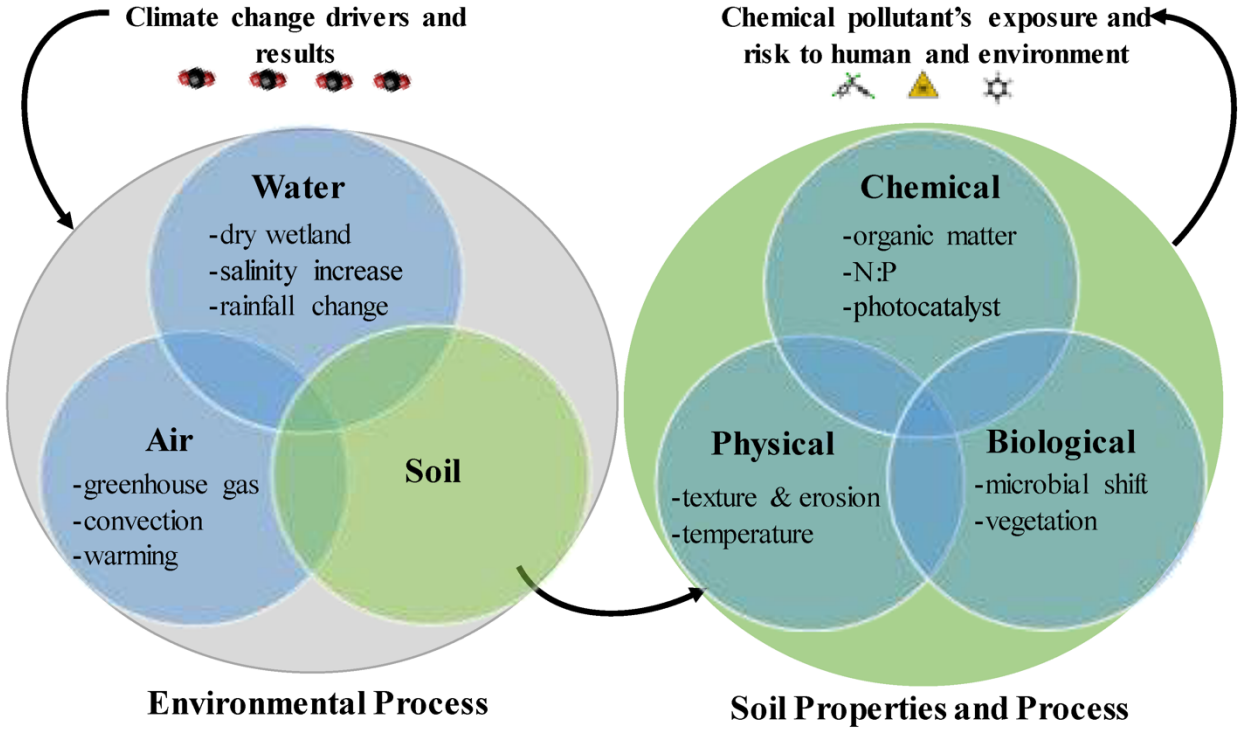
# Lecture 2: The Chemistry of Contamination: Pollutant Properties and Behavior

# A Course in Fundamental of Pollution

## Lecture 2: The Chemistry of Contamination: Pollutant Properties and Behavior

**Core Concept:** The behavior and impact of a pollutant are dictated by its intrinsic chemical properties.

**(Introduction)**
"To manage pollution, we must first understand the actors themselves. Why does DDT persist for decades while some organic solvents volatilize in hours? Why does mercury accumulate in fish tissue but sodium nitrate flushes through a watershed? The answers lie in fundamental chemistry.




Three key properties determine a pollutant's fate:

1. **Persistence:** A measure of a chemical's resistance to degradation through chemical, biological, and photolytic processes. Persistent Organic Pollutants (POPs), like PCBs and dioxins, resist breakdown, leading to long-term ecological and health threats. We quantify this with measures like half-life.

2. **Solubility:** Whether a substance dissolves more readily in water (hydrophilic) or in fats/lipids (lipophilic). Water-soluble pollutants (e.g., nitrate ions) spread rapidly through aquatic systems. Lipophilic pollutants (e.g., DDT, PCBs) bioaccumulate in fatty tissues and biomagnify up food chains, becoming concentrated in top predators, including humans.

3. **Toxicity:** The inherent potential of a substance to cause damage to living organisms. This is not a single property but a spectrum, often summarized in the toxicological maxim, "The dose makes the poison." We will explore concepts like LD50 (lethal dose for 50% of a population) and endocrine disruption.


Furthermore, we must consider **reactivity**. Some pollutants are stable, while others, like nitrogen oxides (NOx), are highly reactive in the atmosphere, leading to the formation of secondary pollutants such as ozone. By profiling a pollutant's chemical personality, we can predict its journey through the environment and its ultimate impact."