Water Quality Module

Luxembourg Outreach event
Quality issues in water bodies
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• Definition of water quality
• Importance of water quality
• Water quality problems
• Causes of water pollution
• Current state of water quality in the world
What is water quality?
What is water quality?

Physical, chemical, biological and ecological characterization of a water body

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<tr>
<th>Physical</th>
<th>Chemical</th>
<th>Biological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Dissolved Oxygen</td>
<td>Macroinvertebrates</td>
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<td>Flow</td>
<td>pH</td>
<td>Bacteria</td>
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<tr>
<td>Turbidity</td>
<td>Metals</td>
<td>Phytoplankton</td>
</tr>
<tr>
<td>Electrical conductivity</td>
<td>Nitrogen/phosphorus</td>
<td>Aquatic wildlife/fish</td>
</tr>
<tr>
<td>Hardness</td>
<td>Chloride</td>
<td>Chlorophyll</td>
</tr>
<tr>
<td>Color</td>
<td>Organic chemicals</td>
<td>Algae</td>
</tr>
</tbody>
</table>
Why is it important?
Water quality problems
Sources of pollution
Water Quality Status

**Water Usage**

- Agriculture: 70%
- Industry: 20%
- Personal Consumption: <10%

**Agriculture**: Farming is water intensive. Current trends have further boosted demand.

Approximately, how many gallons of water are required to produce a pound of...

- Lettuce: 15 gallons
- Chicken: 450 gallons
- Beef: 1850 gallons

**Population**: In 2050, the population is expected to grow by 3 billion people.

Of the 3 billion, how many are estimated to be from developing countries?

- 2.7 Billion

**Urbanization**: By 2050, 7 out of every 10 people will live in an urban area.

**What’s Wrong with the Water?**

- Roughly 95% of sewage in the developing world is dumped directly into rivers, lakes, and coastal waters.
- 80% of China’s rivers are too toxic for fish—let alone people.
- 75% of industrial waste in the developing world is discarded directly into rivers, lakes, and coastal waters.
- US water systems need more than $275 billion in investments through 2023.
WQ Activity

Your life is in danger!

• How to analyse water quality?
• There are many parameters you can measure: heavy metals, bacteria, viruses, organic matter, etc.
• You will analyse some of these parameters today.
• To understand them a bit, pay attention to the next slides
Electrical Conductivity (EC)

• **Definition:** Measures the ionic content in water such as metals, nitrates, phosphates, salts

• **Standard for drinking water:** EC < 2500 $\mu$S/cm @ 20 $^\circ$C (EU standards)

• **Examples**
  
<table>
<thead>
<tr>
<th></th>
<th>Tap Water</th>
<th>Sea water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain</td>
<td>&lt; 50 $\mu$S/cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500-5,000 $\mu$S/cm</td>
<td>$\approx$ 50,000 $\mu$S/m</td>
</tr>
</tbody>
</table>
pH

• **Definition:**
  – Measures the hydrogen ions in water [0-14]
  – Indicates the degree of acidity or alkalinity in waters

• **Standard for drinking water:** 6.5 < pH < 9.5 (EU standards)

• **Examples**
  
  Acid rain ≈ 5.6
  Citric acid ≈ 2.2
  Bleach ≈ 12.6
Turbidity (Tu)

• **Definition:** Measures the suspended particles in water.

• **Standard for drinking water:** $Tu < 1$ NTU
Dissolved Oxygen

• **Definition:** Amount of oxygen dissolved in water
Until the WQ activity then!