

Phytoremediation: Notes for IASExam

Phytoremediation refers to the technologies that use plants to clean up the soil, air, and water which have been contaminated by chemicals.

This concept is featured in the General Science segment of the IAS exam.

What is Phytoremediation?

Phytoremediation is a cost-efficient plant-based approach that takes advantage of the ability of plants to concentrate elements and compounds from the environment and metabolize various molecules in their tissues. It refers to the natural ability of certain plants to bioaccumulate, degrade, or render harmless contaminants in soil, water, or air. Toxic heavy metals and organic pollutants are the targets for phytoremediation.

What is the application of Phytoremediation?

Phytoremediation is usually applied to contaminated soil or water environments that are static in nature. Some of the examples include the restoration of abandoned metal mine workings and sites where polychlorinated biphenyls have been dumped during manufacture and mitigation of ongoing coal mine discharges reducing the impact of contaminants in soils, water, or air.

Contaminants such as metals, pesticides, solvents, explosives, and crude oil and its derivatives, have been mitigated in phytoremediation projects worldwide. Many plants such as mustard plants, alpine pennycress, hemp, and pigweed have proven to be successful at hyperaccumulating contaminants at toxic waste sites.

Not all plants are able to accumulate heavy metals or organics pollutants due to differences in the physiology of the plant. Even cultivars within the same species have varying abilities to accumulate pollutants.

What are the advantages and disadvantages of Phytoremediation?

Advantages:

1. In principle, plants that engage in phytoremediation of toxic elements could be harvested, thus removing these elements from the polluted site.
2. The plants can be easily monitored
3. The possibility of the recovery and re-use of valuable metals (by companies specializing in "phytomining")
4. It is potentially the least harmful method because it uses naturally occurring organisms and preserves the environment in a more natural state.

5. It preserves the topsoil, maintaining the fertility of the soil
6. It increases soil health, yield, and plant phytochemicals

Disadvantages:

1. Phytoremediation simply relocates toxic heavy metals, it does not remove them from the locale.
2. Phytoremediation is limited to the surface area and depth occupied by the roots.
3. Slow growth and low biomass require a long-term commitment
4. With plant-based systems of remediation, it is not possible to completely prevent the leaching of contaminants into the groundwater.
The survival of the plants is affected by the toxicity of the contaminated land and the general condition of the soil.
5. When taking up heavy metals, sometimes the metal is bound to the soil organic matter, which makes it unavailable for the plant to extract.

Relevant Questions regarding Phytoremediation**What type of plants can be used for phytoremediation?**

The following plants are best for phytoremediation:

- Indian mustard
- Willow
- Poplar tree
- Indian grass
- Sunflower

What is phytoremediation important?

Phytoremediation, the use of green plants to treat and control wastes in the water, soil, and air, is an important part of the new field of ecological engineering. Organic and inorganic wastes include metals and metalloids, some xenobiotic contaminants, and salts leachate, sewage, sludge, and other conventional wastes.