Soil pollution

Stripping soil of its natural fertility by using artificial chemicals like pesticides, insecticides, ripening agents etc. is known as “**Soil Pollution**”.

**Soil contamination** or **soil** [**pollution**](http://en.wikipedia.org/wiki/Pollution) is caused by the presence of (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals, or improper disposal of [waste](http://en.wikipedia.org/wiki/Waste). The most common chemicals involved are petroleum [hydrocarbons](http://en.wikipedia.org/wiki/Hydrocarbons), polynuclear aromatic hydrocarbons (such as naphthalene and [benzo(a)pyrene)](http://en.wikipedia.org/wiki/Benzo%28a%29pyrene), [solvents](http://en.wikipedia.org/wiki/Solvents), pesticides, [lead](http://en.wikipedia.org/wiki/Lead), and other [heavy metals](http://en.wikipedia.org/wiki/Heavy_metals). Contamination is correlated with the degree of [industrialization](http://en.wikipedia.org/wiki/Industrialization) and intensity of chemical usage.

Industrial wastes such as harmful gases and chemicals, agricultural pesticides, fertilizers and insecticides are the most common causes of soil pollution.  
Soil pollution results from the build up of contaminants, toxic compounds, radioactive materials, salts, chemicals and cancer-causing agents. The most common soil pollutants are hydrocarbons, heavy metals (cadmium, lead, chromium, copper, zinc, mercury and arsenic), herbicides, pesticides, oils, tars, PCBs and dioxins.

What are the Effects of Soil Pollution?

Decrease in soil fertility and therefore decrease in the soil yield. How can one expect contaminated soil to produce healthy crops?  
Loss of soil and natural nutrients present in it. Plants also would not thrive in such soil, which would further result in soil erosion.  
Disturbance in the balance of flora and fauna residing in the soil.

Increase in salinity of the soil, which therefore makes it unfit for vegetation, thus making it useless and barren.

Generally crops cannot grow and flourish in polluted soil. Yet, if some crops manage to grow, they would be poisonous enough to cause serious health problems in people consuming them.  
 Creation of toxic dust is another potential effect of soil pollution.

Foul smell due to industrial chemicals and gases might result in headaches, fatigue, nausea, etc., in many people.  
Soil pollutants would bring in alteration in the soil structure, which would lead to death of many essential organisms in it. This would also affect the larger predators and compel them to move to other places, once they lose their food supply.

**Pesticides and herbicides**

A [pesticide](http://en.wikipedia.org/wiki/Pesticide) is a substance or mixture of substances used to kill a pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacteria), antimicrobial, disinfectant or device used against any pest. Pests include insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms) and microbes that compete with humans for food, destroy property, spread or are a vector for disease or cause a nuisance. Although there are benefits to the use of pesticides, there are also drawbacks, such as potential toxicity to humans and other organisms.

The term pesticide can be classified by target [organism](http://en.wikipedia.org/wiki/Organism) as the following: [herbicide](http://en.wikipedia.org/wiki/Herbicide), [insecticide](http://en.wikipedia.org/wiki/Insecticide), [insect growth regulator](http://en.wikipedia.org/wiki/Insect_growth_regulator), [nematicide](http://en.wikipedia.org/wiki/Nematicide), termiticide, [molluscicide](http://en.wikipedia.org/wiki/Molluscicide), [piscicide](http://en.wikipedia.org/wiki/Piscicide), [avicide](http://en.wikipedia.org/wiki/Avicide), [rodenticide](http://en.wikipedia.org/wiki/Rodenticide), predacide, [bactericide](http://en.wikipedia.org/wiki/Bactericide), [insect repellent](http://en.wikipedia.org/wiki/Insect_repellent), [animal repellent](http://en.wikipedia.org/wiki/Animal_repellent), [antimicrobial](http://en.wikipedia.org/wiki/Antimicrobial), [fungicide](http://en.wikipedia.org/wiki/Fungicide), [disinfectant](http://en.wikipedia.org/wiki/Disinfectant) ([antimicrobial](http://en.wikipedia.org/wiki/Antimicrobial)), and [sanitizer](http://en.wikipedia.org/wiki/Sanitizer).Or by their chemical structure (e.g., organic, inorganic, synthetic, or [biological (biopesticide)](http://en.wikipedia.org/wiki/Biopesticide), and physical state (e.g. [gaseous (fumigant)](http://en.wikipedia.org/wiki/Fumigation)). [Biopesticides](http://en.wikipedia.org/wiki/Biopesticide) include microbial pesticides and biochemical pesticides .

Pesticides can be classified based upon their biological mechanism function or application method. Most pesticides work by [poisoning](http://en.wikipedia.org/wiki/Poison) pests. A systemic pesticide moves inside a plant following absorption by the plant. With insecticides and most fungicides, this movement is usually upward (through the [xylem](http://en.wikipedia.org/wiki/Xylem)) and outward. Increased efficiency may be a result. Systemic insecticides, which poison [pollen](http://en.wikipedia.org/wiki/Pollen) and [nectar](http://en.wikipedia.org/wiki/Nectar) in the [flowers](http://en.wikipedia.org/wiki/Flower), may kill [bees](http://en.wikipedia.org/wiki/Bees) and other needed [pollinators](http://en.wikipedia.org/wiki/Pollinator).

[Herbicides](http://en.wikipedia.org/wiki/Herbicide) are used to kill weeds, especially on pavements and railways. They are similar to auxins and most are biodegradable by soil bacteria. However, one group derived from [trinitrotoluene](http://en.wikipedia.org/wiki/Trinitrotoluene) (2:4 D and 2:4:5 T) have the impurity dioxin, which is very toxic and causes fatality even in low concentrations. Another herbicide is [Paraquat](http://en.wikipedia.org/wiki/Paraquat). It is highly toxic but it rapidly degrades in soil due to the action of bacteria and does not kill soil fauna

Many pesticides can be grouped into chemical families. Prominent insecticide families include [organochlorines](http://en.wikipedia.org/wiki/Organochlorine), [organophosphates](http://en.wikipedia.org/wiki/Organophosphate), and [carbamates](http://en.wikipedia.org/wiki/Carbamate). [Organochlorine](http://en.wikipedia.org/wiki/Organochlorine) hydrocarbons (e.g., [DDT](http://en.wikipedia.org/wiki/DDT)) could be separated into dichlorodiphenylethanes, cyclodiene compounds, and other related compounds. They operate by disrupting the sodium/potassium balance of the nerve fiber, forcing the nerve to transmit continuously. Their toxicities vary greatly, but they have been phased out because of their persistence and potential to bioaccumulate.[[9]](http://en.wikipedia.org/wiki/Pesticide#cite_note-Kamrin1997-9):239–240 [Organophosphate](http://en.wikipedia.org/wiki/Organophosphate) and [carbamates](http://en.wikipedia.org/wiki/Carbamate) largely replaced [organochlorines](http://en.wikipedia.org/wiki/Organochlorine). Both operate through inhibiting the enzyme [acetylcholinesterase](http://en.wikipedia.org/wiki/Acetylcholinesterase), allowing [acetylcholine](http://en.wikipedia.org/wiki/Acetylcholine) to transfer nerve impulses indefinitely and causing a variety of symptoms such as weakness or paralysis. Organophosphates are quite toxic to vertebrates, and have in some cases been replaced by less toxic carbamates.[[9]](http://en.wikipedia.org/wiki/Pesticide#cite_note-Kamrin1997-9):136–137 Thiocarbamate and dithiocarbamates are subclasses of carbamates .

[Organochlorines](http://en.wikipedia.org/wiki/Organochlorines) include [DDT](http://en.wikipedia.org/wiki/DDT), [Aldrin](http://en.wikipedia.org/wiki/Aldrin), [Dieldrin](http://en.wikipedia.org/wiki/Dieldrin) and BHC. They are cheap to produce, potent and persistent. DDT was used on a massive scale from the 1930s, with a peak of 72,000 tonnes used 1970. Then usage fell as the harmful environmental effects were realized. It was found worldwide in fish and birds and was even discovered in the snow in the [Antarctic](http://en.wikipedia.org/wiki/Antarctic). It is only slightly soluble in water but is very soluble in the bloodstream. It affects the nervous and endocrine systems and causes the eggshells of birds to lack calcium causing them to be easily breakable. It is thought to be responsible for the decline of the numbers of birds of prey like [ospreys](http://en.wikipedia.org/wiki/Osprey) and [peregrine falcons](http://en.wikipedia.org/wiki/Peregrine_falcon) in the 1950s - they are now recovering.

As well as increased concentration via the food chain, it is known to enter via permeable membranes, so fish get it through their gills. As it has low water solubility, it tends to stay at the water surface, so organisms that live there are most affected. DDT found in fish that formed part of the human food chain caused concern, but the levels found in the liver, kidney and brain tissues was less than 1 ppm and in fat was 10 ppm, which was below the level likely to cause harm. However, DDT was banned in the UK and the United States to stop the further buildup of it in the food chain. U.S. manufacturers continued to sell DDT to developing countries, who could not afford the expensive replacement chemicals and who did not have such stringent regulations governing the use of pesticides.

[Health effects of pesticides](http://en.wikipedia.org/wiki/Health_effects_of_pesticides) and [Pesticide poisoning](http://en.wikipedia.org/wiki/Pesticide_poisoning)

Pesticides may cause acute and delayed health effects in people who are exposed.. Pesticide exposure can cause a variety of adverse health effects, ranging from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, mimicking hormones causing reproductive problems, and also causing cancer

In addition, pesticide use reduces [biodiversity](http://en.wikipedia.org/wiki/Biodiversity), contributes to [pollinator decline](http://en.wikipedia.org/wiki/Pollinator_decline), destroys habitat (especially for birds),[[45]](http://en.wikipedia.org/wiki/Pesticide#cite_note-palmerw-45) and threatens [endangered species](http://en.wikipedia.org/wiki/Endangered_species).[[20]](http://en.wikipedia.org/wiki/Pesticide#cite_note-sustaining-20)

Since chlorinated hydrocarbon pesticides [dissolve in fats](http://en.wikipedia.org/wiki/Fat-soluble) and are not excreted, organisms tend to retain them almost indefinitely. [Biological magnification](http://en.wikipedia.org/wiki/Biomagnification) is the process whereby these chlorinated hydrocarbons (pesticides) are more concentrated at each level of the food chain

TYPES OF PESTICIDES

Pesticides are often referred to according to the type of pest they control. Pesticides can also be considered as either biodegradable pesticides, which will be broken down by microbes and other living beings into harmless compounds, or persistent pesticides, which may take months or years before they are broken down: it was the persistence of DDT, for example, which led to its accumulation in the food chain and its killing of birds of prey at the top of the food chain. Another way to think about pesticides is to consider those that are chemical pesticides or are derived from a common source or production method.

**Organochlorine insecticides**

They were commonly used in the past, but many have been removed from the market due to their health and environmental effects and their persistence (e.g., DDT and chlordane).[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

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### Organophosphate pesticides

[Organophosphates](http://en.wikipedia.org/wiki/Organophosphates) affect the nervous system by disrupting the enzyme that regulates acetylcholine, a neurotransmitter. Most organophosphates are insecticides. They were developed during the early 19th century, but their effects on insects, which are similar to their effects on humans, were discovered in 1932.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Some are very poisonous. However, they usually are not persistent in the environment.

**Carbamate pesticides**

Carbamate pesticides affect the nervous system by disrupting an enzyme that regulates acetylcholine, a neurotransmitter. The enzyme effects are usually reversible. There are several subgroups within the carbamates.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

**Pyrethroid pesticides**

They were developed as a synthetic version of the naturally occurring pesticide pyrethrin, which is found in chrysanthemums. They have been modified to increase their stability in the environment. Some synthetic pyrethroids are toxic to the nervous system.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

**Biopesticides**

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] At the end of 2001, there were approximately 195 registered biopesticide active ingredients and 780 products.

In [toxicology](http://en.wikipedia.org/wiki/Toxicology), the **median lethal dose**, **LD50** (abbreviation for "[lethal dose](http://en.wikipedia.org/wiki/Lethal_dose), 50%"), **LC50** (lethal concentration, 50%) or **LCt50** (lethal concentration and time) of a [toxin](http://en.wikipedia.org/wiki/Toxin), [radiation](http://en.wikipedia.org/wiki/Radiation), or [pathogen](http://en.wikipedia.org/wiki/Pathogen) is the [dose](http://en.wikipedia.org/wiki/Dose_%28pharmacology%29) required to kill half the members of a tested population after a specified test duration. LD50 is usually determined by tests on animals such as [laboratory mice](http://en.wikipedia.org/wiki/Laboratory_mice).

**Biodegradation** is the chemical dissolution of materials by bacteria or other biological means. Although often conflated, biodegradable is distinct in meaning from [compostable](http://en.wikipedia.org/wiki/Compostable). While biodegradable simply means to be consumed by microorganisms and return to compounds found in nature, "compostable" makes the specific demand that the object break down in a compost pile. The term is often used in relation to ecology, waste management, biomedicine, and the natural environment ([bioremediation](http://en.wikipedia.org/wiki/Bioremediation)) and is now commonly associated with environmentally friendly products that are capable of decomposing back into natural elements. Organic material can be degraded [aerobically](http://en.wikipedia.org/wiki/Aerobic_organism) with [oxygen](http://en.wikipedia.org/wiki/Oxygen), or [anaerobically](http://en.wikipedia.org/wiki/Anaerobic_digestion), without oxygen. [Biosurfactant](http://en.wikipedia.org/wiki/Biosurfactant), an extracellular surfactant secreted by microorganisms, enhances the biodegradation process.

***Biomagnification*** –

"Biomagnification is the sequence of processes in an ecosystem by which higher concentrations of a particular chemical, such as the pesticide DDT, are reached in organisms higher up the [food chain](http://toxics.usgs.gov/definitions/food_web.html), generally through a series of prey-predator relationships.

In this section, we will examine how pollutants move through the various trophic levels in an ecosystem.  To understand this material, you have to understand trophic levels, food chains, and food webs, as well as pyramids of biomass.  If you haven't reviewed basic ecology yet; perhaps you better do so now:

There are two basic terms we are discussing here.  Bioaccumulation refers to how pollutants enter a food chain; biomagnification refers to the tendency of pollutants to concentrate as they move from one trophic level to the next.  Here are some definitions of these terms:

Bioaccumulation:

increase in concentration of a pollutant from the environment to the first organism in a food chain

Biomagnification:

increase in concentration of a pollutant from one link in a food chain to another

We are concerned about these phenomena because together they mean that even small concentrations of chemicals in the environment can find their way into organisms in high enough dosages to cause problems.  In order for biomagnification to occur, the pollutant must be:

1. long-lived
2. mobile
3. soluble in fats
4. biologically active

If a pollutant is short-lived, it will be broken down before it can become dangerous.  If it is not mobile, it will stay in one place and is unlikely to be taken up by organisms.  If the pollutant is soluble in water it will be excreted by the organism. Pollutants that dissolve in fats, however, may be retained for a long time.  It is traditional to measure the amount of pollutants in fatty tissues of organisms such as[fish.](http://www.flmnh.ufl.edu/fish/)  In mammals, we often test the [milk](http://www.cciw.ca/glimr/data/sogl-final-report/fig14.html)produced by females, since the milk has a lot of fat in it and because the very young are often more susceptible to damage from toxins (poisons).  If a pollutant is not active biologically, it may biomagnify, but we really don't worry about it much, since it probably won't cause any problems.