What does ”environmental” really mean?

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Introduction

The **Oxford American Dictionary** suggests the following definition:

environmental
adjective
1 relating to the natural world and the impact of human activity on its condition: *acid rain may have caused major environmental damage.*
• aiming or designed to promote the protection of the natural world: *environmental tourism.*
2 relating to or arising from a person's surroundings: *environmental noise.*

The **Bauhaus-Universität Weimar** defines “environmental” as:

“The explicit actual measurable or observable effect in the environment that identifies the assessment endpoint as relevant and meaningful and allows evaluation of the significance of the life cycle impact assessment results.”

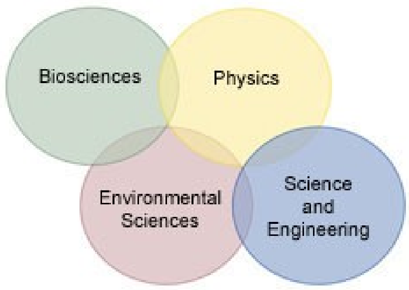
According to the **University of California** “environmental” means:

“Related to the complex of factors, which act upon an individual organism or ecological community to influence or determine development and survival. Topics include conservation, ecology, population growth, climatology and others.”

Environmental science

Definition

Environmental science is the **study of the interactions among the physical, chemical and biological components of the environment**, with a focus on pollution and degradation of the environment related to human activities and the impact on biodiversity and sustainability from local and global development.



In other words, **environmental science encompasses issues such as climate change, conservation, biodiversity, groundwater and soil contamination, use of natural resources, waste management, sustainable development, air pollution and noise pollution**.

Scientific background

Environmental science is inherently an interdisciplinary field that draws upon not only its core scientific areas, but also applies knowledge from other non-scientific studies such as economics, law and social sciences.

- Physics is used to understand the flux of material and energy interaction and construct mathematical models of environmental phenomena.
- Chemistry is applied to understand the molecular interactions in natural systems.
- Biology is fundamental to describing the effects within the plant and animal kingdoms.

Environmental technology

Definition

Environmental technology (sometimes called “*green technology*”) is the **application of the environmental sciences to conserve the natural environment and resources, and by curbing the negative impacts of human involvement**. Sustainable development is the core of environmental technologies. When applying sustainable development as a solution for environmental issues, the solutions need to be socially equitable, economically viable and environmentally sound.

Examples of environmental technologies

The following technologies may be classified as “environmental”:

- Air pollution control
- Air pollution dispersion modeling
- Alternative energy
- Biofuels
- Composting
- Ecoforestry
- Emission markets
- Energy conservation
- Energy development
- Energy efficiency
- Flue gas treatment
- Fuel cells
- Future energy development
- Green building
- Green syndicalism (philosophy of the “*green guild"* or “*sustainable trades”* movement)
- Hybrid vehicles
- Hydrogen technologies
- Power storage
- Recycling
- Remediation (removal of pollution or contaminants from the environment)
- Renewable energy
- Sewage treatment
- Solar heating
- Solar energy
- Solid waste treatment
- Sustainable development
- Sustainable energy
- Waste management
- Waste water treatment
- Water purification

Environmental economics

Definition

Environmental economics is a **subfield of economics concerned with environmental issues**. In using standard methods of neo-classical economics, it is distinguished from green economics or ecological economics, which include the non-standard approaches to environmental problems, science and studies, or ecology.

Quoting from the National Bureau of Economic Research Environmental Economics program: “*[...]* ***Environmental Economics*** *[...]* ***undertakes theoretical or empirical studies of the economic effects of national or local environmental policies around the world*** *[...]. Particular issues include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming.*”

According to the European Commission: “*[...]* ***Economics in environmental policy is to ensure that the costs and the benefits of environmental measures are well balanced.*** *Although it is difficult to estimate costs and benefits, there is an increasing demand that this is done before new environmental policy is decided on a European level. With the use of market-based instruments, environmental goals can sometimes be reached more efficiently than with traditional command and control regulations.*”

Topics and concepts

Central to environmental economics is the concept of an externality. This means that some effects of an activity are not taken into account in its price. For instance, pollution in excess of the socially "optimal" level may occur if the prices a producer pays do not include the impacts (costs) experienced by those adversely affected.

One **frequently noted example of an externality** is *Garrett Hardin's Tragedy of the Commons*, which **occurs in connection to public goods** (goods that are "non-excludable" and "non-rival" – i.e. they are open to all). Visitors to an open-access recreational area will use the resource more than if they had to pay for it, leading to environmental degradation. This, of course, assumes that there is no other policy instrument (such as permits or regulation) being used to control access.

In economic terminology, **these are examples of market failures, and that is an outcome, which is not efficient in an economic sense**. Here, the inefficiency is caused because too much of the polluting activity will be carried out, as the polluter will not take the interests of those adversely affected by the pollution into account. This has led to controversial research into measuring wellbeing, which tries to measure when pollution is actually starting to affect human health and general quality of life.

According to the **Stern Review on the Economics of Climate Change** published in October 2006, "*[...]* ***Greenhouse gases are, in economics terms, an externality: those who produce greenhouse-gas emissions are bringing about climate change, thereby imposing costs on the world and on future generations, but they do not face the full consequences of their actions themselves.*** *[...] Putting an appropriate price on carbon – explicitly through tax or trading, or implicitly through regulation – means that people are faced with the full social cost of their actions. This will lead individuals and businesses to switch away from high-carbon goods and services, and to invest in low-carbon alternatives."*

The Stern Review suggests that climate change threatens to be the greatest and widest-ranging market failure ever seen, and it provides prescriptions including environmental taxes to minimize the economic and social disruptions.

Solutions to environmental externalities

Some of the solutions advocated to correct such externalities include:

Better-defined property rights

The Coase Theorem states that assigning property rights will lead to an optimal solution, regardless of who receives them, if transaction costs are trivial and the number of parties negotiating is limited. For example, if people living near a factory had a right to clean air and water, or the factory had the right to pollute, then either the factory could pay those affected by the pollution or the people could pay the factory not to pollute. Or, citizens could take action themselves as they would if other property rights were violated. Emission markets are based to some extent on the Coase Theorem.

Taxes and tariffs on pollution / removal of "dirty subsidies"

Increasing the costs of polluting will discourage polluting, and will provide a "dynamic incentive", that is, the disincentive continues to operate even as pollution levels fall. A pollution tax that reduces pollution to the socially "optimal" level would be set at such a level that pollution occurs only if the benefits to society (e.g., in form of greater production) exceeds the costs. Some advocate a major shift from taxation from income and sales taxes to tax on pollution – the so-called "green tax shift".

Quotas on pollution

It is often advocated that pollution reductions should be achieved by way of tradable emissions permits, which if freely traded may ensure that reductions in pollution are achieved at least cost. In theory, if such tradable quotas are allowed, then a firm would reduce its own pollution load only if doing so would cost less than paying someone else to make the same reduction.

Environmental regulations

Here the economic impact has to be estimated by the regulator. Usually this is done using cost-benefit analysis. There is a growing realization that regulations (also known as "command and control" instruments) are not so much distinct from economic instruments as is commonly asserted by proponents of environmental economics.

"Command and control" regulation often applies uniform emissions limits on polluters, even though each firm has different costs for emissions reductions. Some firms, in this system, can abate inexpensively, while others can only abate at high cost. Because of this, the total abatement has some expensive and some inexpensive efforts to abate.

Alternative approaches to environmental economics

Another context in which externalities apply is when globalization permits one player in a market who is unconcerned with biodiversity to undercut prices of another who is – creating a "race to the bottom" in regulations and conservation. This in turn may cause loss of natural capital with consequent erosion, water purity problems, diseases, desertification, and other outcomes, which are not efficient in an economic sense.

Environmental economics was once distinct from resource economics but is now hard to distinguish as a separate field as the two became associated with sustainability and more radical green economists split off to work on an alternate political economy.

Environmental economics was a major influence for the theories of natural capitalism and environmental finance, which could be said to be two sub-branches of environmental economics concerned with resource conservation in production, and the value of biodiversity to humans, respectively.

The more radical green economists reject neoclassical economics in favor of a new political economy beyond capitalism or communism that gives a greater emphasis to the interaction of the human economy and the natural environment, acknowledging that "economy is three-fifths of ecology" – Mike Nickerson.

Finally, according to Michael Porter, **strict environmental regulation triggers the discovery and introduction of cleaner technologies and environmental improvements**. The cost savings that can be achieved are sufficient to overcompensate for both the compliance costs directly attributed to new regulations and the innovation costs.

Environmental engineering

Definition

Environmental engineering is the **application of science and engineering principles to improve the environment, to provide healthful water, air, and land for human habitation and for other organisms, and to remediate polluted sites**. Negative environmental effects can be decreased and controlled through public education, conservation, regulations, and the application of good engineering practices.

Briefly speaking, the main task of environmental engineering is to protect (from further degradation), preserve (the present condition), and enhance (the environment).

Development of environmental engineering

Ever since people first recognized that their health and wellbeing were related to the quality of their environment, they have applied thoughtful principles to attempt to improve the quality of their environment. The Romans constructed aqueducts to prevent drought and to create a clean, healthful water supply for the metropolis of Rome.

Conservation movements and laws restricting public actions that would harm the environment have been developed. Notable examples are the laws decreeing the construction of sewers in London and

Paris in the 19th century and the creation of the United States national park system in the early 20th century.

Modern environmental engineering began in London in the mid-19th century when it was realized that proper sewerage could reduce the incidence of waterborne diseases such as cholera. The introduction of drinking water treatment and sewage treatment in industrialized countries reduced waterborne diseases from leading causes of death to rarities.

In many cases, as societies grew, actions that were intended to achieve benefits for those societies had longer-term impacts which reduced other environmental qualities. One example is the widespread application of DDT (potent insecticide) to control agricultural pests in the years following World War II. While the agricultural benefits were outstanding and crop yields increased dramatically, thus reducing world hunger substantially, and malaria was controlled better than it ever had been, numerous species were brought to the verge of extinction due to the impact of the DDT on their reproductive cycles. The story of DDT is considered to be the birth of the modern environmental movement and the development of the modern field of environmental engineering.

Scope of environmental engineering

Environmental engineering emphasizes several areas: process engineering, environmental chemistry, water and wastewater treatment (sanitary engineering), waste reduction/management, and pollution prevention/cleanup. Environmental engineering is a synthesis of various disciplines, incorporating elements from the following: civil engineering, chemical engineering, public health, mechanical engineering, chemistry, biology, geology, ecology.

In other words, environmental engineering is the application of science and engineering principles to the environment. Some consider environmental engineering to include the development of sustainable processes. There are several divisions in the field of environmental engineering:

Environmental impact assessment and mitigation

In this division, engineers and scientists assess the impacts of a proposed project on environmental conditions. They apply scientific and engineering principles to evaluate if there are likely to be any adverse impacts to water quality, air quality, habitat quality, flora and fauna, agricultural capacity, traffic impacts, social impacts, ecological impacts, noise impacts, visual (landscape) impacts, etc. If impacts are expected, they then develop mitigation measures to limit or prevent such impacts.

An example of a mitigation measure would be the creation of wetlands in a nearby location to mitigate the filling in of wetlands necessary for a road development if it is not possible to reroute the road.

Water supply and treatment

Engineers and scientists work to secure water supplies for potable and agricultural use. They evaluate the water balance within a watershed and determine the available water supply, the water needed for various needs in that watershed, the seasonal cycles of water movement through the watershed and they develop systems to store, treat, and convey water for various uses.

Water is treated to achieve water quality objectives for the end uses. In the case of potable water supply, water is treated to minimize risk of infectious disease transmittal, risk of non-infectious illness, and create a palatable water flavor.

Waste-water conveyance and treatment

Most urban and many rural areas no longer discharge human waste directly to the land, but rather deposit such waste into water and convey it from households via sewer systems. Engineers and scientists develop collection and treatment systems to carry this waste material away from where people live and produce the waste and discharge it into the environment.

In developed countries, substantial resources are applied to the treatment and detoxification of this waste before it is discharged into a river, lake, or ocean system. Developing nations are striving to obtain the resources to develop such systems so that they can improve water quality in their surface waters and reduce the risk of water-borne infectious disease.

Air quality management

Engineers apply scientific and engineering principles to the design of manufacturing and combustion processes to reduce air emissions to acceptable levels. Scrubbers, precipitators, after-burners, and other devices are utilized to remove particulate matter, nitrogen oxides, sulfur oxides, and reactive organic gases from vapors prior to allowing their emission to the atmosphere. This field is beginning to overlap with energy efficiency and the desire to decrease carbon dioxide and other greenhouse gas emissions from combustion processes.

Other applications of environmental engineering

- Contaminated land management and site remediation
- Environmental health and safety
- Environmental policy and regulation development
- Hazardous waste management
- Natural resource management
- Noise pollution
- Risk assessment
- Solid waste management

Related phrases

- Environmentalism
- Environmental accounting
- Environmental assessment
- Environmental audit
- Environmental awareness
- Environmental damage
- Environmental design
- Environmental ethics
- Environmental health and safety
- Environmental impact
- Environmental justice
- Environmental law
- Environmental management
- Environmental monitoring
- Environmental policy
- Environmental Performance Index (EPI)
- Environmental preservation
- Environmental protection agency
- Environmental regulation
- Environmental restoration
- Environmental studies
- Environmental sustainability index
- Environmental threats

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