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THEME 3 for practical lessons of the discipline life safety for first-year students of the pharmaceutical department:

The value of the environment in the human-environment system

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**Ecophysiology** (from [Greek](https://en.wikipedia.org/wiki/Ancient_Greek)οἶκος, *oikos*, "house(hold)"; φύσις, *physis*, "nature, origin"; and -λογία, [*-logia*](https://en.wikipedia.org/wiki/-logy)), **environmental physiology** or **physiological ecology** is a [biological](https://en.wikipedia.org/wiki/Biology)[discipline](https://en.wikipedia.org/wiki/List_of_academic_disciplines) that studies the adaptation of an [organism](https://en.wikipedia.org/wiki/Organism)'s [physiology](https://en.wikipedia.org/wiki/Physiology) to environmental conditions. It is closely related to [comparative physiology](https://en.wikipedia.org/wiki/Comparative_physiology) and [evolutionary physiology](https://en.wikipedia.org/wiki/Evolutionary_physiology).

**There are 3 kinds of environment:**

**1.**The internal environment of organism is the internal maintenance, nervous andhumoral mechanisms regulation and maintenance homeostasis.

**2.** The external environment is everything, that is outside of organism and operates on his environments and receptors. From the point of view physiology, internal and an external environment are very individual and dynamical for each person.

**3.**The environment is everything, which surrounds and influences at the person. It is not individual, and general for a population, in hygiene the basic objects of an environment are: atmospheric air, water of reservoirs, ground and food stuffs.

The term **"Human environment"** means natural habitant and production activity of the mankind, which comprises the elements of natural and artificial character, which by means of constant influence a human body predetermine physiological processes in the organism, level of health and capacity for work. Human environment comprises two components. These components act differently. They are external environment and production environment.

***External environment*** is a range of factors of organic and inorganic nature which influence the organism and predetermine its health. These factors are external to the organism. These factors are conditions of dwellings, public transport, educational and medical establishments.

***Production environment*** is a part of human environment formed by natural-climatic and professional factors.Production environment is manifested only during human labor activity. Besides, there is internal environment. Internal environment of the organism is totality of the liquids (blood, lymph, spinal liquid). This liquid washes the cells of the organism and takes part in metabolism.

***Internal environment*** is the medium of the organism, which is delimited from external environment by corneous layer of skin, epithelium of respiratory organs, alimentary canal, urine-genital system, extra- and intrareceptors.

***In terms of safety of vital functions three types of the environment can be distinguished:***healthy environment, unhealthy environment and extreme one. Human environment is considered to be healthy if interrelations of the organism and the environment are developing normally; there is no disruption of homeostasis, illnesses are absent and the man fulfils all his biosocial functions.This sort of the environment is called healthy, if interrelations of the organism and the environment are accompanied by deviations in health, this sort of the environment is classified as unhealthy. Extreme environment is one in which human life is impossible or some illnesses prevent the human from fulfilling his biosocial functions.

**Plants**

Plant ecophysiology is concerned largely with two topics: mechanisms (how plants sense and respond to environmental change) and scaling or integration (how the responses to highly variable conditions—for example, gradients from full sunlight to 95% shade within tree canopies—are coordinated with one another), and how their collective effect on plant growth and gas exchange can be understood on this basis.

In many cases, [animals](https://en.wikipedia.org/wiki/Animal) are able to escape unfavourable and changing environmental factors such as heat, cold, drought or floods, while [plants](https://en.wikipedia.org/wiki/Plant) are unable to move away and therefore must endure the adverse conditions or perish (animals go places, plants grow places). Plants are therefore [phenotypically plastic](https://en.wikipedia.org/wiki/Phenotypic_plasticity) and have an impressive array of [genes](https://en.wikipedia.org/wiki/Gene) that aid in adapting to changing conditions. It is hypothesized that this large number of genes can be partly explained by plant species' need to adapt to a wider range of conditions.

**Food**

As with most abiotic factors, light intensity (irradiance) can be both suboptimal and excessive. Light intensity is also an important component in determining the temperature of plant organs (energy budget).The light response curve of net photosynthesis ([PI curve](https://en.wikipedia.org/wiki/PI_curve)) is particularly useful in characterising a plant's tolerance to different light intensities.

Suboptimal light (shade) typically occurs at the base of a plant canopy or in an understory environment. [Shade tolerant](https://en.wikipedia.org/wiki/Shade_tolerant) plants have a range of adaptations to help them survive the altered quantity and quality of light typical of shade environments.

Excess light occurs at the top of canopies and on open ground when cloud cover is low and the sun's zenith angle is low, typically this occurs in the tropics and at high altitudes. Excess light incident on a leaf can result in [photoinhibition](https://en.wikipedia.org/wiki/Photoinhibition) and [photodestruction](https://en.wikipedia.org/wiki/Photodestruction). Plants adapted to high light environments have a range of adaptations to avoid or dissipate the excess light energy, as well as mechanisms that reduce the amount of injury caused.

**Temperature**

In response to extremes of temperature, plants can produce various [proteins](https://en.wikipedia.org/wiki/Protein). These protect them from the damaging effects of ice formation and falling rates of [enzyme](https://en.wikipedia.org/wiki/Enzyme) catalysis at low temperatures, and from enzyme [denaturation](https://en.wikipedia.org/wiki/Denaturation_%28biochemistry%29) and increased [photorespiration](https://en.wikipedia.org/wiki/Photorespiration) at high temperatures. As temperatures fall, production of [antifreeze proteins](https://en.wikipedia.org/wiki/Antifreeze_protein) and [dehydrins](https://en.wikipedia.org/wiki/Dehydrin) increases. As temperatures rise, production of [heat shock proteins](https://en.wikipedia.org/wiki/Heat_shock_protein) increases. Metabolic imbalances associated with temperature extremes result in the build-up of [reactive oxygen species](https://en.wikipedia.org/wiki/Reactive_oxygen_species), which can be countered by [antioxidant](https://en.wikipedia.org/wiki/Antioxidant) systems. [Cell membranes](https://en.wikipedia.org/wiki/Cell_membrane) are also affected by changes in temperature and can cause the membrane to lose its [fluid properties](https://en.wikipedia.org/wiki/Fluid_mosaic#Structure_and_the_Fluid_mosaic_model) and become a gel in cold conditions or to become leaky in hot conditions. This can affect the movement of compounds across the membrane. To prevent these changes, plants can change the composition of their membranes. In cold conditions, more [unsaturated fatty acids](https://en.wikipedia.org/wiki/Fatty_acid#Unsaturated_fatty_acids) are placed in the membrane and in hot conditions more [saturated](https://en.wikipedia.org/wiki/Saturation_%28chemistry%29) fatty acids are inserted.

Plants can avoid overheating by minimizing the amount of sunlight absorbed and by enhancing the cooling effects of wind and [transpiration](https://en.wikipedia.org/wiki/Transpiration). Plants can reduce light absorption using reflective leaf hairs, scales, and waxes. These features are so common in warm dry regions that these habitats can be seen to form a ‘silvery landscape’ as the light scatters off the canopies. Some species, such as *Macroptilium purpureum*, can move their leaves throughout the day so that they are always orientated to avoid the sun (*[paraheliotropism](https://en.wikipedia.org/w/index.php?title=Paraheliotropism&action=edit&redlink=1" \o "Paraheliotropism (page does not exist))*). Knowledge of these mechanisms has been key to [breeding for heat stress tolerance](https://en.wikipedia.org/wiki/Breeding_for_heat_stress_tolerance) in agricultural plants.

Plants can avoid the full impact of low temperature by altering their [microclimate](https://en.wikipedia.org/wiki/Microclimate). For example, [*Raoulia*](https://en.wikipedia.org/wiki/Raoulia) plants found in the uplands of New Zealand are said to resemble ‘vegetable sheep’ as they form tight cushion-like clumps to insulate the most vulnerable plant parts and shield them from cooling winds. The same principle has been applied in agriculture by using [plastic mulch](https://en.wikipedia.org/wiki/Plastic_mulch) to insulate the growing points of crops in cool climates in order to boost plant growth.

**Water**

Too much or too little water can damage plants. If there is too little water then tissues will dehydrate and the plant may die. If the soil becomes waterlogged then the soil will become anoxic (low in oxygen), which can kill the roots of the plant.

The ability of plants to access water depends on the structure of their roots and on the [water potential](https://en.wikipedia.org/wiki/Water_potential) of the root cells. When soil water content is low, plants can alter their water potential to maintain a flow of water into the roots and up to the leaves ([Soil plant atmosphere continuum](https://en.wikipedia.org/wiki/Soil_plant_atmosphere_continuum)). This remarkable mechanism allows plants to lift water as high as 120 m by harnessing the gradient created by [transpiration](https://en.wikipedia.org/wiki/Transpiration) from the leaves.

In very dry soil, plants close their stomata to reduce transpiration and prevent water loss. The closing of the stomata is often mediated by chemical signals from the root (i.e., [abscisic acid](https://en.wikipedia.org/wiki/Abscisic_acid)). In irrigated fields, the fact that plants close their stomata in response to drying of the roots can be exploited to ‘trick’ plants into using less water without reducing yields. The use of this technique was largely developed by Dr Peter Dry and colleagues in Australia.

If drought continues, the plant tissues will dehydrate, resulting in a loss of [turgor pressure](https://en.wikipedia.org/wiki/Turgor_pressure) that is visible as [wilting](https://en.wikipedia.org/wiki/Wilting). As well as closing their stomata, most plants can also respond to drought by altering their water potential ([osmotic adjustment](https://en.wikipedia.org/w/index.php?title=Osmotic_adjustment&action=edit&redlink=1)) and increasing root growth. Plants that are adapted to dry environments ([Xerophytes](https://en.wikipedia.org/wiki/Xerophytes)) have a range of more specialized mechanisms to maintain water and/or protect tissues when desiccation occurs.

Waterlogging reduces the supply of oxygen to the roots and can kill a plant within days. Plants cannot avoid waterlogging, but many species overcome the lack of oxygen in the soil by transporting oxygen to the root from tissues that are not submerged. Species that are tolerant of waterlogging develop specialised roots near the soil surface and [aerenchyma](https://en.wikipedia.org/wiki/Aerenchyma) to allow the diffusion of oxygen from the shoot to the root. Roots that are not killed outright may also switch to less oxygen-hungry forms of cellular respiration. Species that are frequently submerged have evolved more elaborate mechanisms that maintain root oxygen levels, perhaps most notable being the dramatic aerial roots seen in [Mangrove](https://en.wikipedia.org/wiki/Mangrove) forests.

However, for many terminally overwatered houseplants, the initial symptoms of waterlogging can resemble those due to drought. This is particularly true for flood-sensitive plants that show drooping of their leaves due to [epinasty](https://en.wikipedia.org/wiki/Epinasty) (rather than wilting).

**CO2 concentration**

CO2 is vital for plant growth, as it is the substrate for photosynthesis. Plants take in CO2 through [stomatal](https://en.wikipedia.org/wiki/Stomatal) pores on their leaves. At the same time as CO2 enters the stomata, moisture escapes. This trade-off between CO2 gain and water loss is central to plant productivity. The trade-off is all the more critical as [Rubisco](https://en.wikipedia.org/wiki/Rubisco), the enzyme used to capture CO2, is efficient only when there is a high concentration of CO2 in the leaf. Some plants overcome this difficulty by concentrating CO2 within their leaves using [C4 carbon fixation](https://en.wikipedia.org/wiki/C4_carbon_fixation) or [Crassulacean acid metabolism](https://en.wikipedia.org/wiki/Crassulacean_acid_metabolism). However, most species used [C3 carbon fixation](https://en.wikipedia.org/wiki/C3_carbon_fixation) and must open their stomata to take in CO2 whenever photosynthesis is taking place.

The concentration of [CO2 in the atmosphere](https://en.wikipedia.org/wiki/Carbon_dioxide_in_the_Earth%27s_atmosphere) is rising due to [deforestation](https://en.wikipedia.org/wiki/Deforestation) and the combustion of [fossil fuels](https://en.wikipedia.org/wiki/Fossil_fuels). This would be expected to increase the efficiency of photosynthesis and possibly increase the overall rate of plant growth. This possibility has attracted considerable interest in recent years, as an increased rate of plant growth could absorb some of the excess CO2 and reduce the rate of [global warming](https://en.wikipedia.org/wiki/Global_warming). Extensive experiments growing plants under elevated CO2 using [Free-Air Concentration Enrichment](https://en.wikipedia.org/wiki/Free-Air_Concentration_Enrichment) have shown that photosynthetic efficiency does indeed increase. Plant growth rates also increase, by an average of 17% for above-ground tissue and 30% for below-ground tissue. However, detrimental impacts of global warming, such as increased instances of heat and drought stress, mean that the overall effect is likely to be a reduction in plant productivity. Reduced plant productivity would be expected to accelerate the rate of global warming. Overall, these observations point to the importance of avoiding further increases in atmospheric CO2 rather than risking [runaway climate change](https://en.wikipedia.org/wiki/Runaway_climate_change).

**Wind**

The main impact of wind on plants is through its influence on the canopy, which in turn influences the way leaves regulate moisture, heat, and carbon dioxide. When no wind is present, a layer of still air builds up around each leaf. This is known as the [boundary layer](https://en.wikipedia.org/wiki/Boundary_layer) and in effect insulates the leaf from the environment, providing an atmosphere rich in moisture and less prone to convective heating or cooling. As wind speed increases, the leaf environment becomes more closely linked to the surrounding environment. It may become difficult for the plant to retain moisture as it is exposed to dry air. On the other hand, a moderately high wind allows the plant to cool its leaves more easily when exposed to full sunlight. Plants are not entirely passive in their interaction with wind. Plants can make their leaves less vulnerable to changes in wind speed, by coating their leaves in fine hairs ([trichomes](https://en.wikipedia.org/wiki/Trichomes%22%20%5Co%20%22Trichomes)) to break up the air flow and increase the boundary layer. In fact, leaf and canopy dimensions are often finely controlled to manipulate the boundary layer depending on the prevailing environmental conditions.

In areas where very strong winds are common, plants respond by reducing their above ground growth (known as dwarfing) and by strengthening their stems. Trees have a particularly well-developed capacity to reinforce their trunks when exposed to wind. In the 1960s, this realisation prompted arboriculturalists in the UK to move away from the practice of staking young [amenity trees](https://en.wikipedia.org/wiki/Amenity_tree) to offer artificial support.[[15]](https://en.wikipedia.org/wiki/Ecophysiology#cite_note-15) In the most extreme cases, plants can be mortally damaged or uprooted by wind. This is a particular problem for agriculture in hurricane-prone regions, such as the banana-growing Windward Islands in the Caribbean. When this type of [disturbance](https://en.wikipedia.org/wiki/Disturbance_%28ecology%29) occurs in natural systems, the only solution is to ensure that there is an adequate stock of seeds or seedlings to quickly take the place of the mature plants that have been lost- although, in many cases a [successional](https://en.wikipedia.org/wiki/Ecological_succession) stage will be needed before the ecosystem can be restored to its former state.

**Humans**

[The environment](https://en.wikipedia.org/wiki/Environment_%28biophysical%29) can have major influences on human [physiology](https://en.wikipedia.org/wiki/Physiology). Environmental effects on human physiology are numerous; one of the most carefully studied effects is the alterations in [thermoregulation](https://en.wikipedia.org/wiki/Thermoregulation) in the body due to outside [stresses](https://en.wikipedia.org/wiki/Stress_%28medicine%29). This is necessary because in order for [enzymes](https://en.wikipedia.org/wiki/Enzyme) to function, [blood](https://en.wikipedia.org/wiki/Blood) to flow, and for various body [organs](https://en.wikipedia.org/wiki/Organ_%28anatomy%29) to operate, [temperature](https://en.wikipedia.org/wiki/Temperature) must remain at consistent, balanced levels.

**Thermoregulation**

To achieve this, the body alters three main things to achieve a constant, normal body temperature:

* Heat transfer to the [epidermis](https://en.wikipedia.org/wiki/Epidermis_%28skin%29)
* The rate of [evaporation](https://en.wikipedia.org/wiki/Evaporation)
* The rate of heat production

The hypothalamus plays an important role in thermoregulation. It connects to thermal receptors in the [dermis](https://en.wikipedia.org/wiki/Dermis), and detects changes in surrounding blood to make decisions of whether to stimulate internal heat production, or to stimulate evaporation.

There are two main types of stresses that can be experienced due to extreme environmental temperatures: [heat stress](https://en.wikipedia.org/wiki/Heat_stress) and [cold stress](https://en.wikipedia.org/wiki/Cold_stress).

Heat stress is physiologically combated in four ways: [radiation](https://en.wikipedia.org/wiki/Thermal_radiation), [conduction](https://en.wikipedia.org/wiki/Heat_conduction), [convection](https://en.wikipedia.org/wiki/Convection), and [evaporation](https://en.wikipedia.org/wiki/Evaporation). Cold stress is physiologically combated by shivering, accumulation of [body fat](https://en.wikipedia.org/wiki/Body_fat), circulatory adaptations (that provide an efficient transfer of heat to the epidermis), and increased blood flow to the extremities.

There is one part of the body fully equipped to deal with cold stress. The [respiratory system](https://en.wikipedia.org/wiki/Respiratory_system) protects itself against damage by warming the incoming air to 80-90 degrees Fahrenheit before it reaches the [bronchi](https://en.wikipedia.org/wiki/Bronchi). This means that not even the most frigid of temperatures can damage the respiratory tract.

In both types of temperature related stress, it is important to remain well-hydrated. Hydration reduces cardiovascular strain, enhances the ability of energy processes to occur, and reduces feelings of exhaustion.

**Altitude**

Extreme temperatures are not the only obstacles that humans face. [High altitudes](https://en.wikipedia.org/wiki/High_altitude) also pose serious physiological challenges on the body. Some of these effects are reduced arterial PO2, the rebalancing of the [acid-base content in body fluids](https://en.wikipedia.org/wiki/Acid-base_content_in_body_fluids), increased [hemoglobin](https://en.wikipedia.org/wiki/Hemoglobin), increased [RBC](https://en.wikipedia.org/wiki/Red_blood_cell) synthesis, enhanced circulation, and increased levels of the [glycolysis](https://en.wikipedia.org/wiki/Glycolysis) byproduct [2,3 diphosphoglycerate](https://en.wikipedia.org/wiki/2%2C3_diphosphoglycerate), which promotes off-loading of O2 by [hemoglobin](https://en.wikipedia.org/wiki/Hemoglobin) in the [hypoxic tissues](https://en.wikipedia.org/wiki/Hypoxic_tissues).

Environmental factors can play a huge role in the human body's fight for [homeostasis](https://en.wikipedia.org/wiki/Homeostasis). However, humans have found ways to adapt, both [physiologically](https://en.wikipedia.org/wiki/Physiology) and tangibly.

Environmental factor or ecological factor or ecofactor is any factor, [abiotic](https://en.wikipedia.org/wiki/Abiotic) or biotic, that influences [living organisms](https://en.wikipedia.org/wiki/Living_organism).

**Abiotic factors** include ambient [temperature](https://en.wikipedia.org/wiki/Temperature), amount of [sunlight](https://en.wikipedia.org/wiki/Sunlight), and [pH](https://en.wikipedia.org/wiki/PH) of the water soil in which an organism lives.

**Biotic factors** would include the availability of food organisms and the presence of [conspecifics](https://en.wikipedia.org/wiki/Conspecifics), [competitors](https://en.wikipedia.org/wiki/Competitors), [predators](https://en.wikipedia.org/wiki/Predator), and [parasites](https://en.wikipedia.org/wiki/Parasites).

[Cancer](https://en.wikipedia.org/wiki/Cancer) mainly the result of [environmental factors](https://en.wikipedia.org/wiki/Environmental_factors).

An organism's [genotype](https://en.wikipedia.org/wiki/Genotype) (e.g., in the [zygote](https://en.wikipedia.org/wiki/Zygote)) is translated into the [adult](https://en.wikipedia.org/wiki/Adult) [phenotype](https://en.wikipedia.org/wiki/Phenotype) through development during an organism's [ontogeny](https://en.wikipedia.org/wiki/Ontogeny), and subject to influences by many environmental effects. In this context, a phenotype (or phenotypic trait) can be viewed as any definable and measurable characteristic of an organism, such as its body mass or skin color.

Apart from the true monogenic genetic, environmental factors may determine the development of disease in those genetically predisposed to a particular condition. [Stress](https://en.wikipedia.org/wiki/Stress_%28biology%29), [physical](https://en.wikipedia.org/wiki/Human_body) and mental abuse, [diet](https://en.wikipedia.org/wiki/Diet_%28nutrition%29), exposure to [toxins](https://en.wikipedia.org/wiki/Toxin), [pathogens](https://en.wikipedia.org/wiki/Pathogen), [radiation](https://en.wikipedia.org/wiki/Radiation) and [chemicals](https://en.wikipedia.org/wiki/Chemicals) found in almost allpersonal-care products and household cleaners are common environmental factors that determine a large segment of non-hereditary disease.

If a disease process is concluded to be the result of a combination of [genetic](https://en.wikipedia.org/wiki/Genetics) and *environmental factor* influences, its etiological origin can be referred to as having a [multifactorial](https://en.wikipedia.org/wiki/Multifactorial_inheritance) pattern.

As an example of an environmental trigger, a component of a human's [drinking water](https://en.wikipedia.org/wiki/Drinking_water) may activate (trigger) a change in a person's body. Such changes are mainly negative ones. Using this example, what is in the drinking water may affect one person entirely differently than another – someone may be affected greatly, whereas someone may not be at all.

[Cancer](https://en.wikipedia.org/wiki/Cancer) is overwhelmingly a result of environmental factors, and not largely down to bad luck, according to medical scientists. Maintaining a healthy weight, eating a healthy diet, minimizing alcohol and eliminating smoking reduces the risk of developing the disease, according to researchers.

[Nitrates](https://en.wikipedia.org/wiki/Nitrates) may be an environmental trigger for [Alzheimer's](https://en.wikipedia.org/wiki/Alzheimer%27s), [diabetes](https://en.wikipedia.org/wiki/Diabetes), and [Parkinson's disease](https://en.wikipedia.org/wiki/Parkinson%27s_disease).

**Abiotic factors**

In [biology](https://en.wikipedia.org/wiki/Biology) and [ecology](https://en.wikipedia.org/wiki/Ecology), **abiotic components** or **abiotic factors** are non-living chemical and [physical](https://en.wikipedia.org/wiki/Physical_property) parts of the [environment](https://en.wikipedia.org/wiki/Natural_environment) that affect living [organisms](https://en.wikipedia.org/wiki/Organism) and the functioning of [ecosystems](https://en.wikipedia.org/wiki/Ecosystem).

Abiotic components include physical conditions and non-living [resources](https://en.wikipedia.org/wiki/Resource_%28biology%29) that affect living organisms in terms of [growth](https://en.wikipedia.org/wiki/Developmental_biology), [maintenance](https://en.wikipedia.org/wiki/Maintenance_of_an_organism), and [reproduction](https://en.wikipedia.org/wiki/Reproduction). Resources are distinguished as substances or objects in the environment required by one organism and consumed or otherwise made unavailable for use by other organisms.

Component degradation of a substance occurs by [chemical](https://en.wikipedia.org/wiki/Chemical_process) or [physical processes](https://en.wikipedia.org/wiki/Physical_change), e.g. [hydrolysis](https://en.wikipedia.org/wiki/Hydrolysis). All non-living components of an ecosystem, such as the atmosphere or water, are called abiotic components.

In biology, abiotic factors can include water, light, radiation, temperature, [humidity](https://en.wikipedia.org/wiki/Humidity), [atmosphere](https://en.wikipedia.org/wiki/Atmosphere), and soil. The macroscopic climate often influences each of the above. Pressure and sound waves may also be considered in the context of marine or sub-terrestrial environments.

All of these factors affect different [organisms](https://en.wikipedia.org/wiki/Organism) to different extents. If there is little or no sunlight then plants may wither and die from not being able to get enough sunlight to complete the cycle of photosynthesis. Many [Archaea](https://en.wikipedia.org/wiki/Archea) require very high temperatures, or pressures, or unusual concentrations of chemical substances, such as sulfur, because of their specialization into extreme conditions. Certain fungi have evolved to survive mostly at the temperature, the humidity, and stability of their environment.

For example, there is a significant difference in access to water as well as humidity between [temperate rain forests](https://en.wikipedia.org/wiki/Temperate_rain_forest) and [deserts](https://en.wikipedia.org/wiki/Desert). This difference in water access causes a diversity in the types of plants and animals that grow in these areas.

**BIOTIC FACTORS**

**Biotic components** are the living things that shape an [ecosystem](https://en.wikipedia.org/wiki/Ecosystem).

Biotic components usually include:

* Producers, i.e. [autotrophs](https://en.wikipedia.org/wiki/Autotroph): e.g. [plants](https://en.wikipedia.org/wiki/Plant), they convert the energy from photosynthesis (the transfer of sunlight, water, and carbon dioxide into energy), or other sources such as hydrothermal vents into food.
* Consumers, i.e. [heterotrophs](https://en.wikipedia.org/wiki/Heterotroph): e.g. animals, they depend upon producers (occasionally other consumers) for food.
* [Decomposers](https://en.wikipedia.org/wiki/Decomposer), i.e. [detritivores](https://en.wikipedia.org/wiki/Detritivore): e.g. [fungi](https://en.wikipedia.org/wiki/Fungi) and [bacteria](https://en.wikipedia.org/wiki/Bacteria), they break down chemicals from producers and consumers (usually dead) into simpler form which can be reused.

A **biotic factor** is any living component that affects the population of another [organism](https://en.wikipedia.org/wiki/Organism), or the environment. This includes [animals](https://en.wikipedia.org/wiki/Animal) that consume the organism, and the living [food](https://en.wikipedia.org/wiki/Food) that the organism consumes. Biotic factors also include human influence, pathogens and disease outbreaks. Each biotic factor needs energy to do work and food for proper growth.

All species are influenced by biotic factors in one way or another. For example, If the number of predators will increase, the whole food web will be affected (the population number of organisms that are lower in the food web will decrease). Similarly, when organisms have more food to eat, they will grow quicker and will be more likely to reproduce, so the population size will obviously increase. Pathogens and disease outbreaks, however, are most likely to cause a decrease in population size. Humans make the most sudden changes in an environment (e.g. building cities and factories, disposing of waste into the water). These changes are most likely to cause a decrease in the population of any [species](http://socratic.org/biology/the-elements-of-an-ecosystem/species), due to the sudden appearance of pollutants.

Biotic components are contrasted to [abiotic components](https://en.wikipedia.org/wiki/Abiotic_component)**.**

The factors mentioned above may either cause an increase or a decrease in population size, depending on the organism. For example, rainfall may encourage the growth of new plants, but too much of it may cause flooding, which may drastically decrease the population size.

**The factors determining health of the population**

If all complex of the factors influencing health of the population accept for 100 % they are distributed so:

-48-53 % — social and economic conditions and a way of life;

-18-20 % — the genetic factor;

-17-20 % — quality of an environment;

-8-10 % — quality of medical aid.

On the various data, occurrence 70 % of all diseases, 60 % defects of physical development and more than 50 % cases of death are caused by environmental contamination.

Environmental Factors Affecting Health

Environmental factors affect human health in important ways, both positive and negative.

Positive **environmental factors** sustain health, and promoting them is preventive medicine. Theyinclude:

- sources of nutrition (farming: soil quality, water availability, biodiversity/bio-integrity, geneticallymodified organisms (GMOs); hunting, fishing: wildlife, fish populations.)

- water (drinking, cooking; cleaning / sanitation);

- air quality;

- ozone layer (protection from UV, cancers, etc);

- space for exercise and recreation;

- sanitation / waste recycling anddisposal.



Negative **environmental factors** arethreats to health, and controlling themis public environmental health. Theyinclude:

- environmental conditions favouring disease vectors (endemic and exoticvectors);

-invasive biota (viruses, bacteria,etc), their hosts and vectors;

-environmental disruptions: floods,droughts, storms, fires, earthquakes, volcanoes;

Courtesy of WHO

• air quality: pollen and pollution leading to respiratory diseases or cancers;

• water quality: biotic and abiotic contaminants; integrity of water transport and treatmentinfrastructure;

• monitoring and management of municipal, agricultural, industrial outflows to the environment(gases, liquids, solid wastes);

• human changes of the environment that create conditions that favour disease; disturb and release noxious levels of previously bound chemicals (e.g. mercury releasedbecomes poison) or biota (e.g. methane released from thawed peat contributes to climatechange);create temporary, intense, life-threatening heat islands (e.g. urban heat waves exacerbatedby climate change);result from nuclear, biological or chemical warfare or terrorism;

• disruption caused by other war and violence.

**Space and Environmental Factors Affecting Health**

Environmental information and environmental management contribute to the maintenance and restorationof health. Space based EO and communications can play roles in:

• Environmental information for optimising use of health resources; distribution of and access tohealth advice & treatment (i.e. to health staff, treatment facilities).

• Short range environmental prediction for avoidance of high risk situations, and to guide immediatehealth system responses. Managing acute risks; adapting to them (e.g. temporary moving ofvulnerable elderly frommonitored/predicted intense heatislands).

• Modeling of health impact ofenvironmental parameters; predictionof longer-term health resource needs,and environmental planning andremediation. Mitigation andadaptation to global changes.

• Large benefits are possible fromattention to environmental factors,e.g. asthma prevention, diseasevectors and epidemiology. Benefitsneed to be quantified. This is ofparticular interest and relevance topandemics such as malaria inunderdeveloped countries, potentially saving thousands of lives.

**Human impact on the environment** or **anthropogenic impact on the environment** includes impacts on [biophysical environments](https://en.wikipedia.org/wiki/Environment_%28biophysical%29), [biodiversity](https://en.wikipedia.org/wiki/Biodiversity), and other resources. The term *anthropogenic* designates an effect or object resulting from [human activity](https://en.wikipedia.org/wiki/Human_behavior). The term was first used in the technical sense by Russian geologist [Alexey Pavlov](https://en.wikipedia.org/wiki/Alexey_Pavlov), and was first used in English by British ecologist [Arthur Tansley](https://en.wikipedia.org/wiki/Arthur_Tansley) in reference to human influences on [climax](https://en.wikipedia.org/wiki/Climax_community) plant communities. The atmospheric scientist [Paul Crutzen](https://en.wikipedia.org/wiki/Paul_Crutzen) introduced the term "[Anthropocene](https://en.wikipedia.org/wiki/Anthropocene%22%20%5Co%20%22Anthropocene)" in the mid-1970s. The term is sometimes used in the context of [pollution](https://en.wikipedia.org/wiki/Pollution) emissions that are produced as a result of human activities but applies broadly to all major human impacts on the environment.



**Technology**

The applications of technology often result in unavoidable and unexpected environmental impacts. Environmental impacts caused by the application of technology are often perceived as unavoidable for several reasons. First, given that the purpose of many technologies is to exploit, control, or otherwise “improve” upon nature for the perceived benefit of humanity while at the same time the myriad of processes in nature have been optimized and are continually adjusted by evolution, any disturbance of these natural processes by technology is likely to result in negative environmental consequences. Second, the conservation of mass principle and the [first law of thermodynamics](https://en.wikipedia.org/wiki/First_law_of_thermodynamics) (i.e., conservation of energy) dictate that whenever material resources or energy are moved around or manipulated by technology, environmental consequences are inescapable. Third, according to the [second law of thermodynamics](https://en.wikipedia.org/wiki/Second_law_of_thermodynamics), order can be increased within a system (such as the human economy) only by increasing disorder or [entropy](https://en.wikipedia.org/wiki/Entropy) outside the system (i.e., the environment). Thus, technologies can create “order” in the human economy (i.e., order as manifested in buildings, factories, transportation networks, communication systems, etc.) only at the expense of increasing “disorder” in the environment. According to a number of studies, increased entropy is likely to be correlated to negative environmental impacts.

**Agriculture**

The environmental impact of agriculture varies based on the wide variety of agricultural practices employed around the world. Ultimately, the environmental impact depends on the production practices of the system used by farmers. The connection between emissions into the environment and the farming system is indirect, as it also depends on other climate variables such as rainfall and temperature.

There are two types of indicators of environmental impact: "means-based", which is based on the farmer's production methods, and "effect-based", which is the impact that farming methods have on the farming system or on emissions to the environment. An example of a means-based indicator would be the quality of groundwater, that is effected by the amount of [nitrogen applied](https://en.wikipedia.org/wiki/Nitrogen_fertilizers) to the soil. An indicator reflecting the loss of nitrate to groundwater would be effect-based.

The environmental impact of agriculture involves a variety of factors from the soil, to water, the air, animal and soil diversity, plants, and the food itself. Some of the environmental issues that are related to agriculture are climate change, deforestation, genetic engineering, irrigation problems, pollutants, soil degradation, and waste.

**Issues for the CSA (Community-supported agriculture** **):**

- Contribute to and keep abreast of environmental health forecasts (using existing models andknown parameters); prepare and deliver prospectuses for what space can do in anticipation orresponse.- Steer space programs according to real risks and real cumulative health benefits, as befits steadylong technical investment; don’t focus primarily on threats that may have high emotional impactbut are of low actual risk.Position space technologyis aggressively andrealistically, as a first line contributor to (a) foresight &prediction, long-term maintenance ofwell-being, and prevention of factors of ill-health; (b) ongoing delivery of health services, andmanagement of current health factors; (c) potentially capable and ready to respond in healthemergencies.- Make the full ‘business case’ for investment in space technology and space program contributionsto all the above, showing the savings potential relative to the full and cumulative public andprivate costs of health programs. This connects not only to GDP but to holistic indicators ofquality of life.

**Fishing**

[Fishing down the foodweb](https://en.wikipedia.org/wiki/Fishing_down_the_foodweb).

The environmental impact of fishing can be divided into issues that involve the availability of fish to be caught, such as [overfishing](https://en.wikipedia.org/wiki/Overfishing), [sustainable fisheries](https://en.wikipedia.org/wiki/Sustainable_fisheries), and [fisheries management](https://en.wikipedia.org/wiki/Fisheries_management); and issues that involve the impact of fishing on other elements of the environment, such as [by-catch](https://en.wikipedia.org/wiki/By-catch) and destruction of habitat such as [coral reefs](https://en.wikipedia.org/wiki/Coral_reef).

These conservation issues are part of [marine conservation](https://en.wikipedia.org/wiki/Marine_conservation), and are addressed in [fisheries science](https://en.wikipedia.org/wiki/Fisheries_science) programs. There is a growing gap between how many fish are available to be caught and humanity’s desire to catch them, a problem that gets worse as the [world population](https://en.wikipedia.org/wiki/World_population) grows.

Similar to other [environmental issues](https://en.wikipedia.org/wiki/Environmental_issue), there can be conflict between the [fishermen](https://en.wikipedia.org/wiki/Fishermen) who depend on fishing for their livelihoods and fishery scientists who realize that if future fish populations are to be [sustainable](https://en.wikipedia.org/wiki/Sustainability) then some fisheries must reduce or even close.

The journal [*Science*](https://en.wikipedia.org/wiki/Science_%28journal%29) published a four-year study in November 2006, which predicted that, at prevailing trends, the world would run out of wild-caught [seafood](https://en.wikipedia.org/wiki/Seafood) in 2048.

**Irrigation**

The environmental impact of irrigation includes the changes in quantity and quality of [soil](https://en.wikipedia.org/wiki/Soil) and [water](https://en.wikipedia.org/wiki/Water) as a result of [irrigation](https://en.wikipedia.org/wiki/Irrigation) and the ensuing effects on natural and social conditions at the tail-end and downstream of the irrigation scheme.

The impacts stem from the changed [hydrological conditions](https://en.wikipedia.org/wiki/Hydrology) owing to the installation and operation of the scheme.



An irrigation scheme often draws water from the river and distributes it over the irrigated area. As a hydrological result it is found that:

* the downstream river [discharge](https://en.wikipedia.org/wiki/Discharge_%28hydrology%29) is reduced
* the [evaporation](https://en.wikipedia.org/wiki/Evaporation) in the scheme is increased
* the [groundwater recharge](https://en.wikipedia.org/wiki/Groundwater_recharge) in the scheme is increased
* the level of the [water table](https://en.wikipedia.org/wiki/Watertable) rises
* the [drainage](https://en.wikipedia.org/wiki/Drainage) flow is increased.

These may be called direct effects.

Effects on soil and [water quality](https://en.wikipedia.org/wiki/Water_quality) are indirect and complex, and subsequent impacts on natural, [ecological](https://en.wikipedia.org/wiki/Ecology) and [socio-economic](https://en.wikipedia.org/wiki/Socio-economy) conditions are intricate. In some, but not all instances, [water logging](https://en.wikipedia.org/wiki/Waterlogging_%28agriculture%29) and [soil salinization](https://en.wikipedia.org/wiki/Soil_salinization) can result. However, irrigation can also be used, together with soil drainage, to overcome soil salinization by leaching excess salts from the vicinity of the root zone.

Irrigation can also be done extracting groundwater by [(tube) wells](https://en.wikipedia.org/wiki/Water_well). As a hydrological result it is found that the level of the water descends. The effects may be [water mining](https://en.wikipedia.org/wiki/Water_mining), land/soil [subsidence](https://en.wikipedia.org/wiki/Groundwater-related_subsidence), and, along the coast, [saltwater intrusion](https://en.wikipedia.org/wiki/Saltwater_intrusion).

Irrigation projects can have large benefits, but the negative side effects are often overlooked. Agricultural irrigation technologies such as high powered water pumps, dams, and pipelines are responsible for the large-scale depletion of fresh water resources such as aquifers, lakes, and rivers. As a result of this massive diversion of freshwater, lakes, rivers, and creeks are running dry, severely altering or stressing surrounding ecosystems, and contributing to the extinction of many aquatic species.

**Energy industry**

The environmental impact of [energy harvesting](https://en.wikipedia.org/wiki/Energy_harvesting) and [consumption](https://en.wikipedia.org/wiki/Energy_consumption) is diverse. In recent years there has been a trend towards the increased [commercialization of various renewable energy sources](https://en.wikipedia.org/wiki/Renewable_energy_commercialization).

In the real world, [consumption](https://en.wikipedia.org/wiki/Power_consumption) of fossil fuel resources leads to [global warming](https://en.wikipedia.org/wiki/Global_warming) and climate change. However, little change is being made in many parts of the world. If the [peak oil](https://en.wikipedia.org/wiki/Peak_oil) theory proves true, more explorations of viable alternative energy sources, could be more friendly to the environment.

Rapidly advancing technologies can achieve a transition of energy generation, water and waste management, and food production towards better environmental and energy usage practices using methods of [systems ecology](https://en.wikipedia.org/wiki/Systems_ecology) and [industrial ecology](https://en.wikipedia.org/wiki/Industrial_ecology).

**Electricity generation**

The environmental impact of [electricity generation](https://en.wikipedia.org/wiki/Electricity_generation) is significant because modern society uses large amounts of electrical power. This power is normally generated at [power plants](https://en.wikipedia.org/wiki/Power_plant) that convert some other kind of energy into [electricity](https://en.wikipedia.org/wiki/Electricity). Each such system has advantages and disadvantages, but many of them pose environmental concerns.

**Nuclear power**

The environmental impact of [nuclear power](https://en.wikipedia.org/wiki/Nuclear_power) results from the [nuclear fuel cycle](https://en.wikipedia.org/wiki/Nuclear_fuel_cycle) processes including mining, processing, transporting and storing fuel and [radioactive](https://en.wikipedia.org/wiki/Radioactive) fuel waste. Released [radioisotopes](https://en.wikipedia.org/wiki/Radioisotopes) pose a health danger to human populations, animals and plants as radioactive particles enter organisms through various transmission routes.

Radiation is a [carcinogen](https://en.wikipedia.org/wiki/Carcinogen) and causes numerous effects on living organisms and systems. The environmental impacts of nuclear power plant disasters such as the [Chernobyl disaster](https://en.wikipedia.org/wiki/Chernobyl_disaster), the [Fukushima Daiichi nuclear disaster](https://en.wikipedia.org/wiki/Fukushima_Daiichi_nuclear_disaster) and the [Three Mile Island accident](https://en.wikipedia.org/wiki/Three_Mile_Island_accident), among others, persist indefinitely, though several other factors contributed to these events including improper management of fail safe systems and natural disasters putting uncommon stress on the generators. The radioactive decay rate of particles varies greatly, dependent upon the nuclear properties of a particular isotope. Radioactive [Plutonium-244](https://en.wikipedia.org/wiki/Plutonium-244) has a half-life of 80.8 million years, which indicates the time duration required for half of a given sample to decay, though very little plutonium-244 is produced in the nuclear fuel cycle and lower half-life materials have lower activity thus giving off less dangerous radiation.[[66]](https://en.wikipedia.org/wiki/Human_impact_on_the_environment#cite_note-66)

**Oil shale industry**

The environmental impact of the oil shale industry includes the consideration of issues such as [land use](https://en.wikipedia.org/wiki/Land_use), [waste management](https://en.wikipedia.org/wiki/Waste_management), and [water](https://en.wikipedia.org/wiki/Water_pollution) and [air pollution](https://en.wikipedia.org/wiki/Air_pollution) caused by the [extraction and processing](https://en.wikipedia.org/wiki/Oil_shale_industry) of [oil shale](https://en.wikipedia.org/wiki/Oil_shale). [Surface mining](https://en.wikipedia.org/wiki/Surface_mining) of [oil shale deposits](https://en.wikipedia.org/wiki/Oil_shale_reserves) causes the usual environmental impacts of [open-pit mining](https://en.wikipedia.org/wiki/Open-pit_mining). In addition, the [combustion](https://en.wikipedia.org/wiki/Combustion) and [thermal processing](https://en.wikipedia.org/wiki/Shale_oil_extraction) generate waste material, which must be disposed of, and harmful atmospheric emissions, including [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide), a major [greenhouse gas](https://en.wikipedia.org/wiki/Greenhouse_gas). Experimental in-situ conversion processes and [carbon capture and storage](https://en.wikipedia.org/wiki/Carbon_capture_and_storage) technologies may reduce some of these concerns in future, but may raise others, such as the pollution of groundwater.[

**Petroleum**

The environmental impact of [petroleum](https://en.wikipedia.org/wiki/Petroleum) is often negative because it is [toxic](https://en.wikipedia.org/wiki/Toxic) to almost all forms of life. [Climate change](https://en.wikipedia.org/wiki/Climate_change) exists. Petroleum, commonly referred to as oil, is closely linked to virtually all aspects of present society, especially for transportation and heating for both homes and for commercial activities.

**Reservoirs**

The environmental impact of reservoirs is coming under ever increasing scrutiny as the world demand for water and energy increases and the number and size of reservoirs increases.

[Dams](https://en.wikipedia.org/wiki/Dam) and the [reservoirs](https://en.wikipedia.org/wiki/Reservoir) can be used to supply [drinking water](https://en.wikipedia.org/wiki/Drinking_water), generate [hydroelectric](https://en.wikipedia.org/wiki/Hydroelectric) power, increasing the water supply for [irrigation](https://en.wikipedia.org/wiki/Irrigation), provide recreational opportunities and flood control. However, adverse environmental and sociological impacts have also been identified during and after many reservoir constructions. Although the impact varies greatly between different dams and reservoirs, common criticisms include preventing sea-run fish from reaching their historical mating grounds, less access to water downstream, and a smaller catch for fishing communities in the area. Advances in technology have provided solutions to many negative impacts of dams but these advances are often not viewed as worth investing in if not required by law or under the threat of fines. Whether reservoir projects are ultimately beneficial or detrimental—to both the environment and surrounding human populations— has been debated since the 1960s and probably long before that. In 1960 the construction of [Llyn Celyn](https://en.wikipedia.org/wiki/Llyn_Celyn) and the flooding of [Capel Celyn](https://en.wikipedia.org/wiki/Capel_Celyn) provoked political uproar which continues to this day. More recently, the construction of [Three Gorges Dam](https://en.wikipedia.org/wiki/Three_Gorges_Dam) and other similar projects throughout [Asia](https://en.wikipedia.org/wiki/Asia), [Africa](https://en.wikipedia.org/wiki/Africa) and [Latin America](https://en.wikipedia.org/wiki/Latin_America) have generated considerable environmental and political debate.

**Wind power**

Compared to the environmental impact of traditional energy sources, the environmental impact of wind power is relatively minor. [Wind powered](https://en.wikipedia.org/wiki/Wind_power) electricity generation consumes no fuel, and emits no [air pollution](https://en.wikipedia.org/wiki/Air_pollution), unlike fossil fuel power sources. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant within a few months. While a wind farm may cover a large area of land, many land uses such as agriculture are compatible, with only small areas of turbine foundations and infrastructure made unavailable for use.

There are reports of bird and bat mortality at wind turbines, as there are around other artificial structures. The scale of the ecological impact may[ or may not be significant, depending on specific circumstances. Prevention and mitigation of wildlife fatalities, and protection of [peat bogs](https://en.wikipedia.org/wiki/Peat_bogs), affect the siting and operation of wind turbines.

There are conflicting reports about the effects of noise on people who live very close to a wind turbine.

**Light pollution**

Artificial light at night is one of the most obvious physical changes that humans have made to the biosphere, and is the easiest form of pollution to observe from space. The main environmental impacts of artificial light are due to light's use as an information source (rather than an energy source). The hunting efficiency of visual predators generally increases under artificial light, changing [predator prey interactions](https://en.wikipedia.org/wiki/Balance_of_nature). Artificial light also affects [dispersal](https://en.wikipedia.org/wiki/Biological_dispersal), [orientation, migration](https://en.wikipedia.org/wiki/Animal_navigation), and [hormone](https://en.wikipedia.org/wiki/Hormone) levels, resulting in disrupted [circadian rhythms](https://en.wikipedia.org/wiki/Circadian_rhythms).

**Manufactured products**

**Cleaning agents**

The environmental impact of [cleaning agents](https://en.wikipedia.org/wiki/Cleaning_agent) is diverse. In recent years, measures have been taken to reduce these effects.

**Nanotechnology**

[Nanotechnology](https://en.wikipedia.org/wiki/Nanotechnology)'s environmental impact can be split into two aspects: the potential for nanotechnological innovations to help improve the environment, and the possibly novel type of pollution that nanotechnological materials might cause if released into the environment. As nanotechnology is an emerging field, there is great debate regarding to what extent industrial and commercial use of [nanomaterials](https://en.wikipedia.org/wiki/Nanomaterials) will affect organisms and ecosystems.

**Paint**

The environmental impact of paint is diverse. Traditional [painting](https://en.wikipedia.org/wiki/Painting) materials and processes can have harmful effects on the [environment](https://en.wikipedia.org/wiki/Environment_%28biophysical%29), including those from the use of [lead](https://en.wikipedia.org/wiki/Lead) and other additives. Measures can be taken to reduce environmental impact, including accurately estimating paint quantities so that wastage is minimized, use of paints, coatings, painting accessories and techniques that are environmentally preferred. The [United States Environmental Protection Agency](https://en.wikipedia.org/wiki/United_States_Environmental_Protection_Agency) guidelines and [Green Star](https://en.wikipedia.org/wiki/Green_Star_%28Australia%29) ratings are some of the standards that can be applied.

**Paper**

The environmental impact of paper is significant, which has led to changes in industry and behaviour at both business and personal levels. With the use of modern technology such as the [printing press](https://en.wikipedia.org/wiki/Printing_press) and the highly mechanised harvesting of wood, paper has become a cheap commodity. This has led to a high level of consumption and waste. With the rise in environmental awareness due to the lobbying by [environmental organizations](https://en.wikipedia.org/wiki/Environmental_organization) and with increased government regulation there is now a trend towards [sustainability](https://en.wikipedia.org/wiki/Sustainability) in the [pulp and paper industry](https://en.wikipedia.org/wiki/Pulp_and_paper_industry).

**Pesticides**

The environmental impact of [pesticides](https://en.wikipedia.org/wiki/Pesticide) is often greater than what is intended by those who use them. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including nontarget species, air, water, bottom sediments, and food. Pesticide contaminates land and water when it escapes from production sites and storage tanks, when it runs off from fields, when it is discarded, when it is sprayed aerially, and when it is sprayed into water to kill algae.

The amount of pesticide that migrates from the intended application area is influenced by the particular chemical's properties: its propensity for binding to soil, its [vapor pressure](https://en.wikipedia.org/wiki/Vapor_pressure), its water [solubility](https://en.wikipedia.org/wiki/Solubility), and its resistance to being broken down over time. Factors in the soil, such as its texture, its ability to retain water, and the amount of organic matter contained in it, also affect the amount of pesticide that will leave the area. Some pesticides contribute to [global warming](https://en.wikipedia.org/wiki/Global_warming) and the depletion of the [ozone layer](https://en.wikipedia.org/wiki/Ozone_layer).

**Pharmaceuticals and personal care products**

The environmental impact of pharmaceuticals and personal care products (PPCPs) is largely speculative. PPCPs are substances used by individuals for personal health or [cosmetic](https://en.wikipedia.org/wiki/Cosmetics) reasons and the products used by [agribusiness](https://en.wikipedia.org/wiki/Agribusiness) to boost growth or health of livestock. PPCPs have been detected in water bodies throughout the world. The effects of these chemicals on humans and the environment are not yet known, but to date there is no scientific evidence that they affect human health.

**Mining**

The environmental impact of mining includes [erosion](https://en.wikipedia.org/wiki/Erosion), formation of [sinkholes](https://en.wikipedia.org/wiki/Sinkhole), loss of [biodiversity](https://en.wikipedia.org/wiki/Biodiversity), and contamination of soil, [groundwater](https://en.wikipedia.org/wiki/Groundwater) and [surface water](https://en.wikipedia.org/wiki/Surface_water) by chemicals from mining processes. In some cases, additional forest logging is done in the vicinity of mines to increase the available room for the storage of the created debris and soil. Besides creating environmental damage, the contamination resulting from leakage of chemicals also affect the health of the local population. Mining companies in some countries are required to follow environmental and rehabilitation codes, ensuring the area mined is returned to close to its original state. Some mining methods may have significant environmental and public health effects.

**Transport**

The environmental impact of [transport](https://en.wikipedia.org/wiki/Transport) is significant because it is a major user of [energy](https://en.wikipedia.org/wiki/Energy_and_society), and burns most of the world's [petroleum](https://en.wikipedia.org/wiki/Petroleum). This creates [air pollution](https://en.wikipedia.org/wiki/Air_pollution), including [nitrous oxides](https://en.wikipedia.org/wiki/Nitrous_oxide) and [particulates](https://en.wikipedia.org/wiki/Particulate), and is a significant contributor to [global warming](https://en.wikipedia.org/wiki/Global_warming) through emission of [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide),[ for which transport is the fastest-growing emission sector. By subsector, road transport is the largest contributor to global warming.

[Environmental regulations](https://en.wikipedia.org/wiki/Environmental_regulation) in developed countries have reduced the individual vehicles emission; however, this has been offset by an increase in the number of vehicles, and more use of each vehicle. Some pathways to reduce the carbon emissions of road vehicles considerably have been studied. Energy use and emissions vary largely between modes, causing [environmentalists](https://en.wikipedia.org/wiki/Environmentalism) to call for a transition from air and road to rail and human-powered transport, and increase [transport electrification](https://en.wikipedia.org/wiki/Transport_electrification) and [energy efficiency](https://en.wikipedia.org/wiki/Efficient_energy_use).

Other environmental impacts of transport systems include [traffic congestion](https://en.wikipedia.org/wiki/Traffic_congestion) and automobile-oriented [urban sprawl](https://en.wikipedia.org/wiki/Urban_sprawl), which can consume natural habitat and agricultural lands. By reducing transportation emissions globally, it is predicted that there will be significant positive effects on Earth's [air quality](https://en.wikipedia.org/wiki/Air_quality), [acid rain](https://en.wikipedia.org/wiki/Acid_rain), [smog](https://en.wikipedia.org/wiki/Smog) and climate change.

The health impact of transport emissions is also of concern. A recent survey of the studies on the effect of traffic emissions on pregnancy outcomes has linked exposure to emissions to adverse effects on gestational duration and possibly also intrauterine growth.

**Aviation**

The environmental impact of aviation occurs because [aircraft engines](https://en.wikipedia.org/wiki/Aircraft_engine) emit [noise](https://en.wikipedia.org/wiki/Noise_pollution), particulates, and gases which contribute to [climate change](https://en.wikipedia.org/wiki/Climate_change) and [global dimming](https://en.wikipedia.org/wiki/Global_dimming). Despite emission reductions from automobiles and more fuel-efficient and less polluting [turbofan](https://en.wikipedia.org/wiki/Turbofan) and [turboprop](https://en.wikipedia.org/wiki/Turboprop) engines, the rapid growth of [air travel](https://en.wikipedia.org/wiki/Air_travel) in recent years contributes to an increase in total pollution attributable to [aviation](https://en.wikipedia.org/wiki/Aviation). In the [EU](https://en.wikipedia.org/wiki/European_Union), [greenhouse gas](https://en.wikipedia.org/wiki/Greenhouse_gas) emissions from aviation increased by 87% between 1990 and 2006.[]](https://en.wikipedia.org/wiki/Human_impact_on_the_environment#cite_note-89) Among [other factors](https://en.wikipedia.org/wiki/Environmental_impact_of_aviation#Reducing_air_travel) leading to this phenomenon are the increasing number of [hypermobile travellers](https://en.wikipedia.org/wiki/Hypermobility_%28travel%29) and social factors that are making air travel commonplace, such as [frequent flyer programs](https://en.wikipedia.org/wiki/Frequent-flyer_program#Climate_and_environmental_issues).[

There is an ongoing debate about possible [taxation](https://en.wikipedia.org/wiki/Taxation) of air travel and the inclusion of aviation in an [emissions trading](https://en.wikipedia.org/wiki/Emissions_trading) scheme, with a view to ensuring that the total [external costs](https://en.wikipedia.org/wiki/External_costs) of aviation are taken into account.

**Roads**

The environmental impact of roads includes the local effects of [highways](https://en.wikipedia.org/wiki/Highways) (public [roads](https://en.wikipedia.org/wiki/Roads)) such as on noise, [light pollution](https://en.wikipedia.org/wiki/Light_pollution), [water pollution](https://en.wikipedia.org/wiki/Water_pollution), [habitat destruction](https://en.wikipedia.org/wiki/Habitat_destruction)/disturbance and local [air quality](https://en.wikipedia.org/wiki/Air_quality); and the wider effects including [climate change](https://en.wikipedia.org/wiki/Climate_change) from vehicle emissions. The design, construction and management of [roads](https://en.wikipedia.org/wiki/Roads), [parking](https://en.wikipedia.org/wiki/Parking) and other related facilities as well as the design and regulation of [vehicles](https://en.wikipedia.org/wiki/Vehicle) can change the impacts to varying degrees.

**War**

As well as the cost to human life and society, there is a significant environmental impact of war. [Scorched earth](https://en.wikipedia.org/wiki/Scorched_earth) methods during, or after war have been in use for much of recorded history but with modern [technology](https://en.wikipedia.org/wiki/Technology) war can cause a far greater devastation on the [environment](https://en.wikipedia.org/wiki/Environment_%28biophysical%29). [Unexploded ordnance](https://en.wikipedia.org/wiki/Unexploded_ordnance) can render land unusable for further use or make access across it dangerous or fatal.

**Biodiversity**

Human impact on biodiversity is significant, humans [have caused the extinction of many species](https://en.wikipedia.org/wiki/Holocene_extinction), including the dodo and, potentially, large megafaunal species during the last [ice age](https://en.wikipedia.org/wiki/Ice_age). Though most experts agree that human beings have accelerated the rate of species extinction, the exact degree of this impact is unknown, perhaps 100 to 1000 times the normal background rate of extinction. Some scholars have postulated that without human interference the biodiversity of the Earth would continue to grow at an exponential rate.

**Carboncycle**

[Global warming](https://en.wikipedia.org/wiki/Global_warming) is the result of increasing atmospheric carbon dioxide concentrations which is caused primarily by the combustion of fossil energy sources such as petroleum, coal, and natural gas, and to an unknown extent by destruction of forests, increased methane, volcanic activity and cement production. Such massive alteration of the global carbon cycle has only been possible because of the availability and deployment of advanced technologies, ranging in application from fossil fuel exploration, extraction, distribution, refining, and combustion in power plants and automobile engines and advanced farming practices. Livestock contributes to climate change both thru the production of greenhouse gases and thru destruction of [carbon sinks](https://en.wikipedia.org/wiki/Carbon_sink) such as rain-forests. According to the 2006 United Nations/FAO report, 18% of all greenhouse gas emissions found in the atmosphere are due to livestock. The raising of livestock and the land needed to feed them has resulted in the destruction millions of acres of Rainforest and as global demand for meat rises, so too will the demand for land. Ninety-one percent of all rainforest land deforested since 1970 is now used for livestock. Potential negative environmental impacts caused by increasing atmospheric carbon dioxide concentrations are rising global air temperatures, altered hydrogeological cycles resulting in more frequent and severe droughts, storms, and floods, as well as sea level rise and ecosystem disruption.

**Nitrogen cycle**

Human impact on the nitrogen cycle is diverse. Agricultural and industrial [nitrogen](https://en.wikipedia.org/wiki/Nitrogen) (N) inputs to the environment currently exceed inputs from natural N fixation. As a consequence of anthropogenic inputs, the global [nitrogen cycle](https://en.wikipedia.org/wiki/Nitrogen_cycle) (Fig. 1) has been significantly altered over the past century. Global atmospheric [nitrous oxide](https://en.wikipedia.org/wiki/Nitrous_oxide) (N2O) mole fractions have increased from a pre-industrial value of ~270 nmol/mol to ~319 nmol/mol in 2005. Human activities account for over one-third of N2O emissions, most of which are due to the agricultural sector.