



# "Global Climate Change, Digital Responsibility, and Hydrological Cycle Changes"

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# Introduction

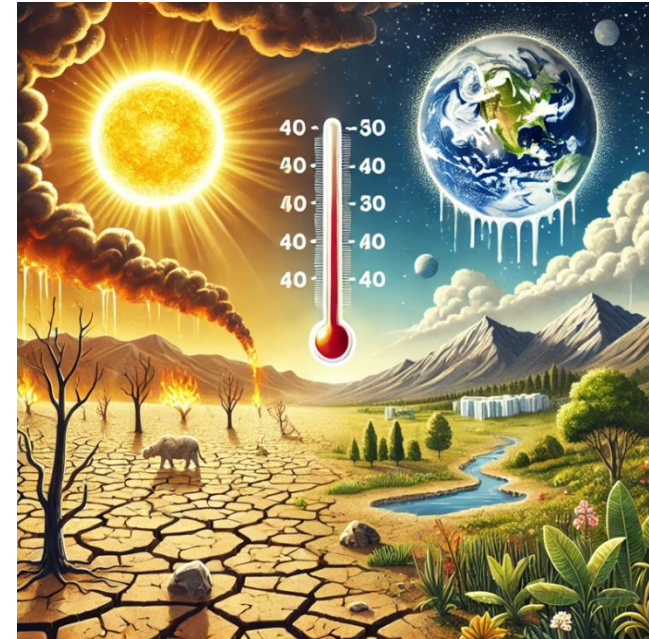
- **Brief overview of the topics:**
  - The impact of global climate change on the environment and society.
  - The growing importance of digital responsibility in a connected world.
  - How the hydrological cycle is changing due to climate and human activities.



# Global Climate Change: Key Definitions

## Global Climate Change

- **Significant, long-term changes** in the Earth's climate system.
- Primarily associated with **rising temperatures**.
- Includes changes in **weather patterns**, precipitation, extreme weather events, and rising sea levels.
- These changes are **persistent**, occurring over decades.
- Driven by both **natural processes** and especially **human activities** (greenhouse gas emissions).



## Global Warming

- The **steady rise** in the Earth's average surface temperature.
- Since 1880, temperatures have risen by **1.2°C**.
- **Consequences:** Rising sea levels, more extreme weather events, and ecosystem disruptions.
- Mainly caused by the **burning of fossil fuels** and **deforestation**.

# Global Climate Change: Key Definitions

## Greenhouse Effect

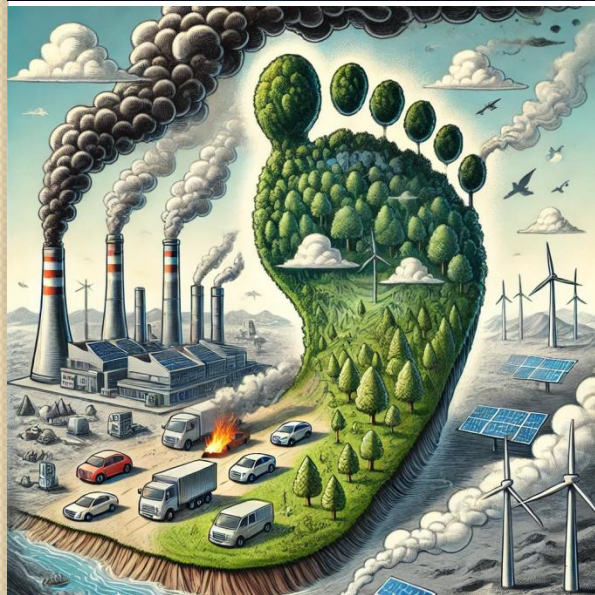
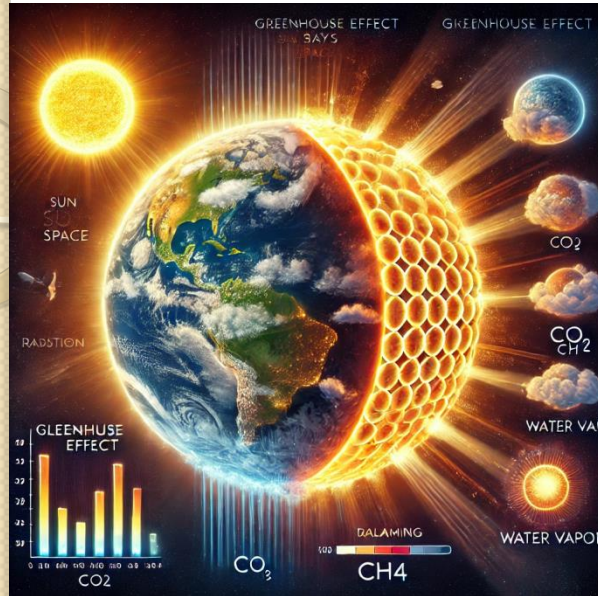
- The trapping of the Sun's warmth in the Earth's lower atmosphere by **greenhouse gases** (CO<sub>2</sub>, CH<sub>4</sub>, water vapor).
- The **greenhouse effect** is necessary for life, but too much of it causes **excessive warming**.

## Carbon Footprint

- The **total amount of greenhouse gases** generated by human activities.
- Global average carbon footprint per person: **4 tons** (varies by country and lifestyle).

## Core Message:

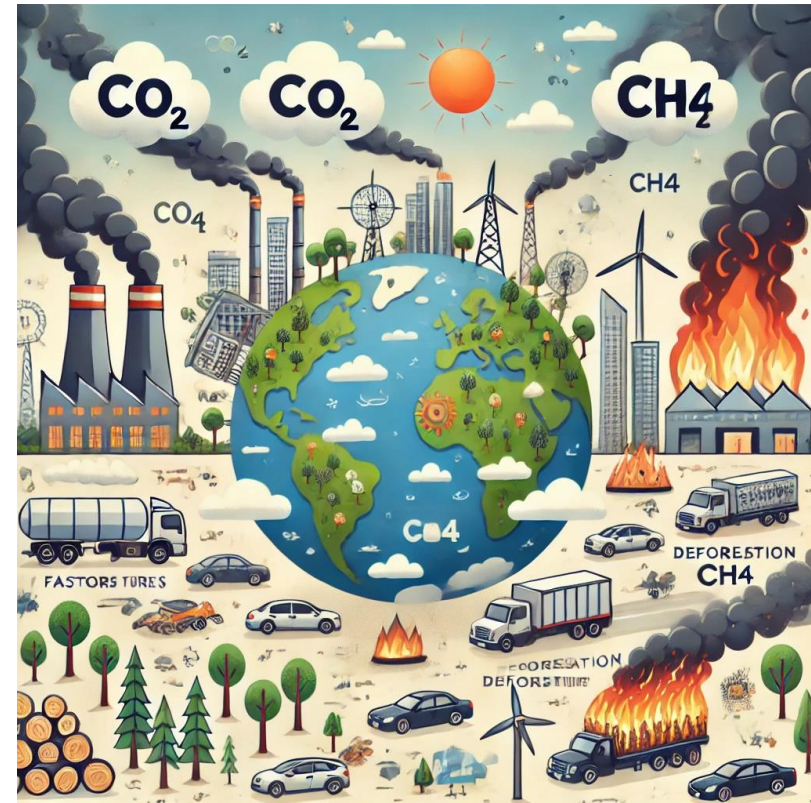
**Human activities** are profoundly changing the Earth's climate, and this will be our focus today.



# Causes of Global Climate Change

## Human Activities:

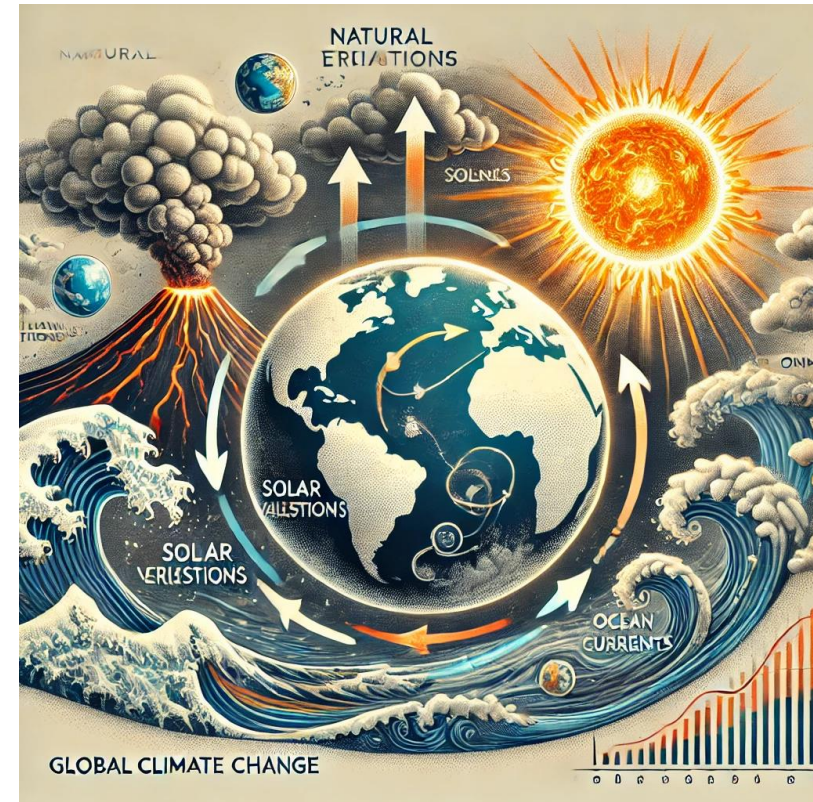
- **Burning of Fossil Fuels:** The combustion of coal, oil, and natural gas for energy and transportation releases large amounts of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases into the atmosphere. Responsible for around **65%** of global emissions.
- **Deforestation:** The clearing of forests reduces the Earth's capacity to absorb CO<sub>2</sub>, exacerbating the greenhouse effect. Accounts for approximately **10%** of global emissions.
- **Agriculture:** Livestock farming releases methane (CH<sub>4</sub>), a potent greenhouse gas, while land use changes for agriculture increase CO<sub>2</sub> emissions. Agriculture contributes around **12-14%** of global emissions.
- **Industrial Processes:** Manufacturing and industrial activities release carbon dioxide (CO<sub>2</sub>) through the burning of fossil fuels. Methane (CH<sub>4</sub>) is also emitted during certain industrial activities, particularly in the oil, gas, and mining sectors. Hydrofluorocarbons (HFCs), used in refrigeration, contribute to global warming. Industry accounts for **6-7%** of global emissions.
- **Waste Management:** The decomposition of organic waste in landfills produces methane (CH<sub>4</sub>), a potent greenhouse gas that contributes to climate change. Waste management contributes **3-5%** of global emissions.



# Causes of Global Climate Change

## Natural Causes:

- **Volcanic Eruptions:** Large volcanic eruptions release ash and gases into the atmosphere, which can temporarily cool the Earth's surface but also contribute to long-term climate effects. Volcanic activity contributes less than **1%** to global climate change.
- **Solar Variability:** Changes in solar radiation can influence the Earth's climate, although current climate change trends are primarily driven by human activities. The contribution of solar variability is less than **1%**.
- **Ocean Circulation Changes:** Natural shifts in ocean currents can influence global climate patterns over time, altering temperatures and weather systems, but they do not contribute significantly to long-term global climate change.



# Impacts of Climate Change on **Ecosystems**, Agriculture, and Human Health

**Ecosystems:** Climate change disrupts natural ecosystems, leading to **species migration**, **habitat loss**, and **extinction**. Changes in **temperature** and **precipitation patterns** affect biodiversity.

**Risk of Extinction:** Approximately **1 million species** are at risk of extinction due to climate change and habitat destruction (according to the **IPBES report**).

**Extinction Threat:** Up to **25% of species** could face extinction due to changing climate conditions.

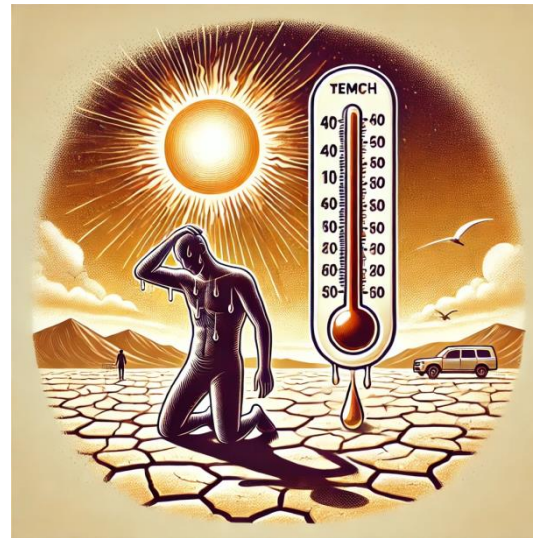


# Impacts of Climate Change on Ecosystems, Agriculture, and Human Health

**Agriculture:** Changes in weather patterns reduce agricultural production and threaten **food security**. **Pests** and **diseases** may thrive in warmer climates, further impacting agricultural productivity.



**Food Security Threat:** Global crop yields may decrease by **10-25%** due to climate change. By **2050**, this could leave **800 million to 1 billion people** facing food insecurity, especially in **Sub-Saharan Africa** and **South Asia**.



**Human Health:** Rising temperatures increase the risk of **heat-related illnesses** and **deaths**. Climate change also contributes to the spread of diseases like **malaria** and **dengue fever**.

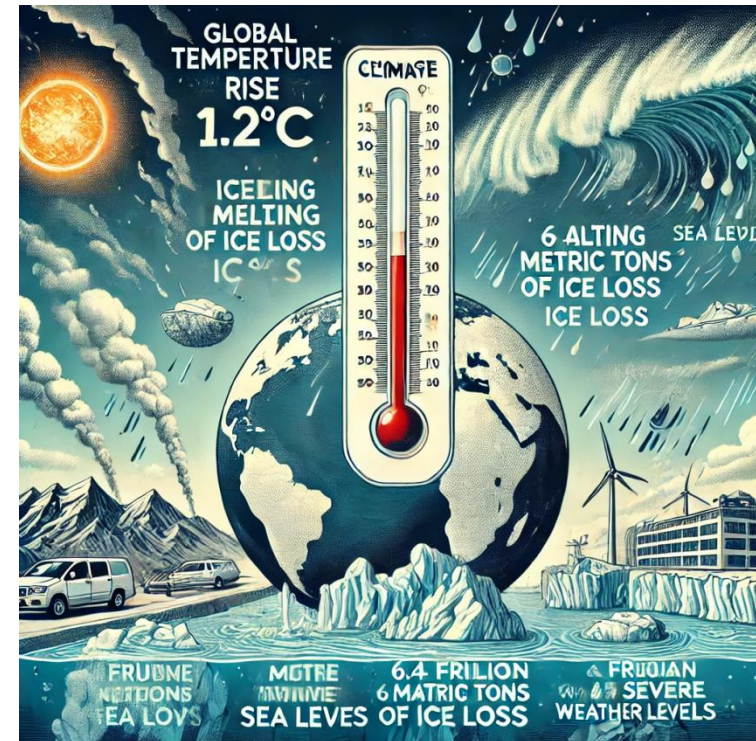
**Mortality Risk:** By **2100**, mortality rates from heatwaves are expected to increase by **50-100%** in vulnerable regions. The risk of **malaria** is projected to double in **Sub-Saharan Africa** and **South Asia** by the **2080s**.



# Observed and Projected Changes Due to Climate Change

## Observed Changes:

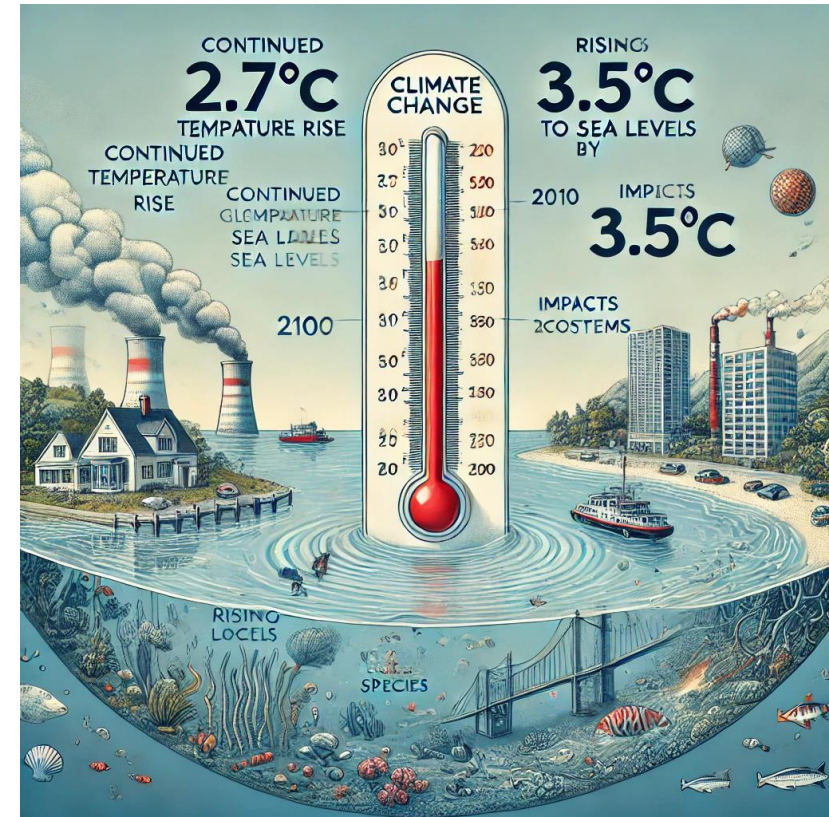
- **Global Temperature Rise:** The Earth's average temperature has increased by approximately **1.2°C** since pre-industrial times (mid-19th century). According to the **IPCC**, this warming trend is largely attributed to human activities, especially the emission of greenhouse gases.
- **Melting Ice Caps:** Studies show that **Greenland** and **Antarctica** have lost **6.4 trillion metric tons of ice** since the 1990s. Greenland's ice melt has increased by about **60%** in the last decade. This contributes to **one-third** of observed global sea level rise.
- **More Frequent and Severe Weather Events:** There is a **70% probability** that heatwaves, extreme storms, floods, and droughts have increased due to climate change. The **frequency of extreme weather events** has doubled in recent decades.



# Observed and Projected Changes Due to Climate Change

## Projected Changes:

- **Continued Warming:** Without significant emissions reductions, global temperatures are projected to rise by **2.7°C to 3.5°C** by the year 2100. The extent of warming depends on future greenhouse gas emissions scenarios.
- **Rising Sea Levels:** Sea levels are projected to rise by **0.3 to 1 meter** by the year 2100, depending on the extent of ice melt and ocean expansion. A **50 cm rise** could displace millions of coastal inhabitants.
- **Impact on Ecosystems:** Climate change is expected to result in the loss of up to **25-30%** of species due to habitat disruption, and **50% of biodiversity** could be severely impacted by the end of the century if global temperatures exceed **2°C**.



# Ongoing Discussions on Climate Change Fundamentals

**Political Debates:** Nations have different responsibilities and capacities in tackling climate change. Key discussions revolve around the **Paris Agreement** and setting **emissions reduction targets**.

- **Developed vs. Developing Countries:** Developed nations have historically contributed more to emissions, while developing countries argue for more time and support to transition to greener economies.
- **Financial Support:** Wealthier countries are expected to provide financial aid for **mitigation** and **adaptation** in developing nations through mechanisms like the **Green Climate Fund**, though debates over fairness continue.



# Ongoing Discussions on Climate Change Fundamentals

## Ethical Concerns:

- **Climate Justice:** This involves determining who should bear the costs of mitigating climate change, with wealthier countries having contributed the most to emissions but poorer nations facing the worst impacts.
- **Environmental Equity:** Developing countries and vulnerable communities suffer the most from climate change. Discussions focus on ensuring they have fair access to resources, technology, and strategies to adapt.
- **Loss and Damage:** Developing nations are seeking compensation from wealthier countries for the irreversible losses caused by climate change, such as land loss due to rising sea levels and destruction from extreme weather events.



# Digital Responsibility

## Ethical Use of Technology:

- **Definition:** Using technology in a way that respects **privacy**, **sustainability**, and **security**, while considering **social** and **environmental impacts**.
- **Example:** Ensuring data protection, using energy-efficient devices, and minimizing e-waste.

## Reducing Environmental Impact of Data Centers and Devices:

- **Issue:** Data centers consume vast amounts of energy, often relying on **non-renewable energy sources**.
- **Solution:** Transition to **renewable energy** and improve **energy efficiency** to reduce the environmental footprint.

## Protecting Privacy & Promoting Sustainable Digital Consumption:

- **Key Concern:** **Data privacy** is a critical issue in the digital age.
- **Sustainable Digital Use:** Be mindful of how **digital services** (e.g., **streaming** or **social media**) contribute to **environmental degradation** through increased energy demand.



# The Environmental Impact of Technology

## 1. E-waste and Recycling Challenges:

- **Key Point:** The rapid turnover of electronic devices results in large amounts of **e-waste**.
- **Impact:** If not properly recycled, e-waste can **leach harmful chemicals** into the environment.

## 2. High Energy Consumption of Data Centers:

- **Key Point:** Data centers consume large amounts of **electricity**, much of which comes from **non-renewable energy sources**.
- **Impact:** This significantly contributes to **carbon emissions**, harming the environment.

## 3. Digital Carbon Footprint (Streaming, Cloud Computing):

- **Key Point:** Streaming high-definition videos and using cloud services create a substantial **digital carbon footprint**.
- **Impact:** These activities require vast amounts of **data transmission** and **storage**, increasing energy demand.



# Solutions for Digital Responsibility

## I. Transition to Renewable Energy in Data Centers:

- **Key Point:** Data centers should transition to using **renewable energy sources** such as **solar**, **wind**, or **geothermal energy** to reduce their **environmental footprint**.
- **Impact:** By reducing the reliance on **fossil fuels**, data centers can significantly cut down **carbon emissions**, helping to combat climate change.
- **Additional Actions:**
  - Invest in **energy-efficient infrastructure** such as advanced cooling systems and energy management software to further reduce consumption.
  - Encourage **green certifications** for data centers, like **LEED** (Leadership in Energy and Environmental Design), to ensure sustainable practices.



# Solutions for Digital Responsibility

## 2. Promote Digital Literacy and Responsible Tech Consumption:

- **Key Point:** Individuals and organizations must adopt **responsible digital behaviors** that reduce energy consumption and **minimize e-waste**.
- **Actions:**
  - **Extend the Life of Devices:** Regular maintenance, software updates, and responsible use can lengthen the lifespan of electronics, reducing the need for frequent replacements.
  - **Optimize Data Usage:** Encourage users to minimize their data footprint by:
    - Reducing video streaming quality when high resolution isn't necessary.
    - Using energy-efficient data transfer methods.
  - **Recycle Electronics Properly:** Partner with certified e-waste recycling companies and educate consumers about proper disposal methods to prevent harmful materials from entering the environment.
  - **Encourage Refurbishing and Reusing:** Before discarding electronics, consider repairing or donating them.





# Solutions for Digital Responsibility

## 3. Encourage Innovation in Sustainable Technology:

- **Key Point:** Companies should prioritize developing **energy-efficient devices** and **sustainable tech solutions**.
- **Actions:**
  - **Eco-friendly Materials:** Use biodegradable or recyclable materials in manufacturing tech devices.
  - **Energy-Efficient Software and Devices:** Develop technology that consumes less power, including energy-saving modes in software and hardware.
  - **Support Circular Economy Models:** Tech companies should promote circular economy practices, where products are designed for longevity, reuse, and recycling at the end of their lifecycle.



# Solutions for Digital Responsibility

## 4. Build Awareness Through Education and Policy Support:

**Key Point:** Both consumers and organizations need to be aware of the environmental impact of their digital consumption.

### **Actions:**

- Create **awareness campaigns** about digital sustainability and how small behavioral changes can make a significant impact.
- Support **policies and regulations** that promote responsible technology use and limit harmful environmental practices in the tech industry.



# How the Hydrological Cycle is Changing Due to Climate and Human Activities

## Key Points:

### Increased Evaporation:

- Rising global temperatures lead to higher evaporation rates.
- This causes more moisture in the atmosphere, contributing to intense storms and flooding.

### Altered Precipitation Patterns:

- Certain regions experience heavier rainfall, while others face prolonged droughts.
- These changes affect water availability, with significant impacts on agriculture and ecosystems.

### Human Activities Disrupting the Cycle:

- **Deforestation and Urbanization:** Reduces natural water absorption, increasing runoff and flooding risks.
- **Over-extraction of Water:** Agriculture and industrial overuse depletes groundwater faster than it can be replenished.
- **Pollution:** Contaminates water sources, affecting both ecosystems and human health.



# Impact of Human Activities on the Hydrological Cycle

## Key Points:

### Deforestation:

- Removal of forests decreases water retention, increasing surface runoff and soil erosion.
- Loss of vegetation disrupts rainfall patterns and reduces groundwater replenishment.

### Urbanization:

- Expanding cities replace permeable surfaces with concrete, which prevents water absorption.
- Increases the risk of flash floods and decreases the natural filtration of water.

### Over-Extraction and Water Pollution:

- Excessive use of water for irrigation and industrial processes depletes aquifers and rivers.
- Pollution from agricultural runoff and industrial waste contaminates water supplies.



# Solutions to Stabilize the Hydrological Cycle

## Actions:

### Climate Change Mitigation:

- Reduce greenhouse gas emissions to limit temperature rise and stabilize global water cycles.

### ➤ Reforestation and Wetland Conservation:

- Protect and restore forests to enhance natural water retention.
- Preserve wetlands, which act as natural water filters and buffer zones for flooding.

### ➤ Sustainable Water Management:

- Promote water-efficient practices in agriculture, industry, and urban planning.
- Support regulations that limit over-extraction of water resources and encourage water recycling.



# SUMMARY

## 1. The Impact of Global Climate Change on the Environment and Society

### Key Points:

- **Rising Global Temperatures:** Global temperatures have been increasing, leading to more frequent heatwaves and changing weather patterns.
- **Extreme Weather Events:** Increased frequency of hurricanes, floods, droughts, and wildfires due to climate change.
- **Effects on Biodiversity:** Many species face extinction as their habitats are destroyed or altered.
- **Human Health:** Climate change exacerbates heat-related illnesses, the spread of diseases like malaria, and threatens food and water security.

### Actions:

- **Reduce Greenhouse Gas Emissions:** Transition to renewable energy sources and improve energy efficiency.
- **Conservation Efforts:** Protect ecosystems and biodiversity by implementing reforestation and conservation strategies.
- **International Collaboration:** Work with global organizations to develop policies that mitigate the effects of climate change.

## 2. The Growing Importance of Digital Responsibility in a Connected World

### Key Points:

- **Energy Consumption:** The increasing use of digital technologies, such as cloud computing and data centers, contributes to energy consumption and carbon emissions.
- **E-waste:** The rapid turnover of electronic devices results in large amounts of electronic waste (e-waste), which poses environmental hazards if not properly recycled.
- **Digital Literacy:** Encouraging individuals and organizations to adopt responsible tech behaviors can reduce the environmental footprint of technology.

### Actions:

- **Sustainable Tech Use:** Encourage practices like extending device lifespan, optimizing data usage, and proper recycling of electronics.
- **Energy-Efficient Solutions:** Data centers and tech companies should prioritize energy-efficient infrastructure and renewable energy use.
- **Policy and Awareness:** Create awareness around digital responsibility and advocate for policies that promote sustainable tech consumption.

## 3. How the Hydrological Cycle is Changing Due to Climate and Human Activities

### Key Points:

- **Increased Evaporation:** Rising global temperatures result in higher evaporation rates, leading to more intense storms and flooding.
- **Altered Precipitation Patterns:** Some regions are receiving heavier rainfall, while others experience prolonged droughts, affecting water availability.
- **Human Impact:** Deforestation, urbanization, and over-extraction of water resources are disrupting the natural water cycle and leading to water scarcity.

### Actions:

- **Sustainable Water Management:** Implement policies that encourage the responsible use of water in agriculture and urban planning.
- **Reforestation and Wetland Conservation:** Protect forests and wetlands to preserve the natural water cycle and reduce the impact of human activities.
- **Climate Change Mitigation:** Reduce carbon emissions to help stabilize the hydrological cycle and prevent further disruption.

# Conclusion

- **The Connection Between Climate Change, Digital Responsibility, and Changes in the Hydrological Cycle:** Climate change not only affects ecosystems and human health but also **disrupts the hydrological cycle** due to human activities, threatening water resources. The increasing **energy consumption** and **e-waste production** from the digital world further exacerbate the problem.
- **Mitigating Climate Change Through Digital Responsibility:** The **responsible use of digital technologies**, including energy-efficient practices and proper recycling, can help **reduce greenhouse gas emissions**. This, in turn, can alleviate the effects of climate change and contribute to **environmental sustainability**.
- **Hydrological Cycle Disruptions and Sustainable Water Management:** Climate change and human activities like **deforestation**, **urbanization**, and **water over-extraction** disrupt the natural water cycle. Implementing **sustainable water management** policies is essential to mitigate water scarcity and ensure the availability of resources for future generations.
- **Global Cooperation and Individual Responsibility:** Both individuals and organizations need to be aware of their environmental impact. Promoting **sustainable digital behaviors** and advocating for **responsible technology use** can play a vital role in mitigating climate change. Additionally, **global collaboration** and supportive policies are crucial in driving sustainable practices across sectors.
- **In conclusion**, climate change, digital responsibility, and water management are interconnected global issues that require a **comprehensive and integrated approach**. **Collective efforts** at both the individual and institutional levels are key to building a **sustainable** and environmentally conscious future.





# Questions & Discussion

- Open the floor for audience questions.

# References:

1. IPCC Report 2021 - AR6 Climate Change Report
2. [NASA Climate Change](#)
3. [UNFCCC - Causes of Climate Change](#)
4. [EPA - Causes of Climate Change](#)
5. NOAA Climate Change Data
6. WMO State of the Global Climate Report
7. [World Bank - Climate Change Overview](#)
8. UNEP - Climate Change Impacts
  
9. IPCC AR6 Climate Change Report
10. [EPA Sources](#)
11. [FAO Deforestation Report](#)
12. IPCC Land Report
13. [EPA Agriculture Emissions](#)
14. [EPA Industrial Emissions](#)
15. [EPA Waste Emissions](#)
16. UNFCCC Waste Emissions
17. USGS Volcanic Eruptions
18. CO2NOAA Ocean Circulation

# References:

19. IPCC Report on 1.5°C Warming
20. [NASA Study on Ice Melt](#)[Nature Journal - Ice Loss](#)
21. NOAA Extreme Weather Report
22. IPCC AR6 Climate Change Report
23. [NASA Sea Level Data](#)
24. IPCC Report on OceansIPBES Global Assessment