water-Energy Nexus by connecting Mitigation and Adaptation Pathways”

Water and Climate Change Task Force, IWRA

Alex Godoy-Faúndez, Ph.D.
Weatherhead Center for International Affair
Harvard University
alexgodoyfaundez@fas.harvard.edu | alexgodoy@udd.cl
Revie Editor, IPCC AR6 | Lead Author, IPBES, Nexus Assessment

Honorary Doctor of Laws, UW-Green Bay
Associate Professor & Director of Sustainability Research Center,
Facultad de Ingeniería, Universidad del Desarrollo
The Largest Source of Global Warming Pollution Is the Burning of Fossil Fuels

Billion Metric Tons of Carbon

1850 1875 1900 1925 1950 1975 2000 2020

The 19 of the 20 Hottest Years on Record Have Occurred Since the Year 2002

- 2020
- 2016
- 2019
- 2017
- 2015
- 2018
- 2014
- 2010
- 2013
- 2005
- 2007
- 2009
- 2012
- 2006
- 2002
- 2003
- 2011
- 1998
- 2008
- 2004
The temperature exceeded 50°C (122° F) in at least four countries: Iran, Kuwait, Oman and the UAE.

Source: 2021 NASA Earth Observatory
Portland, Oregon

June 28, 2021

Portland broke its all-time heat record on June 28th, reaching 46.7° C (116° F).
Lahore, Pakistan
June 2, 2019

Jacobabad, Pakistan reached 124° F (51.1° C) on June 2nd.
As Temperatures Increase, the Oceans Evaporate More Moisture into the Sky

Source: Oak Ridge National Laboratory, National Center for Computational Sciences
Evaporation

Precipitation

The Hydrological Cycle

Water Returns to the Sea

Evaporation

Precipitation

The Hydrological Cycle

Water Returns to the Sea
So the downpours get bigger
Midland, Texas
June 1, 2021
Rare “tandem storms” Marco and Laura caused destruction in the northern Caribbean before reaching the U.S. Gulf Coast.
Hurricanes Eta and Iota affected 7.3 million people and killed more than 200 in Central America. In Honduras alone, the storms caused $10 billion in damage—40% of the country’s GDP.
Global Record-Breaking Precipitation Anomalies

Number of record-breaking events compared to stationary climate (%)

Data: Met Office Hadley Centre for Climate Change Research
Globally, floods and extreme rainfall events now occur four times more often than in 1980.
450,000 people were affected by flooding in Brazil, as the Rio Negro broke its all-time flood record and the Amazon and Solimoes Rivers also reached the highest level of flood alert.
Haleiwa Town, O’ahu, Hawaii
March 9, 2021

Intense rainfall led to flooding on several Hawaiian islands.

Video © 2021 Ryan De Seixas
Satkhira, Bangladesh
May 21, 2020

“The Sundarbans is finished. Amphan has killed it. All our crops, even our trees have been destroyed. What will we do?”

– Chandan Das
Bangladeshi Farmer

More than 1 million people have already migrated farther north.
China’s summer flooding was 2020’s costliest climate disaster, causing $17 billion in damages.
Laura, the strongest recorded hurricane ever to strike Louisiana, grew from a Category 1 to a Category 4 storm in a single day.
Unusually heavy monsoon rains have caused flooding in both South and North Korea.
At least 44 people were killed as torrential rain caused flooding and mudslides.
April 17, 2020

North Dakota

Minnesota

Red River

Forest River

Images: NASA
170,000 people were without power in the Metropolitan, Valparaíso, O’Higgins and Maule regions. There was also the threat of interruption of drinking water due to turbidity in the rivers.
September flooding in Nigeria destroyed an estimated 25% of the country's rice harvest and killed dozens of people.
France and Italy experienced flooding and landslides after some areas received 23 inches (58 cm) of rain in 24 hours.
Flooding forced the Dow Chemical Company to close its headquarters and shut down operations.

The Dow property in Midland is home to a Superfund toxic waste site.
Drying conditions and over-pumping of aquifers are causing some parts of Mexico City to sink at up to 23 cm (9 inches) per year.
Worldwide Extreme Weather Catastrophes
1980 – 2020

- Extreme temperatures, droughts, fires
- Floods, mudslides
- Storms

Number of Events

In the U.S., climate-related events caused $95 billion in damages in 2020.
Types of Infrastructure at Risk from Extreme Weather

- Dams
- Flood Barriers
- Drinking Water Systems
- Sewage Systems
- Roads
- Bridges
- Airport Runways
- Train Tracks
- Power Plants
- Power Lines
- Internet and Telephone Lines
- Oil and Gas Pipelines
- Building Foundations
- Stormwater Drainage
- Aqueducts
- Agriculture
Lake Urmia, Iran
1984 – 2016

Source: NASA Landsat / Copernicus via Google Timelapse
Lake Oroville, California
June 1, 2021
Lake Mead, Nevada
June 8, 2021

The United States’ largest reservoir is at its lowest level since it was filled in the 1930s.

Last Full (2000)

43.6 m (143 ft)
Auckland, New Zealand
May 12, 2020

As of June 2020, New Zealand’s major reservoirs are at just 44% of capacity.
Our dams and other aging infrastructure were not built to withstand today’s climate conditions.
Taipei, Taiwan
May 13, 2021

Taiwan’s ongoing drought has led to blackouts as hydropower plants are unable to produce electricity.
<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Water Consumed per Megawatt-hour (in Gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>About 0</td>
</tr>
<tr>
<td>Solar PV</td>
<td>About 0</td>
</tr>
<tr>
<td>Coal</td>
<td>100 – 560</td>
</tr>
<tr>
<td>Gas</td>
<td>100 – 730</td>
</tr>
<tr>
<td>Nuclear</td>
<td>400 – 720</td>
</tr>
</tbody>
</table>

Source: U.S. Department of Energy
How Does Climate Change Affect Water Availability?

- Drought
- Sea Level Rise
- Melting Ice
- Runoff
- Industry
- Domestic Use
- Agriculture
- Energy

Reduced Supply vs. Increased Demand
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