

Section 2.3.

Effects of Bioaccumulation on Ecosystems.

Textbook pages 92 to 103.

Before You Read.

Everyday activities, such as driving or heating your home, often pollute ecosystems. In your opinion, which human activity is the most harmful to the environment?

How can pollutants affect food chains and ecosystems?

Human activity creates many harmful pollutants. These build up in the environment when decomposers are unable to break them down. Plants take up these pollutants. The pollutants are then transferred along the food chain until they reach the highest trophic level. **Bioaccumulation** refers to the gradual build-up of pollutants in living organisms. **Biomagnification** refers to the process in which pollutants not only accumulate, but also become more concentrated at each trophic level. Organisms at lower trophic levels may be affected by the pollutant, but primary, secondary, and tertiary consumers will be more affected, because levels will build up in their tissues as they consume contaminated food. An example of this is the P.C.B. concentrations in the orca's food web. When orcas consume food contaminated with P.C.B., they store some of the P.C.B. in their blubber. When salmon (their primary food) is not available, orcas use their blubber for energy. This releases P.C.B. into their system. Pollutants can build up to toxic levels in organisms at the top of the food chain. They can also affect entire ecosystems when **keystone species**, species that greatly affect ecosystem health, or the reproductive abilities of species are harmed.

What are some human-made compounds that bioaccumulate and biomagnify?

P.C.B. (polychlorinated biphenyls)

- Polychlorinated biphenyls were once widely used in industrial products but are now banned in North America. They interfere with normal functioning of the body's immune system and cause problems with reproduction.

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- Polychlorinated biphenyls have a long **half-life** (time it takes for the amount of a substance to decrease by half). They stay in the environment for a long time. Aquatic ecosystems are most sensitive to PCBs. Organisms at high trophic levels, like the orca, retain high levels of the pollutant.

P.O.P. (persistent organic pollutants)

- Persistent organic pollutants are harmful, carbon-containing compounds that remain in water and soil for many years.
- **D.D.T.** (dichloro-diphenyl-trichloroethane) is a toxic persistent organic pollutant that was used as a **pesticide** in the past to control disease carrying mosquitoes.
- Accumulation is measured in **parts per million (p.p.m.)**. This refers to one particle of a given substance mixed with 999 999 other particles. D.D.T. is harmful at 5 parts per million.

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Heavy metals

Once heavy metals enter the biosphere, they do not degrade, and they can not be destroyed.

- Heavy metals, such as lead, cadmium, and mercury, are toxic at low concentrations; however, small amounts are naturally present in soil. For humans, the most serious source of cadmium poisoning is smoking.
- Human activities can cause these metals to build up in ecosystems. In the past, use of lead-based insecticides, batteries, and paints, increased lead to harmful levels. Despite reductions, lead still enters ecosystems through improperly disposed electronic waste.

How can the effects of chemical pollution be reduced?

Some harmful chemical pollutants can be removed from the environment by **bioremediation**, a process where micro-organisms or plants help clean them up. Reacting contaminants with certain chemicals can also make them less harmful.

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