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WAVES

Water Awareness and Value for
Environmental Sustainability



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MODULE 3: THE HUMAN WATER CYCLE - ANTHROPOGENIC IMPACTS AND IMPLICATIONS





The Anthropocene and the Water Cycle

Alterations to the Water Cycle:

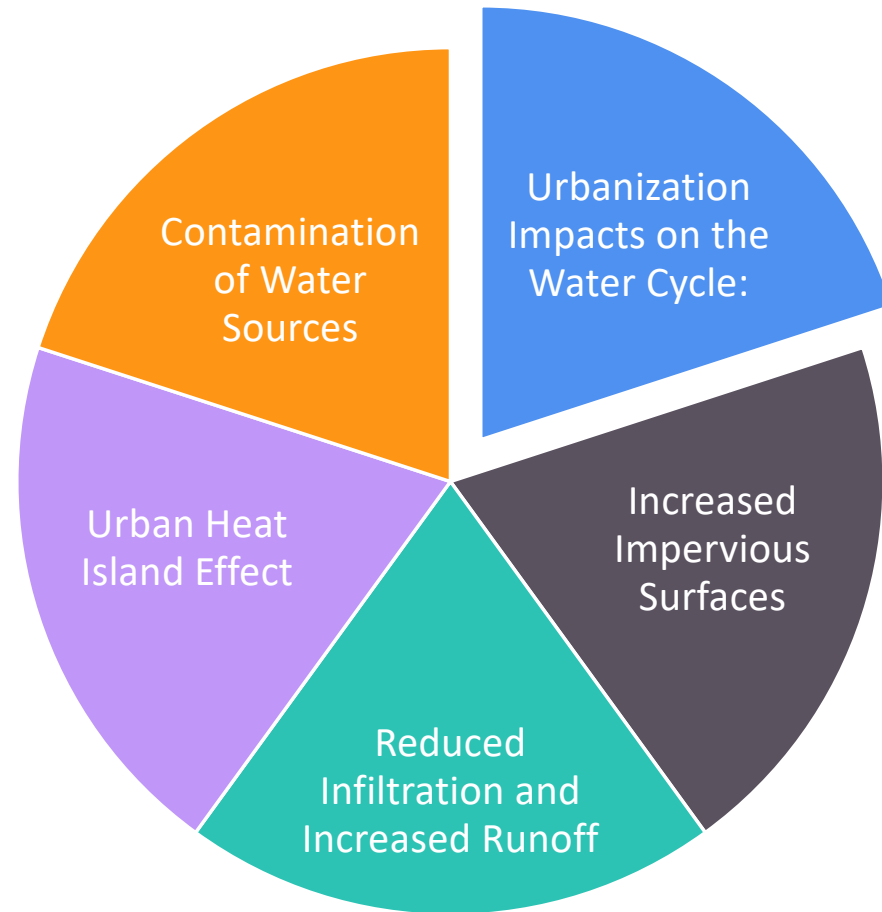
- Changes in Precipitation Patterns
- Increased Runoff
- Altered Evapotranspiration
- Shifts in Water Resource Distribution



Land-Use Change and Deforestation

- Deforestation: A Major Disruptor of the Water Cycle
- Reduced Evapotranspiration
- Increased Surface Runoff
- Soil Erosion and Sedimentation
- Impacts on Groundwater Recharge and Streamflow

Urbanization and Impervious Surfaces





Agricultural Impacts on Water Resources

- Agriculture is the largest water user in the world
- Over-Irrigation and Water Wastage
- Agricultural Runoff and Water Pollution
- Eutrophication and Harmful Algal Blooms
- Sustainable Agriculture: The Way Forward

Industrial Water Use and Pollution

- Industrial Water Pollution is a Major Threat.
- Types of Pollutants: Heavy Metals, Chemicals, POPs
- Impacts on Aquatic Ecosystems and Human Health
- Need for Stricter Regulations and Cleaner Production Technologies





Climate Change and the Water Cycle: A Disrupted Balance

- Climate Change is a Major Disruptor of the Water Cycle
- Increased Frequency and Intensity of Extreme Weather Events
- Rising Sea Levels and Coastal Inundation
- Melting Glaciers and Reduced Water Availability
- Adaptation and Mitigation Strategies is a critical need



Dams and River Regulation: Altering Natural Flows

- Dams and Reservoirs can have drastic impacts on River Ecosystems
- Altered Flow Regimes Sediment Trapping and Downstream Erosion
- Barriers to Fish Migration Changes in Water Quality and Temperature
- Balancing Benefits and Impacts

Groundwater Over-extraction: Depleting a Hidden Resource



- Groundwater Over-extraction: A global challenge threatening water security and sustainability.
- Aquifer Depletion: Lowering of the water table, leading to reduced water availability and increased pumping costs.
- Can impact ecosystems dependent on groundwater, such as wetlands and springs.
- Land Subsidence: Sinking of the ground surface due to the removal of groundwater support.
- Can damage buildings, roads, and other infrastructure.
- Increases flood risk in coastal areas.
- Saltwater Intrusion: In coastal areas, over-extraction can cause saltwater to seep into freshwater aquifers, contaminating them and making them unusable.
- Sustainable Groundwater Management: Reducing pumping rates to match natural recharge rates.



The Pervasive Problem of Plastic Pollution: A Global Scourge

- **Microplastics:** Tiny plastic fragments (<5mm) from the breakdown of larger debris.
- **Marine Life Impacts:**
 - Entanglement
 - Ingestion
 - Habitat Destruction
 - Invasive Species
- **Human Health Impacts:**
 - Food Chain
 - Chemical Contamination
- **Solutions:**
 - Reduce single-use plastic.
 - Improve waste management and recycling.
 - Support plastic cleanup innovations.
 - Raise awareness and promote responsible plastic use.



Nutrient Pollution: The Unseen Menace to Water Quality

- Nutrient Pollution: Excess nutrients, primarily nitrogen and phosphorus, disrupt aquatic ecosystems.
- Harmful Algal Blooms: Can cause oxygen depletion, fish kills, and toxin production.
- Sources: Agricultural runoff, untreated sewage, and industrial discharges.
- Solutions: Improved agricultural practices, wastewater treatment, and sustainable land management.

Water Pollution's Economic Toll: The Hidden Costs



Economic Impacts: Water pollution leads to significant financial costs for communities and industries.



Healthcare Expenses: Treatment of waterborne diseases and long-term health effects.



Lost Revenue: Reduced tourism and fishing opportunities due to polluted waterways.



Property Values: Contamination can decrease property values and hinder economic development.



Investment in Prevention: Cost-effective compared to the long-term costs of pollution.



Protecting Our Water: Collective Action for a Sustainable Future



- **Shared Responsibility:** Everyone has a role to play in protecting water resources.
- **Individual Actions:** Reducing water use, proper waste disposal, and responsible consumption.
- **Policy Advocacy:** Supporting regulations and initiatives that promote sustainable water management.
- **Community Engagement:** Participating in cleanups, education programs, and advocacy efforts.
- **Collective Action:** Collaboration between individuals, communities, governments, and industries is crucial for achieving water security.



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Pop quiz

Which of the following is NOT a consequence of deforestation on the water cycle?

- a) Increased surface runoff
- b) Reduced evapotranspiration
- c) Increased groundwater recharge
- d) Soil erosion and sedimentation

What percentage of global wastewater is discharged untreated into the environment?

- a) 20%
- b) 40%
- c) 60%
- d) 80%

Which innovative technology utilizes semi-permeable membranes to remove contaminants from water based on size and charge?

- a) Atmospheric water generation
- b) Membrane filtration
- c) Nanotechnology
- d) Smart water management

The Aral Sea disaster is a prime example of the negative consequences of:

- a) Climate change
- b) Industrial pollution
- c) Unsustainable water withdrawals for irrigation
- d) Deforestation

Which of the following is an example of an emerging contaminant in water sources?

- a) Heavy metals
- b) Pharmaceuticals
- c) Sediment
- d) Nitrogen