

# What is Bioremediation?

**Bio** means “life”. **Bioremediation** uses living things to break down or remove toxins and harmful substances from soil and water. In particular, “**Bioremediation**” is often used to mean using beneficial bacteria and microorganisms, **phytoremediation** uses plants, and **mycoremediation** uses fungi and mushrooms.

Bioremediation looks at the whole system, the living soil communities, and aims to restore the maximum health, diversity, and life.

## Some methods:

### Bioremediation:

**Compost teas and inoculants** may be **aerobic**—full of air and oxygen, or **anaerobic**, low in oxygen. Generally, beneficial bacteria are oxygen lovers. But some beneficials, known as **Effective Microorganisms** or **EM** breed in anaerobic conditions. EM can be purchased or cultured, and can be used in mold abatement, against pathogens, as a general disinfectant, and for improving soil health.

**Compost** improves soil health and pH, adds organic matter and beneficial microorganisms. It helps soils hold water, provides plants with food at a slow and steady rate, and offers lots of surface area where toxic substances can be held for living organisms to break down or bind and make inert.

**Worm Compost** and **worm castings** increase beneficial soil bacteria that breed in worm guts. It adds valuable nutrients to improve soil health. They are an invaluable source of beneficial bacteria.

**Aerated Compost Tea** is specially brewed from compost, worm castings, molasses (to feed the beneficial bacteria) and other helpful nutrients to favor beneficial microorganisms. It is generally bubbled for 24-36 hours, at temperatures of between 65-85 degrees F and used immediately while populations of beneficials are at their maximum.

**Mulch** adds organic material to the soil, improves soil health and structure, and serves as a **substrate**, a habitat for worms, fungi, and soil bacteria.

## **Phytoremediation:**

Plants are grown that can take up toxic substances, in particular, heavy metals. Specific plants accumulate different substances. When harvested, plant materials need to be treated as toxic wastes and cannot be eaten.

Some plants also generate an environment around their roots that favors beneficial bacteria that can break down some toxins in place.

## **Mycoremediation:**

A mushroom is only a **fruiting body**, the visible reproductive organism of a larger body of **mycelium**, an underground web of threads or **hyphae** that are the main body of the organism.

Mushroom mycelium release enzymes that can break the chemical bonds of many petrochemicals and toxins. Some mushrooms can also uptake heavy metals—they must then be harvested and treated as toxic waste. Different species work best for specific toxins.

A **substrate**, often wood chips, sterilized straw or cardboard, is inoculated with mushroom **spawn** of a beneficial species. Inoculated substrate can also be used as a filter for flowing water. Some species of fungi will attack pathogens and bacteria.

**Mycorrhizal fungi** live in association with plant roots. Their threads interpenetrate the roots, helping them take in more nutrients and water. They can improve soil and plant health, and protect against toxicity and disease.

## **Complex strategies:**

Polluted environments often contain many different sorts of toxic substances. Plants, mushrooms, and microorganisms can be combined in many different ways to regenerate healthy, thriving life in our soils and water.