

## UNIT II - WATER RESOURCES AND ENVIRONMENT MICROBIOLOGY

### 2.1 WATER RESOURCES

#### 1. Definition of Water Resources

- Water resources refer to all sources of water useful for human and environmental needs.
  - Includes surface water (rivers, lakes), groundwater, and atmospheric water.
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#### 2. Types of Water Resources

- Surface Water: Rivers, lakes, reservoirs, and oceans.
  - Groundwater: Water stored underground in aquifers.
  - Rainwater: Precipitation collected for use.
  - Desalinated Water: Freshwater derived from seawater.
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#### 3. Importance of Water Resources

- Human Needs: Drinking, agriculture, sanitation, and industry.
  - Economic Development: Power generation, manufacturing, and transportation.
  - Ecosystem Support: Maintains biodiversity and natural habitats.
  - Cultural and Recreational Value: Religious practices, tourism, and leisure.
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#### 4. Global Water Distribution

- 97% in oceans (saline water).
  - 3% is freshwater:
    - 70% in glaciers and ice caps.
    - 30% in groundwater.
    - Less than 1% is accessible surface water.
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#### 5. Challenges in Water Resources

- Scarcity: Uneven distribution and increasing demand.
  - Pollution: Industrial waste, agricultural runoff, and domestic sewage.
  - Climate Change: Alters water cycles, causes droughts or floods.
  - Overuse: Depletion of groundwater and rivers.
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#### 6. Sustainable Water Management

- Conservation: Reducing water waste, rainwater harvesting.
  - Reuse and Recycling: Treating wastewater for reuse.
  - Efficient Technologies: Drip irrigation, desalination plants.
  - Policy and Planning: Enforcing water laws and international agreements.
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#### 7. Role of Individuals

- Reduce Waste: Fix leaks, use water-efficient appliances.
- Awareness: Educate communities on water conservation.
- Participate: Support policies and initiatives for sustainable water use.

## 2.2 USE AND OVER- UTILIZATION OF SURFACE AND GROUNDWATER

### 1. Uses of Surface and Groundwater

- Domestic Use: Drinking, cooking, cleaning, and sanitation.
- Agriculture: Irrigation for crops; accounts for 70% of water use globally.
- Industry: Used in manufacturing, cooling, and energy production.
- Power Generation: Hydropower (surface water) and geothermal energy (groundwater).
- Recreation and Tourism: Lakes, rivers, and reservoirs for boating, fishing, etc.
- Ecosystem Support: Maintains wetlands, forests, and aquatic habitats.

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### 2. Over-utilization of Surface Water

- **Excessive Extraction:**
  - Diversion for agriculture and industries.
  - Construction of dams and reservoirs reducing downstream flow.
- **Consequences:**
  - Drying rivers and lakes.
  - Degraded ecosystems and loss of biodiversity.
  - Increased risk of conflicts over shared water bodies.

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### 3. Over-utilization of Groundwater

- Reasons for Overuse:
  - Increased demand for agriculture due to population growth.
  - Insufficient surface water availability in arid regions.
  - Dependence on borewells and tube wells.
- Consequences:
  - Depletion of Aquifers: Lowering water tables.
  - Land Subsidence: Ground sinks due to over-extraction.
  - Saltwater Intrusion: Coastal aquifers become saline.
  - Reduced Water Quality: Increased contaminants like fluoride and arsenic.

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### 4. Causes of Over-utilization

- Population Growth: More demand for water for food, industry, and homes.
- Inefficient Practices: Traditional irrigation methods waste water.
- Urbanization: Expanding cities increase water extraction.
- Lack of Regulations: Over-pumping of groundwater in many areas.

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## 5. Solutions to Over-utilization

- Adopt Efficient Irrigation: Drip and sprinkler systems to reduce wastage.
- Rainwater Harvesting: Collect and store rainwater for use.
- Reuse and Recycling: Treat wastewater for non-drinking purposes.
- Improved Policies: Regulate water extraction and enforce water-sharing treaties.
- Community Participation: Educating and involving locals in water conservation.

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## 6. Importance of Sustainable Practices

- Prevents Scarcity: Ensures availability for future generations.
- Supports Ecosystems: Maintains natural habitats and biodiversity.
- Improves Quality: Protects surface and groundwater from pollution.

