

# Environmental Science: Concepts and Application

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**Dr. A Sreenivas<sup>1</sup>**

<sup>1</sup>Associate Professor, Department of Botany, SRR Government Arts and Science College A Karimnagar Telangana

## Abstract

*Certain subfields of the natural science, social science, and applied science can be combined to form the environmental sciences. An increase in environmental challenges has resulted in a corresponding surge in the consumption of the energy and materials, which in turn has had adverse environmental effects. The resolution of environmental issues necessitates the synthesis of knowledge from various academic fields. This difficulty is inherent to the environmental sciences due to the interdisciplinary nature of these fields. This paper discusses the basis of environmental science its components, types along with fundamental concepts that are crucial for the discipline surrounding it and practical applications which gives different methods to deal with challenges or problems that are constantly arriving.*

**Keyword:** *Environment, Sustainability, Environmental science, Types of environment, Circular economy.*

## I. INTRODUCTION

Environmental sciences are an interdisciplinary field that draws inspiration from various natural, social, and applied sciences disciplines. Disciplines such as environmental engineering, environmental management, environmental economics, and environmental science, among others, strive to facilitate sustainable development as well as environmental conservation. Due to the multifaceted nature of environmental sciences, problem-solving in this domain necessitates the integration of expertise from diverse disciplines. As a result, various scientific disciplines are implicated, each with its own set of presumptions, problems, and research methodologies. The field of environmental management is an outcome of the integration of the social and natural sciences. Similarly, the issues it tackles are amenable to investigation using research methodologies derived from the natural & social sciences. Disciplines of science specify the research methodologies necessary to resolve issues and generate new information. Nevertheless, the issue becomes intricate in interdisciplinary fields of study, such as "environmental sciences", where the resolution necessitates the application of diverse research methodologies derived from various scientific disciplines.(Roudgarmi, 2011)

### A. Types of Environment

The term 'environment' encompasses both the physical and chemical environments of living and nonliving objects. The environment is shared by all living things. It significantly contributes to the maintenance of human health. The encircling air, water, land, biological organisms, and materials comprise the environment. Physical along with biological factors combine to form the environment, which therefore comprises both living and nonliving components. Environmental issues such as depletion of the ozone layer, acid rain, energy resources, nuclear catastrophes, and loss of global biodiversity have the potential to impact every individual.

**Physical or Living Environment:** The environment can be categorised as either physical, or abiotic, or alive, or biotic. Solid, liquid, and gaseous substances comprise the physical environment. The respective names of these three elements are lithosphere, hydrosphere, and atmosphere. The living environment comprises fauna and flora, which includes humans as well. The environment of man was composed of the landscape, water, vegetation, and climate, among other physical features of the planet.

**Man-made environment:** This occurs when humanity intentionally modifies and controls the natural environment. Aquariums, municipalities, community parks, & laboratories are some examples.

**Green environment:** This pertains to environmental conservation concerns. This is exemplified through the endorsement of conservation practises, "investment in renewable energy", and the implementation of measures to mitigate carbon emissions and stop climate change. Environmental friendliness will influence both the policies of businesses and the conduct of individuals. The cultivation of domestic gardens is a common pastime that can provide direct health benefits to the gardener. Collectively, we can ensure that the planet's environmental impact is more sustainable, benefiting future generations.

**Smart environment:** "Environment" refers to our immediate surroundings, whereas "smart" specifies intelligence. The phrase "smart environment" is employed in various contexts, including smart health care, smart laboratories, smart cities, smart residences, smart offices, smart classrooms, and smart factories. An intelligent environment is a tangible location where a variety of intelligent devices collaborate to improve the wellbeing of the occupants. It is achieved through the integration of computational elements, sensors, and actuators into commonplace objects that are interconnected via a network. Individual locations must be capable of being determined and predicted by a smart environment.

### ***B. Components of environment***

**Ecosystem:** This constitutes an element of the natural environment, which also includes the physical environment and a community of living organisms. The concept refers to the dynamic interplay between the living and non-living communities (including organisms, vegetation, and air and water). The environment is divided into the four segments listed below:

- **Atmosphere:** This pertains to the atmospheric shield composed of gases that envelops the planet. An approximately 100-kilometer-thick protective layer is formed by it around the globe.
- **Hydrosphere:** This includes all bodies of water, including the ocean, lakes, rivers, glaciers, as well as groundwater.
- **Lithosphere:** The solid earth's outermost mantle comprises this. Minerals found in the earth's crust and soil are present in it.
- **Biosphere:** This domain encompasses the interactions between living organisms as well as their surroundings, including the hydrosphere, lithosphere, and atmosphere.

**Natural Resources:** The resources in question are derived from the earth or nature. They manifest naturally and cannot be manufactured by humans. There are many ways to categorise natural resources, depending on their provenance, current use, distribution, and quantity or reserves. There are two primary categories of natural resources: renewable and nonrenewable. Additionally, our nation possesses a plethora of resources, including agricultural, energy, mineral, and forest assets.

**Energy Resources:** Simply put, energy is the capacity to perform labour. Energy manifests itself in diverse forms. Our principal source of energy is the sun. Energy can also be obtained from water, nuclear power plants, fossil fuels, and petroleum products. Population growth, modern lifestyles, industrialization, and urbanisation have all contributed to an increase in the world's energy demand. Renewable energy and nonrenewable energy are the two forms of energy.

**Biodiversity:** The term for this is "biological diversity." It denotes the presence of a considerable variety of plant and animal species within a given habitat. Diversity refers to the presence of variety among the various forms of life that inhabit the planet. A global conservation effort is urgently required in light of the severity of the threat to biodiversity on an international level.

**Pollution:** Unwanted alterations to the biological, chemical, and physical components of the air, water, and soil that make up the natural environment are what this term describes. It is considered "an adverse modification" to the natural environment's capacity for support and load-bearing.

Additionally, pollution refers to the existence of detrimental contaminants within a given environment, thereby rendering it unfit for human habitation. Luftborne contaminants, waterborne contaminants, noiseborne contaminants, terrestrial contaminants, thermal contaminants, carcinogenic contaminants, toxic contaminants, and nuclear hazards are all forms of pollution.

### **C. Concepts of Environment**

The term "environment" refers to everything that encompasses or influences a living organism throughout its lifetime. In other words, its natural or artificial surroundings consist of places, objects, people, and other living organisms. The origin of the word environment is the French verb "environner," which means to encircle or encompass. Initially, the environment of early Homo sapiens comprised solely physical features of the planet, including aerosols, hydrospheres, and land (lithosphere), as well as biotic communities. However, as time progressed and society developed, Homo sapiens expanded his environment to encompass his social, economic, and political activities. Understanding how various organisms have adapted to their surroundings for the purposes of reproduction, population growth, and survival is essentially the objective of physiological interaction at the organismic level. Every living thing, from viruses to humans, is inextricably linked to the environment for a variety of necessities, including sustenance, shelter, water, respiration, and so forth. The collective term for the surroundings that influence an organism throughout its lifecycle is environment. Alternatively stated, the environment comprises the interconnections between land, air, and water, as well as their interactions with humanity, other living things, and material objects. It consists of the entirety of the external and internal biological environment, as well as their interrelationships. Environmental studies provide a framework for comprehending the global environment and the reciprocal relationship between human activities and environmental conditions. Environmental studies encompass a wide range of academic disciplines, including physics, chemistry, geophysics, hydrology, history, economics, biotechnology, remote sensing, and soil science, among others. Consequently, the environment is a truly universal phenomenon.

The environment, comprising both biotic and abiotic elements, is crucial for all living things. As a result, environmental issues such as global warming, ozone layer depletion, depleting energy resources, decreasing forest cover, and biodiversity loss impact all individuals.

Additionally, environmental studies examine the processes that degrade the biosphere by way of the hydrosphere, the atmosphere, the lithosphere, and the creatures that inhabit it. The environment assists us in establishing standards for a secure and thriving natural ecosystem.

### **D. Environmental sciences and sustainable development**

An analysis is initiated by comparing and contrasting "sustainable development" and "environmental sciences," two prevalent terms utilised to describe and structure scientific endeavours aimed at safeguarding the environment. "Environmental sciences" encompasses not only "environment" but also a multitude of applications within the field. Both are widely employed notions that serve to define and structure scientific endeavours aimed at environmental protection. Although their distinctions are evident, especially concerning the extent of their goals, these two concepts also possess the capacity to diverge and potentially clash, contingent upon the manner in which they are employed and comprehended.

The issue regarding the definition of "environment" arises initially. In its most fundamental form, the term "environment" refers to the biological & abiotic components that encompass a specific organism or species, a significant portion of which are beneficial to its health. Additionally, "environment" can be defined as encompassing all natural elements of the planet in addition to every process that takes place within and between them. Therefore, the parameters of the term "environment" are most effectively delineated by the subject matter under consideration; they may vary depending on the specific challenge, but generally speaking, no environmental concern ought to be excluded from the domain of "environment."

The term "environment" is frequently linked to "environmental protection" in the context of environmental sciences. The latter can be broadly defined as encompassing endeavours to comprehend the underlying mechanisms that operate within the environment as well as technological or non-technological remedies that may yield some influence, whether positive or negative. Environmental sciences were in existence well in advance of societal concerns regarding the environment. These disciplines investigate (and persist in investigating) the environment, irrespective of its degradation status. The recognition of the detrimental consequences of human-induced stresses on diverse ecosystems prompted a shift in the function of environmental sciences: it became apparent that certain forms of human activities lacked sustainability. The

transition to "sustainable development" took place at this juncture.

An important distinction between these two ideas pertains to the function of human beings and the consequences they have on the environment. Anthropocentric in nature, sustainable development is inherently concerned with present and future human generations. Therefore, it is incongruent with the field of environmental sciences. While sustainable development researchers recognise the intrinsic worth of the environment, they predominantly regard it as an integral component of a more comprehensive system that satisfies human desires and requirements. Understanding how present human activities affect the environment of future in a dynamic manner is a central focus of research. From this standpoint, the ultimate objective is sustainable development, while environmental protection is considered a secondary aim. One thing to keep in mind is that there are a lot of social concerns and goals woven into the sustainable development idea, such human rights advocacy, that don't really have much to do with environmental concerns. The possibility of perplexity is undeniably present and is exacerbated by the fact that sustainable development is frequently regarded as a subfield of environmental sciences, rather than the reverse. A considerable number of environmental specialists devote their efforts to comprehending environmental concerns, while conducting minimal or no research on (human) development.

#### ***E. Circular economy***

The term "circular economy" denotes a manufacturing and consumption framework that is inherently distinct from the prevailing "linear economy" framework in society. A straightforward, linear process underpins the linear economy: extract, produce, consume, and discard, with little to no regard for the pollution produced at each phase. In addition to placing little emphasis on ecological & social concerns (along with the internalisation of their costs), the linear economy model places little reliance on public policy interventions that address these issues. Nonetheless, it is important to acknowledge that the Earth has limited resources. This is true even within the framework of a linear economy model of production & consumption, where the byproducts of extraction and manufacturing, as well as those that remain after consumption, eventually pollute the environment by being disposed of in landfills or dispersed in ways that lead to their contamination.

The circular economy seeks to establish a relationship between prosperity and resource consumption; that is, it

considers how goods and services can be utilised without relying on the extraction of new resources; this is achieved through the implementation of closed loop systems that prevent eventual disposal of used goods in landfills. At each stage of production and consumption, "contamination transfers" occur that are also attributed to the environment. Thus, the circular economy can be regarded as a progression towards the aforementioned feeble sustainability. It suggests a system in which recycling and reprocessing serve as alternatives to the utilisation of virgin basic materials. By decreasing our reliance on these resources, both present and future generations are better equipped to fulfil their own requirements. The circular economy increases the likelihood of sustainability.

The linear model of production can lead to sustainable development initiatives that concentrate on reducing pollution, waste, and recycling at the downstream stages of production and consumption, in contrast to the circular economy's emphasis on these issues at the beginning of the product life cycle. Consequently, products recovered through recycling efforts may be abandoned far too frequently in "linear" sustainable development initiatives; value chains may be nonexistent, and few actors may be willing to utilise refuse as raw materials for new applications. Contemporary manufacturing processes exhibit a distinct preference for employing virgin resources that are easily accessible and user-friendly. The circular economy model, on the other hand, is manifestly resource-centric. The circular economy aims to consider all production process inputs and outputs, although it places particular emphasis on waste.

#### ***F. Application of Environmental Science***

##### **Environmental Planning and Consulting:**

Environmental consulting and planning is the best example of the depth and variety of environmental science. Initially, one might assume that this industry is exclusively concerned with industrial applications, including but not limited to oil and gas production, hazardous material removal, and manufacturing.

**Local and Federal Environmental Law and Legislation:** Both businesses and individuals are required to organise their daily operations in accordance with environmental regulations established by federal and local authorities. These mandates affect everyone, from determining the quantity of "carbon emissions" from power plants as well as the subterranean storage tank types that businesses may employ to determining the amount of water that can be drained down lavatories and the price of



common, high-efficiency appliances. These standards are thankfully not arbitrary decrees issued by governmental entities. Environmentally certified professionals balance the numerous associated expenses for the benefit of both the public and the planet.

#### **Impact Assessment, Monitoring, and Remediation:**

Restoration and identification of disaster zones constitutes one of the numerous well-known environmental certification applications. Although some perceive such catastrophes as massive, obvious calamities like the Deepwater Horizon oil release of 2010, there are others that transpire in far more stealthy fashion. Decades of methylmercury disposal into the "waterways of southwestern Japan" precipitated the emergence of Minamata disease. Locating and restoring such sites is the responsibility of remediators, who are armed with credentials and understanding of environmental science.

**Research and Education:** Applications for environmental certification cannot, of course, move forward without the requisite knowledge to support them. Information is necessary for action; therefore, environmental education and research initiatives are crucial. Environmental scientists with the appropriate credentials operate within laboratories that process diverse forms of interconnected data, including analysis, interpretation, and implementation. This specific field of environmental science informs individuals about substances that are secure to consume, apply, and imbibe. Profitability and environmental, water, and soil protection best practises are both attainable by manufacturers. Moreover, pollutants may face legal consequences.

## **II. Literature Review**

(Taran et al., 2021) Energy and material consumption are increasing in tandem with the global population, which has adverse environmental effects. Surface and groundwater contamination, increased air pollution from vehicles and industrial facilities, and increased solid waste production are a few of these detrimental effects. By employing nanomaterials directly to detect, prevent, and remove pollutants, as well as indirectly through the use of more efficient industrial design processes and the manufacture of environmentally friendly products, nanotechnology has the capacity to enhance the state of the environment. The increased reactivity of nanoparticles can be attributed to their diminutive size and elevated surface area. Although this attribute offers numerous advantages and implementations, it could potentially endanger the well-

being of personnel and the environment due to factors such as prolonged air suspension, environmental accumulation, absorption ease, and organ harm.

(Yadav et al., 2021) Presently, there exists widespread apprehension and distress regarding the future of the planet, given the detrimental impact of the ever-increasing environmental pollution which has destabilised the ecosystem. This has compelled international organisations, governmental bodies, professional organisations, and even politicians to implement appropriate measures to tackle environmental issues. Sustainability and environmental pollution were the subjects of this paper. It described the composition of our environment, as well as the escalating problems and challenges that confront it, from various vantage points. Given the current climate for appropriate measures to be taken regarding the implementation of planned environmental strategies (techniques) and instruments to combat environmental threats in various regions of the globe by public, private, and governmental entities, purpose of this paper is germane.

(Sadiku et al., 2020) The field of environment study examines the mechanisms through which pollutants or degraded substances enter and move through land, air, water, and sediment, as well as organisms. This method draws from a wide range of disciplines, including but not limited to: philosophy, economics, anthropology, engineering, sociology, chemistry, physics, engineering, and geology. It investigates the inception, evolution, and effectiveness of environmental policies. The exigent and time-critical character of environmental transformations has generated a need for individuals equipped with the requisite expertise to tackle such matters. This paper offers an introductory overview of environmental studies.

(Okiwelu & Noutcha, 2016) The history of the three main terms in this review—environmental science, development, and sustainability—is the subject of the introduction. Environmental science sustainability and development sustainability comprise the remaining two sections. The ethical implications and problem-solving interdisciplinarity inherent in environmental science are emphasised. Discussed are the unaddressed negative consequences of development and the right to development. The relationships between the three sustainability components—economic, social, and environmental—are described. Emphasis is placed on renewable (forest, fisheries, wildlife) and nonrenewable (minerals), water management, agriculture, and other aspects of sustainability's pervasiveness in environmental science. The

term "sustainable development" has undergone a significant transformation over the past five decades, beginning with its inception almost half a century ago. Its trajectory includes the publication of Brundtland's *Our Common Future*, which inspired political consensus almost everywhere, and culminating in the United Nations General Assembly's seventieth session adoption of the "Sustainable Development Goals" (SDGs). In addition to adopting the sustainability concept in resource management and development, the conclusion emphasises the need for increased international efforts to reduce greenhouse gas emissions, pollution, and human population growth rates in order to ensure a sustainable future.

(Erhabor & Don, 2016) Adolescents who are environmentally conscious and empowered have the potential to be the most influential catalysts for sustainable environmental protection and stewardship in the long run. In Nigeria, therefore, these adolescents will have a greater say in environmental issues if environmental education that promotes this change is implemented effectively. Therefore, the purpose of this research endeavour was to evaluate the status and perspective of students with regard to the environment. The research investigation was carried out among 130 participants who were enrolled as full-time environmental education students at a federal university located in Edo state, Nigeria. Students exhibited a high level of environmental knowledge and a positive attitude, according to the findings. Additionally, a negative correlation, or even the absence of one, was noted between their environmental knowledge and attitude. Consequently, it was determined that environmental literacy is fostered among students, particularly in tertiary institutions, in order to promote EE in Nigeria. Therefore, the researchers advise that greater efforts should be made to encourage and promote EE across all tiers of society, with particular emphasis on government and its agencies to ensure efficient execution. Nongovernmental organisations and international entities also have a responsibility to contribute to the country's pursuit of sustainable development objectives.

(Sauvé et al., 2016) The integration of fields from engineering, management, the natural sciences, and social sciences has emerged as a critical component in effectively tackling the environmental challenges of the present day. However, this can prove to be an intimidating undertaking due to the fact that specialists from various fields may approach the issues from vastly different perspectives and employ terminologies that might not be mutually comprehending. This paper examines three alternate

environmental concepts that are employed in transdisciplinary research. It also delineates several epistemological and practical challenges associated with each of these concepts. This analysis places specific emphasis on the burgeoning notion of the "circular economy" and juxtaposes it with the more widely employed concepts of "sustainable development" and "environmental sciences." By elucidating the characteristics, significance, and interconnections of these alternative notions, the article assists researchers across disciplines in comprehending the potential advantages and obstacles linked to each one.

(Kassim, 2013) This article presents a critical analysis of the articles that were published in the "International Journal Environment," Volume 3, Issues 1 and 2. The inception of this manuscript originated from a request directed at Dr. Niveen Punati by Govinda Bhandari, the Editor-in-Chief of IJE Issues. In light of the substantial quantity of fifty-one (51) papers comprising the two issues, Dr. Punati sought authorization to enlist the assistance of a colleague, "Dr Ajith Rao", in the completion of the evaluations. Mr. Bhandari evaluated the curriculum vitae of Dr. Rao and jointly sanctioned the review's conclusion. Five weeks were devoted to the individual review and summarization of the papers by Drs. Punati and Rao. Drs. Punati and Rao gained valuable insight from the process as a whole, and it adequately portrayed the depth and breadth of the outstanding work presented in these journal issues.

(Roudgarmi, 2011) Some natural science, social science, and applied science subfields may be combined to form the environmental sciences. The resolution of environmental issues necessitates the synthesis of knowledge from various academic fields. This difficulty is inherent to the environmental sciences due to the interdisciplinary nature of these fields. Environmental sciences do not require specialised research methodologies, unlike the majority of academic disciplines. The objective of this paper is to propose a "qualitative research methodology" for addressing environmental issues and provide answers to anticipated inquiries by compiling and deriving conclusions from the findings of numerous qualitative studies. A range of qualitative research methodologies employed in the studies are examined and discussed in this paper. Qualitative research is unavoidable in certain circumstances. Case studies illustrate the usefulness of qualitative research methods in environmental studies. In professional reports and environmental investigations, qualitative research can provide answers to numerous inquiries. In order to address inquiries that emerge during the process of generating

professional reports, such as Protected Area Management Plans, Environmental Impact Statements, and Strategic Environmental Assessment reports, qualitative research methods may be employed. As opposed to certain experimental and quantitative approaches in environmental studies, which are time-consuming, complex, and in some instances, impractical, this research methodology enables its execution with minimal preparation and apparatus.

### III. CONCLUSION

Environmental Science are pertinent and indispensable for individuals of all ages due to their critical function in promoting consciousness, comprehension, and conscientious behaviour in relation to environmental and societal dilemmas. The objective of this paper was to gain knowledge about environmental science classes/Types its components and to analyze the concepts and implementations pertaining to environmental protection, including sustainable development, circular economy, and environmental sciences, and to investigate the application that explains applications for addressing the associated challenges.

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